

HOROWHENUA DISTRICT COUNCIL

WAITARERE BEACH FORESHORE

MANAGEMENT PLAN

Prepared July 2000

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Preface

This draft Reserve Management Plan has been prepared under the requirements of the Reserves Act 1977. The plan is designed to assist with day to day decisions as well as provide a long-term direction for the management and use of the Reserve.

The Reserve Management Plan identifies historical information, management issues, objectives and action points for the reserve. This draft Management Plan should be read in conjunction with the Parks and Reserves General Policy Document.

The purpose of notifying the Draft Reserve Management Plan is to allow public inspection and comment (by way of written submission) on the contents of this draft Management Plan and the associated general policies.

The public is formally invited to send written submissions to Council stating, objections to, support and/or suggestions for the Management Plan.

Following consideration of any comments on the draft plan, the Reserve Management Team will amend the plan accordingly and present the plan to the Development Committee of the Horowhenua District Council for approval.

Chairperson

Development Committee

Horowhenua District Council

**Note: Written submissions on this Draft Reserve Management Plan close on the
28th April 2000.**

Acknowledgment

This Management Plan has been prepared under the requirements of the Reserves Act 1977. Members of the public, Iwi and interest groups were all invited to make submissions and attend a public meeting to express their views and ideas for the reserve. This Plan incorporates those views and along with those of Council and those responsible for maintaining the Reserve.

The Reserve Management Team would like to thank all those who have been involved in the process, in particular those who attended the public meetings, presentations and/or made submissions.

In preparing this Reserve Management Plan the following people, Johanna Rosier, Sandy McKellow, Joseph Hill and Peter Shore, deserve special thanks for their efforts and help in undertaking the initial consultation and report preparation.

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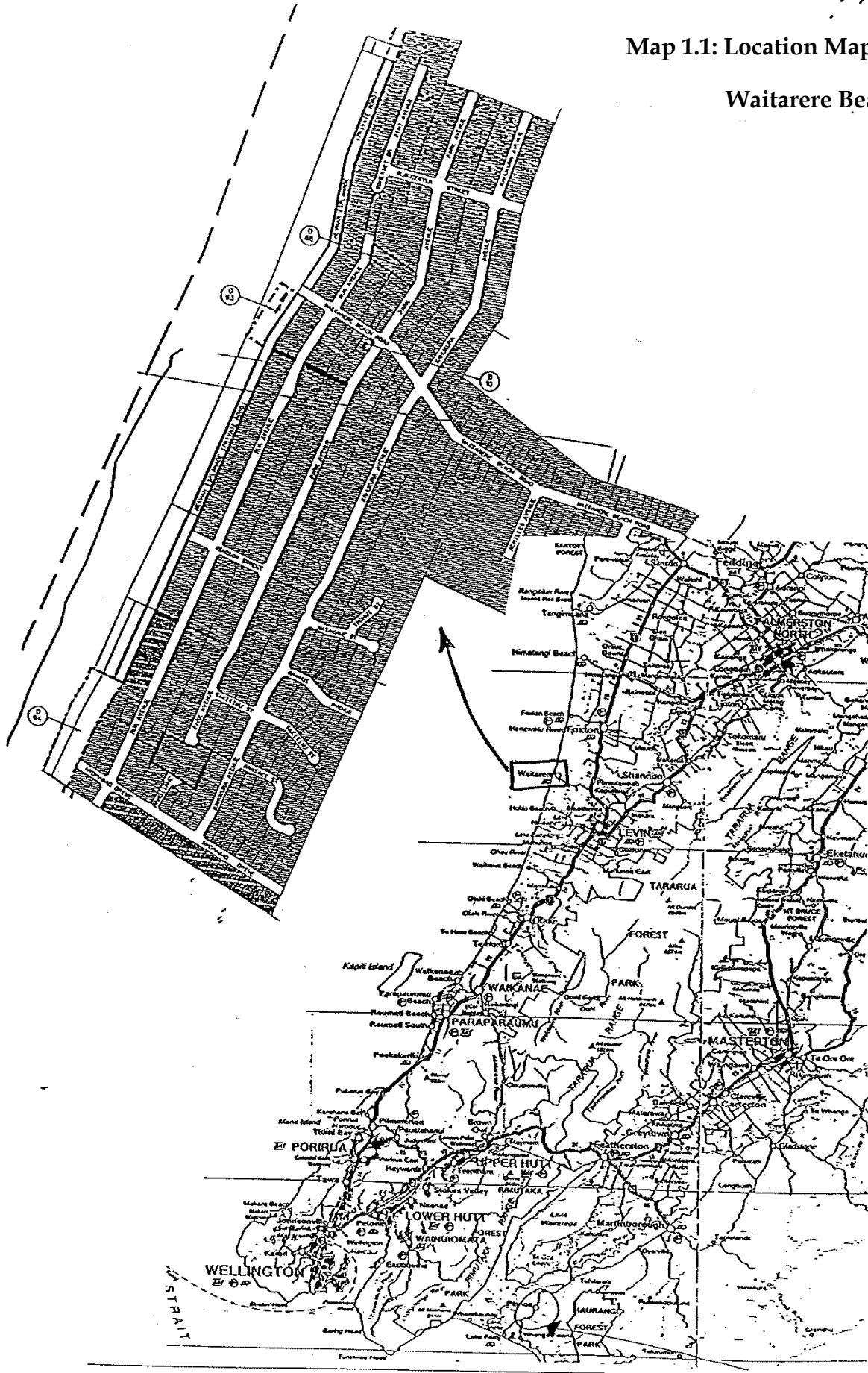
1 STATEMENT OF THE PROBLEM

Waitarere Beach is located 14 kilometres north west of Levin on the West Coast of the North Island. The Location Map (Map 1.1) on the following page shows Waitarere Beach in relation to nearby centres. The community consists of a resident community of 636 people (Statistics New Zealand, 1998). Unlike many of the beaches north and south of it, Waitarere Beach has an accreting coastline. This means that the beach is gaining land at a steady rate each year.

The Waitarere Beach coastline has predominantly spinifex foredunes with marram grass growing on the hind and secondary dunes. Located in behind the foredunes about halfway along the township, is the Waitarere Beach Surf Club building, public toilets and car park. The Waitarere Beach foreshore is probably Horowhenua's most dynamic reserve. The foreshore environment is subject to many natural forces and human activities. The beach is forever responding to accommodate these changes brought about by these forces and activities. Waitarere Beach Foreshore Reserve (see Appendix 1 for Reserve Classification) has a number of issues that need to be addressed before the beach can be managed or developed in a sustainable nature.

Map 1.1: Location Map of

Waitarere Beach



2 INTRODUCTION

2.1 Management Plan Aim

The purpose of this management plan is to outline the current issues and opportunities facing Waitarere Beach and to explain the processes involved in developing the recommended policies and actions.

2.2 Management Plan Objectives

- To understand the natural and physical processes operating in the coastal environment
- To identify the issues associated with Waitarere Beach Foreshore Reserve
- To determine the factors contributing to the issues identified
- To investigate and develop a range of methods and designs to resolve the issues identified
- To provide policies which will assist with both long and short term management decisions and will allow the reserve to be managed and enjoyed in a sustainable manner
- To identify areas which may require specific policies to recognise the more sensitive nature of some parts of the reserve
- To provide the Community with a process that enables them to understand the coastal reserve area and provide important input into its future management.

The following process diagram Figure 2.1 (Eventual Project Process) summarises how this Reserve Management Plan (RMP) has been developed. This process diagram also includes the stages in the RMP development, which have yet to be completed. The process is shown to branch off which is to indicate that much of the early consultation and research formed part of a report presented to Massey University.

2.3 Process History

This section will briefly describe how the process has been implemented, including descriptions of actions or tasks undertaken in each phase.

2.3.1 *Analysis*

The analysis of the Foreshore Reserve and its users was carried out to determine the issues, strengths, weaknesses and opportunities of the site; and to analyse its ability to support the needs and uses, which beach users place on it. This information was gathered from Horowhenua District Council (HDC) files,

newspaper articles, conversations with beach users, interviews and observations. The site has been analysed in terms of its physical capacity, using a 'sieve mapping' technique. This technique uses a series of overlays to highlight areas of the site which present constraints (i.e. which are in need of restoration). The map overlays used in this analysis can be found in Appendix 2. The analysis was used to establish the overall nature of the site and some basic objectives for this management plan.

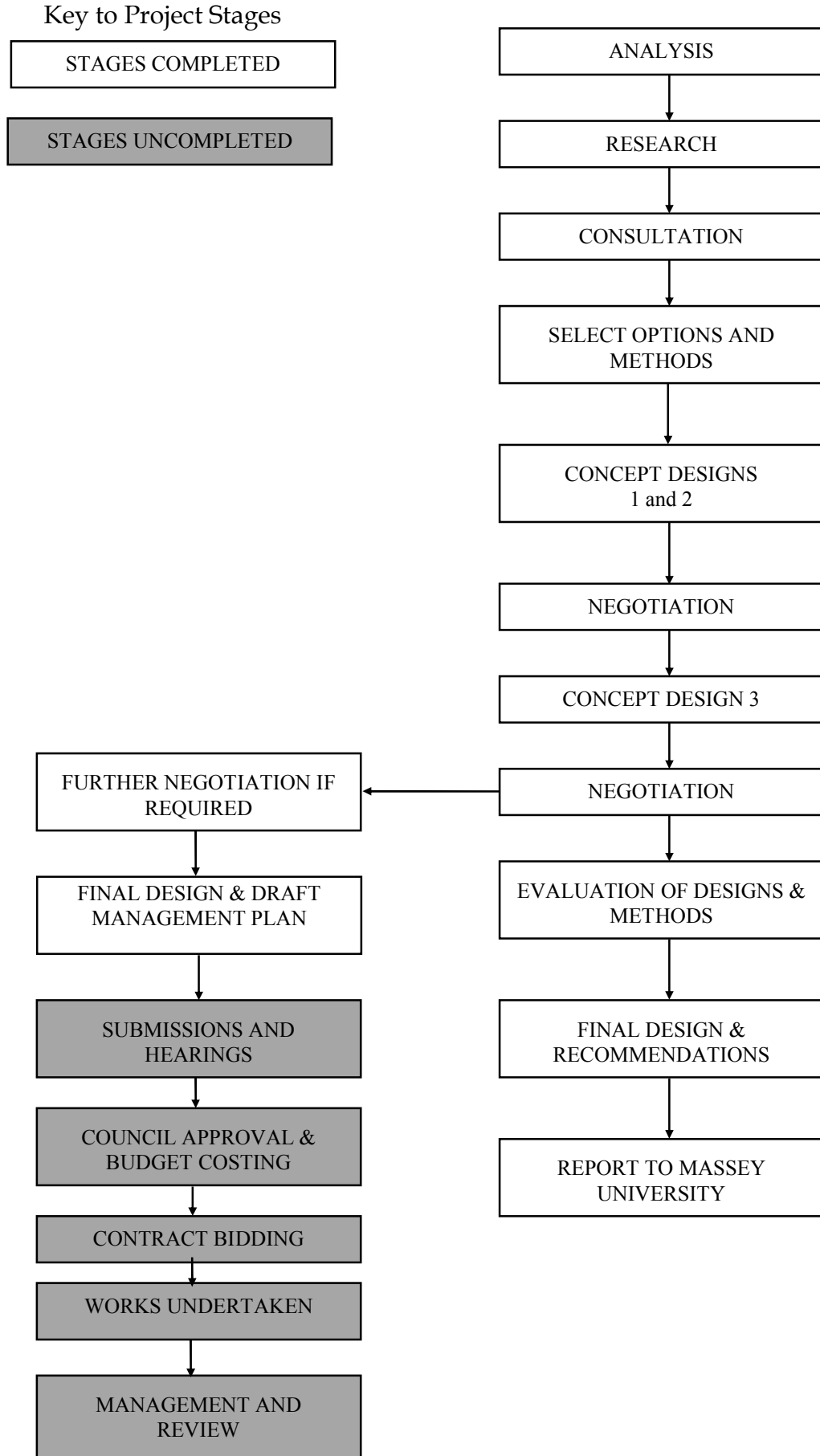
2.3.2 Research

The research stage required data collection about coastal processes, preventative and reactive methods to protect beach and dune systems while facilitating activities. The literature researched gives insights into ways in which certain issues have been resolved in other places. The literature was required to give sufficient understanding to the methodology and process being used.

2.3.3 Consultation

Consultation has been carried out using informal community group meetings and more lately formal public meetings. These meetings were an important means of gaining additional data for the analysis, by raising issues, strengths and weaknesses not previously identified. These meetings were an opportunity for the local residents and interested groups or persons to become involved in the process.

Figure 2.1: Eventual Project Process



2.3.4 Concept Designs for Car Park and Surf Club Area

The opinions of the local residents combined with potential solutions from the literature reviewed, created the basis for the first two concept designs. These were first presented informally to the HDC, and then at a formal public meeting.

2.3.5 Negotiation

A number of heavily debated issues arose from the presentation of the concept designs. These issues became part of a negotiation process, where members of the Waitarere community and the HDC began to negotiate the features of the concept designs in an attempt to find a balance between protecting and developing the coastal environment.

The third and final concept design presented, was a compromise of the first two designs. This final concept design reflects the features agreed upon by both the community and the HDC.

This final design was presented at an extended public meeting, which included representatives from HDC, the Manawatu Wanganui Regional Council (horizons.mw), a local surveyor and members of the Waitarere Beach Progressive and Ratepayers Association (WBPRAs). At a very positive meeting, the third concept design was discussed in detail, and approved by those at the meeting.

This third concept design formed the basis of the recommendations for the report submitted to Massey University (October 1999). The process has since branched off to develop this management plan for the whole foreshore reserve area. The findings of the report where relevant have been incorporated into this management plan.

The process for developing the RMP has followed the requirements of section 41 of the Reserves Act 1977 (see Appendix 3). The Council publicly notified their intention to prepare this document and invited members of the public to make submissions. A public meeting was held on 29 November 1999 to gather public opinions on the reserves at Waitarere (see Appendix 4 for a summary of the meeting minutes). It is these views combined with the previous work carried out consulting with the Waitarere community, that provide the direction for this Management Plan.

2.4 Institutional Context

The land is currently designated by the HDC as Foreshore Reserve in the Horowhenua District Council District Plan. The HDC has responsibility to manage these coastal reserves and is also responsible for issuing consents for activities above the mean high water springs.

Under the Resource Management Act 1991 (RMA), Regional Councils are responsible for developing the Regional Coastal Plan for the management of use, development and protection of the Coastal Marine Area. This plan must be consistent with the purpose and objectives of the New Zealand Coastal Policy Statement, which is prepared by the Minister of Conservation under the RMA. The Regional Council, which for Waitarere Beach is the Manawatu Wanganui Regional Council (horizons.mw), is required to grant or refuse coastal permits for any of the following activities in the Coastal Marine Area

- building or altering a structure
- disturbing the foreshore or seabed
- introducing plants
- taking gravel or sand from the beach
- reclaiming or draining the foreshore or seabed
- discharging waste into coastal water
- depositing material on the foreshore or seabed
- taking or using heat or energy from open coastal water.

2.5 Iwi

Along with all other members of the public, Iwi have been invited to be part of the consultation process in developing this RMP. To date no interest has been shown by Iwi, with the bulk of the consultation being done through the Waitarere Beach Progressive and Ratepayers Association (WBPRA).

3 WAITARERE BEACH: BACKGROUND

3.1 Coastal Processes at Waitarere Beach

Waitarere Beach has an accreting coastline, unlike most of the West Coast beaches in the lower North Island, which are being eroded away by the wind and sea. Accretion occurs when waves break over longshore bars at sea and sand is moved onshore.

The Hyderabad shipwreck, located between Waitarere and Hokio beach is a brilliant example of how the beach has moved out towards the sea. The Hyderabad was ship wrecked during a storm, in June 1878 off the coast of Waitarere Beach (Church, 1978). Even as recently as the mid 1970's people were still able to swim out to the wreck. Now the wreck is almost two thirds buried in sand. The HDC have calculated that the coast is accreting at an approximate rate of 1.65 metres per year.

In most cases an accreting beach has many advantages associated with it, such as the low risk of structures being eroded by the sea. However, there are also disadvantages. The stormwater outlet drains, which go through the dunes, were perfectly designed some 20 years ago, with the end of the drain protruding slightly ahead of the toe of the foredune. Unfortunately with the current coastal accretion, the drain outlets are now as much as 20 metres inland from the toe of the dune. Consequently the natural dune shape is being compromised resulting in the formation of bare sandy blowouts.

