SYSTEM 6 BUSHLAND SUBMISSION FORM
FOR CONSIDERATION IN THE UPDATE PROGRAMME

If you wish to submit more than one area for consideration in the System 6 update, please use a separate form for each area.

Please fill in each section giving as much information as possible.

LOCATION, OWNERSHIP AND ZONING OF THE AREA

1. Location Rocky Bay, N. Fremantle

Please give as accurate and detailed a description as possible of the site location
Please include either a hand drawn or copied map showing the area of the area

a) Bordering Roads: Ellis St., Phyllis St.

b) Nearest Corner: Ellis/Phyllis Sts.

c) Lot Number: 320 Plus foreshore reserve between Cypress Hill & ~~Street Number:~~ Minim Cove (Town of Mosman Park)

d) Town/Suburb/Location: North Fremantle

e) Local Council: City of Fremantle

f) Site Name (if any): Rocky Bay

g) Approximate size of the area (ha): 2ha

h) Please locate the area on a map and give us map references if possible:

i) Map: ..... Streetsmart/UBD/Other: Ed 35

j) Map no.: 25

k) Grid Ref: MS – U6

l) Please give any other information that may help us to find the location:

m) Are you aware of any development proposals that are likely to affect the area?

1) Existing subdivision (Rocky Bay) has resulted in illegal clearing of remnant/revegetated foreshore vegetation.

NOTE: Areas that have already been given development APPROVAL should not be nominated

2) Lot 320 is owned by Homeswest (freehold title) & is zoned Parks & Recreation under the local Town planning Scheme. Homeswest has offered the land to DPUD to be set aside as regional open space but the purchase has not yet taken place (Ecoscape, 1991)

Please fill out those questions that you can answer

2. Who owns the area? (If owned by the person/s making the nomination please indicate) Lot 326 - Homestead & surrounds of site

3. If you own the area, and may be interested in participating in conservation on private land initiatives please indicate (and leave your name and address at the end of this submission form) ✓

4 .What is the area zoned? (please indicate whether zoning is Town Planning Scheme or Metropolitan Region Scheme) Urban and part Parks & Recreation (MRS) Parks and Recreation (TPS)

CAN YOU TELL US A LITTLE ABOUT THE PHYSICAL CHARACTERISTICS OF THE AREA

5. Why do you consider this area important? (Refer to Guiding Issues paper)

see 7. below

6. What is/are the soil type/s and colours ?

Type: Sand/Clay/Gravel/Loam/Silt
Colour: White/Grey/Brown/Orange/Yellow/Red/Black

7. Does the area have any special features such as unusual landforms / landscapes that still retain their natural vegetation? Yes/No

If yes, what are they? features associated with Coastal Limestone formation: caves (sinkholes), solution pipes, columns, solution holes, cross-bedding; remnant & revegetated Melaleuca huegelii/M. acerosa shrubland.

8. Is the area a wetland or does it include a wetland? yes (Swan River foreshore)

If yes, what kind of a wetlands is it?

a) lake
✓ b) river
c) stream
d) swamp
✓ e) estuary
f) seasonally wet
g) other

9. What percentage of the wetland is open water in summer? .....

CAN YOU TELL US A LITTLE ABOUT THE VEGETATION /FAUNA ON THE NOMINATED AREA.

10. What percentage of the area is indigenous vegetation? Approx. 75% (some revegetation)

11. If the area includes regions cleared of native bushland please indicate reasons for the inclusion. 1) To maintain the structural integrity of the wetland reserve 2) cleared area near Phyllis St corner is an important recreation node - presently zoned parks & Recreation).

12. Has any previous flora or fauna survey work been done on the area? ...Some...

If yes, please give details of the work ...North Fremantle Foreshore Management Plan (Ecoscape, 1991).

.....

13. How would you rate the condition of the native bushland? (see attached table)

a) pristine
b) excellent
c) very good
d) good
e) degraded
f) completely degraded
g) don't know

14. Please indicate the disturbances affecting the area and where appropriate the percentage of the area disturbed.

✓a) Partial clearing
b) fragmentation
c) Selective removal of species: timber cutting, wildflower picking, mowing dieback and other plant diseases
d) Fire regime, including intensity, season and frequency
? e) 'Enrichment plantings' that is plantings of species not found in that community
✓f) Weed invasion
✓g) Animal impact: horses, foxes, rabbits, cats, dogs, camels, goats etc
✓h) Soil movement, both removal and dumping – fill
i) Changes in water regimes; flooding, drainage and watering
j) Salinity
k) Fertiliser drift and along waterways nutrient influx
✓l) Mining, including that for road works (past)

m) Grazing: stock, overgrazing by feral or native mammals

n) Proliferation of tracks, fire breaks and walk trails

o) Off-road vehicle use

p) Use as service corridors by the SEC, Main Roads, Water Authority.

(Source: B Keighery. Bushland Plant Survey, September 1994)

15. Does the area contain any plant species of special interest that you know of? (eg. declared rare flora, priority taxa, outlier populations) No known - no botanical survey has been done in area.

Do you know what they are? .....

.....

16. Do you know of any native animals that use the area? Yes - see attached

Can you list those you know of? (birds, mammals, reptiles, amphibians etc)

See attached list

17. Is the area used by any native animals of special interest? (eg. endangered species, large/important populations). yes

If yes, please name them and indicate source of information

.....

See attached.

CAN YOU TELL US A LITTLE ABOUT THE SURROUNDING AREA

18. Are there any bushland areas (including wetlands) near to this area? Cypress Hill (immediately downstream); Minim Cave (immediately upstream); Blackwall Reach (2.5 km).

If yes, how close are they ? .....

.....

.....

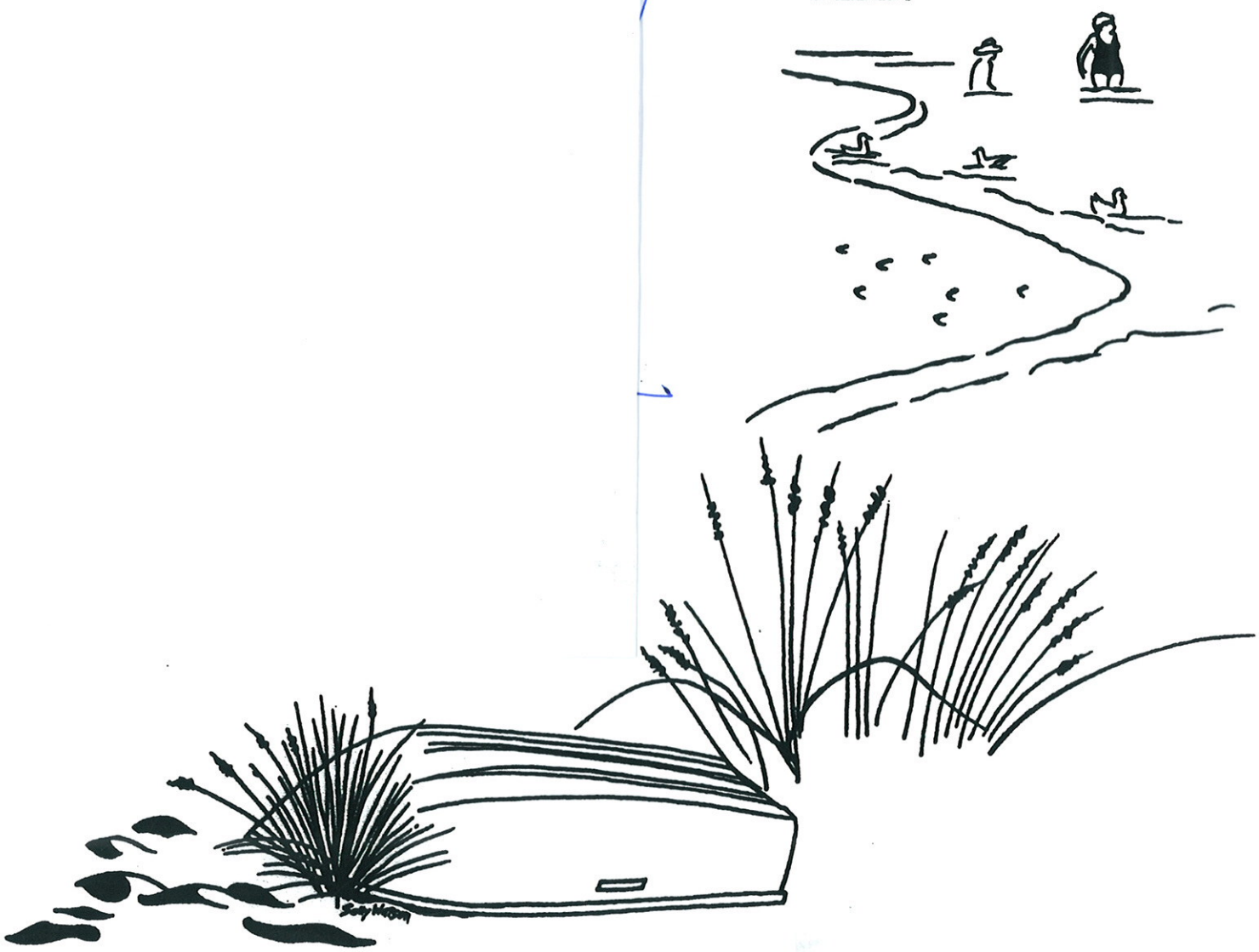
Are they already conservation reserves? Minim Cave & Blackwall Reach only

What is their approximate size? 1 ha (Minim Cave); 2 ha " "

19. Does the submitted area link other bushland areas? Yes - Cypress Hill (downstream); Minim Cave, CSR site & other areas upstream.

Please attach any additional information about the area which may be of use when assessing it.

NORTH FREMANTLE FORESHORE MANAGEMENT PLAN



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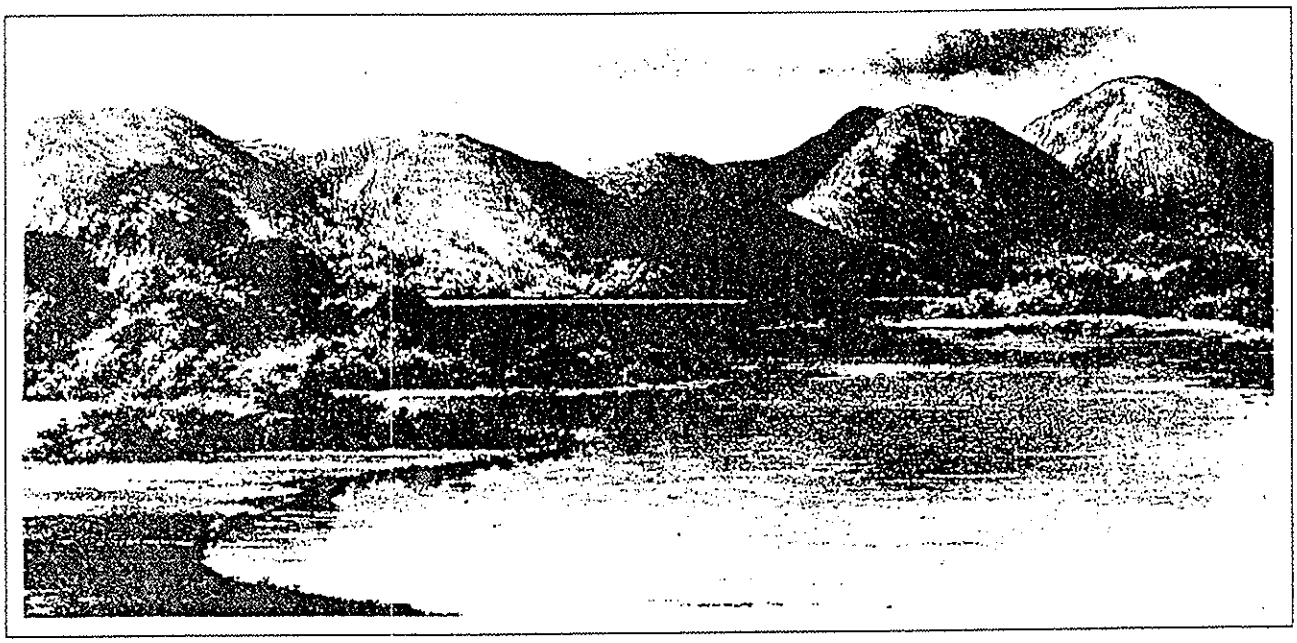
4.0 Physical Environment



Seven Sisters

4.3 Soils

Two soil types are found in the study area; the Cottesloe Soil Association and the alluvial soils found on the low areas south of Harvest Road.

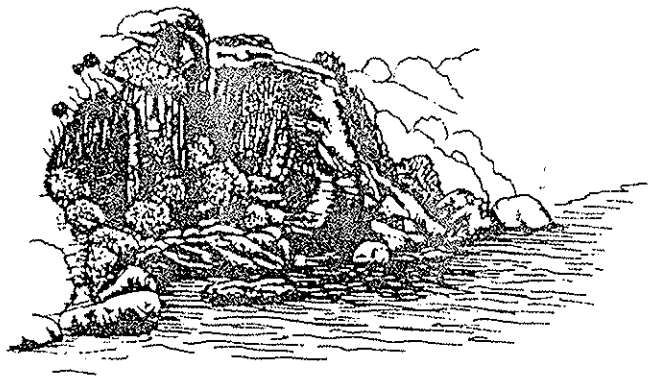
The Cottesloe soils are derived from the weathering of the limestone. This process has given rise to a soil profile which consists of generally shallow yellow and brown sand overlying limestone. Deeper soils occur in valleys or swales while shallow soils are associated with the more exposed and elevated limestone hilltops. These soils are naturally infertile. Shallow soils support low and diverse heath communities while the deeper soils support plant communities which range from low closed forests to tall open woodlands.

The alluvial soils are a result of the deposition action of the river. These consist of medium grained pale grey to white sands with whole and broken bivalve and gastropod shells of alluvial origin (Gozzard, 1983).

Management Implications

1. Species selection for revegetation of denuded areas should be based on those capable of growing in the various soils types.

4.0 Physical Environment



On the southern extremities of North Fremantle the topography is low gradually rising to a limestone ridge east of Stirling Highway through to the river foreshore.

Sinkhole

4.1 Geology

North Fremantle's geological history dates back to the late Pleistocene Age around 140,000 years. The area is made up of Tamala limestone commonly known as Coastal Limestone (Playford, 1989). It is composed of cemented dune sand (aeolianite) consisting of shell fragments of marine origin and quartz grains cemented in calcium carbonate often with a hard capping of secondary calcite. Quartz grains originated from eroded crystalline rocks of the Darling Plateau and were transported to the sea by rivers and along the coast by longitudinal movement. Calcium carbonate leached from overlying dune sands has cemented the grains of quartz and shell fragments together to form a solid mass.

The outcropping limestone has considerable variation in its structure. In some areas examples of sedimentary structures are seen in the form of cross-bedding, this layering feature with a tilt in an east north-easterly direction is seen at places in Rocky Bay. Unconformity is also found in the structure often with loose friable and easily eroded quartz grains and shell fragment comprising the stone.

Many features such as columns, solution pipes or hallows, sinkholes (caves) and capstone are found throughout. Some excellent examples of caves formed from the weathering process are found in the cliffs forming Rocky Bay.

Rocks and shell

Management Implications

1. Control access to minimise erosion is of importance.
2. In some places the weathering of the limestone has resulted in potential rock falls further emphasising the need for controlled access to minimise danger to the public.

4.2 Geomorphology

The Swan Coastal Plain is made up of three dune systems. The most easterly and the oldest is the Bassendean Dune System which contains low hills and leached infertile soils. West of this system is the Spearwood Dune system which is younger, with higher hills and less leached soils; the study area falls within this system. Topographically the Spearwood Dune system is more variable and undulating and as such contains greater relief. Hills are higher and the soils are younger. It is within this system that the coastal limestone has been formed by a process of leaching and deposition of surface soil carbonate.

One of the most noticeable features of the landform is its undulating nature dominated originally by seven hills, of which only five now remain. The seven hills were captured in an illustration by E.Finnerty in 1880 and referred to as the 'Seven Sisters'.

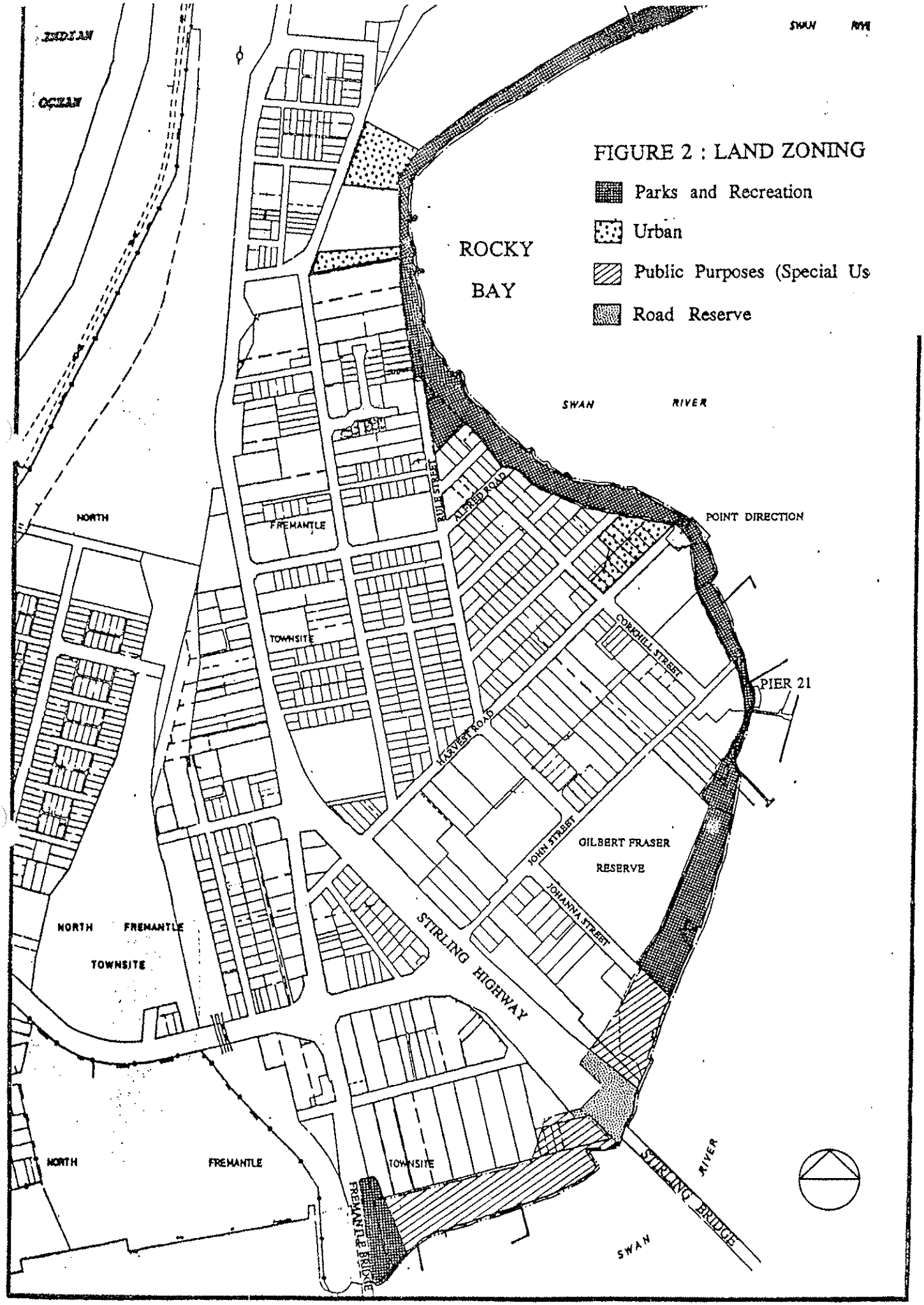


FIGURE 2 : LAND ZONING
Parks and Recreation
Urban
Public Purposes (Special Us
Road Reserve
INDIAN
OCEAN
SWAN
RIVER
ROCKY
BAY
NORTH
FREMANTLE
TOWNSITE
FULLER STREET
ALFRED ROAD
POINT DIRECTION
CORNHILL STREET
PIER 21
HARVEST ROAD
JOHN STREET
GILBERT FRASER
RESERVE
JOHANNA STREET
STIRLING HIGHWAY
FREMANTLE BRIDGE
STIRLING BRIDGE

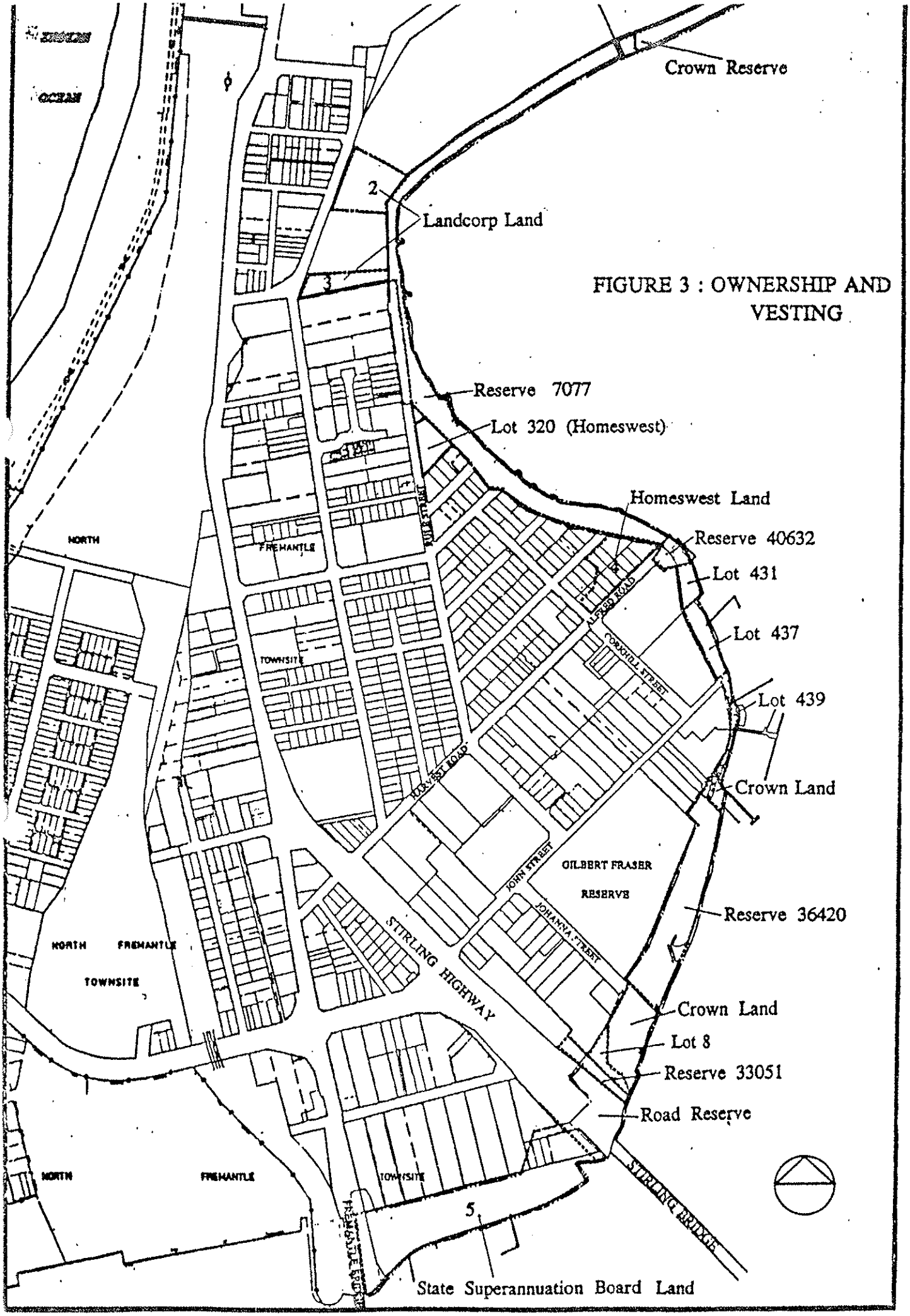


FIGURE 3 : OWNERSHIP AND VESTING

Appendix 7

BIRDS OF THE NORTH FREMANTLE FORESHORE

Species	*Abundance\ Status	Habitats				
		River	Shore	Open	Veg	Suburb
Australian Pelican	C\R	*				
Pied Cormorant	C\R	*	*			
Little Pied Cormorant	VC\R	*	*			
Great Cormorant	UC\R	*				
Little Black Cormorant	C\V	*	*			
White-faced Heron	C\R		*			
Eastern Reef Heron	UC\R		*			
Rufous Night Heron	UC\R		*			
Pacific Black Duck	UC\V	*	*			
Black-shouldered Kite	C\R			*	*	
Australian Kestrel	C\R			*	*	*
Pied Oystercatcher	UC\V		*			
Greenshank	UC\V		*			
Silver Gull	VC\R\V	*	*	*		*
Caspian Tern	C\V	*				
Crested Tern	C\V	*				
Feral Pigeon	VC\\R			*		
Spotted Turtle-Dove	UC\\R				*	*
Laughing Turtle-Dove	VC\\R					*
White-tail Black-Cockatoo	UC\M				*	*
Galah	VC\R			*	*	*
Port Lincoln Ringneck	C\R				*	*
Southern Boobook	R\R			*	*	
Laughing Kookaburra	C\\R				*	*
Sacred Kingfisher	UC\R			*	*	
Rainbow Bee-eater	UC\M			*	*	*
Welcome Swallow	VC\R		*	*	*	*
Tree Martin	C\R		*	*	*	*
Black-faced Cuckoo-shrike	UC\R				*	*
Red Wattlebird	C\R				*	*
Singing Honeyeater	VC\R			*	*	*
Brown Honeyeater	VC\R				*	*
New Holland Honeyeater	C\V				*	*
Mistletoebird	UC\V				*	
Striated Pardalote	UC\R				*	*
Silvereye	C\R\M				*	*
Australian Magpie-lark	C\R			*	*	
Pied Butcherbird	UC\R				*	*
Australian Magpie	VC\R			*	*	*
Australian Raven	VC\R			*	*	*

Appendix 6

MAMMALS OF THE NORTH FREMANTLE FORESHORE
(Terrestrial species only)

Common Name	Scientific Name
Common Brushtail Possum	Trichosurus vulpeca
Domestic Cat	Felis catus
Black Rat	Rattus rattus
House Mouse	Mus musculus
Red Fox	Vulpes vulpes

Appendix 5

REPTILES OF THE NORTH FREMANTLE FORESHORE

Species	Common name
Pseudonaja affinis	Dugite
Pogona minor	Western Bearded Dragon
Diplodactylus spinigerus	Spiny Tailed Gecko
Heteronotia binoei	Bynoe's Gecko
Lialis burtonis	Burton's Legless Lizard
Cryptoblepharus plagiocephalus	Fence Skink
Hemiergis peronii quadrilineata	Yellow bellied Skink
Tliqua rugosa	Bobtail Lizard
Egernia kingii	King Skink
Ctenotus fallens	Striped Skink
Lerista praepedita	Burrowing Skink
Menetia greyii	
Morethia obscura	