Waitarere Beach is a typical accreting beach with wide expansive areas between the ocean and the dunes at low tide. These expansive areas have made the beach quite unique to the Horowhenua-Kapiti region, firstly because it is an accreting beach and secondly it is one of the few New Zealand beaches where vehicles have full access to the beach foreshore area.

3.2 Climate

The Waitarere Beach area enjoys a moderate, dry climate, averaging 74 mm of rain per month, and 892 mm per year. The beach has an average winter temperature of 9°C and summer average of 16°C. The prevailing wind is from the northwest, which is a major factor in the accretion processes at Waitarere Beach (long shore drift).

3.3 Population

The Waitarere community has continued to expand over the last decade. This could be part of a recent internal migration trend, which is seeing many people moving to or investing on the coast (especially the Kapiti Coast). The resident population of Waitarere Beach has increased from 465 in 1986 to 636 in 1996. The number of dwellings at Waitarere Beach has also increased from 224 in 1986 to 272 in 1996 (Statistics New Zealand, 1998). The community is very balanced with a similar number of males to females and both genders having 55 per cent of the population between the age of 30 and 70. This suggests that the population is mainly middle aged.

The community of Waitarere Beach has a number of unemployed and retired workers, which means there is the possibility of involving these people in any major or labour intensive work required at the beach. Of those living at Waitarere Beach, 49 per cent of those over 15 years old are not in the workforce; another five per cent are unemployed but looking for work.

3.4 Waitarere Beach Progressive and Ratepayers Association

The Waitarere Beach community is served by an organised and enthusiastic ratepayers group, known as the Waitarere Beach Progressive and Ratepayers Association (WBPR). The Association has been together since 1942.

Everyone in the community is automatically a member of this Association. However, only financial members can be on the committee. To be a financial member it costs local residents \$5 and absentee homeowners \$10 a year. This group currently meet once a month. The Association sends out a quarterly letter to everyone except absentee homeowners who are not financial members. The Association currently has two councillors (from HDC) on the committee.

4 ISSUES

It must be stressed, that although many of the issues identified in the coastal environment are the same for the whole reserve there are areas within the reserve that (due to the intensive demands placed on them by those using the beach) are far more sensitive than others. Accordingly it is imperative that these areas are managed in a different manner. At Waitarere Beach the area of coastline between the two vehicle entrances is such an area. With the majority of human activities taking place between these entrances the coastline in this area is under far more pressure to remain stable. It is with this in mind that much of the emphasis of this management plan is focussed on this area. The policies which appear in a later section, attempt to cover both the sensitive area (Surf Club area) and also the reserve as a whole.

The issues and their spatial location for this area (the Surf Club area) have been illustrated in Map 4.1 of Waitarere Beach.

Table 4.1: Table of Issues is a complete list of issues relating to the existing situation at Waitarere Beach. The table identifies the issues and whether they are seen as positive or negative aspects at Waitarere Beach. The issues and their spatial locations have been illustrated in Map 4.1, which shows Waitarere Beach as it presently exists. This plan forms the base for the concept design plans, which are to be discussed in a later section. The main issues that have been identified at Waitarere Beach can be grouped under the following headings:

1. The main vehicle entrance to the beach and the associated stormwater outlet
2. Erosion of the foredune around the other stormwater outlets
3. Foredune in front of the Surf Club (Surf Club dune)
4. Car park, Surf Club and toilet facilities
5. Vehicle access to the beach
6. Foot traffic on the dunes
7. Preservation of the coastline
8. Community desire to have a recreation area
9. Vegetation
10. Future development and subdivision

The main issues under each heading will be discussed in brief. The complete list of issues and how they interrelate can be gained from Table 4.1. All photographs referred to in text are located in the Appendix 5 and will be referenced by only their photograph number.

4.1 Main Vehicle Entrance & Associated Stormwater Outlet

The main vehicle access to the beach as illustrated by photograph 1, is a gap (at right angles to the sea) in the foredune, just north of the Surf Club. This road travels right through the Waitarere township and is merely a continuation of the main road (Waitarere Beach Road) off State Highway One.

This entrance acts as a wind funnel, facilitating sand movement inland from the beach. This sand-laden wind causes problems by encroaching on neighbouring properties and blocking drains and gutters. The high velocity winds blowing through the gap, create steep batter slopes, on which there is difficulty establishing vegetation.

The stormwater outlet associated with the main access sometimes becomes blocked from wind blown sand. Photograph 2 shows this outlet, which upon flooding, makes access onto the beach using this point impossible until it has been cleared.

4.2 Other Stormwater Outlets

Due to the accreting nature of the Waitarere Beach coastline, the stormwater outlets to sea no longer extend beyond the toe of the foredune. Photograph 3 illustrates how these outlets are up to 20 metres inland of this point and are severely undermining the dune's natural profile.

This erosion is creating blowouts in the foredune. This issue must be resolved so a uniform dune profile can be re-established and further degradation prevented.

4.3 Foredune in front of the Surf Club

The height of this marram dune is restricting the view of the beach (as shown in photograph 4) from the Surf Club tower and car park, jeopardising public safety. Few people will leave cars in the car park, which in part is due to the inconvenience but also the concerns over vehicle security, since the car park can not be seen from the beach.

The blowout at the toe of this dune is increasing in size despite attempts by local residents to cover the exposed sand. As indicated by photograph 5 an undesirable amount of sand, now blows through and encroaches on the car park. It has been initially caused by foot traffic generated by users of the Surf Club and car park but it has been made worse by off-road motor cycles.

Map 4.1: Location of Issues Present at Waitarere Beach

4.4 Car Park, Surf Club and Toilet Facilities

These facilities are currently under utilised. A lack of awareness is partially responsible for this lack of use. The car park entrance is also a major contributor to this. The design of the main entrance to the beach means many people drive past the difficult turn-off to the car park (shown in photograph 9) without even noticing it.

The car park has poor visual links with the beach and so people are reluctant to leave their vehicles in the car park where they can not see them.

The amount of sand blowing through the car park, combined with the swarms of mosquitoes, has tended to make the car park a less than pleasant place to spend time. The mosquitoes tend to be more noticeable when there are puddles of water sitting around, with nowhere to drain.

4.5 Vehicle Access to the Beach

The beach has two vehicle entrances; the main entrance from Waitarere Beach Road and the second entrance from Windsor Street (one kilometre further south).

The major problem associated with these entrances is sand blowing up the access-ways from the steep bare batter slopes and directly from the beach. This is exacerbated by the fact that the access-ways are gaps in the foredune, aligned with the prevailing wind. The Windsor Street entrance has a design (shown in photograph 7) which is more naturally shaped and subsequently it experiences less sand drift problems.

The excess build-up of soft sand causes vehicles to get stuck as they come off the formed track. The excess sand and driftwood as illustrated by photograph 8, is often pushed in front of the existing foredune, compromising the ideal dune shape and subsequently interfering with nature's processes.

4.6 Foot Traffic on the Dunes

The native sand dune plants at Waitarere Beach (spinifex and pingao) are sensitive to treading damage. While there is formed access tracks for vehicles, no efforts have been made to protect the dune vegetation between entry points or to restrict haphazard movement across the dunes by providing pedestrian access tracks. As illustrated by photograph 6 pedestrians are creating paths at

will, with native sand dune plants (spinifex and pingao) being damaged and destroyed.

The dunes are also being severely damaged by off road motor bikes and four-wheel bikes. These vehicles, like pedestrians have free reign over the dunes destroying the vegetation cover and reshaping dunes in the process.

4.7 Preservation of the Coastline

There is an increasing awareness by local residents, Horowhenua District Council and the Regional Council of the need to protect and preserve the coastline. This has come about from the realisation that the beach is deteriorating and if left as it is, things will only worsen. Some enthusiastic residents have already taken it upon themselves to protect some fragile dune areas but they need guidance, support and additional materials to be effective.

4.8 Recreation Area

The community, driven by the WBPRRA sees potential in developing the Foreshore Reserve. Numerous proposals have been drafted and suggested, but no action has followed. The present focus is for a recreation/picnic area behind the foredune, where people can enjoy the beach environment without needing to drive onto the beach.

4.9 Vegetation

Invasive plants, introduced species and noxious weeds can have extremely harmful effects on the coastal environment. The southern end of Waitarere is fast becoming overtaken by *Acacia longifolia* and *baileyana*. These species colonise very easily and have spread (in part) due to a lack of education. Members of the local community have been planting cuttings from this plant in an attempt to establish vegetation cover. The idea in principle is understandable however the establishment of invasive plants such as this can have irreverisble effects on the natural ecological balance of the coastal environment.

4.10 Future Development and Subdivision

The coastal environment is extremely sensitive to development and construction. Subdivision allowing growth and expansion in the coastal environment opens up and places new demands on areas of the beach not usually used. If not managed appropriately development can have irreversible

effects on the beach. The Council by law, are required to provide a foreshore reserve along the mean high water springs for the purpose of section 230 RMA. Section 233 allows the Council as adjoining landowner to claim the land acquired through accretion. The boundary of the reserve and reserve area subsequently will change although the exact change is not known until it has been surveyed again. This change only takes place for the Foreshore Reserve not Newmans Reserve land. The additional land acquired provides increased development opportunities. The recent subdivision at the north end is an example of how the additional land can be acquired.

4.11 Summary

Many of the issues outlined above and in Table 4.1 are closely interrelated. To illustrate just how closely these issues are linked, take the example of damage to foredunes. In simple terms, the foredune vegetation is damaged, by people walking across it. The foredune without its vegetation cover then becomes susceptible to erosion by wind. The sand-laden wind from the exposed dune is responsible for blocking drains, encroaching on the car park and burying the access to the Hyderabad Monument (shown in photograph 10), which was the walker's original attraction.

Table 4.1: Table of Issues**Key:**

✓ the issue is seen as a positive feature of Waitarere Beach

× the issue is seen as a negative aspect of Waitarere Beach

ISSUE	EXPLANATION
Pingao (<i>Desmoschoenus spiralis</i>)	<ul style="list-style-type: none"> ✓ native sand binding plant ✓ grows best where there is sand movement and exposed, unstable foredunes × only grows in small isolated patches at Waitarere ✓ good sand stabiliser found on the upper slopes or tops of dunes × slow to establish, sometimes out-competed by exotic species and costs similar to Spinifex to buy commercially (> \$1 per plant)
Spinifex (<i>Spinifex sericeus</i>)	<ul style="list-style-type: none"> ✓ native species, which creates a lower more aerodynamically shaped dune system ✓ found on the seaward face of the foredune, spreads by horizontal runners ✓ spinifex dunes can be slow to establish compared to marram dunes, they recover far quicker from erosion than marram which will often develop into blowouts ✓ local residents are willing to propagate some crops × sensitive to browsing animals during its establishment, × costly to establish, commercial nurseries are charging in excess of \$1.30 a plant
Marram Grass (<i>Ammophila arenaria</i>)	<ul style="list-style-type: none"> × exotic species, which tends to create tall hummocky dunes prone to blowouts ✓ found on the upper slopes or top of foredune ✓ is the only species that MWRC can establish with any certainty on the west coast × tends to grow in clumps × spreads by runners, seeds not viable in NZ conditions
Dunes & Reserve Land	<ul style="list-style-type: none"> ✓ currently fairly unusable with no existing uses, inaccessible in some parts consists of mainly stable spinifex vegetation
Experiment Walkway	<ul style="list-style-type: none"> ✓ community experiment area levelled and then covered with bark and mulch × bark and mulch were initially found to be quite nitrogen leaching ✓ bark and mulch has stabilised the dune making the area very easy to maintain
Planting and Landscaping	<ul style="list-style-type: none"> ✓ vegetation has grown successfully and provided a thick cover – stabilising the hind dune × rock wall and seating areas have been buried by sand moving inland in some places
Hydrabad Monument	<ul style="list-style-type: none"> × the one formal access path designed to allow wheel chair access has been buried by sand as has parts of the lookout × the monument location led to a number of other informal paths being haphazardly formed, informal paths have damaged the vegetation
Neighbouring Properties	<ul style="list-style-type: none"> × properties privately owned, and therefore can not be considered in the development ✓ vehicle access for these properties is only from Rua Avenue × informal access path created from the back of the section to the beach entrance
Surf Club Car Park	<ul style="list-style-type: none"> × poorly designed entrance, means many people are not aware of the facilities × difficult and unsafe entrance way for drivers to negotiate × poor links with the beach and a lack of visibility to the beach tends to persuade people to take their cars onto the beach rather than leave them in the car park × the surf club dune is encroaching on the car park × sand blowing through the car park is undesirable and unpleasant

	<ul style="list-style-type: none"> × foot traffic generated by the car park has lead to the major blowout and vegetation damage on the surf club dune
Further Development	<ul style="list-style-type: none"> × Coastal environment is sensitive to development and intensive land use ✓ Coastline is presently accreting, creating a larger area for development
Stormwater Outlet Drains	<ul style="list-style-type: none"> × stormwater outlet drains do not extend past the toe of the foredune and are therefore undermining the natural shape of the dune × this issue needs to be resolved to achieve the ideal foredune shape × drain by main entrance frequently has to be unblocked from the wind driven sand × the erosion caused by the drains is creating wind channels in the foredune
Driftwood	<ul style="list-style-type: none"> ✓ the driftwood and excess sand has been used to form berms either side of the main entrance onto the beach to help prevent the corners of the foredunes being further destroyed, and to give some protection from cars speeding around the corner × the excess sand and driftwood is often pushed in front of the existing foredune compromising the ideal dune shape
Drainage	<ul style="list-style-type: none"> × the design of the car park does not allow heavy rainwater to drain away – the water pools, attracting mosquitoes during the warm summer months ✓ a small artificial channel has been made through the dune to allow some drainage at the northern end of the car park.
Foot Traffic	<ul style="list-style-type: none"> × very minimal efforts have been made to protect vegetation between entry points × fixed points of entry exist for vehicles however very few exist for pedestrians × all current ‘desire lines’ are devoid of vegetation and are linear × access path to the monument is now buried and does not provide wheel chair access like it was designed to
Surf Club Dune	<ul style="list-style-type: none"> × public safety has been jeopardised as lifesavers can not patrol from the surf club tower as the dune is too high, restricting visibility × foot traffic created by the surf club and car park has lead to a major blowout as well as a number of other haphazard paths being formed × dune is encroaching on the car park × sand blowing from destabilised dune through the car park
Surf Club Building	<ul style="list-style-type: none"> × lifesavers can not patrol from the surf club tower as the dune is too high to see the beach × lifesavers are forced to patrol from the beach, at times leaving the gear or surf club unoccupied and unattended × many people are not aware of the surf club, as it can not be seen from on the beach × can be a target for graffiti and vandalism along with the toilets due to the lack of activity in this area × permanent structure which actually goes below the level of the car park
Vehicle Access – Windsor Street entrance	<ul style="list-style-type: none"> × gaps in the foredune are aligned with the prevailing wind × excess build up of soft sand just as you get to the beach causes vehicles to get stuck × excess sand and drift wood is often pushed in front of the existing foredune compromising the ideal dune shape × the entrance design works well and has very few problems compared to the main entrance
Vehicle Access – Waitarere Beach Road entrance	<ul style="list-style-type: none"> × encourages visitors to park their cars on the beach × high velocity winds blowing through the gap in the dune has created steep batter slopes which are difficult to establish vegetation on

	<ul style="list-style-type: none"> × stormwater drain outlet sometimes causes flooding making access difficult × access at this point can also be limited at high tide which comes right up to the toe of the dune
Vegetation – Invasive Plants	<ul style="list-style-type: none"> × Invasive plants like <i>Acacia longifolia</i> can quickly become rampant, outgrowing indigenous vegetation and irreversibly changing the natural ecological balance × Very easily established and quick to spread and costly to eradicate or control

5 SITE ANALYSIS

The analysis of the beach site and its users was carried out early in the project process and is shown in Table 5.1, Table 5.2 and Table 5.3. The analysis reflects the strengths, weaknesses and opportunities associated with not only the site but with the beach users and the project process as well.