Appendix 1

NORTH FREMANTLE FORESHORE PLANT SPECIES LIST

Acacia cyclops	Red Eyed Wattle
Acacia rostillifera	
Acacia xanthina	Summer Scented Wattle
Acacia saligna	
Acanthocarpus preissii	Prickly Lily
Agonis flexuosa	Peppermint
Alyxia buxifolia	Hop Bush
*Anagallis arvensis	Pimpernel
Anthropodium capillipes	
*Artotheca calendula	Cape Weed
*Arundo donax	Giant Reed
*Asphodelus fistulosus	Onion Weed
*Avena barbata	Bearded Oat
*Briza maxima	Blowfly Grass
*Bromus madritensis	Madrid Brome
*Cakile maritima	Sea Rocket
Cassytha racemosa	Dodder Laurel
Cassytha glabella	Tangled Dodder Laurel
Clematis microphylla	Old Man's Beard
*Conyza bonariensis	Fleabane
*Cynodon dacylon	Couch
*Diplotaxis muralis	Wall Rocket
Dodonea aptera	Hop Bush
Dryandra nivea	Couch Honey Pot
Dryandra sessilis	Parrot Bush
Eremophila glabra	Tar Bush
*Euphorbia terracina	Geraldton Carnation Weed
*Foeniculum vulgare	Fennel
*Freesia aff. leichtlinii	Freesia
Grevillea crithmifolia	
Grevillea thelemanniana	Spider Net Grevillea
Guichenotia ledifolia	
Hakea prostrata	Harsh Hakea
Hardenbergia comptoniana	Native Wisteria
*Hedypnois rhagadioloides	Cretan Weed
*Hypochaeris glabra	Smooth Cats ear
Isolepis nodosa	Knotted Club-rush
Juncus kraussii	
Juncus sp.	
*Lagunaria patersonia	Norfolk Island Hibiscus
*Lagurus ovatus	Hare's Tail Grass
Lepidosperma angustatum	
*Leptospermum laevigatum	Coastal Tea Tree
*Lobularia maritima	Sweet Alyssum
*Lolium rigidum	Ryegrass
Loxocarya flexuosa	

Appendix 1

NORTH FREMANTLE FORESHORE PLANT SPECIES LIST

Macrozamia reidlei	Zamia
*Malva parvifloria	Smallflower Mallow
*Medicago polymorpha	Medic
Melaleuca acerosa	
Melaleuca huegelii	Chenille Honey myrtle
Melaleuca lanceolata	Rottnest Island Teatree
*Melilotus indica	King Island Melilot
*Nicotiana glauca	Tree Tabacco
*Oenothera drummondii	Evening Primrose
Opercularia vaginata	
*Orabanche minor	Lesser Broomrape
*Oxalis pes-caprae	Soursop
*Pelargonium capitatum	Rose Pelargonium
*Pennisetum villosum	Feathertop
Petrohagia velutina	
Pimelea leucantha	
Pittosporum phyllyraeoides	Weeping Pittosporum
*Phoenix dactylifera	Date Palm
*Phoenix reclinata	Senegal Date Palm
*Ricinus communis	Caster Oil Bush
*Romulae rosea	Guildford Grass
Sarcocornia quinqueflora	
*Scabiosa atropurpurea	Purple Pincushion
Scaevola crassifolia	Thick leaved fan flower
Scaevola parvifolia	Fan Flower
Scenecio lautus	Coastal Groundsel
Schoenus curvifolius	
*Solanum nigrum	Blackberry Nightshade
*Sonchus asper	Rough Sowthistle
*Sonchus oleraceus	Common Sowthistle
Spinifex hirsutis	
Spyridium globulosum	Basket Bush
*Stenaphrum secundatum	Buffalo Grass
Stipa elegantissima	Feather Spear Grass
Suaeda australis	
Templetonia retusa	Cockies Tongue
*Tetragonia decumbens	Sea Spinach
*Trachyandra divaricata	
Tricoryne elatior	Yellow Autumn Lily
*Ursinia anthemoides	Ursina
Xanthorrhoea preissii	Common Blackboy

* exotic species

5.0 Biological Environment

5.1 Flora and Vegetation

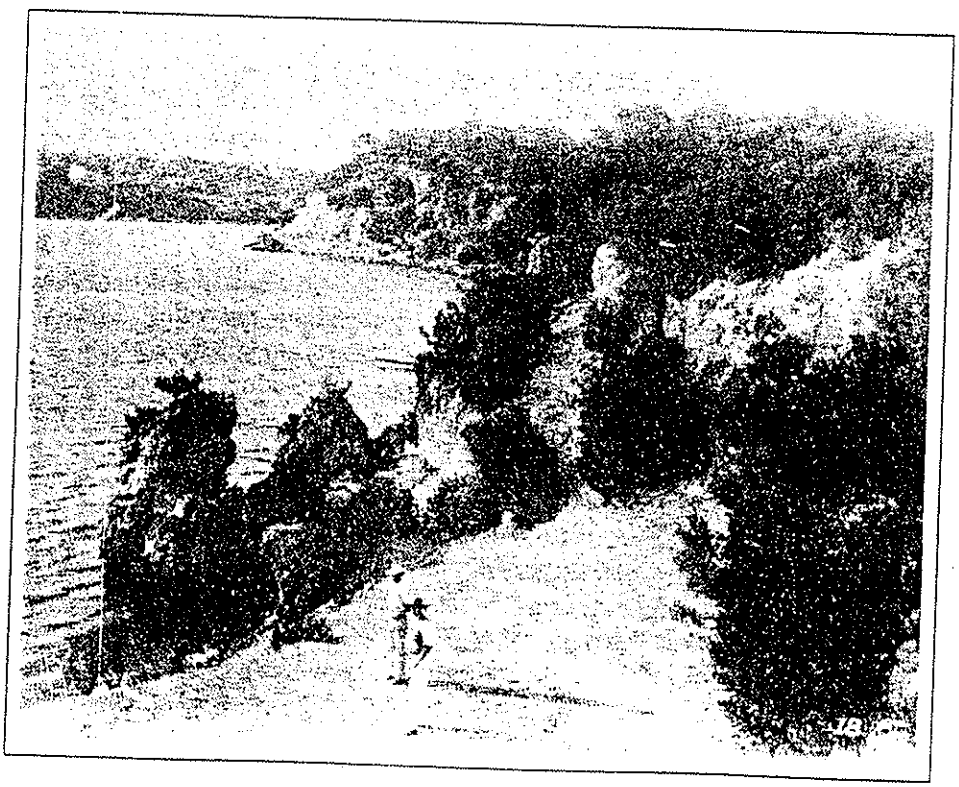
5.1.1. Pre-European vegetation

Although it is difficult to determine the vegetation types found in the study area prior to European settlement some good indications are given from early photographs, anecdotal information, early survey maps of the area and remnants existing today. It is possible to deduce that three community types were found originally along the foreshore. These were related to :

1. the limestone cliffs (low closed-forest community)
2. the beach areas fringing the river (rush community)
3. the alluvial soils found on the low lying areas south of Harvest Road eg Gilbert Fraser Reserve (Tuart forest).

1. The Low Closed-Forest community was found on the cliffs surrounding Rocky Bay and was dominated by the Rottnest Island Pine (*Callitris preissii*) (Seddon, 1972). Testimony to its existence is in the naming of a popular picnic spot at the southern end of Rocky Bay "Cypress Hill". Furthermore, Charles Fraser, the colonial botanist accompanying Captain Stirling's 1827 reconnaissance visit to Fremantle, wrote of the *beautiful species of Calytris or Cypress, of the finest green colour, producing large "warted" cones that studded the hills in this locality* (Seddon, 1972).

Low Closed - Forest community, Rocky Bay. c1890's (Battye Library, B336/18)



5.0 Biological Environment

Other species found in this community would have included the peppermint *(Agonis flexuosa), Acacia xanthina, Phyllanthus calycinus, Spryridium globulosum* and *Eremophila glabra.* The Fremantle Marlock *(Eucalyptus decipiens)* and the Fremantle Mallee *(Eucalyptus foecunda)* may have been found in this area, particularly as specimens are still surviving on the opposite bank of the river in East Fremantle.

Repeated fires and clearing resulted in the degradation of the community. Particularly as the Callitris is not a fire tolerant species. This community type was once common along the banks of the lower Swan and has virtually disappeared today.

2. Fringing the shores rush and samphire communities were found in high abundance. Photographs taken at the turn of the century show extensive rush beds. This community consisted principally of the rush species *Juncus kraussii* and *Isolepis nodosa.* Samphire species such *Sueda australis* would have also been found there. The swamp sheoak, *Casuarina obesa,* would possible have occurred in places along the foreshore.

3. Tall Tuart trees once dominated the low lying areas south of Harvest Road and extended down to the foreshore. Ample photographic evidence exists to support this claim along with anecdotal evidence of species such as the christmas tree, peppermints, banksias and other tree species. Also on an early map of North Fremantle (North Fremantle 19L, 1844) the words "Tuart forest" appear in the area now known as the Anchorage site.

5.1.2 Flora and vegetation today

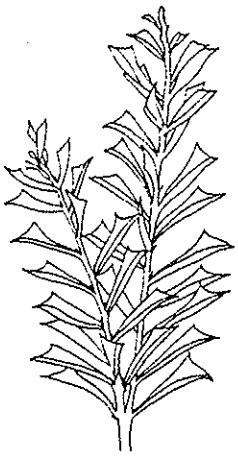
The original vegetation that covered North Fremantle prior to settlement has virtually disappeared. What remains is found on the cliffs of Rocky Bay, parts of the river foreshore and on the sand dunes associated with Port and Leighton Beaches. Hence the remnant natural vegetation is of high local conservation value.

Alluvial Flats (between Fremantle Traffic Bridge and Point Direction)

Fringing the sandy foreshore rush communities consisting of the rush species *Juncus kraussi, Isolepis nodossa* and *Juncus* spp. are found. The most dominant species are the *Juncus kraussii* and the nodding rush *(Isolepis nodosa).* In parts halophytic (salt tolerant) species such as *Sarcocornia quinqueflora* and *Suaeda australis* are found.

Other native species occur in this area but have been planted as part of the Council's efforts to revegetate the foreshore. The Swamp Sheoak *(Casuarina obesa)* fits naturally into the foreshore environment and may have once occurred in these parts. Other species include *Agonis flexuosa, Acacia xanthina, Acacia saligna, Acacia cyclops, Melaleuca cuticularis, Callitris preissii, Eucalyptus gomphocephala, Olearea axillaris* and other Eucalypt species.

5.0 Biological Environment

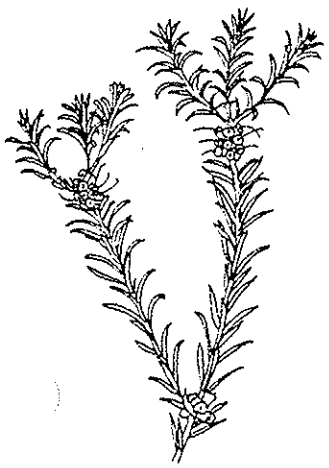


Acacia truncata

Limestone Cliffs (Rocky Bay)

The limestone cliffs support the most diverse flora in North Fremantle even through it has been degraded by fire and weed invasion. Although the cliffs once supported a low closed forest community as previously mentioned, it now contains a community which resembles a typical limestone heathland. Heaths are often referred to as scrub and defined as less than two metres in height with a projected foliage cover of 30-100% (Specht, 1970). In an undisturbed state heath communities are very diverse in species composition. Many of the species growing at Rocky Bay are common to those found in limestone heath communities.

The flora of the cliffs is characterised by the following species *Templetonia retusa* (Cockies Tongue), *Melaleuca acerosa, Alyxia buxifolia, Dryandra sessilis, Acacia rostillifera, Melaleuca heugelii, Acanthocarpus preissii.* The only tree species that was found naturally occurring on the cliffs prior to the Heritage Trail planting in 1988 was a lone peppermint near the main cave. Today more trees are growing as a result of the revegetating programs.



Melaleuca acerosa

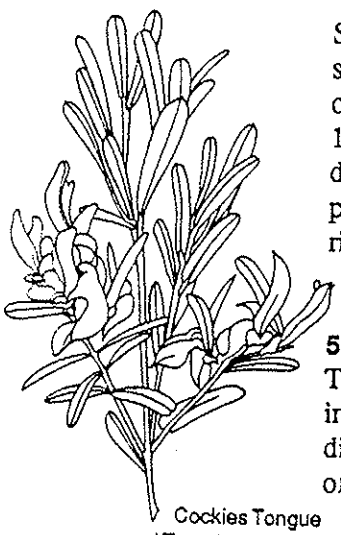
The Cheesewood (*Pittosporum phylliraeoides)* is a species found growing on the cliffs of some regional significance as it is rarely found along the banks of the Swan today. Native grasses (eg. *Stipa elegantissima*) and sedges are found also in the area.

At the base of the cliffs at the waters edge rush species *(Juncus* and *Isolepis* species) are found where suitable substrates exist along with the Swamp Sheoak, *Casuarina obesa.*

Appendix 1 lists of the flora found in the study area.

5.1.3 Species Richness

A total of eighty seven (87) vascular plants have so far been recorded in the study area (Appendix 1). Of these forty five (45) were native and forty two (42) introduced or exotic.



Cockies Tongue
(*Templetonia retusa*)

Species richness is a measure of the number of species in a sample area or quadrat (of standard size). A quadrat size of 10 x 10 metres was used to determine the species richness of the vegetation occurring on Rocky Bay. The average species richness was 21 species/ 100m2 of which 8 species were native and 13 exotic. These figures reflect the level of disturbance that the vegetation has undergone over time. The quadrat data was collected prior to the replanting program associated with the Heritage Trail and today the species richness would generally be higher with a higher percentage of native species.

5.1.4 Introduced Flora

The impact of clearing, grazing, fire, quarrying and rubbish dumping has resulted in the invasion of exotic weeds. Much of the natural environment in North Fremantle has been disturbed. As a consequence many areas are dominated by exotic species. While many of the weed species have a negative effect on the natural biota they do serve to bind the

5.0 Biological Environment

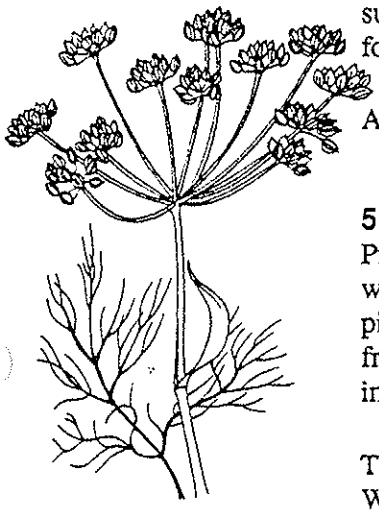
Purple Pincushion
(*Scabiosa atropurpurea*)

surface soil and prevent erosion, although this role should be replaced by native species.

Most of the weeds can be divided into two broad groups: grass weeds and bulbous species. Some of the major grass weeds include Bearded oat (*Avena barbata*), fountain grass (*Pennisetum setaceum*), Lagurus ovatus, couch (*Cynodon dactylon*), buffalo grass (*Stenotaphrum secundatum*), and Kikuyu grass (*Pennisetum clandestinum*).

Bulbous species include *Freesia* affin. *leichtlinii*, *Gladiolus caryophyllaceus*, *Romulae rosea (Guildford Grass)*, *Trachyandra divaricata* and *Asphodelus fistulosus*.

Other weed species which dominate the study area include small shrubs and taller woody species. Fennel (*Foeniculum vulgare*), Castor Oil Bush (*Ricinus communis*), Pelagonium (*Pelargonium capitatum*), Evening Primrose (*Oenothera drummondii*) and *Nicotiana glauca* (Tree tobacco) are the most dominant. One of the most attractive weeds found in the study area is the Purple Pincushion (*Scabiosa atropurpurea*). During summer its variety and abundance of attractive flowers results in it being often mistaken for a native.



Fennel
(*Foeniculum vulgare*)

A list of exotic species is shown in Appendix 1.

5.2 Fauna

Prior to European settlement the North Fremantle/Mosman Park area was once teeming with wildlife. This included kangaroos, wild turkeys, large bronzewing pigeons, blue pigeons, wild duck, the rabbit eared bandicoot and the brush wallaby which were frequently seen during the early settlement days. Many other mammal, bird, reptile and insect species would have also been common to the area habitats (Downey, 1971).

The distribution and abundance of native fauna is closely related to wildlife habitat areas. Within the study area the vast majority of these habitats have been lost and replaced by urban development which has resulted in a severe reduction in native species. A combination of existing remnant vegetation, urban gardens and public parks has engendered the survival of a number of animal species. Increased planting of suitable plant species throughout the suburb will help to increase the general fauna diversity of the area.

The following section deals with the main terrestrial vertebrate groups.

Amphibians.

No native amphibians have been recorded from the study area, however one frog *Limnodynastes dorsalis*, the Banjo Frog has been reported from an area of similar habitat at Buckland Hill. The lack of surface fresh water for breeding will prevent frogs from living within the study area.

5.0 Biological Environment

Reptiles.

The reptile fauna of the study area is relatively diverse with a total of 13 species being reported to date (Appendix 5). The most common species are those which are able to exist in urban gardens or vacant land, these include the smaller skinks and geckos. Some of the larger species such as the Bobtail, King skink and Dugite are confined to rocky areas or natural heathlands were protective vegetation cover is available. Bobtail lizards are frequently seen on foot tracks and cycle ways. Other native species such as Burton's Legless Lizard, the Bearded Dragon and Stripped Skink are relatively rare and confined to areas with suitable ground cover and leaf litter. Introduced predators such as cats and the Laughing Kookaburra predate many of the reptiles found in North Fremantle and contribute to their scarcity in the area.

Mammals

Only one native mammal, the Brushtail Possum has been found in the area in recent years (A. Forma pers. comm.). The Common Brushtail Possum is perhaps the only native species which has been able to adapt to urban areas. They require large established trees for food and shelter. The presence of the native Water Rat (*Hydromys chrysogaster*) and an unidentified species of native bat has been reported however no positive identifications have been made. Introduced mammals include foxes, cats, rats and mice (Appendix 6).

Birds

A total of 36 native and 4 introduced species have been recorded in the study area (Appendix 7). Eleven of these species are associated with the estuarine habitats along the foreshore. The W.A. Naturalists Club survey of the Rocky Bay area in 1985 found the following species: Australian Pelican, Cormorant, Pied Cormorant, Little Black Cormorant, Little Pied Cormorant, Eastern Reef Heron, Greenshank, Silver Gull, Caspian Tern, White Faced Heron, Pied Oystercatcher and the Black Duck. Occasionally large flocks of the Little Black Cormorant can be seen feeding on fish in the area. They are usually accompanied by an equal number of seagulls, together they fly as far as the Stirling Bridge and then return up river (D.Kaesehagen, personal observation).

Common terrestrial species include the Singing Honeyeater, Australian Magpie, Australian Raven, Welcome Swallow and the Laughing Turtle-Dove. Some uncommon species include the Sacred Kingfisher, Striated Pardalote and Pied Butcherbird. The Rainbow Bee-eater use the embankment areas (former State Engineering Works site) for nesting areas during the summer.

The study area is important as a wildlife corridor and habitat area for both terrestrial and aquatic birds. The diversity of species that has been recorded within the study area is large considering the habitats available. This diversity may be due in part to nomadic and/or migratory species passing through the area.

5.0 Biological Environment

Little Pied Cormorant

5.3 Swan River

The river is an integral part of the study area in terms of its aesthetic, biological, recreation, and commercial value. This part of the river is known as the lower estuary (Blackwell Reach to Fremantle Harbour) it contains a deep channel with shallow sand flats and sills occurring along the margins of the river and in the central part of Rocky Bay.

Aquatic macrophytes, in particular the seagrasses are vital for providing habitats for juvenile fish. The seagrass species *Halophila ovalis* is widely distributed in the Swan River estuary (Thurlow et. al. 1986). Shallow waters contain some of the most productive seagrass meadows. These are located between the Fremantle Traffic Bridge and Pier 21 and towards the centre of Rocky Bay. These were identified in the Swan River Management Strategy (1988) as areas of high value as fish nursery grounds.

A diverse range of invertebrate and vertebrate fauna inhabit the Swan River. The invertebrates include crustaceans, molluscs, annelids, coelenterates, echinoderms, foraminiferans, platyhelminths and bryozoans. The benthic faunal species occur in high densities in the seagrass meadows contained in the study area (LeProvost, Seminiuk and Chalmer, 1987). Invertebrate species of notable commercial value also occur in the study area these include; the Western King Prawn (*Penaeus latisulcatus*), the river prawn (*Metapenaeus dalli*) and the Blue Manna Crab (*Portunus pelagicus*). Their importance and abundance in the study area is reflected in the naming of two bays by the early settlers: Prawn Bay and Crab Bay. According to Thurlow et. al. (1986) most invertebrate species are of marine affinity and hence species diversity is highest in the lower reaches of the Swan.

The Swan estuary supports a diverse range of fish species which is related to sheltered and food rich waters. A total of 122 fish species from 62 families have been recorded in the river (Thurlow et. al., 1986). Many of the fish use the estuary as a nursery ground or adult feeding ground, but spend the majority of their life cycle in the ocean (LeProvost, Seminiuk and Chalmer, 1987). The productivity of the lower Swan is reflected in the anecdotal information of early settlers and therefore must have been an important resource for both the Aboriginal population and Europeans. Thomas Briggs writing in the late 19th century said :

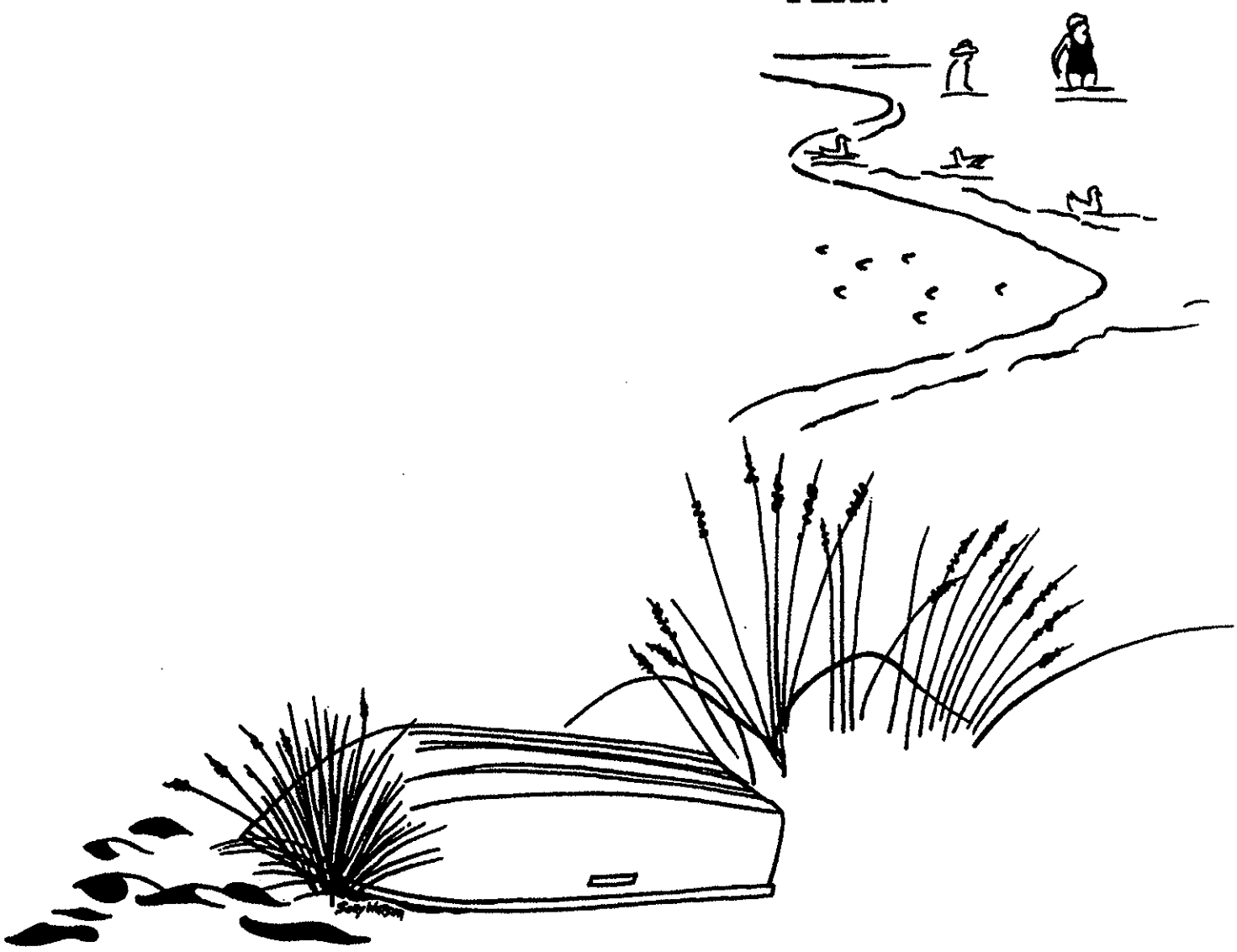
5.0 Biological Environment

> *the river was alive with fish, crabs and prawns, flounder, flathead, kingfish, schnapper, skipjack, mullet, tailer and many other varieties* (Downey, 1971).

Some North Fremantle residents recall the times when they could virtually live off the river. H. Bidders remembers the time when they use to throw sticks of gelignite into schools of mullet resulting in not only stunning and killing the fish but the vibrations from the explosion attracting sharks up to 4 metres in length (H. Bidders, pers.comm.)

Marine mammals are regularly sighted in the study area. Dolphins are often seen playing and feeding in Rocky Bay, good vantage points for such sights are offered by the cliffs around Rocky Bay. A seal was recently seen on the beach in front of Gilbert Fraser Reserve (S.Woollett, pers. comm.).

NORTH FREMANTLE FORESHORE MANAGEMENT PLAN



NORTH FREMANTLE FORESHORE MANAGEMENT PLAN

Prepared for
City of Fremantle

by

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Acknowledgments

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- Justin Crawford
- Carolyn James-Bailey
- Councillor Ann Forma
- Councillor Doug Thompson
- Tom Roberts
- John Walker
- Carol Stokes
- Tony Baird (City of Fremantle)
- Illustrations and Layout Design by Sally Watson

Summary and Recommendations

The North Fremantle river foreshore extends from the Fremantle Bridge to the municipal boundary with Mosman Park. On the southern extremities of North Fremantle the topography is low gradually rising to a limestone ridge east of Stirling Highway through to the river foreshore. The foreshore contains sandy beaches and limestone cliffs (Rocky Bay). Natural vegetation is found throughout the foreshore and consists of rush communities and a remnant of the Low-Closed forest which once dominated Rocky Bay.

The foreshore has inherent Aboriginal and European cultural values. Its river setting and topographic variety has resulted in it being a focus for passive recreation activities.

While much of the vegetation has been degraded over time it still represents an important resource of high local conservation value, particularly as much of the natural vegetation in the North Fremantle area has been destroyed through urbanisation. Through appropriate programs of assisted natural regeneration (bush regeneration) the integrity and biodiversity of the foreshore can be increased.

In order to upgrade the ecological integrity of the foreshore environment and provide for passive recreation requirements of the community a management plan was commissioned by the City of Fremantle. The resulting management plan addresses all the major environmental issues and advocates strategies for regenerating the natural vegetation and protecting the inherent value of the landscape with community involvement.

Recommendation 1
Section 9 - Fire Control
A total fire ban for a period of 15 years should be established.

Recommendation 2
Section 9 - Fire Control
A system of fire breaks be established to ensure the protection of adjoining property. Fire breaks should be designed and constructed in empathy with the environments aesthetic and ecological values.

Recommendation 3
Section 10 - Weed Control
A works program be implemented to control major weed species.

Recommendation 4
Section 11 - Ecological Restoration
A program of ecological restoration be implemented using bush regeneration principles. This program should include training of local volunteers in bush regeneration techniques.

Summary & Recommendations

Recommendation 5
Section - 12 Monitoring Program

A monitoring and research program be implemented by Council. Specific areas which require attention include:

a. Increasing the resource inventory on the biotic and physical elements found along the foreshore.
b. Weed invasion and effectiveness of control methods
c. Vandalism
d. Monitoring quadrats.
e. User impact and user requirements.
f. Fire risk.
g. Public safety.
h. Water quality
i. Effectiveness of management strategies.

Recommendation 6
Section 13 - Access & Trails

a. A system of integrated trails as shown on the Concept Plan should be developed.
b. In steep areas which are subject to erosion hard surface paths and steps will be required. These should be constructed with materials which harmonise with the surrounding environment in terms of texture, form, scale and colour.
c. Where required appropriate hand rails should be provided particularly to assist the elderly. These should be built out of appropriate materials.
d. All unwanted paths should be closed off and revegetated with appropriate thorny and quick growing local plant species.
e. Sign posts emphasising access through built areas such as Pier 21 should be erected to assist public access.
f. A dual use path should not be extended along the natural foreshore in front of Gilbert Fraser Reserve or the along the cliff top between the end of Rule Street (north) and Harvey Beach.

Recommendation 7
Section 14 - Public Interpretation

An interpretative program be developed and the following aspects considered
a. Signage, including appropriately scaled and located display boards.
b. A brochure on the biophysical and historic attributes of the foreshore be developed.

Recommendation 8
Section 15 - General Management Authority

A Friends group be established for the North Fremantle foreshore. A coordinating committee be established consisting of 1 Councillor, 2 Council Officers and four members of the Friends group to oversee the implementation of the management plan and any other issues which affect the conservation and recreation values of the foreshore.

Summary & Recommendations

Recommendation 9
Part C - Concept Plan
The vacant crown land contiguous with Reserve 36420 should be incorporated into Reserve 36420 and this reserve be reclassified to an A Class reserve.

Recommendation 10
Part C - Concept Plan
The current zoning of Special Use in the study area between the end of Johanna Street and Stirling Bridge, as shown on the Metropolitan Region Scheme and the City of Fremantle's Town Planning Scheme No.3, be amended to "Parks and Recreation".

Recommendation 11
Part C - Concept Plan
The current MRS zoning on the foreshore area of the Anchorage site be amended to "Parks and Recreation" as shown on the Concept Plan (Figure 14).

Recommendation 12
Part C - Concept Plan
The City of Fremantle develop the North Fremantle river foreshore along the lines shown in the Concept Plan to maximise the conservation and passive recreation value of the foreshore.

Recommendation 13
Part C - Concept Plan
The design of all park furniture, paths, signs and other embellishments to be constructed of suitable materials of sympathetic form, scale, colour and texture to harmonise with the existing environment.

1.0 Introduction

The North Fremantle river foreshore has intrinsic biological, historical and recreational value. For example, it contains important native vegetation which in turn supports many animal species. It has considerable landscape appeal including sandy beaches and elevated limestone cliffs which offer panoramic views of the river and ocean.

Before the arrival of European settlers in 1829 North Fremantle formed part of an important Aboriginal area used primarily during the summer months. Following settlement the foreshore continued to provide a focus for the community in terms of recreation and commerce. Many changes to the foreshore have taken place as a consequence of European settlement and include quarrying, reclamation and the removal of native vegetation.

Despite changes to the foreshore environment it has been historically a highly valued resource of the local and more regional community.

In 1987 the City of Fremantle developed a foreshore's policy to guide the development of the area. This policy was developed in conjunction with the Department of Planning and Urban Development and was endorsed by the State Government's Swan River Management Strategy (1988).

In 1990 State Cabinet gave in-principle support for a Regional Park system to be developed in the Leighton Peninsula area. This proposal was put forward by the Leighton Peninsula Planning Study Group which was established by the Department of Planning and Urban development in 1989 and had representatives from the City of Fremantle, Town of Mosman Park and community representatives from Fremantle and Mosman Park. The North Fremantle river foreshore forms an integral part of the proposed Regional Park.

The City of Fremantle has a longstanding commitment to managing its natural areas. This has resulted in management plans being prepared for two of its three existing natural reserves. The commissioning of this report means that all of the City's natural areas have management plans for them.

The objectives of the study were:

a. Assess the various elements that comprise the landscape :- the natural and man-made, the visual and functional, with the view to adopting a balanced approach in the management of the foreshore. In particular the protection, conservation and enhancement of those aspects that are natural as well as providing for public enjoyment and recreation use.

1.0 Introduction

b. Undertake an assessment of the biophysical nature of the reserves including:
   i) geology and geomorphology
   ii) vegetation and flora
   iii) fauna
   iv) soils
   v) the relationship of the reserves to the Swan River estuary.
c. Assess the effects of disturbance to the natural environment in particular:
   i) types of disturbance
   ii) the level of disturbance
   iii) invasion of exotic species
   iv) the effects of fire and a fire history of the reserves.
d. Investigate the cultural and historical significance of the foreshore:
   i) Aboriginal
   ii) European
e. Determine existing recreational use of the reserves. Assess impacts of these recreational activities on the natural environment.
f. Determine public access to the reserves and access through the reserves.
g. Guide the public in using the foreshore to maximise public enjoyment and education while minimising disruption to any environmentally sensitive areas.
h. Assess the impact of weed species on the native biota and examine their control.
i. Prepare an outline of a bush regeneration program for use by the community including revegetation of those areas denuded of native vegetation.
j. Prepare a fire management plan.
k. Prepare a Concept Plan for the integration of recreation and conservation for the reserves.

PART A : THE FORESHORE ENVIRONMENT

2.0 Study Area

2.1 Location

The study area is located on the river margin of the Leighton Peninsula in the suburb of North Fremantle (Figure 1). It includes the foreshore extending from the Fremantle Traffic Bridge to Fremantle's municipal boundary with the Town of Mosman Park. Two distinct landscape elements are found in the study area; firstly the low-lying sandy foreshore found between the Fremantle Traffic Bridge and the end of Harvest Road (Water Police Headquarters) and secondly, the elevated limestone cliffs which make up Rocky Bay.

The foreshore has also been divided into primary and secondary study areas. The study will focus upon the primary study area, however reasonable attention will be given to the secondary area. The main criterion for the separation of the study area is in terms of the uncertainty of future land use and development options for the secondary study area, particularly the Anchorage site and Cypress Hill. However secondary areas are integral to both the conservation and recreational values of the entire foreshore.

2.2 Zoning and Tenure

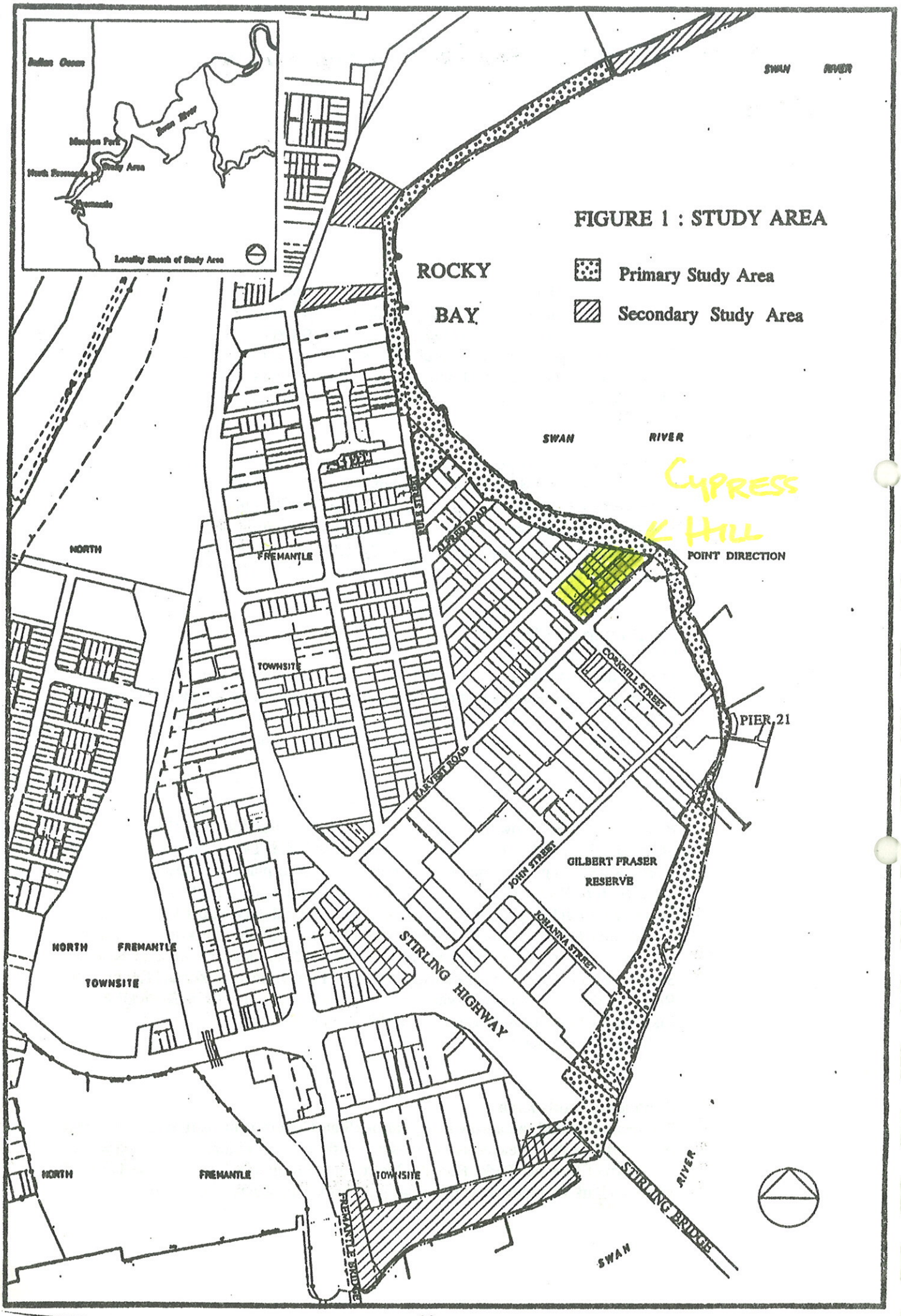
Primary Study Area

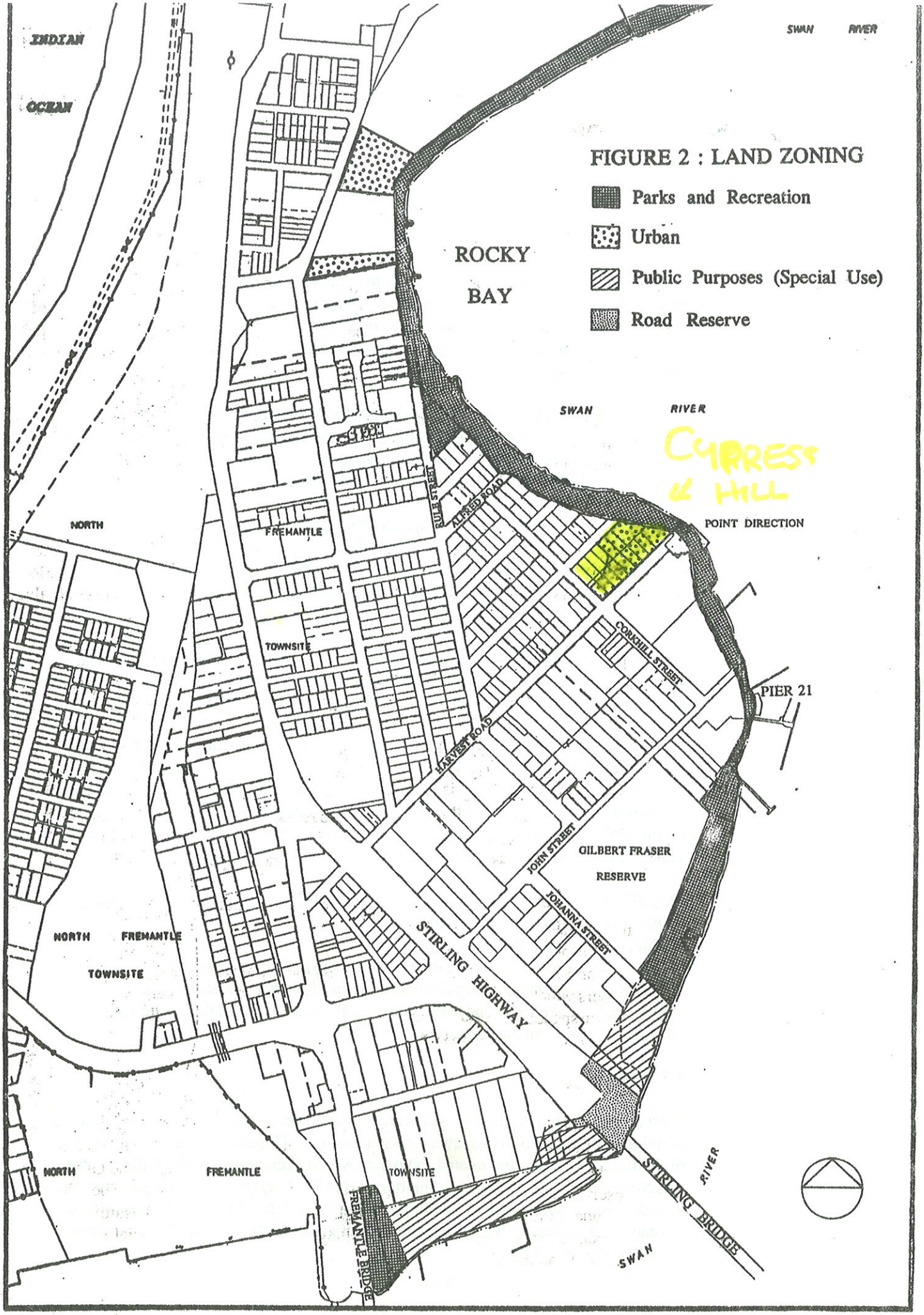
Most of the land in this area is zoned 'Parks and Recreation' under the Metropolitan Region Scheme (MRS) apart from an area between Johanna Street and the Stirling Bridge which is zoned 'Public Purposes' and 'Road Reserve' (Figure 2). The City of Fremantle Town Planning Scheme No. 3 reflects this zoning of the land.

Ownership varies but most of the land is crown land vested with the City of Fremantle (Figure 3). Reserve 7077 is an A class reserve vested with the City of Fremantle for Recreation. Lot 320 is owned by Homeswest in freehold title. Although Homeswest has offered the land to the Department of Planning and Urban Development so that it can be set aside as regional reserve no purchase has taken place yet. Reserve 40632 is reserved for "Water Police Facility". Lot 431 is crowned land leased to Clough Superannuation Pty. Ltd. for the purpose of "Marine Industry"; Lots 437 and 439 are crown land leased to Corkhill Nominees Pty. Ltd. for the purposes of "Marine Industry". The area between lot 439 and reserve 36420 is vacant crown land. Reserve 36420 is a C class reserve vested with the City of Fremantle for Parks and Recreation. Reserve 33051 is a C class reserve vested with the City of Fremantle for Recreation. Lot 8 is owned in freehold by the Department of Planning and Urban Development and leased to the City of Fremantle.

Secondary Study Area

The secondary study area is owned by various State Government instrumentalities. The most north-western area located in Mosman Park (Area 1 - Figure 3) is located within the Town of Mosman Park. Both the Metropolitan Region Scheme and the Town of Mosman Park Planning Scheme shows it as 'Parks and Recreation Reserve'.


Indian Ocean
Swan River
Locality Sketch of Study Area
SWAN RIVER
FIGURE 1 : STUDY AREA
ROCKY BAY
Primary Study Area
Secondary Study Area
SWAN RIVER
Cypress Hill
POINT DIRECTION
NORTH FREMANTLE
TOWNSITE
ALFRED ROAD
CORKHILL STREET
PIER 21
HARVEST ROAD
JOHN STREET
GILBERT FRASER RESERVE
JOHANNA STREET
STIRLING HIGHWAY
NORTH FREMANTLE TOWNSITE
NORTH FREMANTLE
TOWNSITE
FREMANTLE BRIDGE
STIRLING BRIDGE
SWAN RIVER


INDIAN
OCEAN
SWAN RIVER
FIGURE 2 : LAND ZONING
Parks and Recreation
Urban
Public Purposes (Special Use)
Road Reserve
ROCKY
BAY
SWAN RIVER
CYPRESS HILL
POINT DIRECTION
NORTH
FREMANTLE
TOWNSITE
RULE STREET
ALFRED ROAD
CORNHILL STREET
PIER 21
HARVEST ROAD
JOHN STREET
GILBERT FRASER
RESERVE
JOHANNA STREET
STIRLING HIGHWAY
NORTH FREMANTLE
TOWNSITE
NORTH
FREMANTLE
TOWNSITE
FREMANTLE BRIDGE
STIRLING BRIDGE
SWAN RIVER

2.0 Study Area

Areas 2 and 3 (Figure 3) is zoned under the MRS as 'Urban' and under the City of Fremantle Town Planning Scheme No. 3 as 'Development Zone'. On completion of the development of the former State Engineering Works (SEW) site, it can be assumed that the present 'Development ' zoning under the Local Scheme will be replaced 'Local Reserve, Open Space'.

Both areas 2 and 3 are included in Stage 1 of the SEW development, for which site works are now underway; in due course both areas would be taken over by Council; area 2 being intended to function mainly as a local open space to serve the immediate area, and area 3 as a key part of the developing east-west link between the river and the ocean.

Area 4 (Figure 3) is currently zoned under the MRS as 'Urban' and under the Local Scheme as 'Residential, R40'. This land is current owned by Homeswest. The possibility of a land-swap between Homeswest and the Fremantle City Council to ensure the long-term future of the Heritage Trail and its setting has been discussed; relevant land values/ development potentials are currently being determined.

If this comes to fruition, that portion taken over by the Council would presumably be given a 'reserve' designation, either a Local Scheme reserve, or more likely an MRS 'Parks and Recreation' classification in the line with the rest of the North Fremantle foreshore.

Area 5 (Figure 3) is part of the 'Anchorage Site' which is zoned under the MRS as 'Public Purposes, Special Use' for most of the area except the far western section alongside the Fremantle Bridge which is zoned 'Parks and Recreation'. It also includes a section on the western abutment of the Stirling Bridge zoned as 'Road Reserve'. Under the City of Fremantle's Town Planning Scheme No.3 the entire area is zoned 'Development Zone'. This section of the study area is owned by the State Superannuation Board.

Regardless of the eventual process of development Council's minimum expectations/ requirements could be summarised as:

- Public access to the foreshore.
- A continuous pedestrian/cycle link across the site at water's edge.
- Users which have some rational relationship to a foreshore location.
- Open space at the eastern end of the area to establish a link under the bridge and protect the existing beach in that area.

2.3 Land Use

Most of the foreshore is used for parks and recreation purposes and contains a mixture of indigenous vegetation and lawns and grassed areas (Figure 4). The other major use of the foreshore is marine related industries which occur between the Gilbert Fraser reserve and the Water Police Headquarters and at the Anchorage site. These industries include marinas, slipways, boat building and maintenance facilities, leisure industries and a restaurant. Land use surrounding the study area is essentially residential except for small areas of commercial use.

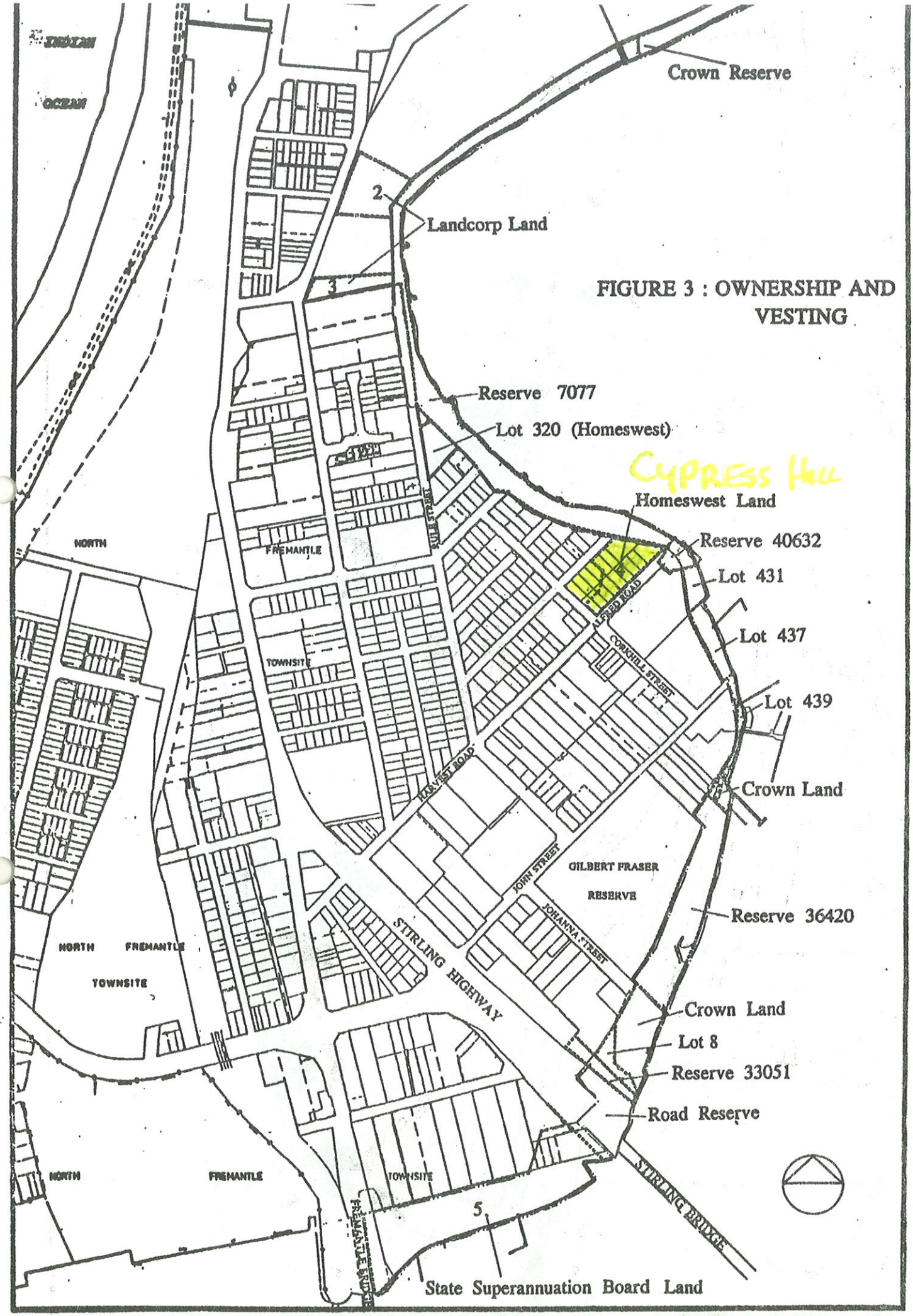
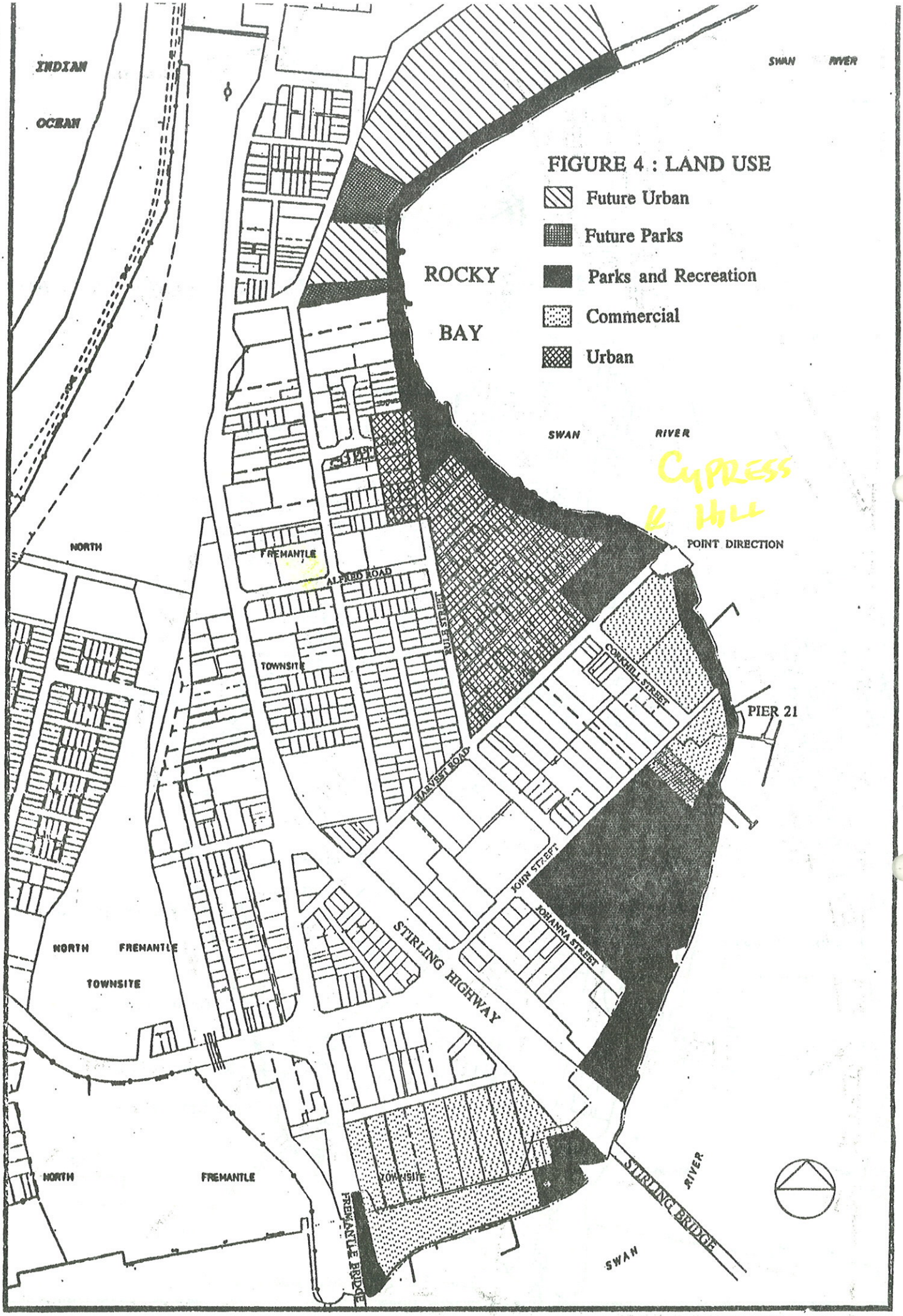


FIGURE 3 : OWNERSHIP AND VESTING


INDIAN
OCEAN
SWAN RIVER
FIGURE 4 : LAND USE
Future Urban
Future Parks
Parks and Recreation
Commercial
Urban
ROCKY
BAY
SWAN RIVER
CYPRESS
HILL
POINT DIRECTION
NORTH
FREMANTLE
ALFRED ROAD
TOWNSITE
ROTE STREET
CORKHILL STREET
PIER 21
HARVEST ROAD
JOHN STREET
JOHANNA STREET
STIRLING HIGHWAY
NORTH FREMANTLE
TOWNSITE
NORTH
FREMANTLE
TOWNSITE
FREMANTLE BRIDGE
STIRLING BRIDGE
SWAN RIVER

3.0 Cultural Environment

3.1 Aboriginal

The Aborigines of the South West of W.A. are commonly referred to as belonging to a single group called the Nyungar. Similarities in language and the absence of male circumcision in manhood ceremonies are the major factors that distinguish the Nyungar from groups further east.