Key:

- DC ~ Horowhenua District Council
 RC ~ Manawatu Wanganui Regional Council (horizons.mw)
 WC ~ Waitarere Beach Community
 SC ~ Levin Waitarere Surf Lifesaving Club

Table 5.1: Analysis of Opportunities

OPPORTUNITIES	DC	RC	WC	SC
For development of the Foreshore Reserve which is currently waste land			✓	
For use of an integrated approach to resolving issues at Waitarere Beach	✓	✓		
For restoration, protection and preservation of the foredunes and coastal protection	✓	✓		
For further beach protection education in the wider community	✓	✓		
For participation and involvement in the development process		✓	✓	
For verbal input in the development of the Reserve Management Plan	✓	✓	✓	✓
For increasing the attractiveness of the beach to a greater variety of people (e.g. elderly people) all year round	✓	✓		
For preservation of the beach for future generations to benefit			✓	
For the establishment of a Reserve Management Plan to guarantee future funding from the Council			✓	
To manage future development of the reserve in a sustainable manner	✓	✓		
To control and manage the presence of invasive plants at Waitarere Beach	✓	✓	✓	

Table 5.1 demonstrates how there are opportunities to resolve a number of the issues identified in Section 4. The opportunity exists for the HDC and MWRC to protect and preserve the beach. By protecting and preserving the coast and furthering beach protection education throughout the wider community; the HDC and MWRC can, through increased awareness, mitigate the issue concerning misuse of dunes through damage by vehicles and pedestrians.

Table 5.2: Analysis of Strengths

STRENGTHS	DC	RC	WC	SC
Accreting coastline is creating more land for development from stabilising the dunes	✓		✓	✓
Change in Council's attitude to one of working with and supporting the community	✓		✓	
A well established and enthusiastic community which is eager to be involved in any decision making			✓	✓
The land is already designated Foreshore Reserve	✓			
Many of the issues identified are interrelated and can be solved with an integrated approach	✓	✓		
Very good dune vegetation cover in most places	✓	✓		
The Reserve land is mainly wasteland with no existing or competing users	✓			
High environmental awareness within the community for the need to protect the beach			✓	
Management plan is an appropriate tool to accomplish significant physical and mental changes at the beach	✓			

Table 5.3: Table of Weaknesses

WEAKNESSES	DC	RC	WC	SC
Costs - Financial, resources, materials, labour	✓	✓	✓	
Timing of the work, any reshaping work is best carried out in the winter months	✓	✓		
Dynamic nature of the beach environment - dealing with accretion and erosion	✓	✓		
Pressure from community to fast track the time dependent development process	✓			
Favourable weather conditions are required for any development to be a success	✓	✓	✓	✓
Vegetation - the availability and the success of supplies for replanting		✓		
Surf Club building and toilet block - permanent structures which must be considered as part of the development	✓			
Uncertainty over suitability of restoration and protection methods used overseas	✓	✓		
Existing problems will worsen if left unresolved	✓	✓	✓	✓
Irreversible effects of invasive plants on ecosystem and coastal environment	✓	✓		
Lack of education has lead to invasive plants being planted at southern end of Waitarere			✓	
Resource Consent required before any major work can be carried out	✓		✓	

5.1 Discussion

The signs from the analysis are on the whole very positive. The Reserve Management Plan process offers many opportunities for the local community to be involved and to 'push' for their desired uses of the reserve. As an accreting

beach, Waitarere Beach offers those involved with its development, many more opportunities than an eroding beach does.

Many of the weaknesses associated with the site appear to be avoidable or can at least be mitigated to some extent. Obviously, when dealing with natural processes any development or protection work is at the peril of the natural elements. The coastal environment is subject to harsh weather conditions, storms, high seas, strong winds and hot temperatures. An example of how these can be mitigated would be to carry out any replanting during the wet season so the new plants are not exposed to high winds and dry sand conditions. Other weaknesses mentioned such as the obtaining resource consents and having to work to a time dependent process can be also seen as strengths. These weaknesses are both important to ensure that any final design has input from all those wishing to participate in the process.

6 LITERATURE and POLICIES

6.1 Introduction

The coastal environment is a complex system involving the interactions of coastal processes and human activities. Sand dunes are used for a wide range of human activities, some of which impinge on natural process. As literature will show, the dune system has the important role of protecting the coastline and the land behind it, from erosion. Due to the dynamic nature of dunes and their interdependence with beaches and near-shore sedimentation, their management can not be considered in isolation (Viles & Spencer, 1995).

6.2 Coastal Processes

The beach consists of many zones (e.g. frontal dune, hind dune and secondary dune), these zones are determined not only by the physical features found in the zone but also by the capacity of the zone to withstand the natural processes and human activities that take place at the beach. Interference with natural processes often exacerbates the extent of natural change (Land Conservation Council, 1995). There are some zones, which are extremely sensitive to man's activities and development (e.g. foredunes) while on the other hand some zones are more tolerant and are more suitable for certain types of usage (e.g. hind or secondary dunes).

The beach itself is tolerant to intensive recreational usage, but the frontal dune is extremely fragile. Destruction of frontal dune vegetation results from even moderately concentrated pedestrian usage (Beach Protection Authority of Queensland, V-01.1). Any increased use of the beach, should be carefully planned to minimise damage to the dunes (especially the foredunes) and their vegetation.

6.2.1 *Why are dunes important?*

Vegetated foredunes play an important part in coastal processes, by protecting the beach in front and the land behind from erosion. The dunes act as a buffer against wave attack and as a source of sand during periods of erosion (BPAQ, V-03.1). The dune vegetation, protects the beach by trapping wind blown sand, aiding dune build up and by preventing sand moving inland, where it is lost from the dune system. The vegetation raises the wind level above the surface of the sand, so less is carried by the wind. Since over 95 per cent of sand moves

across the surface it is understandable why vegetation cover of the foredunes is so vital to the beach's survival.

6.2.2 *How are dunes damaged?*

Natural causes and human activities damage coastal dunes and the vegetation they support. Oma, Clayton, Broun and Keating (1992, p. 26) identified the common natural causes of vegetation destruction to include:

- *wave erosion of the foredune or frontal dunes leaving a scarp which is vulnerable to erosion by on shore winds*
- *overwash and breaching of the frontal dunes by storm surge waves*
- *inundation of dune vegetation by sand blown off the beach*
- *loss of vigour or death of vegetation due to strong winds and salt spray*
- *wind erosion during unusually windy periods*
- *loss of vegetation as a result of fire, disease or drought*
- *wind funneling through low points or troughs in the dunes.*

Apart from these natural causes, human activities such as grazing, burning, development and foot and vehicular traffic will also result in damage or destruction of vegetated dunes. Usually not all of these causes will be found at one beach. There will usually be a mixture of human and natural causes combining to create serious problems for beach management.

POLICY: Dune Protection

- * Where possible damage to dune vegetation will be avoided, by encouraging human activities to locate away from the foredune and by providing appropriate signage and restrictions.
- * Recognise the importance of dune vegetation cover by minimising the effects of natural and human impacts on retaining vegetation cover.

6.2.3 *The effects of vehicles on beaches*

Vehicles travelling on the beach between high and low watermarks have little impact on the beach system (BPAQ, V-07.1). However any vehicle movement across dunes is extremely likely to damage and destroy vegetation on the dunes. Plants growing on frontal dunes are particularly sensitive to vehicle impacts. Vehicles affect dune vegetation in two ways, "firstly by directly bruising and breaking of the above ground parts and secondly by physical damage to the underground parts by shearing forces applied when the sand is displaced by tyres" (BPAQ, V-07.1). Vehicles can also reduce the height of

dunes by forcing sand downhill. The damage, vehicles cause dunes is directly related to the volume of traffic using the dunes. As the volume of traffic increases so does the damage to the dunes.

POLICY: Vehicles

- * Vehicles shall be prohibited from travelling on the dune area. Drivers found not complying will be fined and prosecuted for costs incurred for any damage caused.
- * Vehicles will be encouraged to use specified access points to enter the beach and to travel along the beach between the high and low tide marks.

6.2.4 *What happens if dunes are damaged?*

Destruction of vegetation on the frontal dunes results initially in the development of bare areas on the dune. Once these bare areas are subject to wind action, they become blowouts (BPAQ V-03.1). When sand is lost from the frontal dune system by wind action, the landward movement of the coastline is accelerated. The sand blown landward from the beach is no longer trapped in the frontal dune and as a result these mobile dunes cover anything in their path, causing serious property damage in some areas.

Unfortunately, because environmental conditions are not favourable natural recovery of damaged dunes is very slow (BPAQ, V-1.01). Once dunes have been damaged it requires human initiative to set about restoring and managing the dunes back to their natural state.

6.3 Repair of Damaged Dunes

Where dunes have been damaged by human activities (i.e. pedestrian traffic) it may be feasible to repair the damaged areas to prevent the development of wind erosion and to maintain the dune as a natural barrier against wave overwash.

Dunes damaged by localised, specific human impacts will be easier (and more appropriate) to restore (Viles & Spencer, 1995) and cheaper to manage than those arising from natural processes (Oma *et al.*, 1992).

6.4 Coastal Rehabilitation Strategy

Through a combination of "wise land use planning and resource management, mistakes of the past can be corrected and an improved system can be ensured for the future" (O'Brien, 1997 p.4).

Once an area of coastline has been damaged it is essential to begin the restoration of it as soon as possible. To undertake any such restoration work, (unless it is a minor project) the work should be planned and form part of an overall strategy.

A coastal rehabilitation strategy should aim to resolve existing or potential problems (and their causes) and be appropriate for the needs of the local community and the coastal environment. Oma *et al.* (1992, p.31) identified six fundamental steps in developing a successful coastal rehabilitation strategy

These are:

1. *Identify the problem and the cause of destabilisation*
2. *Identify the management options available to address the problem*
3. *Determine the preferred management option*
4. *Develop the rehabilitation plan or the appropriate action, (work out a time schedule and source of funds)*
5. *Implement the rehabilitation plan or the appropriate action*
6. *Monitor the site to evaluate the effectiveness of the rehabilitation plan or the action undertaken*

6.5 Re-Establishment of Dunes

Accreting coasts are best managed by revegetating the bare areas of accumulating sand and concentrating the rehabilitation efforts in the area immediately behind the beach to prevent sand drift inland (Oma *et al.*, 1992).

Re-creation of breached or absent foredunes is often an essential first step in rehabilitation, as it re-creates a natural buffer to protect the coastline. Rehabilitated foredunes are able to trap and bind sand, increasing the sand supply to the back of the beach to maintain the beach sand cycle.

The re-establishment of frontal sand dunes involves the physical replacement of a mass of sand of appropriate size, shape and location to provide the required protection against storm waves (BPAQ, V-03.2). Dunes may be re-created or reshaped in several ways. Earthworks, fencing and brushing can be involved depending on the requirements of the rehabilitation plan and local characteristics. These methods will be described in detail further into this report.

6.6 Sand Dune Design

"An undisturbed frontal dune system is a complex state of dynamic equilibrium and its stability, shape and position at any time are a result of the interplay of the effects of wind, waves, tides and vegetation"

(BPAQ, V-03.2).

Re-created dunes should be built to similar dimensions and shapes and along similar alignments as existing dunes in the area to ensure that they interact with the climatic and coastal processes in similar ways (Oma *et al.*, 1992). Returning the dune to a natural, undamaged condition provides a degree of flexibility that allows the vegetation line to retreat under wave attack and advance during calmer weather conditions. Failure to trap wind blown sand in the dune results in significant, long term and permanent erosion of the beach dune system.

It is important to understand that although the frontal dunes act as buffers, they are designed to be eroded during storms, with inevitable losses of vegetation, walkways and fences.

An important objective of good restoration practice is to minimise maintenance commitments by providing vegetation which regenerates naturally and by using flexible or expandable structures which can survive storm attacks or be replaced at minimum cost (BPAQ, V-03.2). The main considerations when designing or recreating dunes include the following:

6.6.1 Material

The sand used in any construction or reshaping should be free of clay or other binding materials, which could adversely affect drainage of the dune. The median grain size of the sand should preferably be at least as large as existing beach sand sampled at about the mid tide level (BPAQ, V-03.3).

POLICY: Dune Reconstruction

- * Materials used for the reconstruction of sand dunes should be free of binding materials (such as clay) which could adversely effect drainage of the reconstructed dune.

6.6.2 Height and Width

The frontal dune in developed areas should ideally be of sufficient height and width, to prevent overtopping and breaching of the dune by waves occurring during a major storm.

POLICY: Dune Reconstruction

- * Reconstructed dunes should be of sufficient height to prevent the dune being breached by waves occurring during major storms.

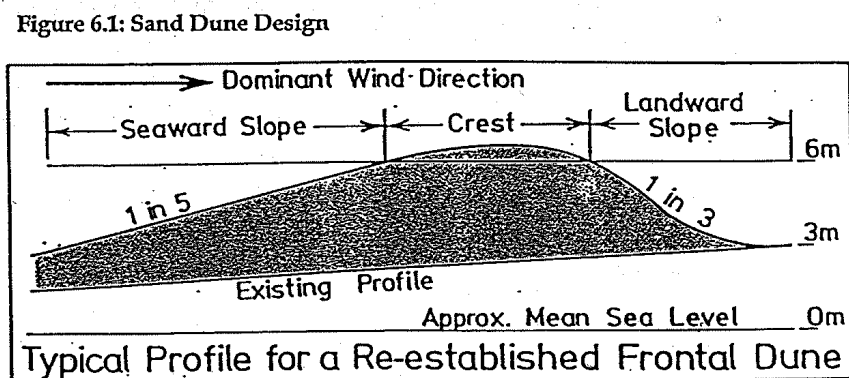
6.6.3 *Slopes*

The slopes of the frontal dune are critical to the success of the rehabilitation work. At the construction stage, the dune's maximum slope will be dictated by the safe working capability of equipment used for dune formation and surface treatment. Slopes should permit ease of vegetation establishment and long term maintenance of the stabilised dune. "The ideal aerodynamic dune shape has a seaward slope of 1 in 5 and a landward slope of about 1 in 3" (BPAQ, V-03.3).

POLICY: Dune Reconstruction

- * To enhance the likelihood of successful re-establishment reconstructed dunes should reflect the ideal aerodynamic shape (of a seaward slope of 1 in 5 and a landward slope of 1 in 3).

Figure 6.1: Sand Dune Design



6.6.4 *Reshaping foredunes*

The main objective of reshaping the foredune at Waitarere is to lower the height of the surf club dune to allow visibility from the surf club tower while still retaining the ideal dune profile. The larger identified blowouts will also require some reshaping work. Reshaping work must be completed by mid-June of any one year, with planting and stabilisation work by mid-July. The dune must be stabilised and a vegetation cover established as quickly as possible.

Preferably any spinifex vegetation present on the foredune should be retained; aiming in the long-term to achieve a spinifex dominated dune system. Once the marram grass has been established, spinifex plants should be planted during the following spring.

POLICY: Dune Reshaping

- * Where possible repair and stabilise minor blowouts as they occur to ensure they are not left to worsen.
- * Any reshaping work of foredunes shall be completed by the middle of winter to ensure sand is not being moved during the windy season.
- * Any reshaping work of the 'Surf Club dune' that lowers the height to allow better visibility shall not compromise the ideal dune shape.
- * Bare exposed sand from reshaping shall be planted and covered immediately using suitable surface stabilising agents

6.7 Plants

Coastal plants play an important role in the formation and continued stability of coastal sand dunes. While dunes remain fully vegetated (especially their windward slope and crest) they will not become degraded or eroded by wind or water (Oma *et al.*, 1992). However if the vegetation cover is damaged in parts or entirely removed by natural processes or human activity, significant erosion (especially by wind) can develop rapidly.

The coast is a particularly harsh environment for plant growth. Plants in the coastal environment need to be able to contend with the following natural phenomena:

- *short growing season*
- *long periods of drought*
- *period of extreme heat and water stress*
- *wind scouring*
- *burial by sand*
- *strong onshore winds*
- *salt spray*
- *sand blasting*
- *wave erosion and*
- *infertile soil' (Oma et al. 1992, p. 23)*

As well as these natural causes the plants must also contend with the human interferences discussed earlier.

6.7.1 Planting Programme

Any planting programme requiring native species should also be based on a local seed source, if available, as this material is likely to be better adapted to

local conditions (Bergin & Herbert, 1998). The successful establishment of seedlings is largely dependant on favourable temperatures (20°C to 35°) and availability of soil moisture at planting depth. Planting in the coastal area should only commence after the opening rains of the wet (winter) season have dampened the sand to a depth of 20-30 cm (Oma *et al.*, 1992). The earlier that planting is completed, the greater the likelihood of establishment as the plants will gain the maximum benefit from the rainy season and be established before the strong equinotical winds (Oma *et al.*, 1992).

POLICY: Planting

- * To enhance the success of establishing plants and vegetation, any planting in the coastal environment shall be undertaken during the winter months.

6.7.2 Secondary Stabilisation Program

A secondary stabilisation program is vital to the long-term success of any planting program. On the West Coast marram grass is chosen for initial planting programmes because of its comparatively lower cost and also its reliability of establishment. However, marram has only a maximum life expectancy of six to eight years before it tends to become 'woody'. The woody nature and eventual death of the marram plant creates opportunities for blowouts. Consequently, a secondary stabilization programme is essential to achieve a long-term stability for the area before the marram becomes 'woody'.

A native re-vegetation program would concentrate on one area at a time after stabilisation with sand binding plants. A succession of species is needed for complete stabilisation. Appendix 6 provides a list of plants suited to the coastal environment. Initial planting's of low shrubby species would be used as nurse crops for taller species at a later date.

POLICY: Dune Vegetation

- * Encourage the use of a secondary stabilisation program to ensure long-term stability before the initial marram crop dies out.
- * Encourage the use of low shrubby species as a nurse crop for taller species.

6.7.3 Fertiliser Programme

A fertilising programme is necessary to help stimulate growth in replanted or fragile areas. The MWRC (1999) recommends for Waitarere 100 kg of nitrogen per hectare split evenly into two or three dressings. The first dressing should be applied at planting, the second at the start of the spring, and the third during

the autumn. Once the vegetation is established, two dressings (spring and autumn) will be sufficient. Nitrogen is usually applied as urea, ammonium sulphate or calimonium nitrate. The reason multiple dressings are required is that nitrogen is extremely easily leached. Slow release forms of nitrogenous fertiliser can be used however they are much more expensive.

Phosphorus fertiliser should be applied at a rate of 20 kg/ha/year as a single application at planting and then re-applied at the onset of the spring. Phosphorus and potassium is usually applied as superphosphate or cropmaster. Potassium requirements should be satisfied by the amount of potassium present in superphosphate or cropmaster. The hind dune areas although completely vegetated, should be included in the fertiliser program to ensure continued vigour.

Long term stability of the dune system will require annual fertiliser applications in spring. A single dressing of 80 kg of nitrogen, 20 kg phosphorus, and 15 kg of potassium. The phosphorus and potassium can be applied as superphosphate or cropmaster and nitrogen as either urea or ammonium sulphate. For the best results application by helicopter is recommended (MWRC, 1999).

POLICY: Fertiliser

- * Ensure that growth is stimulated in replanted and fragile areas through a suitable fertiliser program.
- * Encourage long-term dune stability through annual fertiliser applications.

6.8 Surface Stabilising Agents

Surface stabilising agents are required to overcome the natural elements effecting dune stabilisation. These agents are designed to help establish vegetation and dunes by stabilising the sand surface and by providing a more conducive, environment for establishing vegetation. The most effective surface stabilisers are usually those methods using plant materials. Plant materials can be used as surface mulches, or they can be employed as surface stabilisers. They each serve to stabilise bare sand surfaces in exposed dune areas. Several different methods are commonly used.

POLICY: Dune Stabilising

- * Where bare sand is exposed, natural stabilising agents will be used to help establish vegetation and stabilise the surface.

6.8.1 Brush Matting

This method consists of placing a single complete layer of leafy parts from young trees or branches of larger trees over bare sand, which has previously been planted and fertilised. Placement of brush is critical in exposed areas such as the seaward slope and rest of the frontal dune. The brush must be placed so that it leaves no spaces otherwise 'blowouts' will develop. The branches should be placed so that they overlap slightly face into the dominant wind. This reduces the chances of the brush blowing away.

"Brush matting is very effective in dune stabilisation because:-

- *it enables vegetation, especially spinifex grass to establish and grow well;*
- *the mat withstands strong winds, even during cyclones, and keeps the surface stable;*
- *the original dune shapes are retained as brush traps a uniform thickness of wind blown sand which eventually buries it;*
- *skilled labour is not required to spread the brush;*
- *seed or seedlings can be planted, and fertiliser applied before or after the brush is laid;*
- *the brush traps wind blown sand which covers the seeds during the germination period and protects seedlings from wind and sand blast after germination; and*
- *decaying brush adds organic matter to the sand and helps it retain moisture"*

(BPAQ, V-03.6).

Tea-tree (*Melaleuca* spp.) and pine prunings are ideal brush materials because they retain their leaves for long periods of time, which increases their ability to trap sand and to protect the surface (Oma *et al.*, 1992). The other advantage is that the prickly nature of pine prunings deters pedestrians from crossing the rehabilitating dune. The only real disadvantage with brush matting is that it is labour intensive and limited to areas where brush is readily available.

6.8.2 Brush Barriers

These consist of pieces of brush laid horizontally on the bare sand surface to form a low barrier. To prevent wind damaging the barrier the pieces of brush are anchored into the sand by either partly burying each piece of brush or by holding the barrier down with wire loops or wooden pegs (BPAQ, V-03.6).

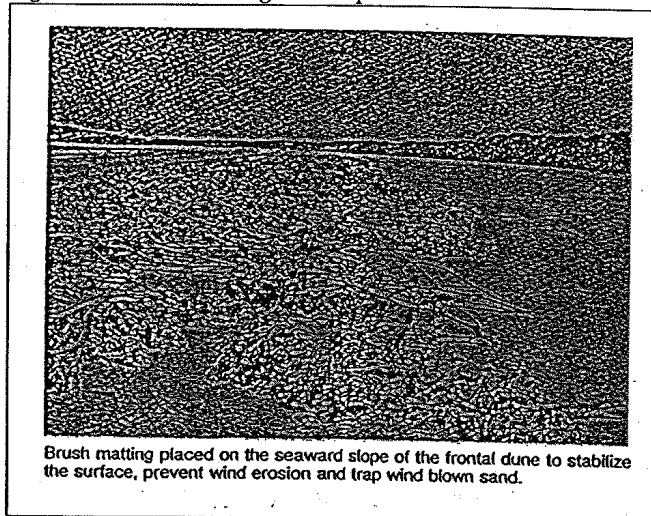
6.8.3 Mulching

Mulching involves spreading a layer of material (usually organic) over the area to be stabilised. Materials suitable for use as mulch includes, hay, bracken fern, blady grass, cane tops, forage harvested heath material and straw (BPAQ, V-

03.6). The mulch is spread on the surface and mechanically or manually and pushed into the sand using a rubber tyred tractor, roller or discs.

Figure 6.2: Brush Matting Technique

Figure 6.2: Brush Matting Technique



6.8.4 *Stabilisation of foredune*

Once the foredune has been reshaped (if required) it should then be planted using marram grass. The marram grass should be planted 80 cm apart and the distance between rows should not exceed 1.0 m. Planting between May and July ensures good stabilisation prior to spring winds and dry summer months, with fertilising to aid establishment.

Stabilisation and protection of the replanted areas benefit from using natural materials, preferably straw mulch. Brush matting using prunings from pine trees or other similar plants also accumulates sand and protects replanted areas. Brush matting and barriers will be the most effective methods for rebuilding the blowouts caused by the stormwater outlets.

6.9 Sand Accumulators

Dune forming fences (also known as Sand trapping fences) are another way to reform dunes especially breached or eroded foredunes, where it is not crucial that the dune be reformed quickly (Oma *et al.*, 1992). Dune forming fences are constructed by attaching wooden slats, brush material or plastic or nylon mesh to wire strand fence for the purpose of trapping wind blown sand. The fence

should be semi-permeable. It is generally found that “fences are most effective when located at right angles to the prevailing onshore wind and constructed with porosity’s of 20 to 50%, especially around 50%” (Oma *et al.* 1992, p.61).

The capacity of dune forming fences to accumulate sand depends on:

- *“the amount of sand blowing across the beach or dune which is determined by wind speed, wind direction, surface slope, grain size and sand moisture content;*
- *the number, position and height of fences*
- *fence type and porosity”* (BPAQ, V-03.5)

POLICY: Sand Accumulation

- * Where time is not important, dune forming fences will be encouraged to assist in accumulating sand to reform breached or eroded foredunes.

6.9.1 Fence Types

The most commonly used types of dune forming fences include

Slat fences

- Slat fences are usually less prone to vandalism than those constructed using plastic or nylon mesh

Plastic or nylon fences

- These fences are easy to erect as the mesh is light, easily handled and can be quickly attached to the supporting fence wires.

Brush fences

- These fences are efficient sand accumulators but labour costs involved in their construction are high and their use is limited by the availability of brush.

6.10 Pedestrian Control

As earlier emphasised, vegetation is essential to dune stability. It anchors sand in the dune and traps sand blown from the beach aiding dune build-up. Damage or destruction of dune vegetation results in wind erosion and lowering of the dune making it less effective as a barrier against wave attack.

6.10.1 Pedestrian Fences

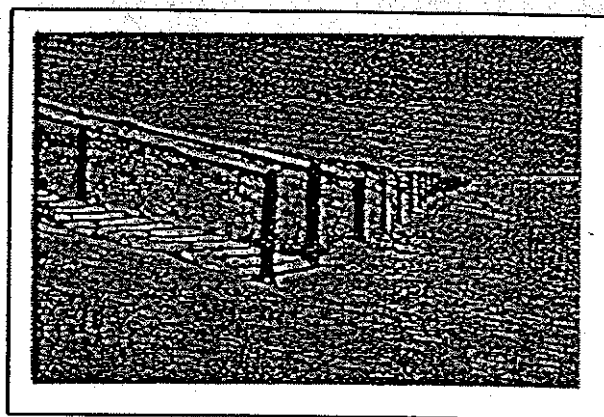
To prevent human damage to dune vegetation and to give the damaged dune areas a chance to recover it is often necessary to fence off and restrict movement across the dune. Fencing provides protection to vegetation by excluding people from fragile and sensitive rehabilitating areas (using barrier fences) and guiding them to their destination through environmentally suitable areas (using access ways) (Oma *et al.*, 1992).

Unlike sand trapping fences, pedestrian fences must have a low wind resistance so that they will not accumulate wind blown sand. The fences should be constructed using materials that are capable of withstanding corrosion and sand blasting (i.e. normal beach weather). Regular maintenance of fences is necessary to ensure they remain in good working order.

POLICY: Fences

- * Pedestrian fences will be used to restrict movement across dune vegetation and to encourage pedestrians to use specified access points.

Figure 6.3: Pedestrian Fences



6.10.2 *Access Tracks*

Off-road vehicles, beach buggies and trail bikes are responsible for much of the serious damage to dunes and the vegetation. Beach fenced access tracks are required to prevent this damage continuing. For the tracks to be used they must be conveniently placed, so people will not need to take short cuts. In some cases it is necessary to treat the surface of the access track so that it is not susceptible to wind erosion. This usually involves surfacing the access track with gravel and bitumen and installing board and chain walkways or steps at the seaward end of the track (BPAQ, V-02.1).

POLICY: Access

- * To prevent the erosion of dune vegetation by vehicles, specified vehicle access points and tracks will be provided where vehicles are required to cross dunes.
- * Access tracks (pedestrian and vehicle) shall be provided in logical convenient locations to reflect the desire lines of beach users.
- * Ensure that signs are located in obvious places to inform users of access points and to encourage beach users to use the paths provided.

6.11 Pedestrian Access to Beaches

The use of walkways prevents lowering of the dune and the development of blowouts, which result when pedestrian traffic is concentrated at one spot on the dune. For the walkways to be successful, the design of paths should be inviting and convenient. "They are most likely to be used if they are aesthetically pleasing and appear to be the easiest way of reaching a destination" (Department of Conservation, Forests and Lands & Ministry for Planning and Environment Victoria (2), 1995 p.4).

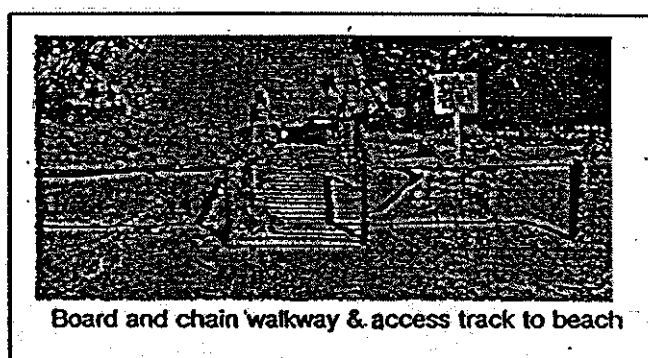
6.11.1 *Board and Chain Walkways*

Board and chain walks are used where frontal dune slopes are between 17 and 31° (BPAQ, V-02.2). Properly constructed and installed boardwalks improve the ease of access to and from the beach. The bottom end of the board and chain walkway is left free to allow it to be lifted when sand accumulates on it. Repair and maintenance of the boardwalks should be carried out as required. They should not be aligned parallel with the prevailing winds so as to avoid forming wind tunnels which will worsen erosion (Oma *et al.*, 1992). Construction diagrams of these walkways can be found in Appendix 7.

POLICY: Pedestrian Access

- * In areas where the seaward slope is less than 30° and pedestrian access is required, the use and provision of board and chain walkways will be encouraged.

Figure 6.4: Board and Chain Pedestrian Walkway ¹



6.11.2 *Steps*

Steps should be used for beach access when the seaward face of the frontal dune has a slope of greater than 26.5° (BPAQ, V-02.2). Steps are commonly

¹ (Figures used in this section have been taken from the series produced by the Beach Protection Authority of Queensland).

used where the foredune has been destroyed and a retaining wall has been constructed.

POLICY: Pedestrian Access

- * In areas where the seaward slope is greater than 30° and pedestrian access is required, steps will be provided.

6.12 Recreation Areas, Car Parks, and Other Structures

6.12.1 Recreation Areas

Providing recreational facilities within the area being rehabilitated may conflict with long term protection and management of the area. However, Oma *et al.* (1992, p. 82) states “these conflicts can be minimised if the recreational requirements of the community are considered and included in the rehabilitation plan”.

Identifying recreational requirements early in the development of the rehabilitation plan allows

- *Recreational facilities to be located and designed to minimise damage of rehabilitating areas and long-term management costs*
- *Earthworks for recreation facilities (such as access roads, car parks and active recreation areas) to coincide with dune re-creation or reshaping to minimise site preparation costs.*
- *Costly recreational facilities such as car parks, picnic areas and ablution facilities to be located away from identified hazardous areas susceptible to wave and wind erosion or sand inundation*
- *Public use areas such as picnic areas and active recreation areas to be located in sheltered or more protected areas (such as dune swales or deflation areas) where trees and lawn can be successfully established” (Oma et al. 1992, p. 82).*

POLICY: Development

- * Any development of structures and buildings in the reserve area shall be located and designed in such a way to minimise damage to rehabilitating area and long-term management costs.
- * Encourage any earthworks for Recreation Area to coincide with reshaping work to help minimise costs.

6.12.2 Car parks

Should be located so that,

- *“a logical and convenient relationship between car park and feature (beach lookout, or toilet, for example) can be established*
- *construction will cause minimal vegetation loss*
- *people and vehicles moving to and from the car park cause least impact on surrounding vegetation”* (Department of Conservation, Forests and Lands & Ministry for Planning and Environment Victoria (2), 1995 p.4).

The size and design of car parks must be appropriate to the degree of development in the area and to the capacity of the local environment to absorb visitors (Department of Conservation, Forests and Lands & Ministry for Planning and Environment Victoria (2), 1995). To control the movement of vehicles, car parks need to have visible signs and be well defined. The uses of natural barriers, fencing and mounding are common ways of defining the car park area. Separating car parks from destinations (such as beaches) by using distance, vegetation, or gradients can be an effective way of encouraging visitors to use defined paths.

POLICY: Car Parks

- * Ensure the car park is maintained as a safe environment by using traffic calming devices such as judder bars and planter boxes.
- * Car parks will be located so they improve links with the beach, by allowing some car parks to have views of the beach.
- * Car parks will be located in such a way so to minimise the interference to natural coastal processes.

6.12.3 Structures

Structures such as toilets or work sheds must be sited away from tide and flood zones, unstable soils, and cliff tops. The consequences of building in dunes may be severe and expensive, as dunes are highly unstable and may be subject to erosion by wind and sea. “Structures and roads other than necessary steps or walkways should never be sited on primary dunes, or where they can interfere with natural coastal erosion” (Department of Conservation, Forests and Lands & Ministry for Planning and Environment Victoria (3), 1995 p.5). Structures intended for use by the public should be well signed, easily accessible and via a logical and convenient route.

POLICY: Development

- * Coastal development and conditions for approval must take into account natural coastal processes and be located or designed to avoid or to minimise disruption to those processes.
- * An assessment of the visual impact of development proposals including all associated infrastructure, be incorporated into the approvals process.

6.12.4 Signs

The use of signs will be critical for the success of any work carried out at the beach. Strategically placed and suitably worded signs advising the location of access tracks, board and chain walkways and steps can reduce damage to dune vegetation. The use of access tracks will require an adjustment for most people; the use of signs should help make this a smooth transition. Signs can serve a variety of purposes ranging from educational and informative signs to warning signs, each however fulfilling a vital role in achieving a sustainable and well managed beach.