Smaller sub-groups were associated with a specific area. They were not restricted solely to it but covered large areas with little permanency of habitation. However, patches of edible roots and other plant staples as well as seasonal abundance of certain foods brought groups back to the same places regularly, often for extended periods. White settlement interrupted these patterns of food gathering. Aboriginals could not understand why they no longer had access to their traditional food gathering areas. Friction with white settlers was also caused by the traditional 'firing of the land'.

At settlement, the study area was part of 'Mooro' the district of the chief Yellagonga, sometimes spelt Yellowgonga or Yallagonga. His area was bounded by the sea on the west, by Melville water and the Swan on the south: by Ellen's Brook on the east and by the Moore River (Gyngoorda) to the north.

The length of Aboriginal occupation of South West Australia has been estimated to be at least 40,000 years or more. Archaeologists date Devil's Lair near Augusta as at least 29,000 years old and a Swan Valley site yielded an age of 38,000 years.

Over 10,000 years ago Aboriginal hunters left tools made from small chips of quartz and chert at Minim Cove in Mosman Park (Clarke and Dortch, 1977). They were discovered in a 1975 dig at the municipal tip at Minim Cove. Carbon dating of the materials from the site suggest they are at least 10,000 years old. Archaeologists conclude that at the time these deposits were laid down, the Minim Cove site was situated on a high limestone ridge overlooking a deep gorge of the Swan River; and that the coastal plain extended westward some ten to thirty kilometres from the present shoreline.

Nyungar Aborigines used the North Fremantle area mainly during the summer months when the low river allowed easy crossing and fish were plentiful. The dryness of the surrounding bush allowed easy firing for small game and Macrozamia palms fruited during the summer months (Robinson, 1989).

Fish from the Swan River and adjacent coast were important resources in the summer coastal camps. Fishing could be an individual activity or involve groups of women and children driving schools of mullet into sheltered bays where they were speared by the men. They sometimes used bonfires to attract the fish and James Stirling witnessed night fishing by torch light. He testified that their skill in spearing fish is truly wonderful.

Mary-Ann Friend of Preston Point records in her 1830 diary the Aboriginal fishing party who discarded their catch when frightened away by gunfire. Left behind was a catch of

about a bushel of fish, each fish was cleaned and carefully wrapped up in a piece of the bark of a tree and tightly bandaged.

Hammond (1933) wrote that North Fremantle was among the places where traditional Aboriginals *would visit their place of birth and stay as long as food conditions would allow them to do so.* Tracks and pads connected various localities and campsites. One such pad led from Perth along the north shore of the river to North Fremantle where a shallow ford allowed the river to be crossed. The Aboriginals did not swim. This pad led to Bibra Lake and eventually through Mandurah, Pinjarra, and Busselton to Albany. How far individuals and groups travelled along these pads is unknown (Hammond,1933).

It is thought that Aborigines crossed the river at Ferry Point, which ran out into the river where the Fremantle Railway Station is now. The rocky bar at the river mouth and shallows near Stirling Bridge were two other sites speculated as crossing points. However the former was swept by swell and the latter was too deep in parts (Old Shoreline Heritage Trail, Fremantle - Manjaree Track, 1988).

According to Charles Dortch (Curator of Archaeology, W.A. Museum, and local resident) in a letter to the North Fremantle Heritage Trail Committee in 1987,

> *The part of North Fremantle of most value to Aboriginal hunter-gathers would have been the river foreshore extending from the present harbour around to Point Direction (ie. the northeast end of Harvest Road), and the low-lying ground in the vicinity of the football oval, the Stirling Bridge abutment and the Anchorage development site, and extending northward to the higher ground beginning about the Great Southern Rolling Mill site. Some of this zone was undoubtedly freshwater swamp or wetland, and was probably a food-source of considerable importance to Aborigines, who are most likely to have camped on the higher ground immediately to the east (ie. the west-facing hillside bounded by Thompson Road) and the south-east side of this elevated ground, bounded by John Street. It seem unlikely that most other parts of North Fremantle, ie. the more exposed or high ground around the Ford plant and the state engineering works, the marshalling yards and tank farm areas behind Port and Leighton beaches, and the west end of Tydeman Road were used as much by the Aborigines.*

In 1987 Mr Ken Colbung (Chairperson of the Nyungar Community) met the North Fremantle Heritage Trail Committee. At that meeting he told that committee what he knew about the area. Mr Colbung explained he was not the custodian for Rocky Bay. Therefore we would have to consult with Corrie Bodney, the custodian for this area, and some other elders for further information. Mr Colbung did say that the site around the old traffic bridge is where the spirit dingoes, known as Doodaroo, live and there is a special corroboree for this story. Garungup is the name of the cave in front of the Soap Factory at Rocky Bay. This is where the Rainbow Snake slept after the great flood flooded all the land between Wadjimup (Rottnest) and the coast. He explained how you can see where the

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Rainbow Snake curled around the central pillar of the cave. All the land around Rocky Bay and Buckland Hill is the dreaming place of the Rainbow Snake. Minim Cove was corroboree ground. There were many water holes and springs along the river, including one just East of the new traffic bridge, one at Minim Cove and another opposite Point Brown.

According to the information held by the Department of Aboriginal Sites the 2 or 3 caves at Rocky Bay, also called Garungup, are the final resting place of the rainbow-snake before he made the tunnel underneath out to the Indian Ocean. The spirit of an Aboriginal person goes to rest at Garangup before going out under the sea. The snake slept at Garangup after he'd created the local hills 'Seven Sisters'. Before that he made the Avon River, got sunburnt and constipated (the stones/artefacts at Walyunga represent his hard-baked excreta, "guna") and he had to shake off his skin with its orange spots.

3.2 European

Before the major residential grants in North Fremantle in the 1850s, there were just a few isolated farms. Communication was difficult until the Fremantle road bridge opened in 1866.

Settlement of North Fremantle dated from the introduction of convict labour in 1850. Land was granted free to the Pensioner Guards who were ex-servicemen brought over with the convicts as military guards during the voyage. The Pensioner Guards took thirty-five lots west of the Stirling Bridge and south of John Street on either side of Queen Victoria Street. Unfortunately, all trace of the original settlement has been lost. West of Queen Victoria street the area was cleared in the 1960's for the container terminal and on the 'Anchorage' site, industry and road works have replaced the early development.

A horse ferry operated on the river west of the wooden Fremantle traffic bridge. The circular limestone structure which formed the base of a capstan for pulling boats between the shores remains today on the south side next to the bridge.

In 1852 Colonel John Bruce, a Staff Officer of the Pensioner Guards was granted 20 acres to the east of the Pensioner guards' allotments. It was titled Swan Location 130. In October 1857 Colonel Bruce was granted another piece of land to the East of Swan Location 130 known as North Fremantle Suburban Lot number 25.

North Fremantle Suburban Lot No. 25 included the present day foreshore from the Gilbert Fraser Reserve around past Pier 21 to the Water Police Headquarters at Point Direction.

The foreshore between Pier 21 and Point Direction had an interesting boat building tradition between the turn of the century and the 1980s. Cargo barges for the river trade

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from the Port to Perth and back were moored and repaired until World War II on the site of the present Clough Engineering. They unloaded cargo from ships in the harbour then travelled up river tethered together in twos or threes. There were also piles in Rocky Bay near the Burford's Soap Factory where they could be moored. The river commerce in goods lasted from 1829 to 1939 when road and rail competition finally brought river trade to an end (Catomore, 1986). It was the end of the era when the Swan River was the transport artery for the colony.

Places of special significance

Harvest Road beach and jetty

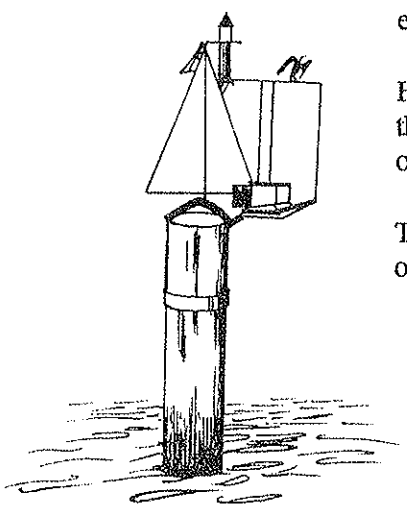
The historic importance of the beach and the jetty are well documented. Generations of North Fremantle children learned to swim here at their beach called 'Harvey'. The jetty on which the Water Police Headquarters is built was a public jetty, in the early days important in the recreational life of the town.

> *There is also a jetty on the river end of Harvest Road just below Rocky Bay and improvements are being made there to enable any river steamer to come alongside, and to land or take up passengers, and this will prove a great boon during the summer months* (The Morning Herald (supplement), 1907).

Each year the North Fremantle Council would treat the schoolchildren to a ferry trip to the South Perth Zoo. The ferry would pull alongside the Harvest road jetty as this school record from 1936 shows.

> *The 17th December 1936 was the day of the school picnic to the zoo. Children were transported by boat from the Harvest Road jetty* (North Fremantle School Magazine, Centenary edition, 1986).

Daredevils used to race their bicycles recklessly down the hill and sail directly off the end of the jetty into the river, bicycle and all (Roy Welsh 1991, pers. comm.).

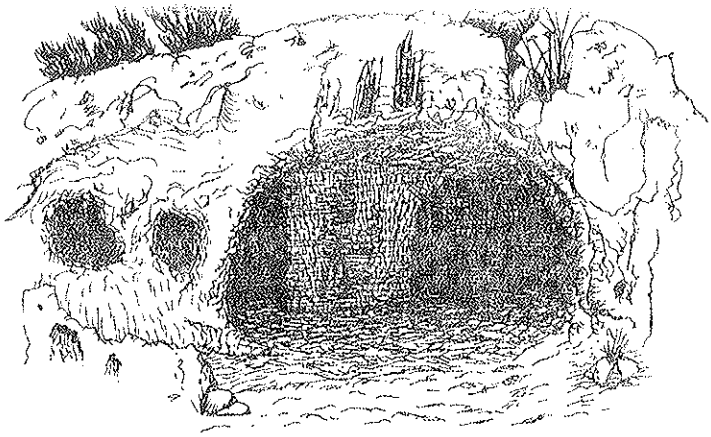


Harvest Road beach is just as popular today although daredevils have to content themselves with a daring jump from the Water Police jetty when there is a tolerant officer on duty.

There was considerable boating traffic back and forth between Harvest Road and the other side of the river.

> *On the weekend we would all go down to Harvest Road. Where Leeuwin is now, that was just a big green paddock. We would take our tents with us and spend the weekend over on the Leeuwin. We used to think that was beautiful. There were big trees all the way down and we all used to go over in a row boat* (Mr and Mrs Cooper, Centenary magazine, 1986).

3.0 Cultural Environment



Cypress Hill

The cliff top area above Harvest Road beach, known as Cypress Hill, is the highest point in North Fremantle. With its panoramic views it was always a popular picnic spot and together with Buckland Hill it had the best vistas in the area.

> *Cypress Hill, so named from the growth of native cypress, is another popular resort, and from this also a good view may be obtained* (The Morning Herald, 1907).

The view takes in the meandering of the river from the C.S.R. factory, via Minim Cove, Preston Point, and Rocky Bay to the harbour and sea. The hill was once higher than today. During World War II anti- aircraft guns were installed on the hill, presumably dug into the flat circular clearing on top of the hill. This is a good vantage point to view the narrow neck between Rocky Bay and the sea.

Cypress Hill was also the site of the annual bonfire.

> *On top of the hill above Harvest Road, we used to have a bonfire for Guy Fawkes night. That was bonfire Hill. You' d see the children up there after school and they would all be getting bits of wood and making their big bonfire. And then on bonfire night they would all be up there, that' s if someone hadn' t come from another suburb and burnt it down for them. You used to have to watch the river because the kids from East Fremantle would swim across and set fire to the bonfire early* (Mr and Mrs Cooper, Centenary magazine, 1986).

Rocky Bay cave

According to Aboriginal mythology the Waugal, or rainbow Serpent rested here curling itself around the central pillar of the cave on its journey upriver to its home in a cave near where Bennett Brook meets the Swan River (Ken Colbung, pers. comm. 1987).

From the 1890s until 1914 a lime burning and quarrying company operated in the area between Mosman Park and North Fremantle. T. H. Briggs and Co used the cave to burn lime. The squaring out of the natural 'chimney' to the surface was probably to fit materials being hoisted up and down by a headgear on top.

Charles Dortch (a local archaeologist) carried out a dig in 1987 to find tools or other artefacts as evidence for Aborigines using the cave. Below about 600 mm he found a hard compacted limestone floor. This would have been a floor built by the lime burners.

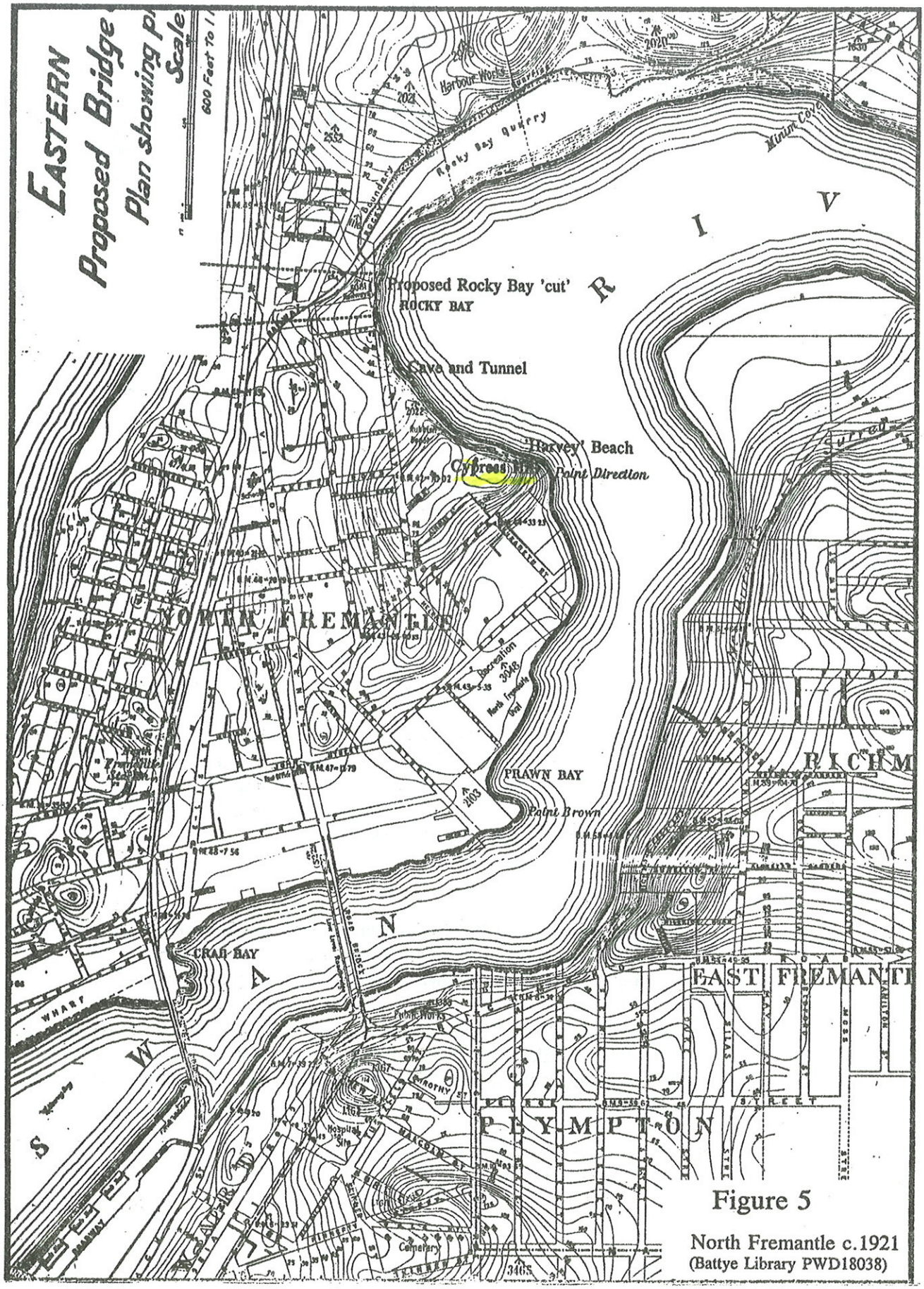


Figure 5

North Fremantle c.1921
(Battye Library PWD18038)

3.0 Cultural Environment

The Tunnel

Moving down from the cave to the water's edge one can see the entrance to a tunnel. This tunnel extends underground as far as Thompson road. Its original purpose was to carry effluent from the soap factory into Rocky Bay.

This spot has also been used as a recreation spot for at least 100 years.

Small caves and fissures abound, where many seek shelter from the heat of the afternoon, with the cool waters of the Swan lapping at their feet (Morning Herald, 1907).

Before parts of the Swan River were dredged the river beach here was wider and you could see two freshwater springs oozing through the sand at low tide close to the tunnel entrance (G. Doepel, pers. comm.).

Rocky Bay 'cut'

The quest for a suitable harbour was to be debated for many years after settlement before C.Y.O'Connor's 1892 plan was carried out.

The narrowest neck of land on the Leighton Peninsula today lies between the beach and the river foreshore near the I.C.I. factory via Craig Street. The short distance between river and sea here did not escape the notice of the explorers of Stirling's 1827 expedition. It was planned to cut a canal connecting Rocky Bay to Leighton Beach to allow large ships to find safe harbour in the Swan River.

The first idea of bringing ships into the Swan Estuary via the Rocky Bay cut was superseded by C. Y. O'Connor's scheme to blast the limestone bar at the river mouth which was approved by Parliament in 1892. When the bar had been successfully blasted and the harbour built the original river crossing place for the Aborigines, Willis' Point promontory, which stretched across to the North Quay, disappeared.

The adoption of C.Y. O'Connor's scheme was significant for its effect on the topography of Rocky Bay due to quarrying of limestone for harbour construction.

Management Implications

1. Appropriate signage should be placed at historical places to highlight their importance and aid in the interpretation of their historical value. This would augment the heritage trail brochure which lists these places.

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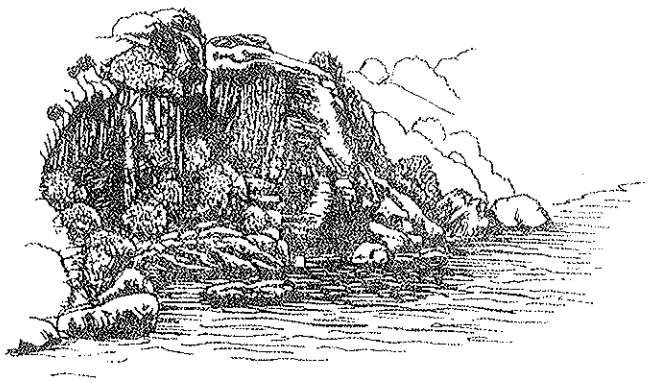


On the southern extremities of North Fremantle the topography is low gradually rising to a limestone ridge east of Stirling Highway through to the river foreshore.

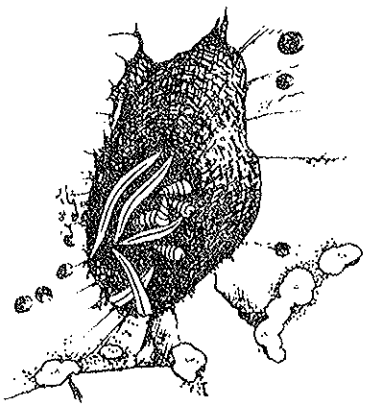
Sinkhole

4.1 Geology

North Fremantle's geological history dates back to the late Pleistocene Age around 140,000 years. The area is made up of Tamala limestone commonly known as Coastal Limestone (Playford, 1989). It is composed of cemented dune sand (aeolianite) consisting of shell fragments of marine origin and quartz grains cemented in calcium carbonate often with a hard capping of secondary calcite. Quartz grains originated from eroded crystalline rocks of the Darling Plateau and were transported to the sea by rivers and along the coast by longitudinal movement. Calcium carbonate leached from overlying dune sands has cemented the grains of quartz and shell fragments together to form a solid mass.

The outcropping limestone has considerable variation in its structure. In some areas examples of sedimentary structures are seen in the form of cross-bedding, this layering feature with a tilt in an east north-easterly direction is seen at places in Rocky Bay. Unconformity is also found in the structure often with loose friable and easily eroded quartz grains and shell fragment comprising the stone.

Many features such as columns, solution pipes or hallows, sinkholes (caves) and capstone are found throughout. Some excellent examples of caves formed from the weathering process are found in the cliffs forming Rocky Bay.



Rocks and shell

Management Implications

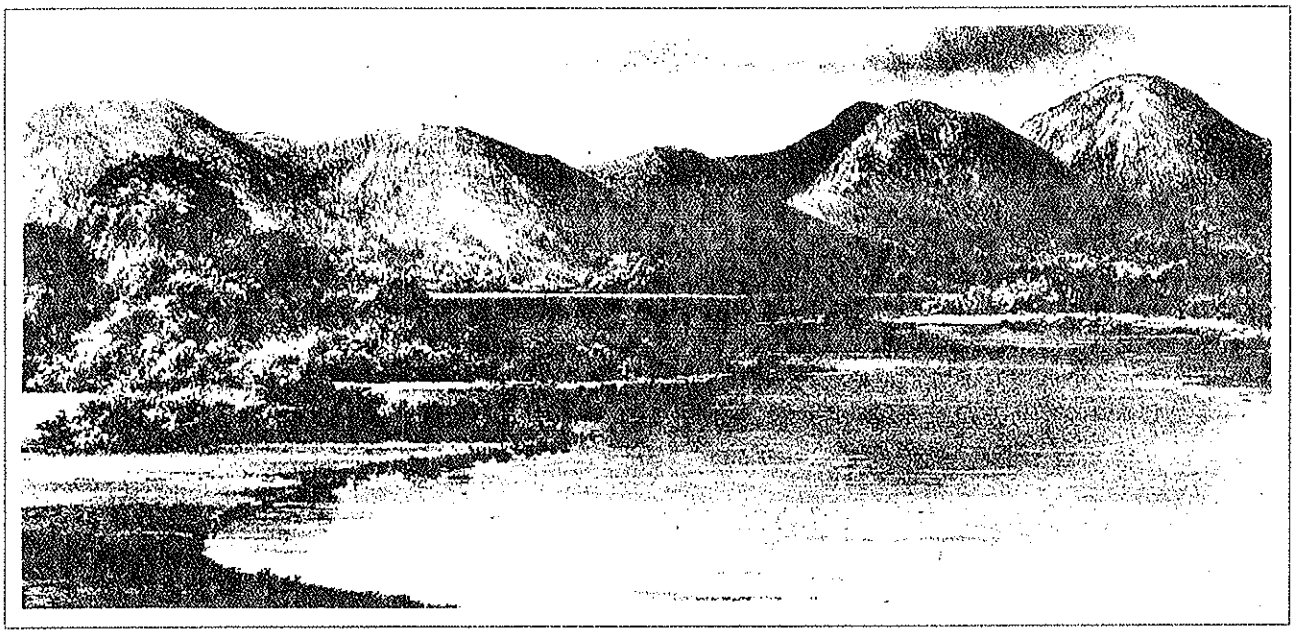
1. Control access to minimise erosion is of importance.
2. In some places the weathering of the limestone has resulted in potential rock falls further emphasising the need for controlled access to minimise danger to the public.

4.2 Geomorphology

The Swan Coastal Plain is made up of three dune systems. The most easterly and the oldest is the Bassendean Dune System which contains low hills and leached infertile soils. West of this system is the Spearwood Dune system which is younger, with higher hills and less leached soils; the study area falls within this system. Topographically the Spearwood Dune system is more variable and undulating and as such contains greater relief. Hills are higher and the soils are younger. It is within this system that the coastal limestone has been formed by a process of leaching and deposition of surface soil carbonate.

One of the most noticeable features of the landform is its undulating nature dominated originally by seven hills, of which only five now remain. The seven hills were captured in an illustration by E.Finnerty in 1880 and referred to as the 'Seven Sisters'.

4.0 Physical Environment



Seven Sisters

4.3 Soils

Two soil types are found in the study area; the Cottesloe Soil Association and the alluvial soils found on the low areas south of Harvest Road.

The Cottesloe soils are derived from the weathering of the limestone. This process has given rise to a soil profile which consists of generally shallow yellow and brown sand overlying limestone. Deeper soils occur in valleys or swales while shallow soils are associated with the more exposed and elevated limestone hilltops. These soils are naturally infertile. Shallow soils support low and diverse heath communities while the deeper soils support plant communities which range from low closed forests to tall open woodlands.

The alluvial soils are a result of the deposition action of the river. These consist of medium grained pale grey to white sands with whole and broken bivalve and gastropod shells of alluvial origin (Gozzard, 1983).

Management Implications

1. Species selection for revegetation of denuded areas should be based on those capable of growing in the various soils types.

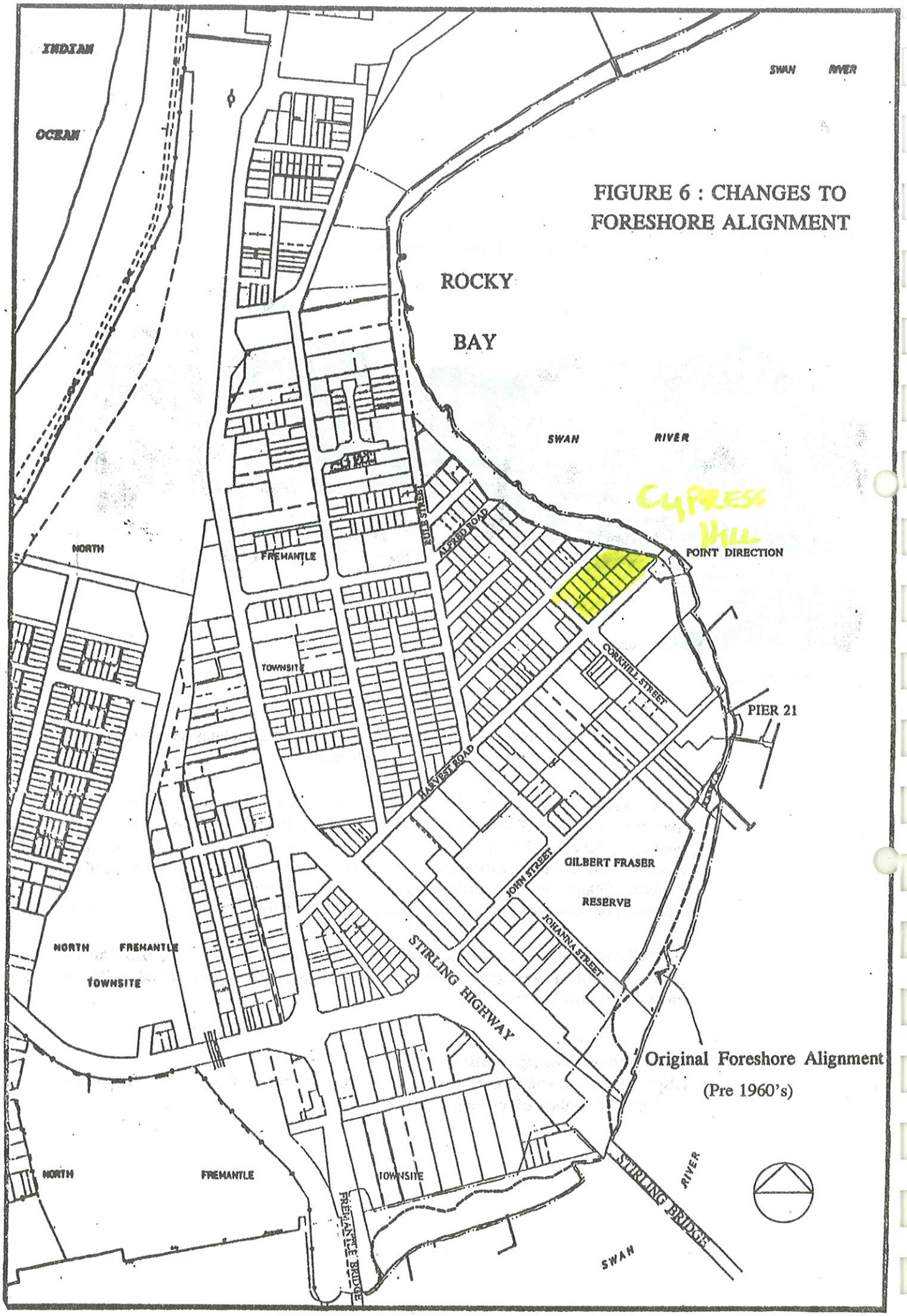
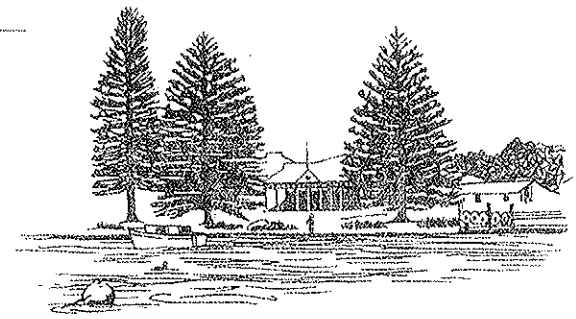


FIGURE 6 : CHANGES TO FORESHORE ALIGNMENT

4.0 Physical Environment



4.4 Climate

The climate experienced in the North Fremantle area is one seasonally marked by hot dry summers and mild wet winters. It is typically mediterranean with an annual rainfall of 870mm with most of the rainfall occurring in the period between April and October. Mean maximum temperatures range from 28.80C in February to a mild 17.50C in August while the mean minimum temperatures range from 18.70C in February to 9.80C in August.

Summer winds are predominantly east to south easterly between 3.00 am to midday, changing in the afternoon to strong south westerly sea breezes. In winter the wind direction is north-west to south-west with strong gusty winds associated with storms.

Management Implications

1. The strong easterly winds will increase the fire hazard with vegetation growing on the cliffs. Strong updrafts will increase the fire hazard and future development will need adequate setback from the cliff area.

2. Access points for firefighters will need to be developed at critical points along the cliff, particularly around Cypress Hill and the Myuna Flats.

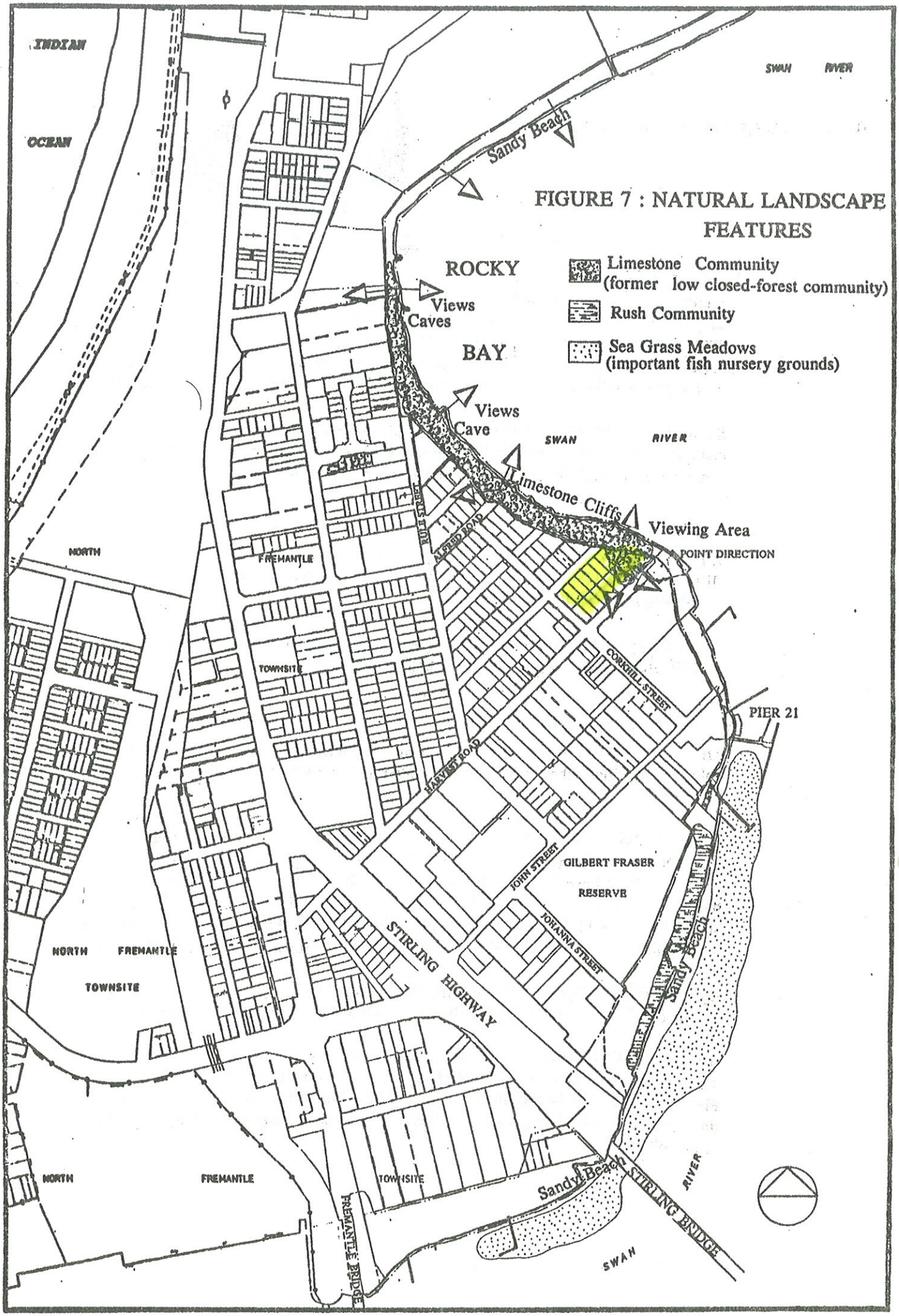
4.5 Changes to the Foreshore

The original form and alignment of the North Fremantle foreshore has changed since colonisation. These changes have been related to two main activities; quarrying and reclamation.

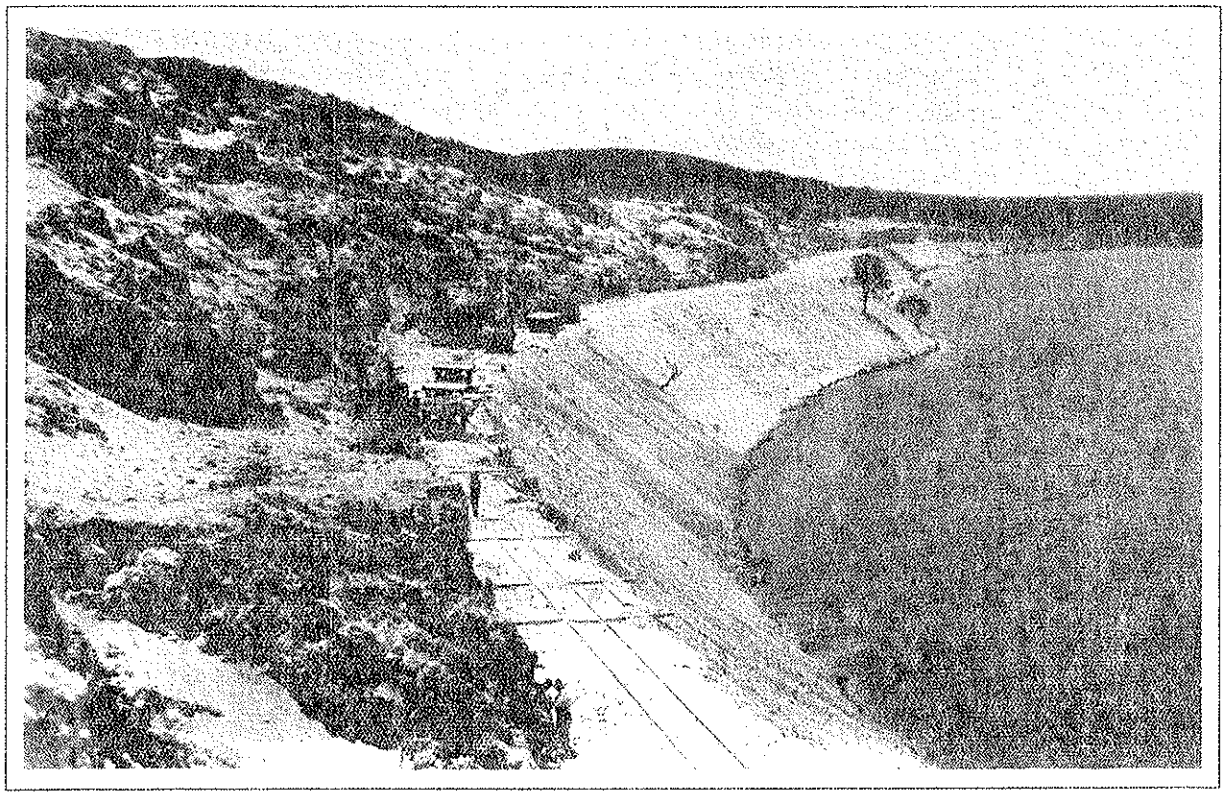
Up to the 1890's the tall cliffs of Rocky Bay extended around to Minim Cove in Mosman Park. Quarrying commenced in 1892 as part of the development of the new harbour. Limestone was quarried and transported by rail to build both of the moles forming the harbour entrance. The stone was also used for buildings such as the University of WA and the Fremantle Goal. The northern shoreline of Rocky Bay (former State Engineering Works site) was created from the cut and fill operation associated with the quarrying

Cypress Hill was once 4-5 metres higher than it is today. During World War II the top was quarried to a circular platform so that anti- aircraft guns could be installed.

In the 1960's the harbour was extended upriver on the northern shore. The dredging spoil was dumped on the North Fremantle foreshore between the Fremantle Traffic Bridge and Pier 21 as part of the reclamation operation. Two important bay's were lost as part of this operation; Crab Bay and Prawn Bay. Figure 6 shows the original shoreline and that found today.


INDIAN
OCEAN
SWAN RIVER
Sandy Beach
FIGURE 7 : NATURAL LANDSCAPE FEATURES
ROCKY
Views
Caves
BAY
Views
Cave
Limestone Community
(former low closed-forest community)
Rush Community
Sea Grass Meadows
(important fish nursery grounds)
SWAN RIVER
Limestone Cliffs
Viewing Area
POINT DIRECTION
ALFRED ROAD
NORTH
FREMANTLE
TOWNSITE
CORKHILL STREET
PIER 21
HARVEST ROAD
JOHN STREET
GILBERT FRASER
RESERVE
JOHANNA STREET
STIRLING HIGHWAY
NORTH FREMANTLE
TOWNSITE
NORTH
FREMANTLE
TOWNSITE
FREMANTLE BRIDGE
Sandy Beach
STIRLING BRIDGE
SWAN RIVER

4.0 Physical Environment



Quarry Site at Rocky Bay

4.6 Landscape Features

The natural beauty of the foreshore was noted by early settlers. According to Downey (1971) early settlers described Rocky Bay, then known as Rocky Cove, as one of the most beautiful bays in the Swan River with its cliffs overhung with peppermint trees, cypress pine and many shrubs. "The foliage of the trees was exquisite, and together with the many turnings in the river, one might fancy themselves in fairyland" observed James Turner in March 1830 (Downey, 1971).

Today's landscape features include natural and cultural elements. The main natural features include; the beaches, cliffs, river and vegetation. These areas are visual focal points, provide texture, colour and diversity in composition. Extensive views are offered from the foreshore beaches and particularly the cliffs. Certain points along the cliff provide expansive views of the river and ocean simultaneously. The narrowness of the Peninsula is readily observable from these points too. The beaches, cliffs and vegetation provide visual interest on a regional scale as they contribute to the diversity of the Swan River foreshore for the boating public.

The cultural landscape is made up of buildings, roads, ovals, lawns, tracks, carparks, quarrying, earthworks and ornamental trees. Some of the modifications have had a

positive effect and some negative. Many of the buildings contribute to the character of the landscape, particularly those built in the early part of the century and include the Soap Factory, Gilbert Fraser Grandstand, Dingo Flour Mill. Some of the newer buildings contribute visual interest and also harmonise with existing buildings. The ovals, ornamental trees (especially the Norfolk Island Pines), gardens and ovals integrate with the built environment and provide attractive settings for recreation activities.

Boats moored at the marina and river moorings also contribute visual interest to landscape.

Some activities and buildings have had a negative impact such as the quarrying in Rocky Bay particularly the recent clearing of surface contaminants on the embankments at the former State Engineering Works site. Some of the industrial buildings along the foreshore contribute little visual interest.

Management Implications

1. Those parts of the landscape which offer extensive views should be developed as viewing nodes and appropriate seating provided along with interpretive material such as a compass rose etc.
2. Integrating the various elements in the landscape should be part of the overall design strategy.

5.0 Biological Environment

5.1 Flora and Vegetation

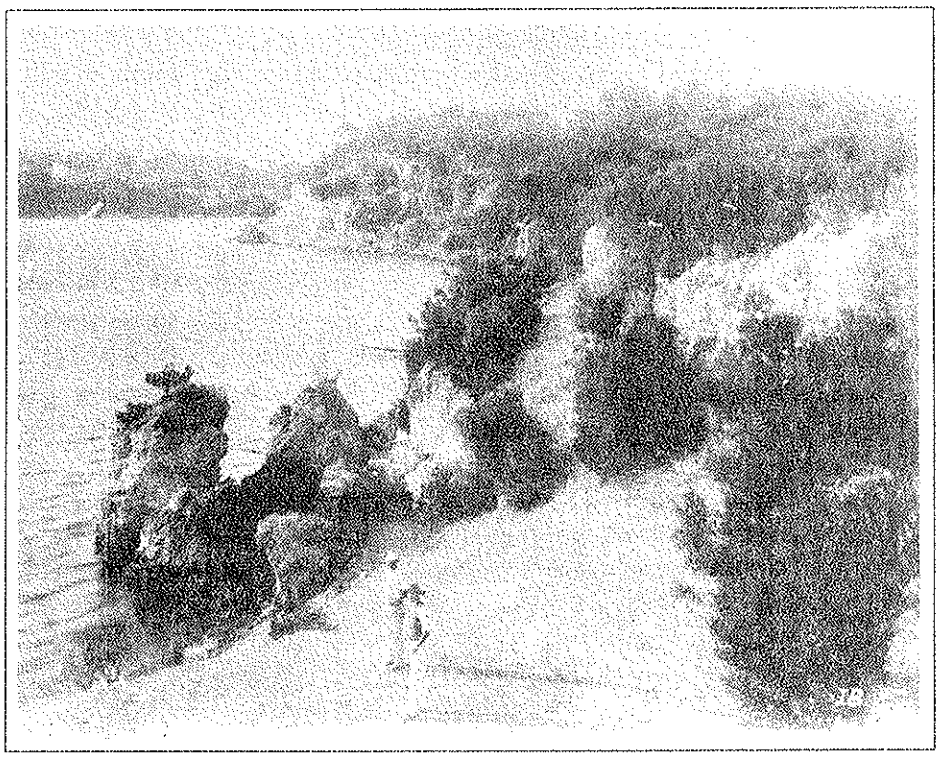
5.1.1. Pre-European vegetation

Although it is difficult to determine the vegetation types found in the study area prior to European settlement some good indications are given from early photographs, anecdotal information, early survey maps of the area and remnants existing today. It is possible to deduce that three community types were found originally along the foreshore. These were related to :

1. the limestone cliffs (low closed-forest community)
2. the beach areas fringing the river (rush community)
3. the alluvial soils found on the low lying areas south of Harvest Road eg Gilbert Fraser Reserve (Tuart forest).

1. The Low Closed-Forest community was found on the cliffs surrounding Rocky Bay and was dominated by the Rottnest Island Pine (*Callitris preissii*) (Seddon, 1972). Testimony to its existence is in the naming of a popular picnic spot at the southern end of Rocky Bay "Cypress Hill". Furthermore, Charles Fraser, the colonial botanist accompanying Captain Stirling's 1827 reconnaissance visit to Fremantle, wrote of the *beautiful species of Calytris or Cypress, of the finest green colour, producing large "warted" cones that studded the hills in this locality* (Seddon, 1972).

Low Closed - Forest community, Rocky Bay, c1890's (Battye Library, B336/18)



Other species found in this community would have included the peppermint *(Agonis flexuosa), Acacia xanthina, Phyllanthus calycinus, Spryridium globulosum* and *Eremophila glabra.* The Fremantle Marlock *(Eucalyptus decipiens)* and the Fremantle Mallee *(Eucalyptus foecunda)* may have been found in this area, particularly as specimens are still surviving on the opposite bank of the river in East Fremantle.

Repeated fires and clearing resulted in the degradation of the community. Particularly as the Callitris is not a fire tolerant species. This community type was once common along the banks of the lower Swan and has virtually disappeared today.

2. Fringing the shores rush and samphire communities were found in high abundance. Photographs taken at the turn of the century show extensive rush beds. This community consisted principally of the rush species *Juncus kraussii* and *Isolepis nodosa.* Samphire species such *Sueda australis* would have also been found there. The swamp sheoak, *Casuarina obesa,* would possible have occurred in places along the foreshore.

3. Tall Tuart trees once dominated the low lying areas south of Harvest Road and extended down to the foreshore. Ample photographic evidence exists to support this claim along with anecdotal evidence of species such as the christmas tree, peppermints, banksias and other tree species. Also on an early map of North Fremantle (North Fremantle 19L, 1844) the words "Tuart forest" appear in the area now known as the Anchorage site.

5.1.2 Flora and vegetation today

The original vegetation that covered North Fremantle prior to settlement has virtually disappeared. What remains is found on the cliffs of Rocky Bay, parts of the river foreshore and on the sand dunes associated with Port and Leighton Beaches. Hence the remnant natural vegetation is of high local conservation value.

Alluvial Flats (between Fremantle Traffic Bridge and Point Direction)

Fringing the sandy foreshore rush communities consisting of the rush species *Juncus kraussi, Isolepis nodossa* and *Juncus* spp. are found. The most dominant species are the *Juncus kraussii* and the nodding rush *(Isolepis nodosa).* In parts halophytic (salt tolerant) species such as *Sarcocornia quinqueflora* and *Suaeda australis* are found.

Other native species occur in this area but have been planted as part of the Council's efforts to revegetate the foreshore. The Swamp Sheoak *(Casuarina obesa)* fits naturally into the foreshore environment and may have once occurred in these parts. Other species include *Agonis flexuosa, Acacia xanthina, Acacia saligna, Acacia cyclops, Melaleuca cuticularis, Callitris preissii, Eucalyptus gomphocephala, Olearea axillaris* and other Eucalypt species.

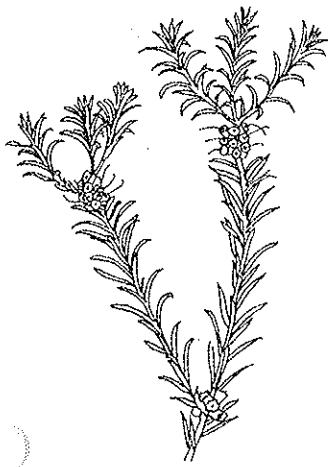
5.0 Biological Environment

Acacia truncata

Limestone Cliffs (Rocky Bay)

The limestone cliffs support the most diverse flora in North Fremantle even through it has been degraded by fire and weed invasion. Although the cliffs once supported a low closed forest community as previously mentioned, it now contains a community which resembles a typical limestone heathland. Heaths are often referred to as scrub and defined as less than two metres in height with a projected foliage cover of 30-100% (Specht, 1970). In an undisturbed state heath communities are very diverse in species composition. Many of the species growing at Rocky Bay are common to those found in limestone heath communities.

The flora of the cliffs is characterised by the following species *Templetonia retusa* (Cockies Tongue), *Melaleuca acerosa, Alyxia buxifolia, Dryandra sessilis, Acacia rostillifera, Melaleuca heugelii, Acanthocarpus preissii.* The only tree species that was found naturally occurring on the cliffs prior to the Heritage Trail planting in 1988 was a lone peppermint near the main cave. Today more trees are growing as a result of the revegetating programs.



Melaleuca acerosa

The Cheesewood (*Pittosporum phylliraeoides)* is a species found growing on the cliffs of some regional significance as it is rarely found along the banks of the Swan today. Native grasses (eg. *Stipa elegantissima*) and sedges are found also in the area.

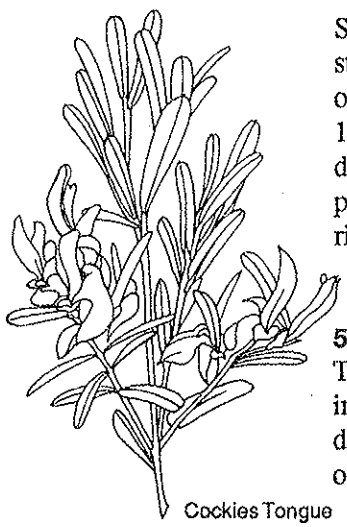
At the base of the cliffs at the waters edge rush species *(Juncus* and *Isolepis* species) are found where suitable substrates exist along with the Swamp Sheoak, *Casuarina obesa.*

Appendix 1 lists of the flora found in the study area.

5.1.3 Species Richness

A total of eighty seven (87) vascular plants have so far been recorded in the study area (Appendix 1). Of these forty five (45) were native and forty two (42) introduced or exotic.

Species richness is a measure of the number of species in a sample area or quadrat (of standard size). A quadrat size of 10 x 10 metres was used to determine the species richness of the vegetation occurring on Rocky Bay. The average species richness was 21 species/ 100m2 of which 8 species were native and 13 exotic. These figures reflect the level of disturbance that the vegetation has undergone over time. The quadrat data was collected prior to the replanting program associated with the Heritage Trail and today the species richness would generally be higher with a higher percentage of native species.



Cockies Tongue
(*Templetonia retusa*)

5.1.4 Introduced Flora

The impact of clearing, grazing, fire, quarrying and rubbish dumping has resulted in the invasion of exotic weeds. Much of the natural environment in North Fremantle has been disturbed. As a consequence many areas are dominated by exotic species. While many of the weed species have a negative effect on the natural biota they do serve to bind the

5.0 Biological Environment

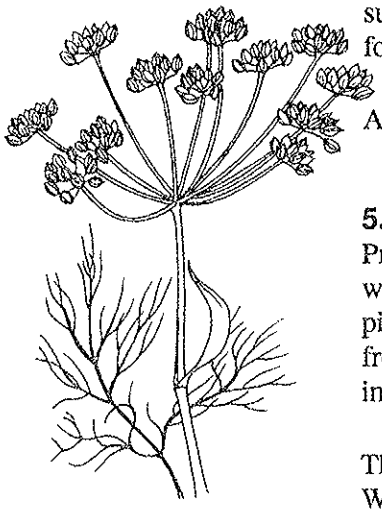
Purple Pincushion
(*Scabiosa atropurpurea*)

surface soil and prevent erosion, although this role should be replaced by native species.

Most of the weeds can be divided into two broad groups: grass weeds and bulbous species. Some of the major grass weeds include Bearded oat (*Avena barbata)*, fountain grass *(Pennisetum setaceum)*, Lagurus ovatus, couch (*Cynodon dactylon)*, buffalo grass (*Stenotaphrum secundatum*), and Kikuyu grass *(Pennisetum clandestinum)*.

Bulbous species include *Freesia* affin. *leichtlinii, Gladiolus caryophyllaceus, Romulae rosea (Guildford Grass), Trachyandra divaricata* and *Asphodelus fistulosus.*

Other weed species which dominate the study area include small shrubs and taller woody species. Fennel (*Foeniculum vulgare)*, Castor Oil Bush (*Ricinus communis)*, Pelagonium (*Pelargonium capitatum*), Evening Primrose (*Oenothera drummondii)* and *Nicotiana glauca* (Tree tobacco) are the most dominant. One of the most attractive weeds found in the study area is the Purple Pincushion (*Scabiosa atropurpurea*). During summer its variety and abundance of attractive flowers results in it being often mistaken for a native.



Fennel
(*Foeniculum vulgare*)

A list of exotic species is shown in Appendix 1.

5.2 Fauna

Prior to European settlement the North Fremantle/Mosman Park area was once teeming with wildlife. This included kangaroos, wild turkeys, large bronzewing pigeons, blue pigeons, wild duck, the rabbit eared bandicoot and the brush wallaby which were frequently seen during the early settlement days. Many other mammal, bird, reptile and insect species would have also been common to the area habitats (Downey, 1971).

The distribution and abundance of native fauna is closely related to wildlife habitat areas. Within the study area the vast majority of these habitats have been lost and replaced by urban development which has resulted in a severe reduction in native species. A combination of existing remnant vegetation, urban gardens and public parks has engendered the survival of a number of animal species. Increased planting of suitable plant species throughout the suburb will help to increase the general fauna diversity of the area.

The following section deals with the main terrestrial vertebrate groups.

Amphibians.

No native amphibians have been recorded from the study area, however one frog *Limnodynastes dorsalis*, the Banjo Frog has been reported from an area of similar habitat at Buckland Hill. The lack of surface fresh water for breeding will prevent frogs from living within the study area.

5.0 Biological Environment

Reptiles.

The reptile fauna of the study area is relatively diverse with a total of 13 species being reported to date (Appendix 5). The most common species are those which are able to exist in urban gardens or vacant land, these include the smaller skinks and geckos. Some of the larger species such as the Bobtail, King skink and Dugite are confined to rocky areas or natural heathlands were protective vegetation cover is available. Bobtail lizards are frequently seen on foot tracks and cycle ways. Other native species such as Burton's Legless Lizard, the Bearded Dragon and Stripped Skink are relatively rare and confined to areas with suitable ground cover and leaf litter. Introduced predators such as cats and the Laughing Kookaburra predate many of the reptiles found in North Fremantle and contribute to their scarcity in the area.

Mammals

Only one native mammal, the Brushtail Possum has been found in the area in recent years (A. Forma pers. comm.). The Common Brushtail Possum is perhaps the only native species which has been able to adapt to urban areas. They require large established trees for food and shelter. The presence of the native Water Rat (*Hydromys chrysogaster*) and an unidentified species of native bat has been reported however no positive identifications have been made. Introduced mammals include foxes, cats, rats and mice (Appendix 6).