POLICY: Signs

- * Signs will be provided to:
 - educate users about the need for beach protection and the ways they can help
 - inform visitors about the beach, the climate, the Hydrabad and accretion
 - inform users of beach access and exit points
 - inform the community of the development process and where the process is at
 - welcome people to the beach and indicate feature points
 - make people aware of the imposable fine for riding motorbikes in the dunes
- * Ensure that signs are strategically placed and suitably worded to ensure beach users receive maximum benefit.

6.13 Conclusion

“Ultimately the goal of coastal planning and management should be to achieve a balance between the protection of environmental quality and provision for the social and economic needs of the community”

(O’Brien & MacRae, 1992 p.87).

The beach is a very complex and dynamic environment with many external factors influencing the natural processes occurring at the beach. As Viles and Spencer (1995) stated, dune management can not be considered in isolation.

It is important to have stable dunes to protect the coastline from erosion by wind and sea. The processes, which lead to the destruction of dunes, have been outlined, as have the many methods to restore, protect and develop the dune environment. The key success is developing an overall strategy for a beach and to have a balance between protecting environmental quality and meeting community desires. This is the aim in developing the conceptual designs and management plan for Waitarere Beach.

7 EVALUATION OF SOLUTIONS

The solutions have been negotiated between the Horowhenua District Council, Manawatu Wanganui Regional Council, Waitarere Beach Community and Levin Waitarere Surflifesaving Club (LWSC). During the formal meetings where the concept designs were presented, the advantages and disadvantages with each design were identified. This has led to the evaluation of methods used and the selection of an approved final design. A full list of advantages and disadvantages associated with the solutions from the literature reviewed has been incorporated into a table found in Appendix 9.

The Concept Design Evaluation matrix (Table 7.1) evaluates advantages and disadvantages of the three concept designs from the perspectives of the four stakeholder groups. These four groups include HDC, MWRC, Waitarere Beach Community and the LWSC. The advantages and disadvantages may be based on the costs of implementation, ecological interferences, safety, beach protection or whether a design feature resolves an issue for the beach. The final column of the matrix contains brief statements about the main features of each concept design. Using the changed car park entrance (Concept Design 2) as an example of how the table works; the car park entrance is an advantage to the HDC because it resolves an identified issue. The design is also an advantage to the Waitarere Beach Community and the LWSC because the design makes access easier and improves people's awareness of the facilities. However the design is a disadvantage to the LWSC because the entrance makes it more dangerous for Surf Club members.

The evaluation highlights that the majority of financial and material costs will be borne by the HDC and MWRC. From this evaluation and upon considering the views of those people at the meetings; the final design solution chosen as the most appropriate solution was Concept Design 3.

Table 7.1: Concept Design Evaluation Matrix

	H C		R C		W C		S C		Comments
Concept Design 1	A	D	A	D	A	D	A	D	
No change to main vehicle access	✓	×		×		×	✓		Cheapest option but does not resolve many of the associated issues
Stormwater outlets extended	✓	×		×		×			Short term solution which will become an ongoing cost
Board and chain walkways and shrubs/fences	✓		✓		✓				Protects dunes and vegetation by providing specified access for pedestrians and restricting haphazard movement
Surf Club dune lowered					✓		✓		Visibility for lifesavers restored, less sand drift and encroachment on the car park
Recreation Area	✓				✓		✓		Meets the community desires
Foredune stabilised and planted	✓		✓		✓				Beach is protected and preserved Blowouts are not left to worsen
Concept Design 2	A	D	A	D	A	D	A	D	
Main entrance south of Surf Club, current entrance filled in	✓	×	✓	×	✓	×		×	Huge capital cost, natural design with less sand drift and clearing costs, involves major earthworks, makes the car park more dangerous, not compatible with recreation area
Surf Club dune lowered	✓				✓		✓		Visibility for lifesavers restored, less sand drift and encroachment on the car park, reshaping work can be done with the other earthworks for the road
Board and chain walkways and shrubs/fences	✓		✓		✓				Protects dunes and vegetation by providing specified access for pedestrians and restricting haphazard movement
Recreation Area	✓				✓		✓		Meets the community's desires
Foredune stabilised and planted	✓		✓		✓				Beach is protected and preserved Blowout not left to worsen
Car park entrance easier to negotiate	✓				✓		✓	×	Improved awareness of the facilities
Car parks with views of the beach	✓				✓				Allows everyone to enjoy the beach
Stormwater pumped down Rua Ave.	✓		✓		✓				Costly exercise, Long term solution
Visitor Lookout	✓		✓		✓				Attraction for beach users, eliminates some haphazard movement

	H C		M W		W C		S C		Comments
Concept Design 3	A	D	A	D	A	D	A	D	
Main entrance north of Surf Club, with current entrance filled in	✓	×	✓	×	✓		✓		Huge capital cost, natural design with less sand drift and clearing costs, better safety in the car park, involves major earthworks
Surf Club dune lowered	✓				✓		✓		Visibility for lifesavers restored, less sand drift and encroachment on the car park, reshaping work can be done with other earthworks for the entrance
Board and chain walkways and shrubs/fences	✓		✓		✓				Protects dunes and vegetation by providing specified access for pedestrians, restricts motorbikes and haphazard movement
Recreation Area	✓				✓		✓		Meets the community's desires, allows people to enjoy the beach without going on to the beach
Foredune stabilised and planted	✓		✓		✓				Beach is protected and preserved
Car park entrance easier to negotiate	✓				✓		✓		Improved awareness of the facilities by making them visible from the road
Car parks with views of the beach	✓				✓				Allows people to enjoy the beach even when they may not be able to access the beach
Stormwater pumped down Rua Ave.	✓	×	✓		✓				Costly exercise, Long term solution, Outlets no longer interfere with the beach
Visitor Lookout	✓		✓		✓				Attraction for beach users, eliminates some haphazard movement across the dunes
Surf Club Area					✓		✓		Improves safety around the Surf Club

Key

HC ~ Horowhenua District Council

RC ~ Manawatu Wanganui Regional Council (horizons.mw)

WC ~ Waitarere Beach Community

SC ~ Levin Waitarere Surf Lifesaving Club

A ~ Advantage

D ~ Disadvantage

7.1.1 *Resolved Issues*

Concept Design 3 has major benefits in resolution of the issues dealt with in section 4. For example the main vehicle access onto Waitarere Beach is seen to be the main problem. By changing this entrance design, other issues can be resolved. The Concept Design 3 option of taking the entrance over the dune was designed to keep a natural shape to the entrance as well as to provide an easier and safer access to the beach and car park (this is shown in Appendix 8). This change allows the Surf Club dune to be reshaped at the same time as the entrance construction, and avoids the wind funnel effect while still retaining vehicle access onto the beach. Once a stabilised vegetation cover has been established the design should result in less sand drift inland. Vehicles will still have access onto the beach from Windsor Street, which will help encourage a circular movement of traffic.

The stormwater drains had to be changed to eliminate the blowouts, for the ideal dune profile to be re-established. The best long-term option was to divert the stormwater so that it is pumped north along Rua Avenue, as it completely removes the effects of the drains from the beach. Without the present outlets, the dunes can resume a natural shape and become stabilised, preventing blowouts.

To improve the visibility from the Surf Club tower, the Surf Club dune will be reshaped and lowered by about two metres to a similar height to the other foredunes. This will be included as part of the earthworks involved in changing the main vehicle access onto the beach. The major blowout issue will be overcome once the reshaped dune has been stabilised and the vegetation cover established.

With much of the damage to dunes resulting from pedestrians and vehicles, this was seen as an important area to take preventative action. To define specific paths for beach users board and chain walkways were chosen. When combined with fences or shrubs, board and chain walkways are an excellent way of preventing damage to the vegetation cover on dunes (see section 6). The slope angle of the foredunes at Waitarere Beach means board and chain walkways are the most appropriate method for pedestrian access at Waitarere Beach.

The walkway designs take into consideration best practice ideas from the literature. The location of the board and chain walkways is designed to give convenient and logical access to beach users, to restrict haphazard movement across dunes, to avoid wind funnels and unnecessary destruction of vegetation.

Motor bikes and beach buggies cause the majority of vehicular damage to vegetation. The use of fences and restricted pedestrian walkways will lessen the ability of motor bikes to ride the dunes. Signs making riders aware of the imposable \$500 fine will also be used as a deterrent and will be enforced upon those caught.

Replanting of bare and reshaped areas will initially be done with a nurse crop of marram grass, so that spinifex can be established in the following planting season. Stabilisation using straw mulch and brush matting will help establish the marram vegetation cover, as well as lessening sand drift during the establishment period. The fertiliser programme is designed to regenerate growth in fragile areas of vegetation and help establish growth in the areas of new plantings.

The recreation area has been a community driven idea, arising from a demand for an area where people can enjoy the beach environment without having to go onto the beach. The recreation site proposes areas of passive and active leisure.

Car parks with views of the beach are designed to cater for those who do not feel confident driving on the beach or for those who do not want to leave the safety and comfort of their vehicles. Both features enable people to still enjoy the beach when vehicle access onto the beach is prevented by high tides.

Signs at the beach will achieve a number of purposes including informing visitors, educating beach users, making beach users aware of facilities and access points, welcoming visitors to the beach and informing people of the penalty fines for riding motorbikes in the dunes.

Providing the vehicle free area adjacent to the Surf Club is designed to increase pedestrian safety around the building and to allow lifesavers a greater freedom of movement in fulfilling their duties.

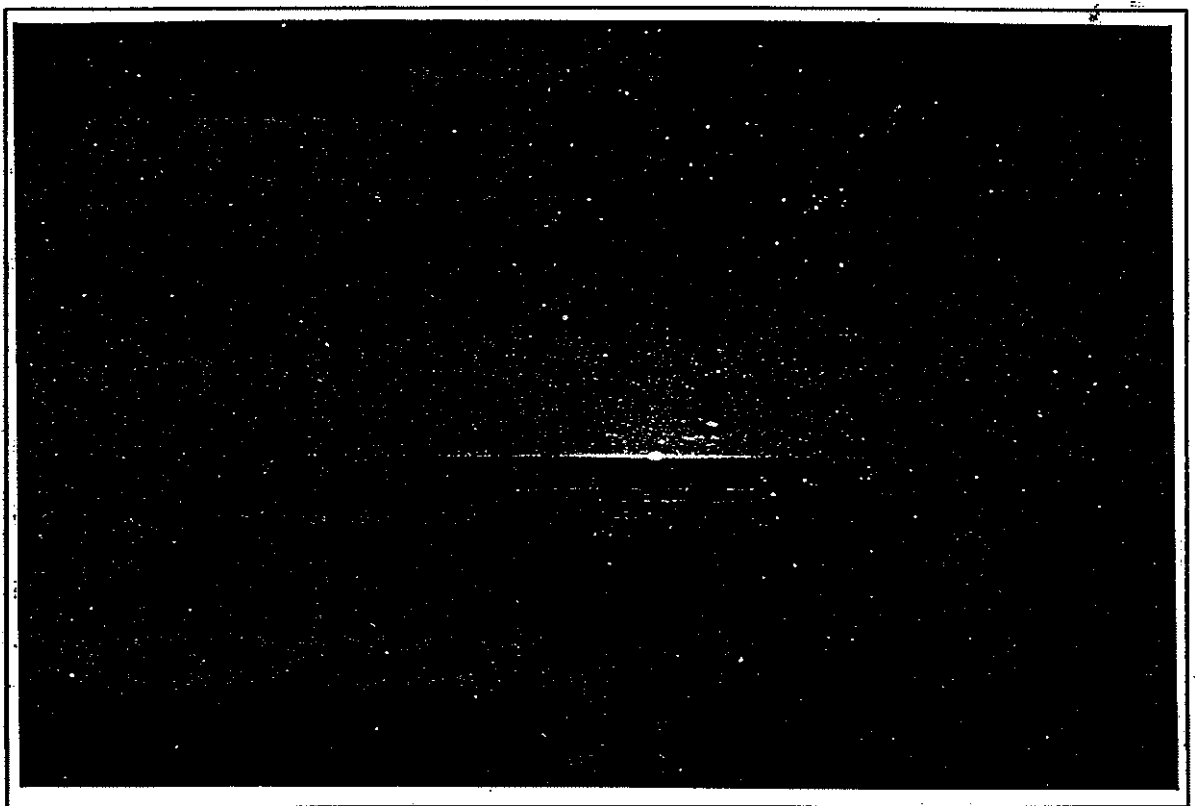
7.1.2 Strengths

This final design looks to build on the strengths of the site by using an integrated approach to resolve the issues at Waitarere Beach. The recreation area on dune wasteland, made stable by an accreting coastline is a good example of how a site strength is being capitalised on. The design seeks to

maintain and protect the good vegetation cover and dune profile found in most places at Waitarere Beach.

7.1.3 *Weaknesses Overcome*

Site weaknesses have been overcome throughout the project process. The permanent structures of the Surf Club building have been incorporated into the final design creating a Surf Club vehicle free area. The existing issues, which if left unresolved would worsen have been included in the final design (i.e. blowouts caused by stormwater outlets and sand drift from the existing entrance design). For the best results from the reshaping and replanting work, this work will be scheduled to be carried out during the winter months.



Sunset at Waitarere Beach

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Recommendations

From the process followed the following recommended action points have been recommended for the Council and Waitarere Beach community.

8.1.1 *Action Points for Horowhenua District Council*

- Concept Design 3 be adopted as the basis for the policies written for this Reserve Management Plan.
- Approve draft RMP for public inspection and submissions.
- Carry out further consultation with any stakeholders not already involved.
- Conduct a quantity survey of work and material required so funding can be organised and budgeted for.
- Prepare resource consent application for the MWRC for the work recommended by this RMP.
- Reshaping and replanting of dunes not to be carried out until winter when conditions are more favourable, (i.e. the sand has the most moisture and less wind).
- Immediate fertilising and stabilisation work to be carried out as finances and resources permit.
- Carry out an annual fertiliser programme along the beach coastline.
- A secondary stabilisation programme should be carried out in the wet season following the completion of the initial reshaping and planting work.
- Set up a regular maintenance programme for the general repair and maintenance of structures and protection works.
- Beach education and awareness program should be started before the protection measures are carried out. The work proposed for the beach will require a change of attitude and behaviour by some users. Signs and education will be the most effective way to support the changes required.
- Constantly review and monitor the work carried out at the beach to ensure that the policies are kept consistent with the changing beach conditions.

8.1.2 *Action Points for Waitarere Beach Community*

- Support the Reserve Management Plan through submissions voicing approval.

- Immediate work can be carried out protecting dunes and stabilising fragile areas using brush matting techniques until the Reserve Management Plan has been implemented.
- Beach education and awareness programs for the community should start before and continue during and after the protection and restoration work is carried out.
- Community members should act as watch dogs for inappropriate behaviour on the beach (especially on the foredunes) and towards the works when they begin.

8.2 Conclusion

Identifying and understanding the factors contributing to the issues at Waitarere Beach has been aided by consulting with key stakeholder groups and reviewing literature. The informal meetings and public comments have been very useful in drawing on local knowledge and perspectives and identifying issues.

The literature reviewed has given the project a solid background understanding of coastal processes. Despite having to extensively summarise the literature reviewed for the purpose of this plan, there were still a number of practicable solutions identified. These solutions although based mainly on Australian examples appear to have a high success rate when used as part of an overall strategy. The environmental conditions for Waitarere Beach appear to be not as harsh as those faced by Australian beaches with tropical storms and extreme summer temperatures. For these reasons, the methods are recommended with confidence in their ability to be successful in resolving the issues identified at Waitarere Beach.

Implementing a plan in a dynamic coastal environment is a never-ending story. The process of protecting and preserving the beach will be an ongoing one, however it is important that positive action is taken before the issues become irreversible. The general feeling amongst all those involved in the process, is that this process and the resulting plan has been a step in the right direction; action is being taken before the issues have become unresolvable.

Finding the balance between meeting community desires, ecological constraints and financial restrictions is a difficult task. However it is felt that the final design recommended and the policies written have achieved this balance.

A detailed street map of Waitarere, New Zealand. The map shows a grid of streets, with 'Waitarere' labeled in the center. The map is oriented with North at the top. The coastline is visible on the left side, and the map is bordered by a thick black line on the right. The map shows a dense network of streets, including Main Road, and various residential blocks. The map is bordered by a thick black line on the right.