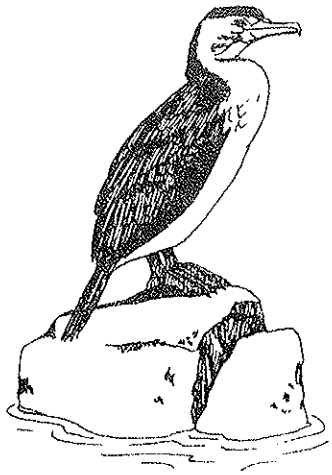
Birds

A total of 36 native and 4 introduced species have been recorded in the study area (Appendix 7). Eleven of these species are associated with the estuarine habitats along the foreshore. The W.A. Naturalists Club survey of the Rocky Bay area in 1985 found the following species: Australian Pelican, Cormorant, Pied Cormorant, Little Black Cormorant, Little Pied Cormorant, Eastern Reef Heron, Greenshank, Silver Gull, Caspian Tern, White Faced Heron, Pied Oystercatcher and the Black Duck. Occasionally large flocks of the Little Black Cormorant can be seen feeding on fish in the area. They are usually accompanied by an equal number of seagulls, together they fly as far as the Stirling Bridge and then return up river (D.Kaesehagen, personal observation).

Common terrestrial species include the Singing Honeyeater, Australian Magpie, Australian Raven, Welcome Swallow and the Laughing Turtle-Dove. Some uncommon species include the Sacred Kingfisher, Striated Pardalote and Pied Butcherbird. The Rainbow Bee-eater use the embankment areas (former State Engineering Works site) for nesting areas during the summer.

The study area is important as a wildlife corridor and habitat area for both terrestrial and aquatic birds. The diversity of species that has been recorded within the study area is large considering the habitats available. This diversity may be due in part to nomadic and/or migratory species passing through the area.

5.0 Biological Environment



Little Pied Cormorant

5.3 Swan River

The river is an integral part of the study area in terms of its aesthetic, biological, recreation, and commercial value. This part of the river is known as the lower estuary (Blackwell Reach to Fremantle Harbour) it contains a deep channel with shallow sand flats and sills occurring along the margins of the river and in the central part of Rocky Bay.

Aquatic macrophytes, in particular the seagrasses are vital for providing habitats for juvenile fish. The seagrass species *Halophila ovalis* is widely distributed in the Swan River estuary (Thurlow et. al. 1986). Shallow waters contain some of the most productive seagrass meadows. These are located between the Fremantle Traffic Bridge and Pier 21 and towards the centre of Rocky Bay. These were identified in the Swan River Management Strategy (1988) as areas of high value as fish nursery grounds.

A diverse range of invertebrate and vertebrate fauna inhabit the Swan River. The invertebrates include crustaceans, molluscs, annelids, coelenterates, echinoderms, foraminiferans, platyhelminths and bryozoans. The benthic faunal species occur in high densities in the seagrass meadows contained in the study area (LeProvost, Seminiuk and Chalmer, 1987). Invertebrate species of notable commercial value also occur in the study area these include; the Western King Prawn (*Penaeus latisulcatus*), the river prawn (*Metapenaeus dalli*) and the Blue Manna Crab (*Portunus pelagicus*). Their importance and abundance in the study area is reflected in the naming of two bays by the early settlers: Prawn Bay and Crab Bay. According to Thurlow et. al. (1986) most invertebrate species are of marine affinity and hence species diversity is highest in the lower reaches of the Swan.

The Swan estuary supports a diverse range of fish species which is related to sheltered and food rich waters. A total of 122 fish species from 62 families have been recorded in the river (Thurlow et. al., 1986). Many of the fish use the estuary as a nursery ground or adult feeding ground, but spend the majority of their life cycle in the ocean (LeProvost, Seminiuk and Chalmer, 1987). The productivity of the lower Swan is reflected in the anecdotal information of early settlers and therefore must have been an important resource for both the Aboriginal population and Europeans. Thomas Briggs writing in the late 19th century said :

5.0 Biological Environment

the river was alive with fish, crabs and prawns, flounder, flathead, kingfish, schnapper, skipjack, mullet, tailer and many other varieties (Downey, 1971).

Some North Fremantle residents recall the times when they could virtually live off the river. H. Bidders remembers the time when they use to throw sticks of gelignite into schools of mullet resulting in not only stunning and killing the fish but the vibrations from the explosion attracting sharks up to 4 metres in length (H. Bidders, pers.comm.)

Marine mammals are regularly sighted in the study area. Dolphins are often seen playing and feeding in Rocky Bay, good vantage points for such sights are offered by the cliffs around Rocky Bay. A seal was recently seen on the beach in front of Gilbert Fraser Reserve (S.Woollett, pers. comm.).

6.0 Access

One of the principle planning objectives of the North Fremantle Foreshore Plan developed by the City of Fremantle and the Department of Planning and Urban Development was to create continuous access along the foreshore at waters edge or as close as possible to it.

Today continuous access exists virtually through most of the foreshore. Only at the Anchorage site is access limited to approximately sixty percent of the foreshore. No access is available through the Water Police Headquarters.

Access along the foreshore is in the form of a number of different tracks or paths. These include (see Figure 8):

a. A dual use bitumen path which runs from the boundary with Mosman Park to the end of Rule Street, most of this path follows the alignment of the railway used for transporting quarried stone to build the moles at the harbour.
b. The Rocky Bay Heritage trail continues from the dual use path at the end of Rule street to Harvest Road and Harvey Beach. This trail is a foot worn track developed at clifftop level.
c. A foot worn track extends north of Harvey Beach for approximately 150 metres at waters edge to a point where access is difficult due to steep cliffs.
d. The Heritage Trail links into a cobble stone path which runs from behind the Water Police Headquarters then along the waters edge to the vacant crown land west of Pier 21. Access past Pier 21 is in the form of a timber boardwalk perched over the water in front of the Restaurant.
e. Access along the foreshore from Pier 21 to the Stirling Bridge is along the sandy beach or the lawn area further back from the foreshore.
f. A dual use path connects the end of Johanna Street to the Stirling Bridge and Swan Street.
g. From Stirling Bridge to Fremantle Bridge access along the beach continues from Stirling Bridge for about 100 metres until marine industries restrict foreshore access, however just near the Fremantle Bridge access at foreshore level continues for a short distance to the Bridge.

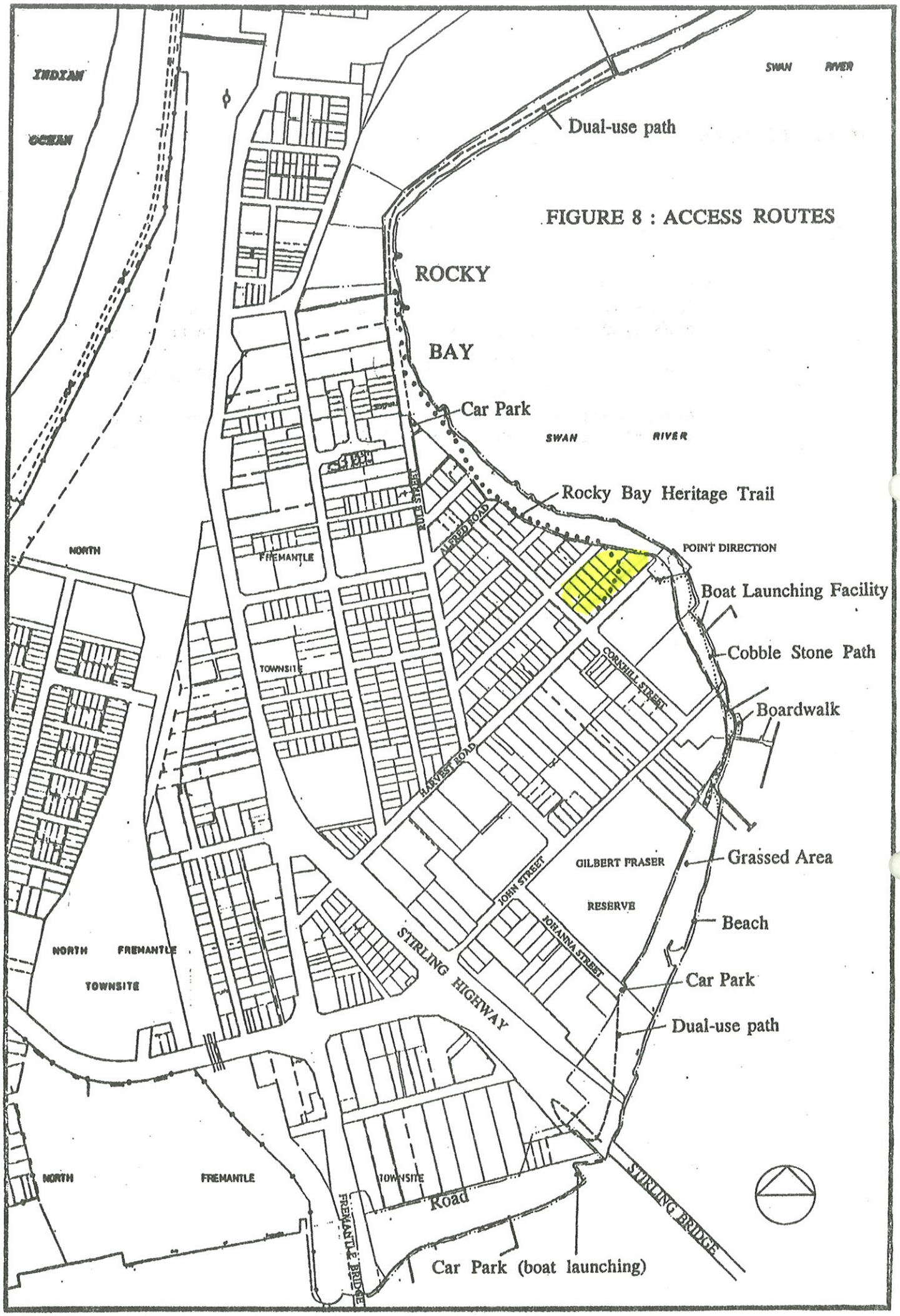
A number of formal and informal car parks exist along the foreshore, these include;

- The end of Doepel Street and under the Stirling Bridge (informal) . This area is used regularly to launch small boats, it is also a popular picnic area.
- At the end of Johanna Street (formal).
- At the end of Ainsle Street on Cypress Hill (informal).
- Towards the end of Rule Street near the old Soap Factory (formal).
- Parking is also available on many of the streets near the foreshore eg. John Street.

6.0 Access

Management Implications

1. All tracks, paths and steps should be designed and constructed with materials which are of sympathetic form, scale, colour and texture to harmonise with the surrounding environment.
2. Unwanted tracks should be closed using obstacles and revegetating with appropriate quick growing thorny species.
3. Where possible artists should be employed in the design and construction of certain pathways to enhance the cultural component of the landscape.

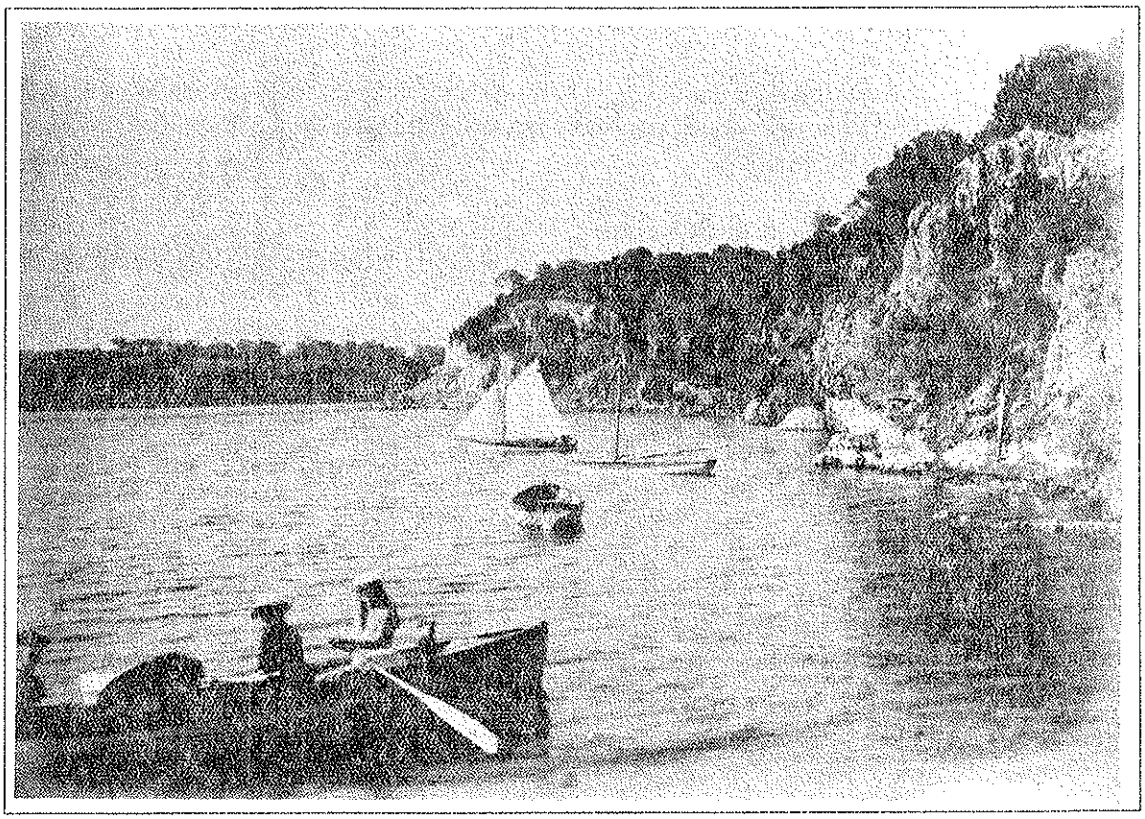

INDIAN
OCEAN
SWAN RIVER
Dual-use path
FIGURE 8 : ACCESS ROUTES
ROCKY
BAY
Car Park
SWAN RIVER
Rocky Bay Heritage Trail
POINT DIRECTION
Boat Launching Facility
Cobble Stone Path
Boardwalk
Grassed Area
Beach
Car Park
Dual-use path
Car Park (boat launching)
NORTH
FREMANTLE
TOWNSITE
STIRLING HIGHWAY
STIRLING BRIDGE
Road
FREMANTLE BRIDGE
ALFRED ROAD
HARVEST ROAD
CORKHILL STREET
JOHN STREET
JOHANNA STREET
GILBERT FRASER
RESERVE

7.0 Recreation

The river foreshore in North Fremantle offers a diverse range of recreational activities for family groups, children, adults, sporting clubs and individuals, people interested in running, walking, bicycle, fishing, sailing, canoeing and many more.

Some of the most common forms of recreation occurring along the foreshore include;

Swimming: this occurs along the river between Stirling Bridge and Pier 21 where the water is shallow for some distance. Harvey Beach is the most popular swimming place in North Fremantle and is used by a wide range of ages. The small beach below lot 320 is another area used for swimming. Certain rock outcrops on the cliff are popular with older children and teenagers for jumping off.



Tranquil days on the Swan River at Rocky Bay c1890's (Battye Library 374 B/8)

Diving: snorkling occurs at various places along the foreshore but the most popular place is off the sand bank in Rocky Bay.

Fishing: the entire foreshore is used for fishing (including crabbing and prawning).

Boating: Swing moorings occur along the river between the Anchorage site and Pier 21. An informal local boating community exists amongst the owners of these boats. More regional use is made of the marina at Pier 21. Boat launching is possible under Stirling

7.0 Recreation

Bridge at the end of Doepel Street and between the Water Police Headquarters and Pier 21.

Canoeing: the entire length of the foreshore is used by canoeists, Rocky Bay is idyllic for this pursuit.

Walking/running/cycling: these commonly occur along the foreshore and are becoming more popular. Some of the dual use paths cause a level of conflict between fast cyclists and pedestrians. Speed humps may have to be introduced to reduce potential accidents.

Sitting/viewing: Rocky Bay and the river beaches provide important sitting and viewing areas. People often sit at the cliffs edge at Rocky Bay taking in the views.

Nature study: the natural vegetation and animals as well as the river and its biota provide important nature study opportunities for school, the local community and regionally interested groups.

Management Implications

1. Recreation activities should be monitored to ensure that damage to the natural environment is minimised.
2. Recreation opportunities should be increased in the form of barbecue areas, children's playgrounds and other suitable alternatives where opportunities exist.

8.0 Past and Present Management

Various parts of the foreshore have had management input by the City of Fremantle and the local community group, the North Fremantle Community Association (NFCA) over the past five years. Council currently carries out some management to the foreshore which includes replanting programs, generally in conjunction with the North Fremantle Community Association and mowing programs.

Council's current program includes:

- Regular mowing of lawned areas on reserves 36420 and 33051 (in front of the Gilbert Fraser Reserve).
- Watering of young trees over the summer period.
- Maintaining paths.
- Some minor weeding programs.
- Council has also constructed steps down to the waters edge from Lot 320 near the cave. It also supplies plants to the NFCA each year to plant on the foreshore.

In 1988 the North Fremantle Community Association in conjunction with APACE Aid received grants from the Heritage Trail Secretariat and Greening Australia to construct a heritage trail and plant a number of indigenous plants on the cliffs at Rocky Bay. A list of the species and their numbers planted on the cliffs is shown in Appendix 3.

More recently as part of the redevelopment of the former State Engineering Works Landcorp undertook the planting and direct seeding of this section of the foreshore. A species list is shown in Appendix 4.

9.0 Fire Control

Fire History

The only area where fires have occurred on the foreshore is at Rocky Bay. Fires use to occur regularly as part of the prescribed burning by Homeswest of their land (Cypress Hill and Lot 320). This was stopped in 1988 after considerable objection by the North Fremantle Community Association. Minor fires were also lit by vandals prior to 1988. Since then no major fires have occurred on the foreshore.

Environmental Effects

Prescribed regular burning of vegetation has been common practise adopted by most metropolitan land holders. The result of this practise and that of arson has resulted in an impoverished native vegetation and the destruction of wildlife habitats.

Even though much of Western Australia's native vegetation is adapted to fire, frequent fires are responsible for destroying the integrity of the bush. A regular cycle of burning favours the spread of exotic weeds by creating conditions such as increased light from a burnt-out over storey, reduced competition from native perennials and increased availability of nutrients.

Evidence is now available that frequent fires prevent adequate regeneration of species causing its loss from particular areas and the general loss of species diversity. The cycle of a seedling growing to a level of maturity where it can produce and set enough fertile seed to guarantee the future survival of the species may take several years (K. Dixon, Kings Park, Pers. comm.)

The dominance of legume species at Rocky Bay such as *Templetonia retusa* and *Acacia xanthina* reflects a post-fire early successional stage. In time their dominance will be replaced by non-legume species until another disturbance event, such as a fire, and the cycle is repeated.

It is generally agreed that infrequent burning cycles of ten to fifteen years or longer are best to sustain a healthy relative weed free bush environment (CALM, pers. comm.). A landscape with a burnt bush losses its social amenity and aesthetic appeal.

Management Strategies

1. Residential areas abut fire prone areas on the foreshore. Firebreaks are required to ensure safety of property in this area.
2. Access for fire fighting equipment should be maintained in those areas of risk.
3. Many of the species found on the foreshore have poor regenerative capacity and care should be taken to minimise fire risk to these areas.

10.0 Weed Control

A weed is generally defined as a plant which is growing where it is not wanted, this may be in either a garden, lawn, crop or bushland. Moore(1975) defines a weed as :

> *A plant is a weed where it interferes with man's use of land for particular purposes, with his well-being or with the quality of his environment.*(In B uchanan, 1989).

Weeds are often described as introduced, exotic, alien or naturalised plants. When weeds invade an area they:

- compete with native species;
- repress the juvenile plants of the canopy species;
- change the natural fire regime because of their different flammabilities and responses to fire;
- enrich the soil by adding nutrients;
- change the food sources and habitats available to wildlife, and so change the wildlife populations.

Much of the exotic flora found on the foreshore has originated mainly from Mediterranean Europe and South Africa. Port areas were often some of the first areas to be colonised by exotic species as seed was often carried in cargo and ships' ballast. While their introduction has been either accidental or deliberate their spread has been greatly assisted by an increase in the frequency of fire and disturbance to the soil. The majority of weeds invade the bushland by the dumping of garden refuse in the bush. Many weeds find their way into bush by human induced disturbance (along tracks, picnic areas, drains, lawns etc), via machinery and attached to people and livestock (Dixon & Keighery, 1992).

Weeds can also be usefully categorised as being "Major", "Nuisance" or "Minor which assists in determining management priorities:

- **Major** - These are the most serious weeds in the vegetation, often difficult to control with high invasion rates. eg. fennel, castor oil bush, feather tail grass, freesia, guildford grass, couch, and kikuyu.

- **Nuisance** - generally ones which pose a threat to the vegetation but are not classified in the above category eg. buffalo grass, wild oats, *Arundo donax*, tree tobacco.

- **Minor** - weeds which tend to have little known effect, are generally less competitive and are not yet serious. eg. *Briza maxima, Briza minor*, climbing fumitory, purple pincushion.

9.0 Fire Control

Recommendation 1
A total fire ban for a period of 15 years should be established.

Recommendation 2
A system of fire breaks be established to ensure the protection of adjoining property. Fire breaks should be designed and constructed in empathy with the environments aesthetic and ecological values.

10.0 Weed Control

Control Methods

Weeds can be controlled in a number of ways. However weed control should be used as part of the process of bush regeneration and not considered as an isolated event. That is, used in conjunction with a regeneration program which includes revegetation, erosion control and fire management.

Methods of weed control include:

1. Herbicide:

This is one of the most common methods of weed control as is very effect when applied skillfully. When using chemical methods of control it is important to observe safety precautions printed on container labels. Users should have appropriate training in methods of applying herbicides to avoid personal injury and injury to the general public. Herbicides can be applied in a number of ways these include:

a. mist spray,
b. via an applicator, either wick, brush, sponges
c. stem injection and frilling (good for tree or shrub weeds eg. castor oil).

The optimum time to apply herbicides is during the active stages of growth. For grass weeds before flowering time and for bulbous species just after flowering before seed set. Currently two of the most effective herbicides on the market are:

Glyphosate (Roundup®) - a systemic non-selective herbicide. Useful for controlling most weeds especially bulbous species. This herbicide should not be sprayed in areas containing native species as it will also kill them.

Fluazifop (Fusilade®) - a selective herbicide effective on most grass weeds.eg. wild oats. This herbicide does not affect non-grass natives species.

b. Hand weeding

The Bradley method developed by the Bradley sisters in N.S.W. is the best method of hand weeding. This involves observing three basic principal: 1. start from the least weed infested area and work to the most infested; 2. minimise soil disturbance when removing weeds; 3. only remove weeds at a rate at which the native plants grow and recolonise an area. ie do not over weed an area and create large bare soil patches, as these will only be colonised by weed species.

c. Competition

Through revegetation of a disturbed area with native species shading and direct competition for water and nutrients can effective reduce the weed biomass.

d. Burning

This is useful for some weed species by the present area should be excluded from this method as it will only increase the level of weed invasion.

10.0 Weed Control

Control of major weeds:
Fennel ; remove seed head, cut stems and leave on site, apply Roundup® to regrowth. Hand removal is also advocated for young plants.

Fountain grass; remove seed heads and burn or compost. Spray with Fusilade®. This plant can also be grabbed out. Invert plant and leave on site.

Couch, buffalo and Kikuyu: spray with Fusilade®.

Castor oil bush: stem inject large plant with Roundup®, when dead cut up and leave on site, hand pull young plants, remove seeds from mature plants.

Recommendation 3
A works program be implemented to control major weed species.

11.0 Ecological Restoration

Ecological restoration is a generic term for treatments which aim to reinstate the functioning ecosystem traditionally characteristic to a site. These include (from McDonald 1991, unpublished glossary of terms):

• **assisted natural regeneration** (bush regeneration) : this applies to sites where a remnant exists. It is the practise of amending conditions and/or removing obstacles to reinstate a system's own regenerative biological processes.

• **reconstruction** : where little or no remnant component exists, the wholesale reinstatement of the original system's abiotic and biotic elements to effect restoration of a functioning ecosystem.

• **rehabilitation** : remnant temporarily and grossly disturbed. It is a generic term referring to practises of bringing a degraded ecosystem to a less-degraded but not necessarily fully-restored state.

• **fabrication**: remnant never existed. The installation of better-adapted local vegetation systems where site conditions are permanently altered and can no longer support the original vegetation system. (While not strictly restoration, such treatments could be incorporated into the restoration of a larger system if they assist with its reintegration.)

Most of the foreshore can be restored through a process of assisted natural regeneration (bush regeneration) as it supports an existing remnant. Certain areas will require reconstruction in the above sense particularly the foreshore embankment south of the former State Engineering Works site.

The foreshore can be divided into two broad restoration areas, these are:

a. the low-lying foreshore ie. south of Harvest Road

b. the limestone cliffs

a. Low-lying foreshore (Fremantle Bridge to Harvey Beach)

The areas lying adjacent to the beach contain good stands of rush communities eg. Juncus and Isolepis and larger species appropriate to this environment including the swamp sheoak.

Restoration of this should include weed control programs, particularly the control of couch and buffalo grass, judicious planting of the swamp sheoak should also be given some priority along with the planting of rush communities where appropriate to maintain

the naturalness of the foreshore. An appropriate theme to develop along the foreshore edge is a mixed community of rush species interspersed with the swamp sheoak and *Melaleuca cuticularis*. Removal of some of the young exotic eucalypts from the rush communities should be carried out. Further inland from the rush communities, appropriate woodland species have been planted, these include peppermints, *Acacia saligna* and *Acacia cyclops* as well as various *Allocasuarina* species and others. This woodland theme should be enhanced with thematic planting, but will require a more detailed design so that recreation requirements of the public can be balanced with increasing the biodiversity of the area.

Appropriate species for revegetation are shown in Appendix 1.

b) Limestone cliffs (Rocky Bay)

Two distinct landscape elements are found in Rocky Bay; firstly the natural limestone cliffs which support indigenous vegetation and secondly, the artificially created embankment area at the northern end of Rocky Bay. The latter was recently scraped to remove surface contaminants from the operation of the former State Engineering Works. Limited vegetation is found on this area and it has recently been rehabilitated.

The natural cliff areas should be restored through a process of assisted natural regeneration ie. weed removal, judicious planting of endemic stock and where possible some direct seeding. The Rottnest Island Pine should be planted as one of the main theme species along with other species shown in Appendix 2. Throughout this area there is good regeneration of native species which is a result of the lack of fires since 1988. Unwanted tracks should be closed through the planting of species such as *Acacia xanthina*, *Hakea prostrata*, *Acacia pulchella* adjacent to tracks.

The embankment area at the northern end of Rocky Bay needs further reconstruction work. This includes revegetation with species selected from Appendix 2, brushing with seed bearing branches

Planting Program:

Indigenous seedlings should be planted in late Autumn and early Winter to ensure good establishment from beneficial winter rains. Seedlings which have grown beyond post emergent stage (around 4-9 months, depending on species growth rates) in square plastic pots (75 x 75 x 100mm) are considered the most suitable for planting. Mature stock, although less suitable, do provide an obvious statement to the general public that a regeneration program is underway and are therefore useful in some places. Adequate ground preparation is important for good plant establishment. A small area approximately

11.0 Ecological Restoration

50cm in diameter should be cleared of weeds either by manual hoeing or with herbicides. It is generally considered advisable to water plant stock immediately after planting, however, in some cases water will not be readily available. Under these circumstances it is best to plant preceding good wetting rains. It is not advisable to stake plants for support. Free standing plants become more durable and strong.