Figure 1 is a line graph with two axes. The horizontal axis (x-axis) is labeled 'Number of fish' and ranges from 0 to 1200 with major tick marks every 200 units. The vertical axis (y-axis) is labeled 'Number of fish per 100m' and also ranges from 0 to 1200 with major tick marks every 200 units. Two lines are plotted: a solid line and a dashed line. The solid line starts at the origin (0,0) and increases linearly, passing through points such as (200, 200), (400, 400), (600, 600), (800, 800), (1000, 1000), and ending at (1200, 1200). The dashed line starts at a point on the y-axis (approximately 100) and decreases linearly, passing through points such as (200, 80), (400, 60), (600, 40), (800, 20), and ending at (1000, 0).

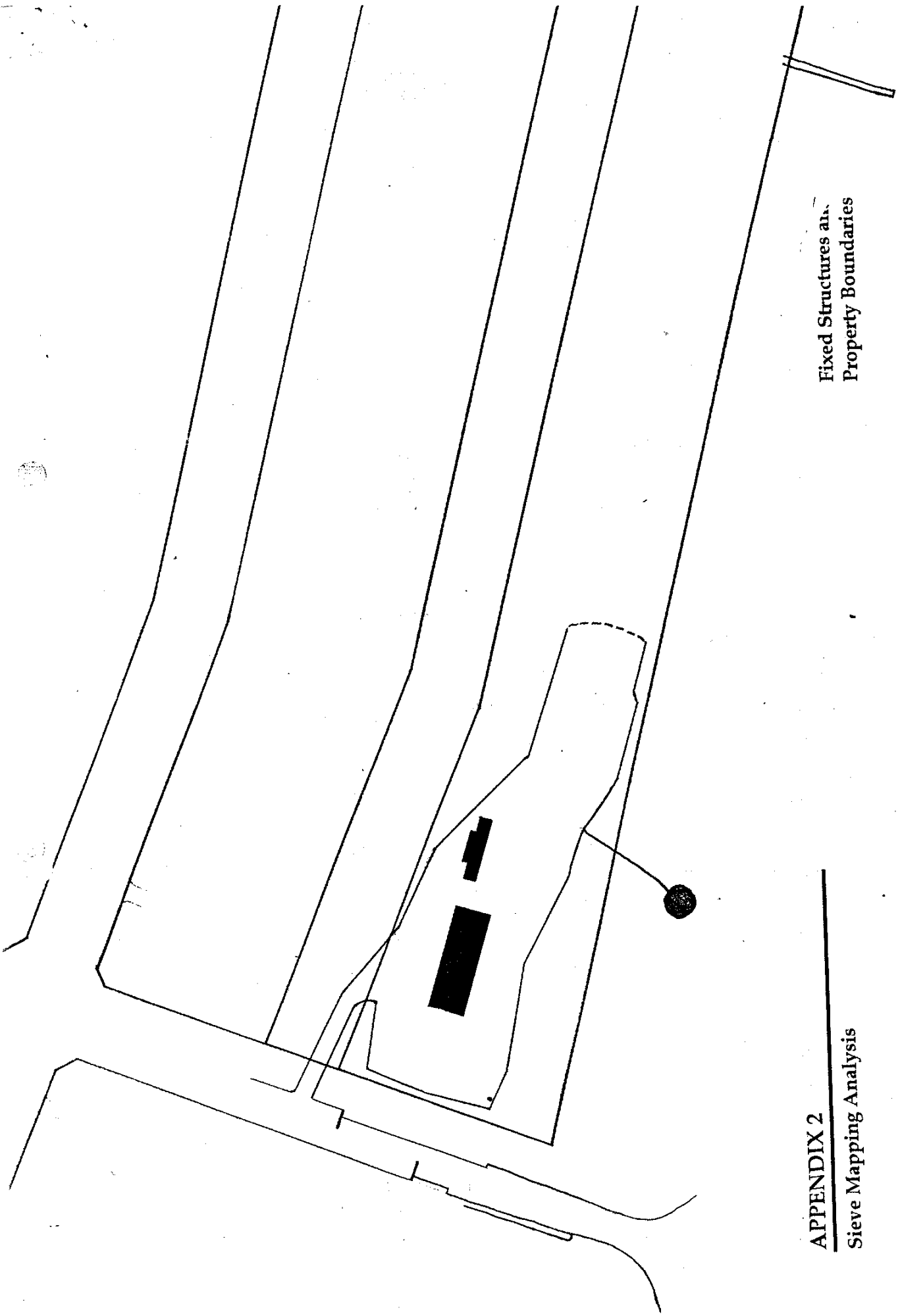
TERRALINK NZ LTD (Terraview)-DCDB Data as at 19.11.1999 Title & Valuation data as at 19.11.1999 Geodetic data as at 11.10.97.
Cadastral Information from LINZ Digital Cadastral Database (DCDB). CROWN COPYRIGHT RESERVED.

LEGAL DESCRIPTION & CLASSIFICATION

<i>Lot Number</i>	Lot 30	Lot 29
<i>Plan Number</i>	DP 45133	DP 45133
<i>Area</i>	0.4920 ha.	0.9973 ha.
<i>Classification</i>	Local Purpose Reserve (Esplanade Reserve vested on deposit) Recreation Reserve	Recreation Reserve (vested DP 45133) Esplanade Reserve
<i>Lot Number</i>	Lot 17	Lot 18
<i>Plan Number</i>	DP 18323	DP 18323
<i>Area</i>	0.3318 ha.	0.4060 ha.
<i>Classification</i>	Local Purpose Reserve (Esplanade Reserve vested on deposit)	Recreation Reserve (vested on deposit)
<i>Lot Number</i>	Lot 19	Lot 24
<i>Plan Number</i>	DP 18323	DP 11306
<i>Area</i>	0.3316 ha.	0.9116 ha.
<i>Classification</i>	Local Purpose Reserve (Esplanade Reserve vested on deposit)	Waitarere Domain (gaz 1933 p2435) Esplanade Reserve Recreation Reserve
<i>Lot Number</i>	Lot 25	Lot 62
<i>Plan Number</i>	DP 11306	DP 10023
<i>Area</i>	0.4290 ha.	1.0092 ha.
<i>Classification</i>	Local Purpose Reserve (Esplanade Reserve - Section 16 Land Act 1924)	Local Purpose Reserve (Esplanade Reserve - Section 16 Land Act 1924)
<i>Lot Number</i>	Lot 60	Lot 61
<i>Plan Number</i>	DP 10023	DP 10023
<i>Area</i>	5.3623 ha.	1.0155 ha.
<i>Classification</i>	Waitarere Domain (Gazetted 1933 p2435)	Local Purpose Reserve (Esplanade Reserve - Section 16 Land Act 1924)
<i>Lot Number</i>	Lot 6	Lot 5
<i>Plan Number</i>	DP 24346	DP 24346
<i>Area</i>	0.0650 ha.	0.0986 ha.
<i>Classification</i>	Local Purpose Reserve (Esplanade Reserve - vested DP 24346) Road Reserve Recreation Reserve	Recreation Reserve (vested DP 24346) Road Reserve Esplanade Reserve

APPENDIX 2
Sieve Mapping Analysis

Fixed Structures and
Property Boundaries



KEY:-

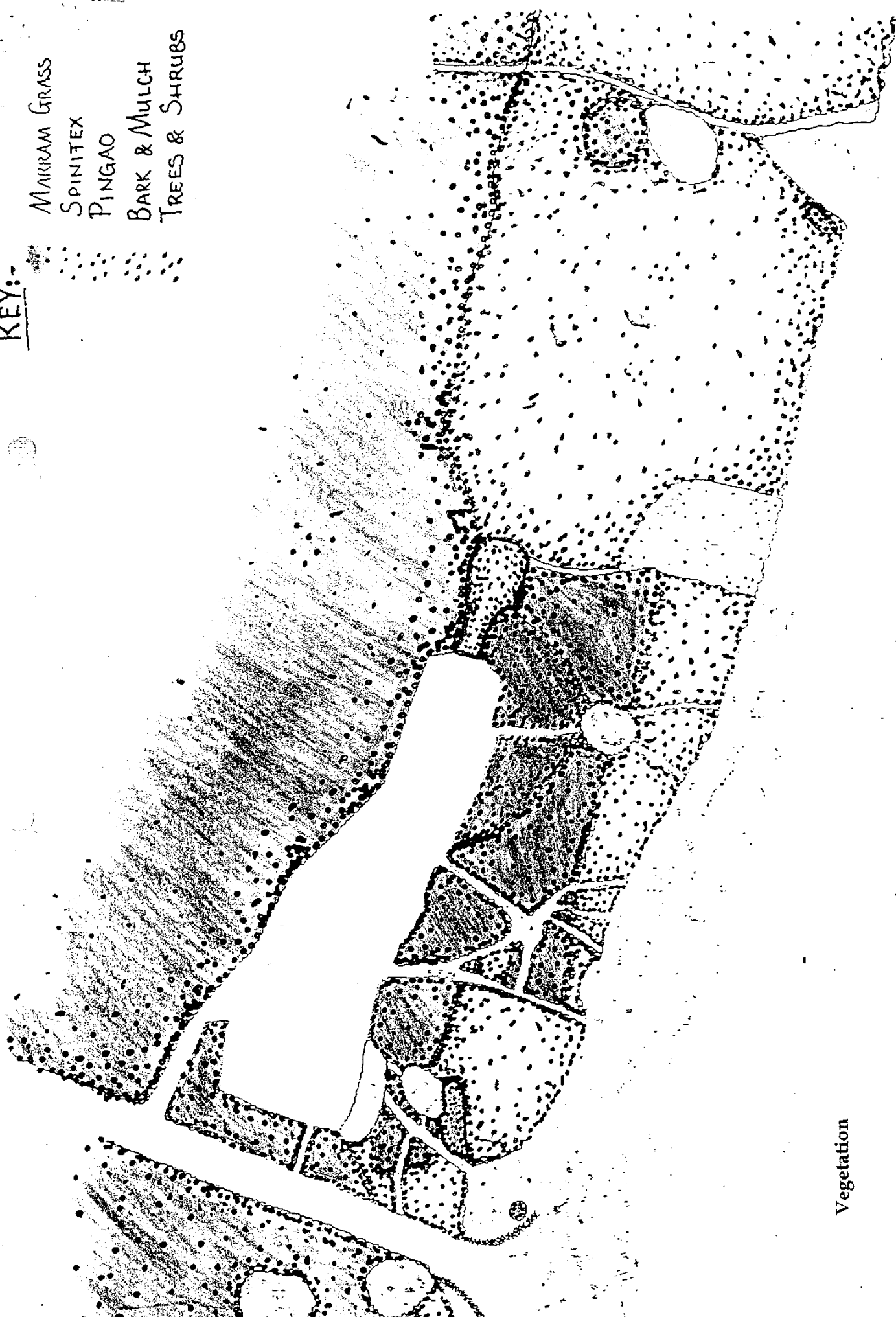
MARRAM GRASS

SPINITEX

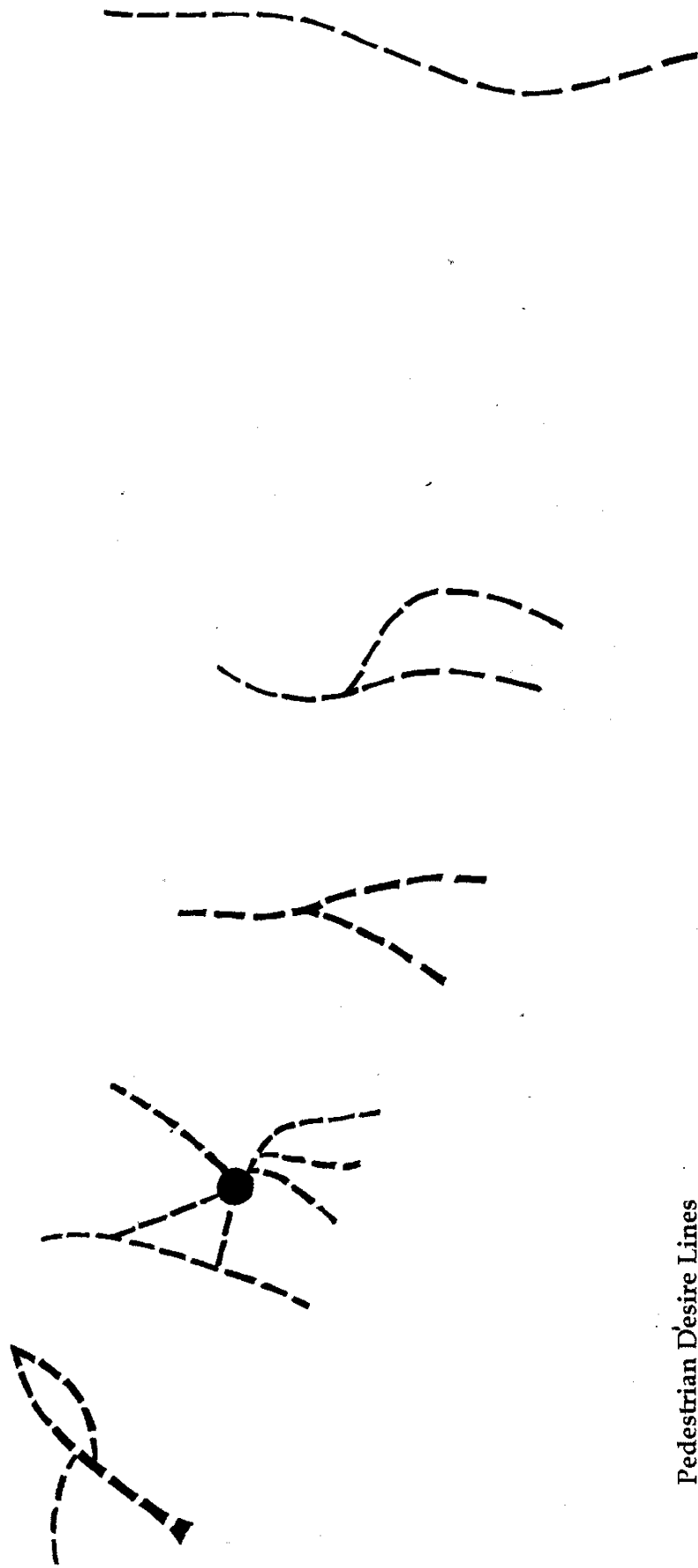
PINGAO

BARK & MULCH

TREES & SHRUBS



Vegetation

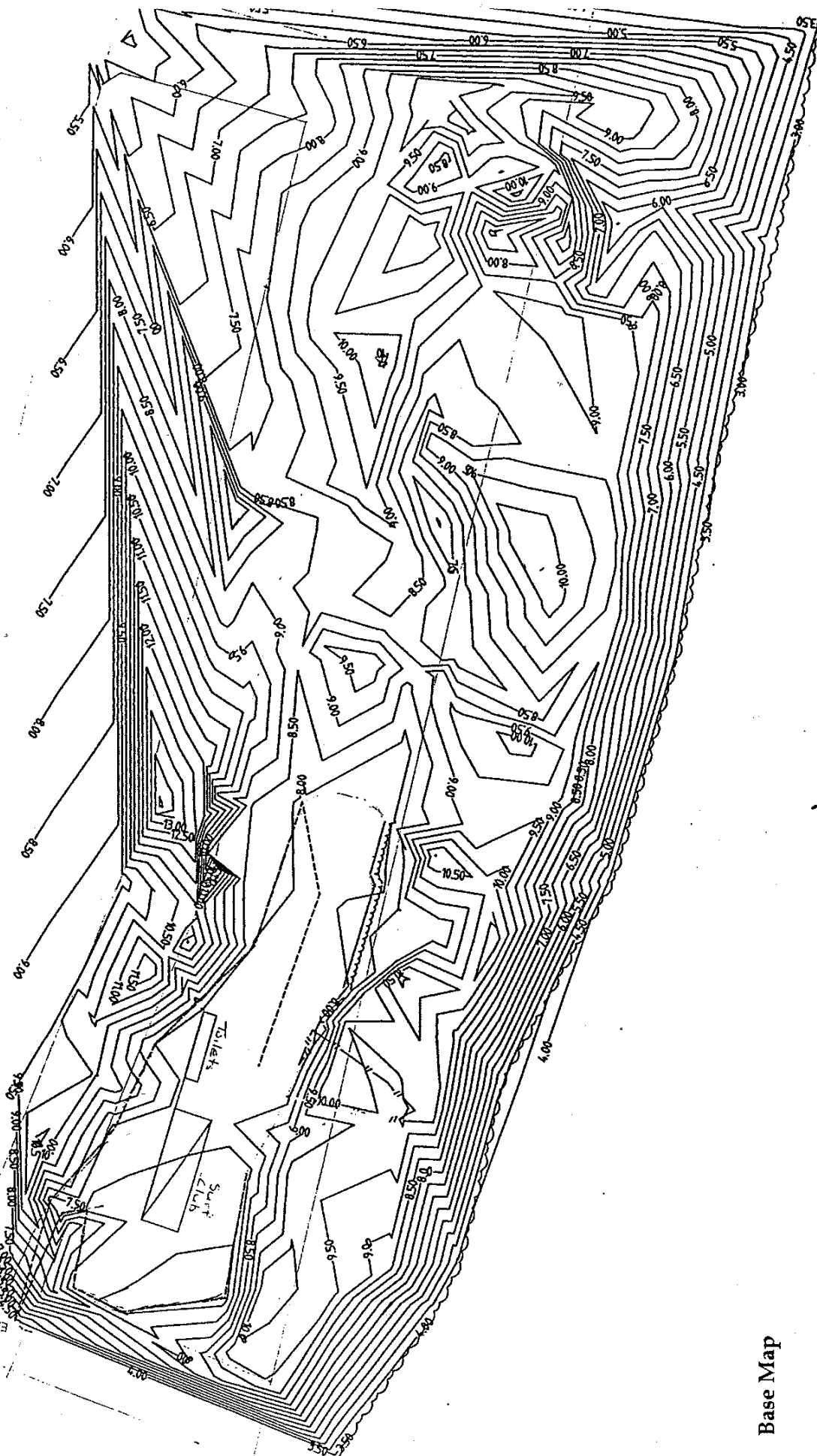


Pedestrian Desire Lines

AVENUE 2

FLICA

Entrance to Surf Club



Base Map

APPENDIX 3

41. Management plans—

(1) The administering body shall, within 5 years after the date of its appointment or within 5 years after the commencement of this Act, whichever is the later, prepare and submit to the Minister for his approval a management plan for the reserve under its control, management, or administration.

(2) The Minister may extend the time within which an administering body is required to submit its management plan to him for approval, where he is satisfied with the progress the administering body has made with the preparation of its management plan.

(3) The management plan shall provide for and ensure the use, enjoyment, maintenance, protection, and preservation, as the case may require, and, to the extent that the administering body's resources permit, the development, as appropriate, of the reserve for the purposes for which it is classified, and shall incorporate and ensure compliance with the principles set out in section 17, section 18, section 19, section 20, section 21, section 22, or section 23, as the case may be, of this Act for a reserve of that classification.

(4) The administering body of any reserve shall keep its management plan under continuous review, so that, subject to subsection (3) of this section, the plan is adapted to changing circumstances or in accordance with increased knowledge; and the Minister may from time to time require the administering body to review its management plan, whether or not the plan requires the approval of the Minister under this section.

(5) Before preparing a management plan for any one or more reserves under its control, the administering body shall—

(a) Give public notice of its intention to do so; and

(b) In that notice, invite persons and organisations interested to send to the administering body at its office written suggestions on the proposed plan within a time specified in the notice; and

(c) In preparing that management plan, give full consideration to any such comments received.

[(5A) Nothing in subsection (5) of this section shall apply in any case where the administering

APPENDIX 4

Waitarere Public Meeting, at Waitarere Beach Surf Club

29 November 1999

Waitarere Beach Foreshore Reserve

Community Query

Reservations over any redevelopment at the southern end. Does not feel communication with those out of town has been good. Felt very strongly that this should be done and improved so that absentee home owners are not discriminated against.

Council Response

Admitted that without wanting to discriminate anyone, RMP team were advised not to contact all residents neighbouring reserves as it would be a huge task because there are literally thousands throughout the district.

Currently in liaison with a group at the south end of Waitarere Beach over a different issue but will use this opportunity to invite their comments on the reserves.

Community Suggestion

All Reserve boundary neighbours (and interest groups) should be contacted. If there was to be any increase in rates due to new projects or other outcomes of the RMP process then those people likely to be affected should be contacted.

Concept Designs presented, it was stressed that these were ideas part of an earlier process and in no way should people limit their ideas to these designs.

Community Query

Is the road shown on the 'McCorkindale' plan a single or double entrance way?

Council Response

It is a double carriage way.

Community Response

Emphasised that the development of Concept Design 3 was required because the previous design was just not practical. The volume of traffic using the beach in the height of summer was just too great (1000+ cars). There were 360 on Labour day this year alone. Desired to see free access and sand hill by the surf club lowered.

Council Response

It was pointed out that any design that involved vehicles moving through the car park would use judder bars or alternative means to calm traffic.

Community Query

Wanted to know what sort of timeframe was envisaged when this development was discussed, would it be in this lifetime?

Council Response

Not prepared to give an exact timeframe, the actions though would benefit the region as a whole, the process is designed to be a fair and just one; democracy in action.

Community Query

Concern expressed over the frequent flooding of the car park.

Council Response

This is a maintenance issue but could definitely become part of the overall plan, which happens over a 2-3 year period.

Community Suggestion

Mentioned the urgent need for something to be done otherwise next July the sea will be right next to the houses. There was a certain tidal flow, which has been predicted for July next year. If we still want a beach then we need to act now.

Council Response

Obviously there are some wider issues we need to be aware of. Spoke of the meeting held in September this year where Lachie Grant of the Regional Council recommended that any work should not take place until May next year. It would be possible to use the \$5000 (which is gradually decreasing as background work is done) set aside and there would be a good chance of a Regional Council 25% subsidy to make the funds go further.

Community Response

Support for Concept Design 3 and for the report prepared by the Regional Council. Waitarere Beach is a major tourist attraction for the district and could be made even better, there is now about a chain of reclaimed land which could be developed. Could the Eastern and Central community trust be used for this?

Community Response

The Surf Club is actually in the process of putting together an application to HDC to get some of this funding. It was thought they might have more success if it was coming on behalf of a sports club as the fund was designed for projects which were not the normal responsibility of Council.

Council Response

Councillors have not yet been fully briefed on how the funds will be allocated.

Community Query

Queried why 5 cubic metres could not be moved from by the Surf Club if it was done by the subdivision further north. Why the difference?

Council Response

The area north is less sensitive than by the Surf Club. The aim is to get the process right. By having community involvement and by doing things the correct way. Seeking the community's vision was part of this exercise.

Community Suggestion

At Waitarere Beach we really do have the best beach on the west coast, but it is not only for the spinifex dunes but for the space and safety of the beach. The beach is shared with people throughout the coast so the cost should be a regional cost.

A donation of machinery and labour, is possible, but may need to be split into 2-3 stages. The concept is 10-20 years ahead of its time, the need for concept design 3 will increase as use does. We are starting to get to a design that has a feel of some thing right about it.

Would really like to see the elderly catered for. Provision of elevated car parks on the dunes for people to drive up on would allow many elderly people to enjoy the beach without having to drive onto it.

The beach should cater for everyone, but it should perhaps not be as broad and harsh as at Foxton.

Council Response

We need to extend this concept to encompass further areas of the foreshore both north and south of the main entrance.

Community Query

Raised a query over the design of the main vehicle entrance.

Council Response

It was pointed out that the road design included a two crown effect. The first crown taking the road to the level of the car park. The second crown taking the road to the crest of the foredune, bringing the road over the top.

Community Query

Raised the question over the prevailing wind and which direction it came from?

Council Response

The prevailing wind at Waitarere Beach is from the north-west. The main vehicle entrance and many of the access ways onto the beach have been designed so that they are not aligned with the prevailing wind. If they are then we will have more problems just like we have with the wheelchair access/walkway to Hyderabad monument.

Community Query

The concept designs cater for vehicle traffic quite well but what about foot traffic? Will kids still be able to access the beach like they do now along Waitarere Beach Road or will toddlers be penalised?

Council Response

It was thought that the designs did cater for pedestrians pretty well. The main entrance to the beach although it may be crowned still provides for pedestrians.

Community Response

Pointed out that his grandchildren of 2-3 years were able to handle the Windsor Street entrance so he did not see why the new entrance would be any different.

Community Suggestion

Had the use of concrete blocks on the beach been considered instead of just a rope for the summer period? Was there any plan to upgrade the toilet facilities?

Council Response

The need for upgraded toilet facilities was noted and would be considered. The use of concrete blocks instead of rope had been considered but was generally not a favoured option. A variety of reasons such as the concrete blocks being a danger to swimmers at high tide have built this view.

Community Query

Growth at the beach was outstripping the facilities and amenities. The beach is the most important recreation asset the district has and it is fast falling behind the growth

Community Suggestion

Waitarere Beach is enjoyed not only by locals but also by tourists and people from Levin. The people of Waitarere Beach often feel neglected because its those in Levin which get the funding but they still get the use and enjoyment from a place like Waitarere Beach.

Council Response/Suggestion

Wanted the people of Waitarere Beach to consider an important issue - invasive plants. They are beginning to be a problem at the beach but only if the community sees it that way.

Does the community see the need to get rid of these plants which over time grow and begin change the eco-system of the area? Should we be looking to keep the beach a clean green area with native plants where possible? This is the type of thing we need to consider when preparing the management plan.

Community Suggestion

The Asian countries have beaches, which use large trees to create a border for their beaches. The use of small shrubs (marram and spinifex) does not allow us to do this in NZ.

Community Query

Why use Marram grass? It is useless, it dies out too quickly.

Council Response

Marram grass is the one species that the Regional Council can establish with some certainty along our west coast. Unfortunately the marram grass tends to become woody and die out after 6-8 years. Marram grass is cheaper than the other native species but builds very tall hammocky dunes, which are more prone to blowouts than spinifex dunes, which are more aerodynamic.

What would probably need to happen is that for any replanting the marram would be used as a nurse crop so that other species such as spinifex and pingao could be established.

Community Query

The boxthorn at Waitarere Beach is becoming a problem, whose responsibility is it to remove it?

Council Response

The Regional Council does have a 'noxious weeds strategy' that we will look to be incorporating into our management plans. As to whose responsibility it is, this would probably depend on where it was located. In some cases joint responsibility would probably suit both councils.

Community Query

Lupin growth on the beach is quite an issue, can they just pull it out?

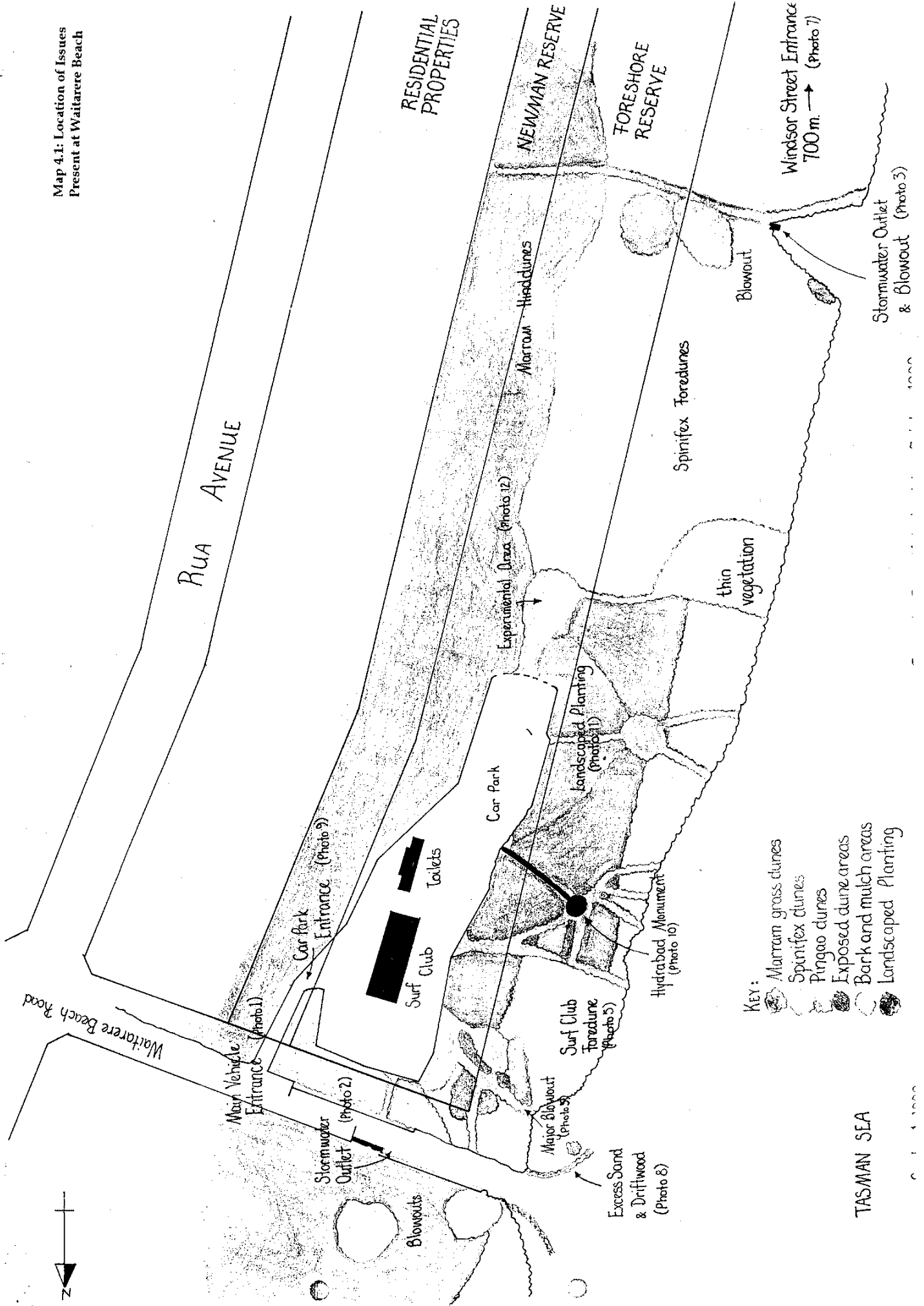
Council Response

There needs to be consideration given to how and when it is to be removed, so that the problem is not made worse.

Council Response

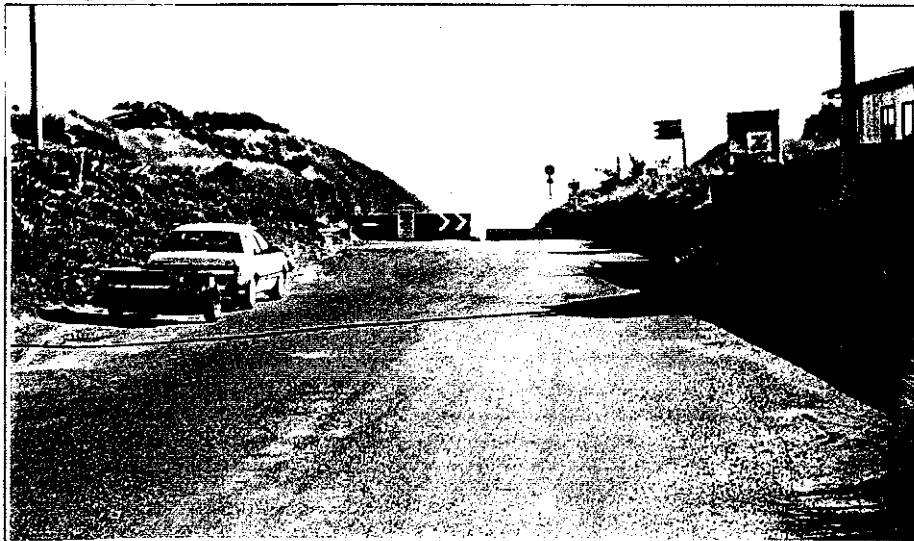
Would really like to work with locals to see if together they could come up with a strategy to control, remove and resolve some of these noxious weeds.