Seed Collection:

In revegetating bushlands it is desirable to use plant material with the same genetic background as the naturally occurring plants. Local provenance seed is available in the Fremantle and Mosman Park region. Collection of this material will require a CALM seed collecting licence and should be carried out by personal experienced in collection techniques. Permission from local authorities may also be a requirement for collection. Volunteers interested in collecting seed should be given some training to avoid potential damage to indigenous plants.

Recommendation 4

A program of ecological restoration be implemented using bush regeneration principles. This program should include training of local volunteers in bush regeneration techniques.

12.0 Monitoring Program

While the management plan provides an essential structure for the management of the foreshore further information on the physical, biological and recreational components will be needed to augment existing information contained in this report. Monitoring the effectiveness of certain strategies is critical to the success of any management plan.

Further research and monitoring can be carried out by the Local Authority and interested school and community groups, provided that the information is effectively directed to the body responsible for the foreshores management.

Areas which require further research and monitoring include:

•the development of a complete herbarium of the terrestrial flora, this will help community groups interested in assisting with weed control to identify weed species. The development of a herbarium of the marine flora associated with the foreshore would also be desirable.

•photographic records of the fauna found in the area.

•permanent monitoring quadrats (10 x 10 metres) should be established in three or four areas along the foreshore to measure changes in the vegetation structure as bush regeneration programs are implemented. In each quadrat notes and description of the vegetation and flora as well as photographs from fixed points should be taken.

•fire risks as vegetation structure changes through revegetation programs
•the effectiveness of measures to control disturbance and erosion.
•user impact and user requirements.
•public safety
•effectiveness of park interpretation program.

Recommendation 5

A monitoring and research program be implemented by Council. Specific areas which require attention include:

a. Increasing the resource inventory on the biotic and physical elements found along the foreshore.
b. Weed invasion and effectiveness of control methods
c. Vandalism
d. Monitoring quadrats.
e. User impact and user requirements.
f. Fire risk.
g. Public safety.
h. Effectiveness of management strategies.

13.0 Access andTrails

The existing network of paths and trails has been dealt with in a previous section. The foreshore is generally accessible from a number of points and access along it is good except for areas with in the Anchorage site. Although public access is available through the Pier 21 and marine related industries east of Corkhill Street most people assume that the area is private property and are therefore inhibited to use existing accessways within the development.

The natural pathway developed as the Rocky Bay Heritage Trail requires further development to assist ease of movement and stabilise areas prone to erosion. Paths of this kind developed in natural areas should be constructed with materials which area sympathetic to the environment.

Recommendation 6

a. A system of integrated trail as shown on the Concept Plan should be developed.

b. In steep areas which are subject to erosion hard surface paths and steps will be required. These should be constructed with materials which harmonise with the surrounding environment in terms of texture, form, scale and colour.

c. Where required appropriate hand rails should be provided particularly to assist the elderly. These should be built out of appropriate materials.

d. All unwanted paths should be closed off and revegetated with appropriate thorny and quick growing local plant species.

e. Sign posts emphasising access through built areas such as Pier 21 should be erected to assist public access.

f. A dual use path should not be extended along the natural foreshore in front of Gilbert Fraser Reserve or along the cliff top between the end of Rule Street (north) and Harvey Beach.

14.0 Public Interpretation

Public interpretation of the foreshore's physical and biological resources is a valuable aid in conserving and upgrading the natural environment. Awareness of the inherent values of the foreshore by the public encourages a sense of ownership and thus promotes more involvement in the conservation of the resource.

The level of interpretation of an environment's resources varies considerably. For example, it can range from brochures, guided tours by park rangers and informative booklets on all aspects of the reserve or park. Some level of interpretative material already exists on the foreshore ie. the Heritage Trail Brochure and display boards.

Suitable adjuncts to these existing resources include:

•combining the existing heritage trail signs with more detailed information on the physical and biological resources of the foreshore. These could be placed at focal points for the public ie car parks or recreation areas.

•a useful interpretative aid would be the development of a brochure which summaries and graphically depicts resource of the foreshore. This could be available from the City of Fremantle and at Apace Aid.

•small appropriate wooden routed signs should be placed at places of significance such as Harvey Beach, the historic Rocky Bay cut proposal, cave etc. All signs should be in scale and texture with the environment.

Recommendation 7

An interpretative program be developed and the following aspects considered:

a. Signage, including appropriately scaled and located display boards.
b. A brochure on the biophysical and historic attributes of the foreshore be developed.

15.0 General Management Considerations

15.1 Management Authority

The managing authority for the foreshore will be carried out by the City of Fremantle. However, consultation with the Swan River Trust and relevant government departments should also be undertaken to ensure uniformity of policy.

15.2 Community Involvement.

The City of Fremantle has a long standing policy of community involvement with public open space area under their control. This ranges from a partnership agreement whereby the local community is divested with some powers of funding allocation to simple information release.

The North Fremantle community has maintained a proactive role in its concern for the foreshore and has historically demonstrated a strong level of commitment both in terms of voluntary labour and providing policy initiatives for the protection and enhancement of the foreshore.

It is essential that a structure be developed to allow community input at both a decision making and implementation level.

The most useful form of structure to incorporate community support is through the establishment of a "Friends" group made up of local residents in partnership with elected representatives and Council officers.

This body could oversee the implementation of the management plan, coordinate community voluntary labour in restoration programs and undertake monitoring and interpretative programs.

Recommendation 8

A Friends group be established for the North Fremantle foreshore. A coordinating committee be established consisting of 1 Councillor, 2 Council Officers and four members of the Friends group to oversee the implementation of the management plan and any other issues which affect the conservation and recreation values of the foreshore.

Introduction

A balanced approach was adopted as part of the design process to protect areas of conservation value yet ensure passive recreation requirements of the public were maintained and enhanced.

As part of the study a community based consultative committee was established to assist, through a process of interactive design, in the development of the foreshore concept plan (Figure 14).

The following description of the concept plan was developed as part of this process. The foreshore was treated in a systematic fashion starting from the northern boundary with Mosman Park Town Council and working through to the west end of the study area at the Fremantle Traffic Bridge.

The foreshore has been divided into eight different areas to aid in the description of the concept plan, these are shown in Figure 9.

Area A : Foreshore area in front of the former State Engineering Works.

One of the aims of the City of Fremantle's North Fremantle Foreshore Planning Policy (1986) was to develop access to the rivers edge from the top of the embankment. This principle was adopted and the design arrived at was a path leading down the embankment to the foreshore. The path is in the form of a wooden or wood and steel structure with two or three small platforms with seating incorporated at different levels (Figure 10). At the western end of the beach area a small jetty which runs parallel to the shoreline has been incorporated into the design to enhance recreational use. The jetty should not be used as a mooring facility for river craft.

The embankment requires appropriate stabilisation through an intense revegetation program which will increase the biological corridor between the natural vegetation on the cliffs and that occurring in Mosman Park.

Seating sympathetic with the natural elements found on the foreshore should be provided at nodes alongside the bicycle path.

Area B: Public Open Space (local park)

This area of public open space will eventually be vested with the City of Fremantle as a local park. Some work on its development has already been carried out and includes the construction of a dual use path and the planting of tree and shrub species.

Design concepts for this area were based on recognising the important role of industries in North Fremantle, particularly the State Engineering Works. Hence themes for the park are related to locally important industries and incorporated into elements such as park furniture and playground equipment eg. swings supported from crane-like structures.

Barbecue facilities should be provided in the park along with a public toilet, particularly as the only public toilet on the foreshore is located at the Gilbert Fraser Reserve. Again the design of the toilet should reflect an industrial theme.

Appropriate use of native tree and shrub species should be incorporated into the park to provide shade and extend the area of natural vegetation of the foreshore.

A community orientated designer should be used to assist in the park design.

Area C: Public Open Space (walkway between dual use path and Thompson Road)

This thin area of open space was developed to accommodate an eventual pedestrian/ cyclist link between the river and the sea and also represents the historical proposal to develop the "Rocky Bay cut" (see Section 3.2). It also represents the narrowest point in the Leighton Peninsula.

This area should be revegetated with low growing native species with one or two trees at the river end of the path. Other suggestions for the path include a story path which illustrates the history of the area through appropriate sculptural forms or murals. These should be of appropriate scale and form.

Area D: Limestone cliffs

The limestone cliffs of Rocky Bay are an outstanding natural feature of the foreshore. They have high conservation value and are of regional significance. The design has focussed on protecting and enhancing their inherent natural beauty and upgrading their conservation value. This includes:

- a program to ecologically restore the low closed forest community which once naturally occurred on the cliffs. This can be achieved through assisted natural regeneration (bush regeneration) including weed control programs and revegetation using key species such as the Rottnest Island Pine, Tuarts, Acacia xanthina and other naturally occurring species.
- access down the cliff should be limited to designated areas such as the path leading down to the cave and beach below lot 320 and down from Cypress Hill to Harvey Beach.
- appropriate viewing nodes should be developed along the cliff top at points shown on the concept plan (Figure 14). Each node should contain well designed seats which

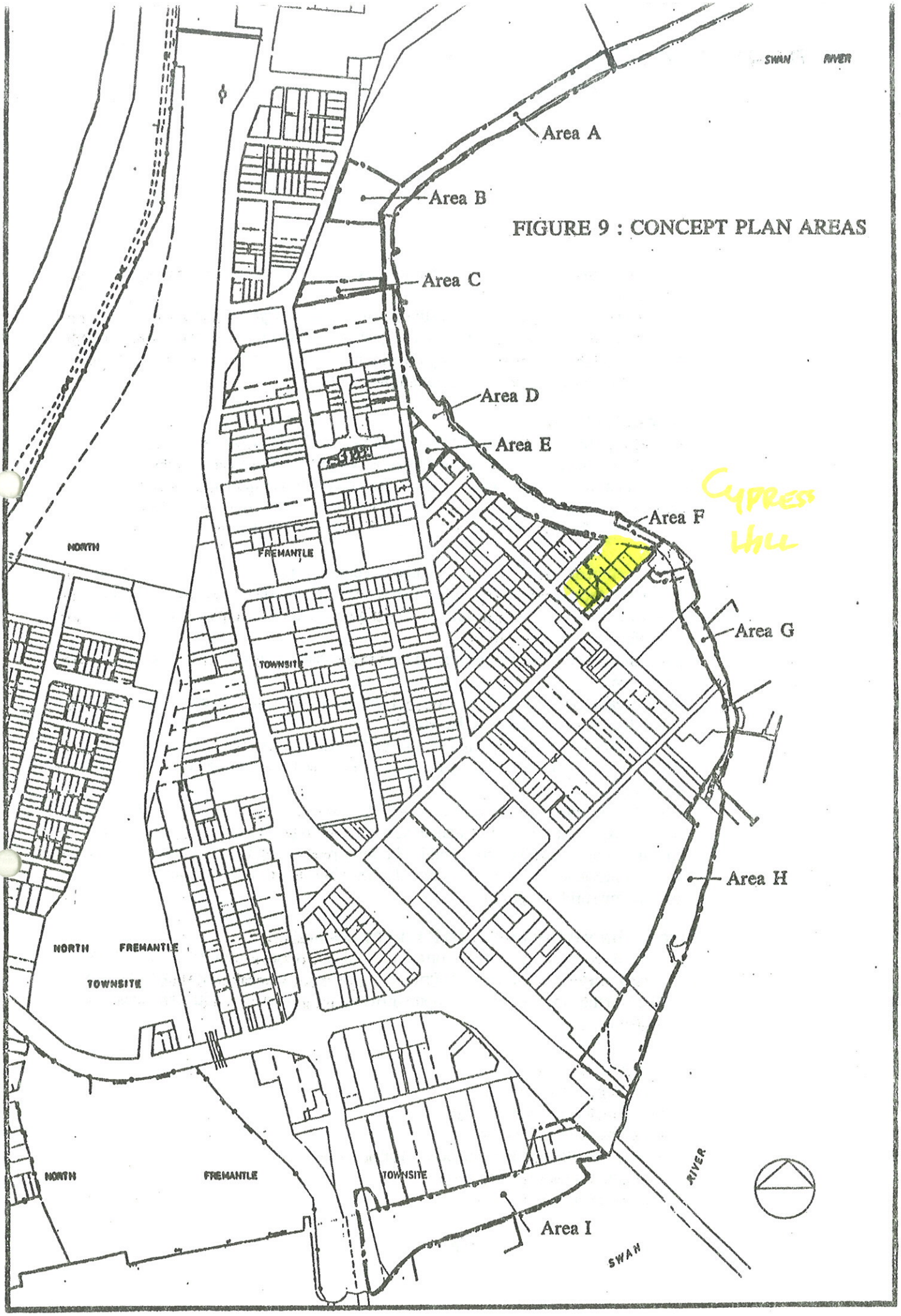


FIGURE 9 : CONCEPT PLAN AREAS

integrate into the natural environment along with shade trees (eg. Melaleuca lanceolata).
- the Heritage Trail which runs along the cliff top between Cypress Hill and the end of Rule Street should be maintained as a natural foot worn track. The reserve width in front of the Myuna flats (at cliff-top level) is not wide enough to allow safe passage and should be widened to a minimum of five metres.

Area E: Lot 320

Lot 320 is a relatively large open area which rises gradually from Rule Street towards the cliffs edge which contains limestone outcrops. Vegetation found in this area consists primarily of introduced grasses such as buffalo and couch grass and the bulbous species *Freesia aff. leichtlinii*. Towards the cliffs edge more native vegetation occurs. The design concept for this area is shown in Figure 11. It incorporates:

- an arboretum of low growing local native species that includes many ephemeral and uncommon species originally found in the area but have since disappeared through disturbance, for example orchids and trigger plants. This will also extend the existing area of native vegetation.
- some trees are included in the design to provide shade and add vertical scale to the landscape.
- arcs of seating are shown at the south-eastern corner of the park to enable views into Lot 320 and outwards across the river.
- two names have been suggested for this park: "Rocky Bay Park" or the Aboriginal name for the Rocky Bay area "Garangup". Public opinion should be canvassed on the preferred name.
- access to the beach, cave and tunnel below Lot 320 should be improved with additional steps constructed in the same manner as those existing. The recreational amenity of this area should be enhanced through additional planting and weed removal. Access to the former pumping station concrete platform should be developed through wooden or limestone bridging platforms.

Area F : Harvest Road Beach ("Harvey Beach")

As part of the community consultation component of this study twenty three Year 6 and 7 students from the North Fremantle Primary School were taken to Harvest Road Beach and asked for their ideas on the development of the area. A summary of their suggestions is given below:

- upgrade shelters
- ladder at the end of the jetty
- diving board at the end of the jetty
- put a pontoon near the buoy
- another drinking fountain with better quality water
- put in more shade trees and shrubs
- improve the quality of paths

PLAN VIEW

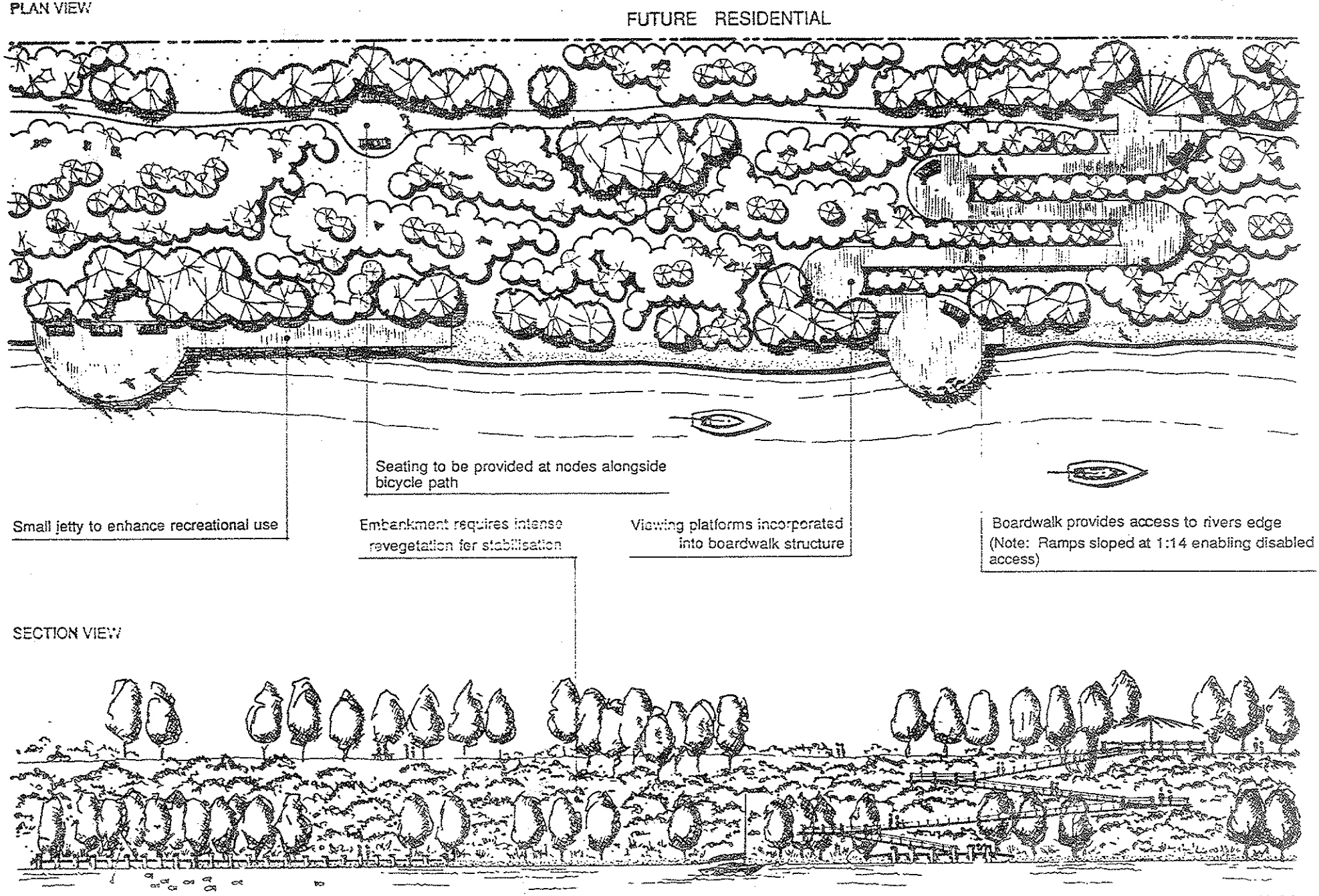


Figure 10 : Boardwalk Detail Area

N.T.S

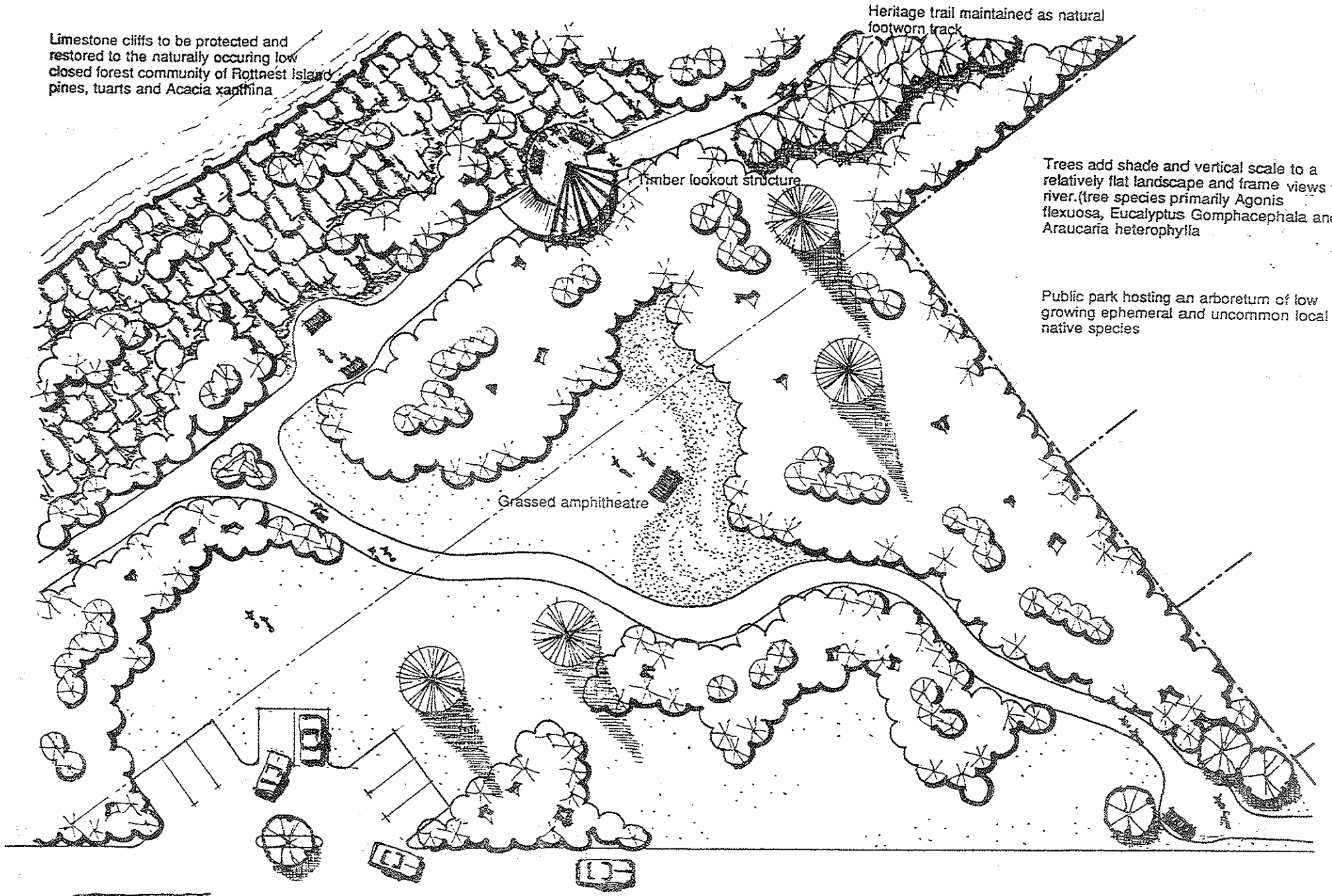


Figure 11 : Lot 320 Detail Area N.T.S

Their major concern however was over the level of water pollution.

These ideas were considered by the Steering Committee and the final design concept is shown on Figure 12:

Some of the main features of the design include:

- provision of access to the water for the disabled

- change the design of the steps entering the water to a semi-circular form with standard distances between treads (not the oversized ones that exist today)

- consider the option of building a wooden platform off the northern face of the water police jetty

- provision for a ladder at the end of the existing jetty

- increased planting of indigenous trees and shrubs.

Some concerns have been raised over the conflicts between beach users, dogs and people fishing. This problem should be monitored and appropriate action taken if required.

Area G: Harvest Road Beach to Gilbert Fraser Reserve

The City of Fremantle's North Fremantle Foreshore Policy document has stated the requirement for provision of a public access route through privately owned land next to the Water Police Headquarters on future redevelopment of this site. It also stated that the existing route between Harvest Road and the Gilbert Fraser Reserve should be protected and the public be made aware of its location and availability through signposting. This policy is endorsed by this study and adequate sign posts should be erected at appropriate locations to guide the public in its use.

The small beach area at the end of John Street should be enhanced and provisions for launching small boats and canoes considered.

Theme planting should be developed along the length of the access route to integrate and enhance it with other parts of the foreshore.

The public should be informed, through signposting, of the provision of a public accessway between the private jetties as shown below.

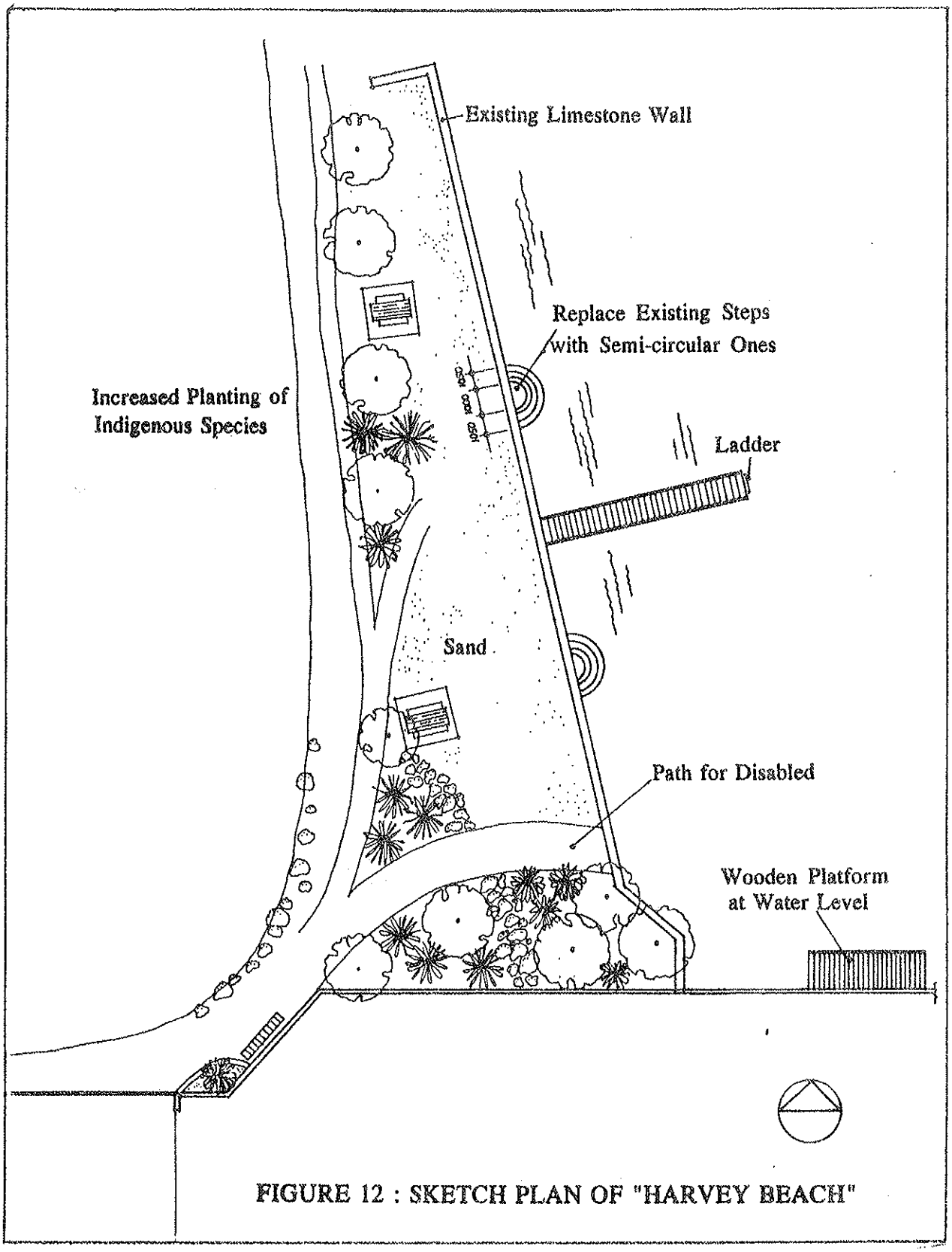


FIGURE 12 : SKETCH PLAN OF "HARVEY BEACH"

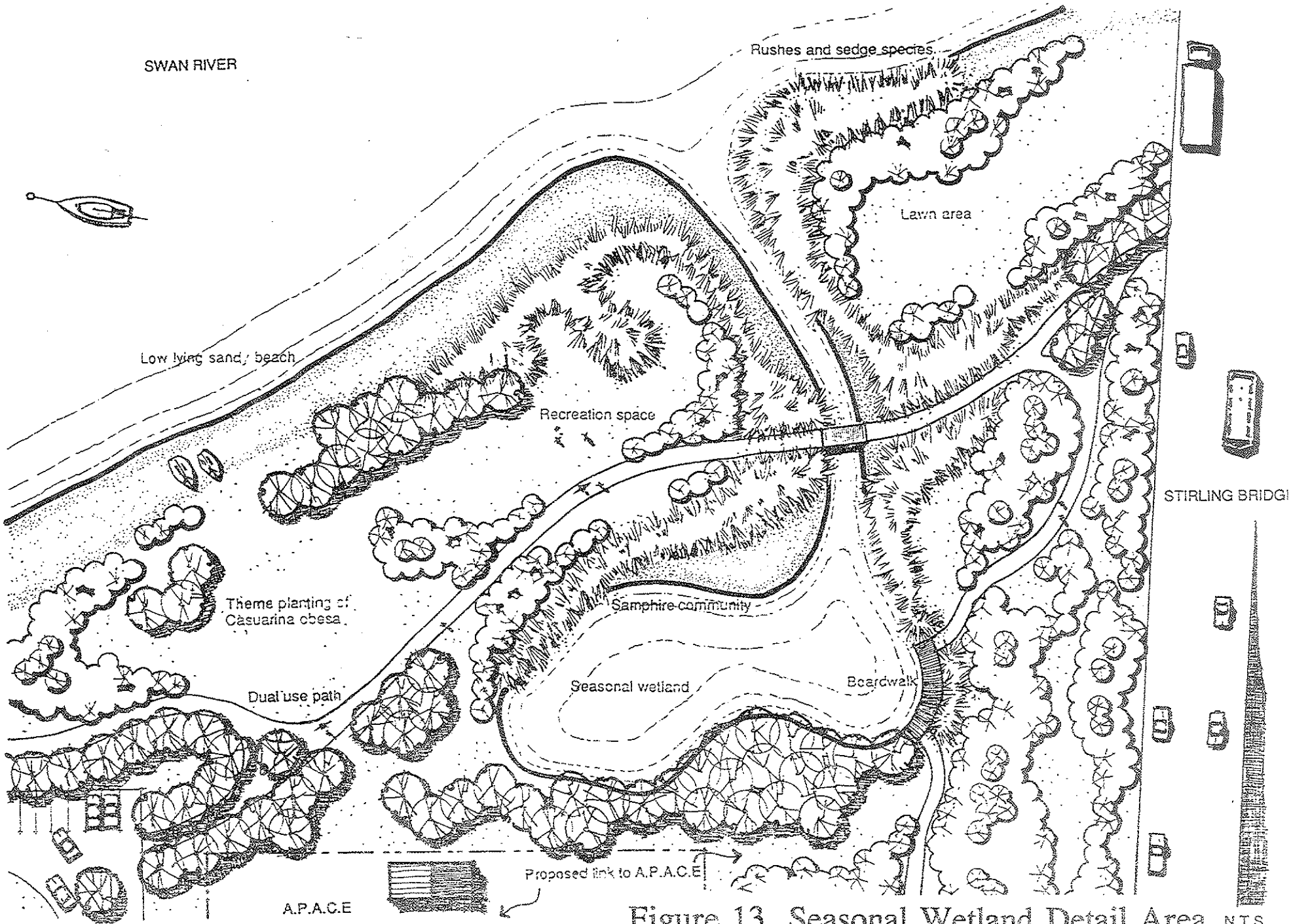


Figure 13 Seasonal Wetland Detail Area N.T.S

Area H: Gilbert Fraser Reserve to Stirling Bridge

This part of the foreshore consists of a sandy beach and swards of native rushes growing next to the beach edge. A traditional parkland landscape consisting of lawn and trees is also found in this part of the study area. The whole of this area is extensively used for passive recreation by local and more regional users.

Protection and enhancement of the natural features particularly the beach and native rushes was considered a design priority. The area of rush communities should be extended were appropriate and a clear delineation between the lawn areas and rush communities should be developed (to avoid mowing of the rushes). The existing occurrence of *Casuarina obesa* within the rush communities and along the beach should be extended as a theme species.

Vistas to the river should be maintained and developed, this may involve the judicious removal of some existing species (especially on the river side of the bicycle path between Johanna Street and Stirling Bridge).

Consideration should be given to the removal of the low fence on the southern side of Gilbert Fraser Reserve. This will increase the visual integration of the entire public open space in this area.

The design also includes the development of a seasonal wetland on the northern side of the bicycle path between Johanna Street and Stirling Bridge. This area is seasonally inundated during the winter months and the design proposes to enlarge and deepen this area and link it to the river. It is envisaged that the wetland will be flushed by river water at high tides. The perimeter of the wetland should be planted with appropriate rushes and sedge species along with suitable trees and shrubs. Seasonal wetland areas once occurred through this area and the design aims to increase the biodiversity of the area by providing habitats for additional plant and animal species. It should serve to increase habitats for waders and other water birds.

There is great potential to develop this proposal as part of a demonstration project within existing environmental education projects run by Apace Aid which adjoins this site.

Areas of vacant crown land found at either end of Reserve 36420 should be incorporated into this reserve and the reserve upgraded to a Class A reserve.

Recommendation 9

The vacant crown land contiguous with Reserve 36420 should be incorporated into Reserve 36420 and this reserve be reclassified to an A Class reserve.

Recommendation 10

The current zoning of Special Use in the study area between the Johanna Street and Stirling Bridge, as shown on the Metropolitan Region Scheme and the City of Fremantle's Town Planning Scheme No.3, be amended to "Parks and Recreation".

Area I: Stirling Bridge to Fremantle Bridge

The area between the bridges forms part of the secondary study area and contains beach and marine related industries. The policy formulated for this area by the City of Fremantle was recognised in the design process.

There was particular recognition of the relatively limited areas of natural sandy beaches occurring in the Fremantle region, most of which are found in North Fremantle. The opposite river bank in East Fremantle is composed of a developed edge. Thus it was felt that the foreshore area of the Anchorage site should retain as much as possible of the undeveloped natural beach. Groynes or some hard edging may be required in places to minimise erosion of the foreshore, however these should be developed in an environmentally and aesthetically sensitive fashion.

Where possible the existing jetties should be retained and be made available for public use.

The current zoning (see Section 2.2) should be changed to increase the MRS "Parks and Recreation" reserve to the area shown on the Concept Plan (Figure 14). Appropriate development which reflects the proposed new zoning could take place within this reserve. By reserving this area as "Parks and Recreation" it would ensure the following objectives of the City of Fremantle's foreshore policy are met:

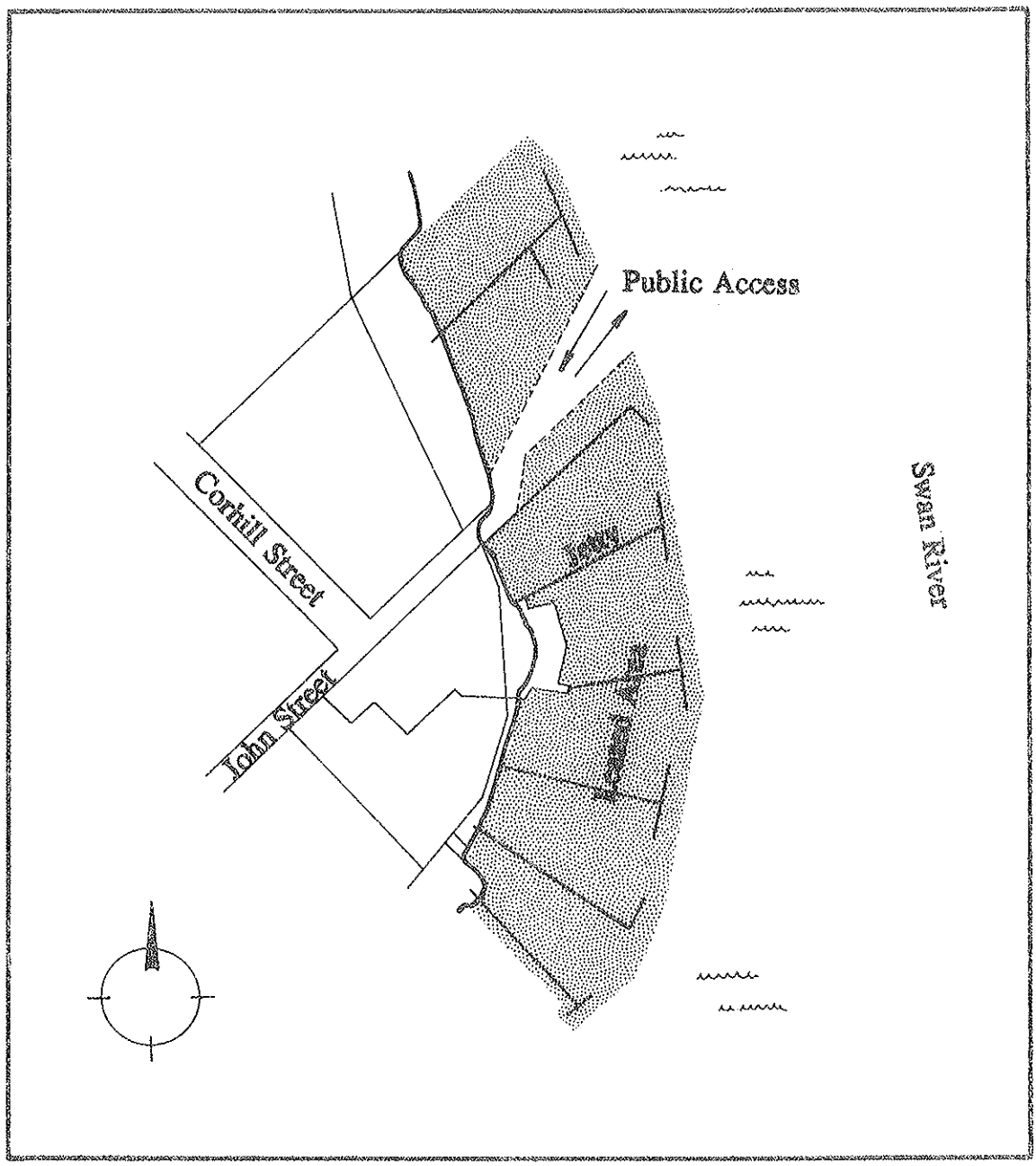
- public access to the foreshore
- continuous pedestrian/cycle link across the site at waters edge
- users have some rational relationship to the foreshore location
- protect the existing beach.

To preserve the recreational and aesthetic amenity of the foreshore any future dual use path in this area should be located away from the waters edge.

Recommendation 11
The current MRS zoning on the foreshore area of the Anchorage site be amended to "Parks and Recreation" as shown on the Concept Plan (Figure 14).

Recommendation 12
The City of Fremantle develop the North Fremantle river foreshore along the lines shown in the Concept Plan to maximise the conservation and passive recreation value of the foreshore.

Recommendation 13
The design of all park furniture, paths, signs and other embellishments to be constructed of suitable materials of sympathetic form, scale, colour and texture to harmonise with the existing environment.



Map showing location of public accessway between leased jetties (Courtesy : Marine and Harbours Dept.)

SWAN RIVER

POINT DIRECTION

AREA G HARVEST ROAD BEACH TO PIER 21
Public access route

PIER 21

Area for dinghy storage

Area for dinghy storage

AREA H PIER 21 TO STIRLING BRIDGE
Rush and samphire communities enhanced with casuarina theme planting

Vistas to river enhanced

Seasonal Wetland
REFER TO DETAIL PLAN

WATER POLICE HEADQUARTERS

AREA F HARVEST ROAD BEACH

Heritage trail to be maintained as a natural foot worn track

AREA D LIMESTONE CLIFFS
Limestone cliffs to be protected and restored to the naturally occuring low closed forest community

ROCKY BAY

Homeswest

CYPRESS HILL

GILBERT FRASER RESERVE

STIRLING BRIDGE

Retain undeveloped beach areas

A.P.A.C.E.

AREA A FORESHORE
REFER TO DETAIL PLAN

BOARDWALK

VIEWING NODE
Viewing nodes integrated into natural environment

FUTURE RESIDENTIAL

SMALL JETTY

AREA C "ROCKY BAY CUT"
Lineal open space forms visual link between river and ocean.

NORTH FREMANTLE PRIMARY SCHOOL

AREA B INDUSTRIAL THEME PARK
SECONDARY STUDY AREA
Use of native tree and shrub species reinforces area of natural foreshore vegetation

Park furniture & playground structures to reflect industrial heritage of site area.

FUTURE RESIDENTIAL

FUTURE RESIDENTIAL

AREA E LOT 320
REFER TO DETAIL PLAN

P.O.S

ANCHORAGE SITE
SECONDARY STUDY AREA
Proposed "Parks and Recreation Zoning"

FREMANTLE BRIDGE

Street
Rule
Road
Highway
Stirling

KEY

- ECOLOGICAL RESTORATION AREA: LOW CLOSED FOREST
- ECOLOGICAL RESTORATION AREA: RUSH AND SAMPHIRE COMMUNITY
- THEME PLANTING: CASUARINA OBESA, CALLITRIS PREISSII AND MELALEUCA LANCEOLATA
- SANDY BEACH
- NORFOLK ISLAND PINE
- PEDESTRIAN ACCESS AND VIEWING NODE

NORTH FREMANTLE FORESHORE

CONCEPT PLAN

SCALE 1:2000

North

•ECOSCAPE•
LANDSCAPE ECOLOGISTS and ENVIRONMENTAL CONSULTANTS

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References

Catamore R. (1986). Swan River, Perth to Fremantle harbour: guide to points of interest with maps.

Clark, J. & Dortch, C.E. (1977). A 10,000 year radiocarbon date for archaeological date finds within a soil of the Spearwood dune system. Search 8(1/2), Jan-Feb.

Dixon I.R. and Keighery, G.J. (1992). Weeds and their Control. Unpubl. manuscript.

Downey, H.S.G. (1970). Mosman Park, Western Australia. University of W.A. Press

Hammond, J.E. (1933). Winjan's People. Facsimile (1980), Hesperian Press.

LeProvost, Seminiuk and Chalmer (1987) Relocation of Swan Wool Scouring (W.A.) and the Fremantle Steam Laundry : Impact of Effluent Discharges on the Swan River. Public Environmental Report for Superannuation Board.

Management Strategy Task Force (1988). Swan River Management Strategy. Report to the Government of W.A.

McDonald, T. (1991). Glossary of Ecological Restoration Terms. Unpubl.

North Fremantle School Magazine, Centenary Edition (1986).

North Fremantle Foreshore Policy. (1987). City of Fremantle.

Old Shoreline Heritage Trail, Fremantle - Manjaree Track (1988). City of Fremantle.

Perth Gazette (1837)

Personal Communication. H.Bidders (1991)

Personal Communication. Ken Colbung, July 28, 1987.

Personal Communication. G. Doepel.

Personal Communication. S.Woollett (1991)

Playford, P.E. (1988). Guidebook to the Geology of Rottnest Island. Excursion Guidebook No. 2. Geol. Soc. of Aust. (WA Div) & Geol. Sur. of W.A. Publ.

Robinson J. (1989). North Fremantle - a changing environment. Environmental Science Discussion Paper 4/87, Murdoch University.

Rocky Bay Heritage Trail (1988) W.A. Heritage Committee Publ.

Seddon, G. (1972). Sense of Place. University of W.A. Press, Perth. Specht, R.L. (1970). Vegetation in The Australia Environment. (ed. G.W.Leeper) (C.S.I.R.O. and M.U.P.)

The Morning Herald supplement, 1907

Thurlow,B.H., Chambers, J. and Klemm, V.V. (1986). Swan-Canning Estuarine System, Environment,Use and the Future. Waterways Commission Report No. 9.

Western Australian Museum (1971). The fossil deposit at Minim Cove, Mosman Park. Museum Leaflet, May 1971.

Western Australian Naturalists' Club (1985). Submission to Mosman Park Council on reserves in the Town.

Appendix 1

NORTH FREMANTLE FORESHORE PLANT SPECIES LIST

Acacia cyclops	Red Eyed Wattle
Acacia rostillifera	
Acacia xanthina	Summer Scented Wattle
Acacia saligna	
Acanthocarpus preissii	Prickly Lily
Agonis flexuosa	Peppermint
Alyxia buxifolia	Hop Bush
*Anagallis arvensis	Pimpernel
Anthropodium capillipes	
*Artotheca calendula	Cape Weed
*Arundo donax	Giant Reed
*Asphodelus fistulosus	Onion Weed
*Avena barbata	Bearded Oat
*Briza maxima	Blowfly Grass
*Bromus madritensis	Madrid Brome
*Cakile maritima	Sea Rocket
Cassytha racemosa	Dodder Laurel
Cassytha glabella	Tangled Dodder Laurel
Clematis microphylla	Old Man's Beard
*Conyza bonariensis	Fleabane
*Cynodon dacylon	Couch
*Diplotaxis muralis	Wall Rocket
Dodonea aptera	Hop Bush
Dryandra nivea	Couch Honey Pot
Dryandra sessilis	Parrot Bush
Eremophila glabra	Tar Bush
*Euphorbia terracina	Geraldton Carnation Weed
*Foeniculum vulgare	Fennel
*Freesia aff. leichtlinii	Freesia
Grevillea crithmifolia	
Grevillea thelemanniana	Spider Net Grevillea
Guichenotia ledifolia	
Hakea prostrata	Harsh Hakea
Hardenbergia comptoniana	Native Wisteria
*Hedypnois rhagadioloides	Cretan Weed
*Hypochaeris glabra	Smooth Cats ear
Isolepis nodosa	Knotted Club-rush
Juncus kraussii	
Juncus sp.	
*Lagunaria patersonia	Norfolk Island Hibiscus
*Lagurus ovatus	Hare's Tail Grass
Lepidosperma angustatum	
*Leptospermum laevigatum	Coastal Tea Tree
*Lobularia maritima	Sweet Alyssum
*Lolium rigidum	Ryegrass
Loxocarya flexuosa	

Appendix 1

NORTH FREMANTLE FORESHORE PLANT SPECIES LIST

Macrozamia reidlei	Zamia
*Malva parvifloria	Smallflower Mallow
*Medicago polymorpha	Medic
Melaleuca acerosa	
Melaleuca huegelii	Chenille Honey myrtle
Melaleuca lanceolata	Rottnest Island Teatree
*Melilotus indica	King Island Melilot
*Nicotiana glauca	Tree Tabacco
*Oenothera drummondii	Evening Primrose
Opercularia vaginata	
*Orabanche minor	Lesser Broomrape
*Oxalis pes-caprae	Soursop
*Pelargonium capitatum	Rose Pelargonium
*Pennisetum villosum	Feathertop
Petrohagia velutina	
Pimelea leucantha	
Pittosporum phyllyraeoides	Weeping Pittosporum
*Phoenix dactylifera	Date Palm
*Phoenix reclinata	Senegal Date Palm
*Ricinus communis	Caster Oil Bush
*Romulae rosea	Guildford Grass
Sarcocornia quinqueflora	
*Scabiosa atropurpurea	Purple Pincushion
Scaevola crassifolia	Thick leaved fan flower
Scaevola parvifolia	Fan Flower
Scenecio lautus	Coastal Groundsel
Schoenus curvifolius	
*Solanum nigrum	Blackberry Nightshade
*Sonchus asper	Rough Sowthistle
*Sonchus oleraceus	Common Sowthistle
Spinifex hirsutis	
Spyridium globulosum	Basket Bush
*Stenaphrum secundatum	Buffalo Grass
Stipa elegantissima	Feather Spear Grass
Suaeda australis	
Templetonia retusa	Cockies Tongue
*Tetragonia decumbens	Sea Spinach
*Trachyandra divaricata	
Tricoryne elatior	Yellow Autumn Lily
*Ursinia anthemoides	Ursina
Xanthorrhoea preissii	Common Blackboy

* exotic species

Appendix 2

REVEGETATION SPECIES LIST

Acacia cochlearis	
Acacia cyclops	Red Eyed Wattle
Acacia rostillifera	
Acacia xanthina	Summer Scented Wattle
Acacia saligna	
Acacia truncata	
Acanthocarpus preissii	Prickly Lily
Agonis flexuosa	Peppermint
Alyxia buxifolia	Hop Bush
Allocasuarina humilis	
Banksia attenuata	Candle Banksia
Callitris preissii	Rottnest Island Pine
Calothamnus quadrifidus	One-sided Bottlebrush
Casuarina obesa	Swamp Sheoak
Clematis microphylla	Old Man's Beard
Conostylis candicans	
Dianella divaricata	
Dodonea aptera	Hop Bush
Dryandra nivea	Couch Honey Pot
Dryandra sessilis	Parrot Bush
Eucalyptus decipiens	Limestone Marlock
Eucalyptus foecunda	Fremantle Mallee
Eucalyptus gomphocephala	Tuart
Eremophila glabra	Tar Bush
Grevillea crithmifolia	
Grevillea thelemanniana	Spider Net Grevillea
Guichenotia ledifolia	
Hakea prostrata	Harsh Hakea
Hardenbergia comptoniana	Native Wisteria
Hemiandra pungens	
Isolepis nodosa	Knotted Club-rush
Juncus kraussii	
Kennedia prostrata	Running Postman
Logania vaginalis	White Spray
Macrozamia reidlei	Zamia
Melaleuca acerosa	
Melaleuca huegelii	Chenille Honeymyrtle
Melaleuca lanceolata	Rottnest Island Teatree
Nitraria billardierei	Nitre Bush
Pimelea leucantha	
Pittosporum phyllyraeoides	Weeping Pittosporum
Santalum acuminatum	Quandong
Scaevola crassifolia	Thick leaved fan flower
Scaevola parvifolia	Fan Flower
Spyridium globulosum	Basket Bush
Templetonia retusa	Cockies Tongue
Xanthorrhoea preissii	Common Blackboy

Appendix 3

ROCKY BAY HERITAGE TRAIL REVEGETATION SPECIES LIST

In 1988 the North Fremantle Community Association and Apace Aid planted a number of endemic plants along the foreshore associated with the development of the Heritage Trail. The following is the species and numbers were planted.

SPECIES	NUMBER
Acacia cochlearis	60
Acacia cyclops	162
Acacia lasiocarpha	1
Acacia littorea	240
Acacia rostillifera	55
Acacia saligna	507
Acacia truncata	148
Acacia xanthina	249
Agonis flexuosa	237
Atriplex isatidea	21
Callitris preissii	318
Casuarina obesa	202
Clematis microphylla	20
Eucalyptus decipiens	45
Eucalyptus foecunda	162
Eucalyptus gomphocephala	386
Grevillea crithmefolia	6
Guichenotia ledifolia	74
Hakea prostrata	112
Hardenbergia comptoniana	618
Isolepis nodosus	46
Kennedia prostrata	79
Melaleuca heugleii	606
Melaleuca lanceolata	42
Olearia axillaris	210
Rhagodia baccatta	110
Scaevola crassifloia	263
Sollya heterophylla	10
Spyridium globulosum	3
Templetonia retusa	989
Xanthorrhoea pressii	253
Total	7752

Appendix 4

REVEGETATION LIST OF SEW SITE EMBANKMENT

Species

Agonis flexuosa
Callitris preissii
Eucalyptus foecunda
Eucalyptus gomphocephala
Melaleuca lanceolata
Acacia xanthina
Dryandra sessilis
Hakea prostrata
Pittosporum phylliraeoides
Spyridium globulosum
Scaevola crassifolia
Templetonia retusa
Eremophila glabra
Grevillea thelemanniana
Hardenbergia comptoniana
Kennedia prostrata

Appendix 5

REPTILES OF THE NORTH FREMANTLE FORESHORE

Species	Common name
Pseudonaja affinis	Dugite
Pogona minor	Western Bearded Dragon
Diplodactylus spinigerus	Spiny Tailed Gecko
Heteronotia binoei	Bynoe's Gecko
Lialis burtonis	Burton's Legless Lizard
Cryptoblepharus plagiocephalus	Fence Skink
Hemiergis peronii quadrilineata	Yellow bellied Skink
Tliqua rugosa	Bobtail Lizard
Egernia kingii	King Skink
Ctenotus fallens	Striped Skink
Lerista praepedita	Burrowing Skink
Menetia greyii	
Morethia obscura	

Appendix 6

MAMMALS OF THE NORTH FREMANTLE FORESHORE
(Terrestrial species only)

Common Name	Scientific Name
Common Brushtail Possum	Trichosurus vulpeca
Domestic Cat	Felis catus
Black Rat	Rattus rattus
House Mouse	Mus musculus
Red Fox	Vulpes vulpes

Appendix 7

BIRDS OF THE NORTH FREMANTLE FORESHORE

Species	*Abundance\ Status	Habitats				
		River	Shore	Open	Veg	Suburb
Australian Pelican	C\R	*				
Pied Cormorant	C\R	*	*			
Little Pied Cormorant	VC\R	*	*			
Great Cormorant	UC\R	*				
Little Black Cormorant	C\V	*	*			
White-faced Heron	C\R		*			
Eastern Reef Heron	UC\R		*			
Rufous Night Heron	UC\R		*			
Pacific Black Duck	UC\V	*	*			
Black-shouldered Kite	C\R			*	*	
Australian Kestrel	C\R			*	*	*
Pied Oystercatcher	UC\V		*			
Greenshank	UC\V		*			
Silver Gull	VC\R\V	*	*	*		*
Caspian Tern	C\V	*				
Crested Tern	C\V	*				
Feral Pigeon	VC\\R			*		
Spotted Turtle-Dove	UC\\R				*	*
Laughing Turtle-Dove	VC\\R					*
White-tail Black-Cockatoo	UC\M				*	*
Galah	VC\R			*	*	*
Port Lincoln Ringneck	C\R				*	*
Southern Boobook	R\R			*	*	
Laughing Kookaburra	C\\R				*	*
Sacred Kingfisher	UC\R			*	*	
Rainbow Bee-eater	UC\M			*	*	*
Welcome Swallow	VC\R		*	*	*	*
Tree Martin	C\R		*	*	*	*
Black-faced Cuckoo-shrike	UC\R				*	*
Red Wattlebird	C\R				*	*
Singing Honeyeater	VC\R			*	*	*
Brown Honeyeater	VC\R				*	*
New Holland Honeyeater	C\V				*	*
Mistletoebird	UC\V				*	
Striated Pardalote	UC\R				*	*
Silvereye	C\R\M				*	*
Australian Magpie-lark	C\R			*	*	
Pied Butcherbird	UC\R				*	*
Australian Magpie	VC\R			*	*	*
Australian Raven	VC\R			*	*	*

Notes
*Bird species abundance:

VC Very Common

C Common

UC Uncommon

R Rare

*Bird species status:

VR Very Rare

R Resident

M. Migrant

V Visitor

I Introduced

Primary Bird habitat areas:

River: includes deep and shallow water areas.

Shore: shoreline, beach, boats and rocky river edge.

Open: ovals, grasslands, limestone cliffs and rocks.

Veg: includes all areas of remnant native vegetation.

Suburbs: suburban gardens,parks, and street trees.

Bird names follow the Royal Australasian Ornithologists Union's (RAOU) recommended list of Common English names.

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