Map 4.1: Location of Issues
Present at Waitare Beach

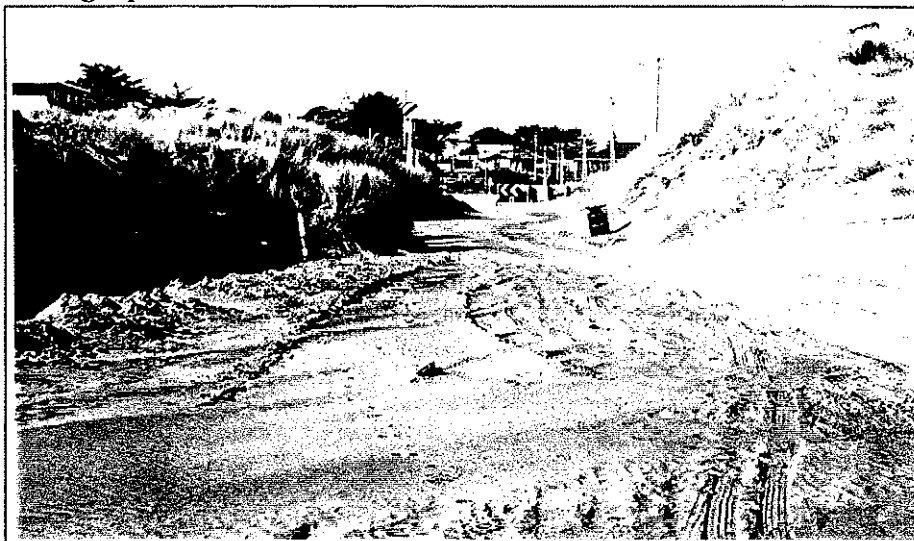


APPENDIX 5

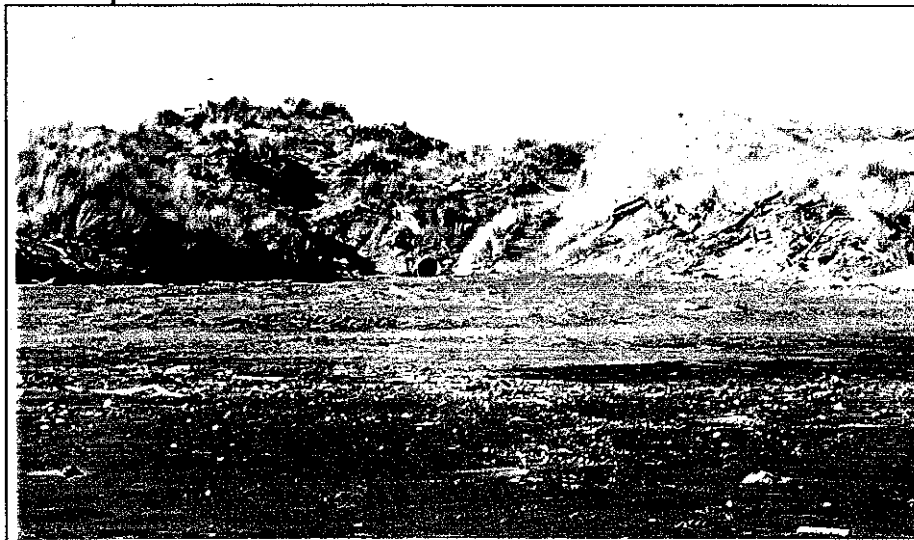
Photograph 1: Main vehicle entrance to the beach from Waitarere Beach Road.



Photograph 2: Seaward side of the main vehicle entrance to Waitarere Beach.



Photograph 3: Blowout formed by the stormwater outlet compromising the dune's natural profile.



Photograph 4: View from the car park of the bare Surf Club foredune and pedestrian foot tracks.



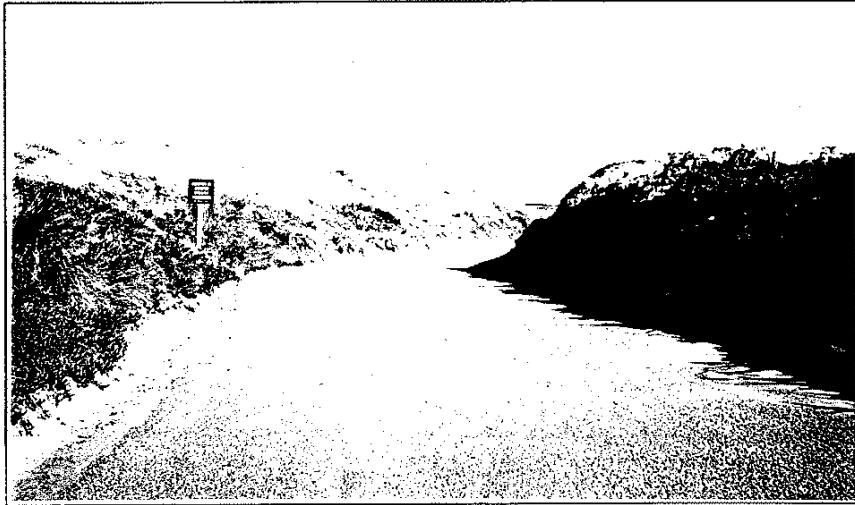
Photograph 5: Surf Club foredune and major blowout.



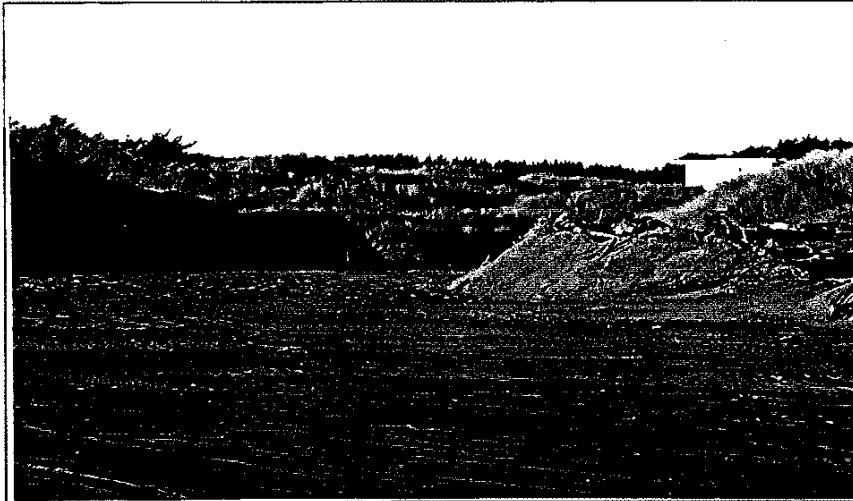
Photograph 6: A pedestrian desire line completely devoid of vegetation



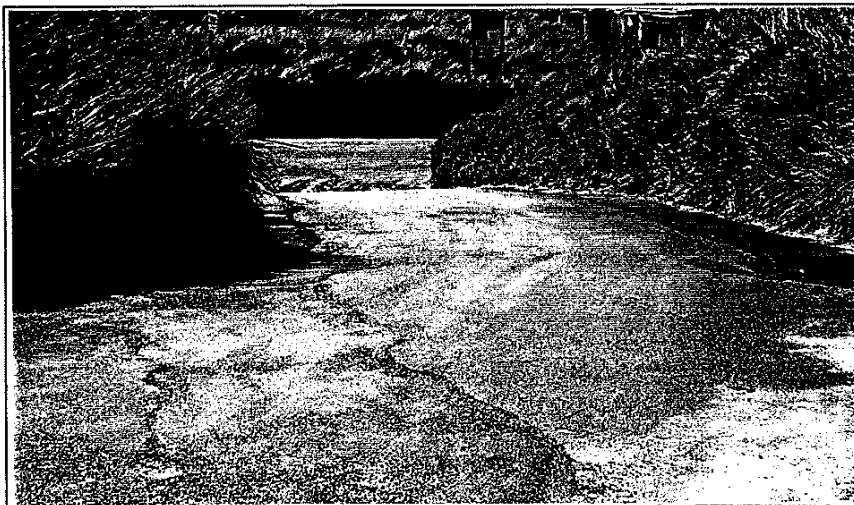
Photograph 7: Windsor Street entrance onto Waitarere Beach, showing the stable nature of this curving design.



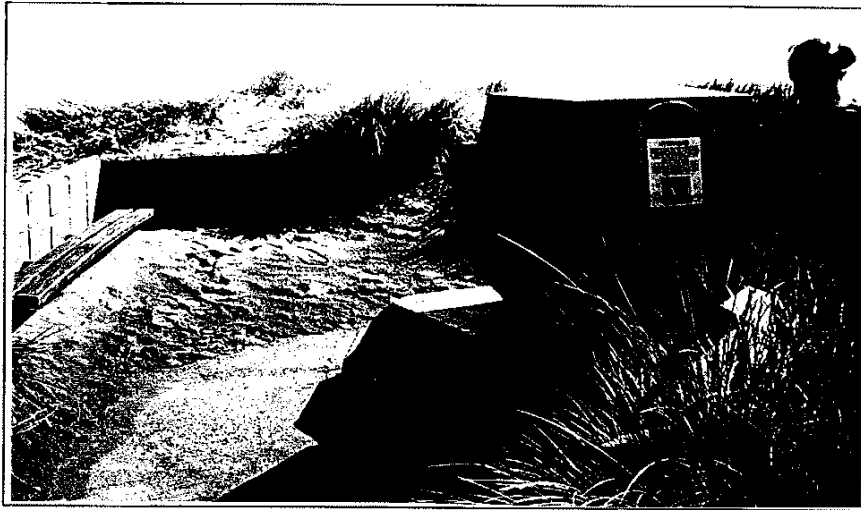
Photograph 8: The main vehicle entrance to Waitarere Beach with berms created by excess sand and driftwood.



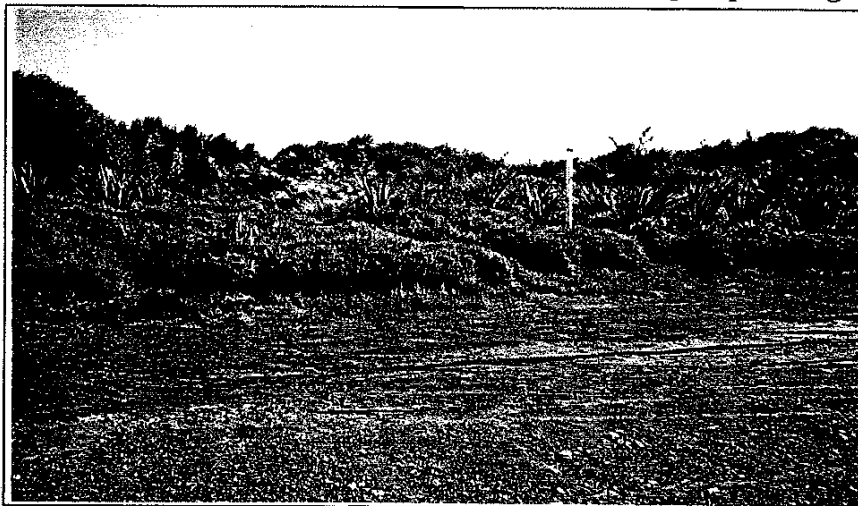
Photograph 9: Difficult vehicle entrance to car park and Surf Club.



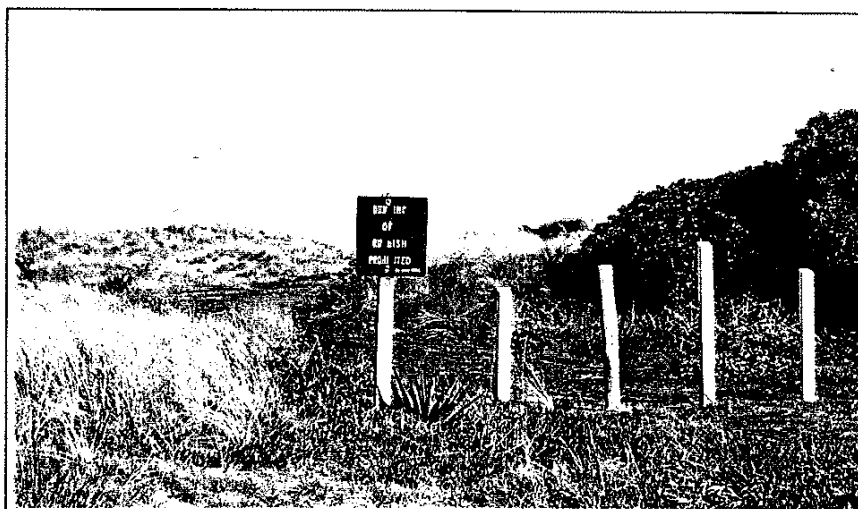
Photograph 10: The buried and overgrown Hyderabad monument.



Photograph 11: Stable foredune with intense landscaped planting.



Photograph 12: Experimental walkway area south of the carpark, which uses bark and mulch to stabilise the surface.



APPENDIX 6

A list of shrubby species already present in the area and that would be suitable as a nurse crop include

Coprosma acerosa (sand coprosma),

Pimelea arenaria (sand daphne),

Cassinia leptophylla (Tauhinu),

Kunzea ericoides (Kanuka).

Species that can be planted amongst these nurse crops may include

Olearia paniculata (Akiraho),

Phormium tenax (coastal flax),

Coprosma repens (taupata),

Cordyline australis (cabbage tree),

Myoporum laetum (ngaio),

Olearia avicenniaefolia (akeake),

Podocarpus totara (totara).

FOREDUNE

Foredunes run the entire length of Kapiti-Horowhenua. South of Waikanae, however, we are gradually losing that line of dunes to the sea. The remnants are shored up with walls and groynes. North of Waikanae, although the foredunes are surviving, stabilisation is an ongoing concern. So how people garden here is

important for the entire neighbourhood. The pressures of human trampling, rabbit browse and storm events on the foredune vegetation can often be overcome by the home gardener as well as by local authorities!

Factors for gardeners to consider:

Q The prevailing west-to-north-westerlies

are drylog, salty and ensure constant sand-drift inland. There are summer droughts, and this is when most salt damage can occur. Q The dunes are not only low in nutrient but without organic content, they drain and dry rapidly. If you add organic material, you must keep on adding it, for it will break down quickly in these

conditions. Q Frost should not be problem here.

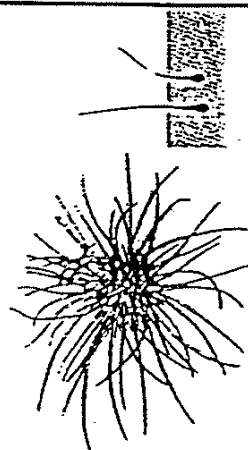
Design interest: few species, but colourful & texturally interesting. The suit massing together in informal group which reflect the underlying landforms.

It is not just the action of waves that causes coastal erosion during storms - turbulent wind increases the damage.

Foresore gardeners should aim to get air flowing smoothly up the beach and over the foredune by controlling the height of vegetation or having permeable fencing that wind can filter through.



Solid fences, walls and shelterbelts will only make the turbulence, and wind erosion, worse.



To germinate spinifex seeds, first catch your whiffles! Feet for plump, hard seeds in the centre and use those, keeping the remainder moist.

In the lee
small leaved pohuehue Muhlenbeckia complexa
autetearanga, sand daphne Pimelea arenaria
sand coprosma Coprosma acerosa
watuatua, shore spurge Euphorbia glauca
taupata Coprosma repens
tauhinu, cottonwood Cassinia leptophylla
piripiri, bidibidi Acaena novae-zelandiae
mingimingi Coprosma propinqua
Eleocharis neozelandica
ngalo Myoporum laetum
akoake Dodonaea viscosa
whau Entelea arborescens

seaward side (spreading plants)
nihinihi, shore bindweed Calystegia soldanella
pingao Dasmoschoenus spiralis
spinifex Spinifex sericeus
sand sedge Carex pumila (on moist sites)
tatarakeke, sand coprosma Coprosma acerosa
horokaka, lee plant Displyma australe
NZ spinach Tetragonia tetragynia

DRY DUNELAND

Dunes increase in age as you travel inland and their soils mature accordingly. Between the dunes there are often flat sandplains and hollows created by wind-eroding where the soil is damp. Much of our urban development occurs in this zone and not all the dunes have survived bulldozing, so soils may be less developed

than expected. Successful planting relies on matching the dry/damp patterns and using hardier species in sites exposed to dry salty winds.

Factors for gardeners to consider:
 • Use salt-resistant species to create shelter for other plants. • Frost is an issue - although less to the south where

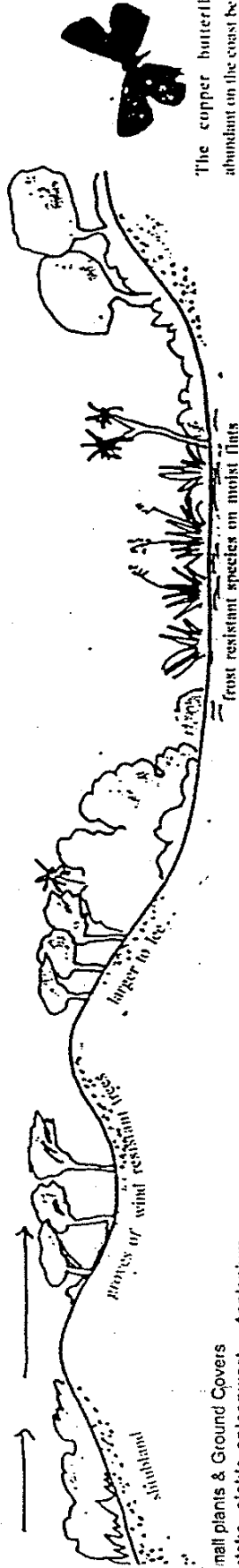
air drainage off the hills helps prevent frost. Plants listed have an asterisk if they are frost-tender. • The entire area experiences summer drought. Mulching with a heavy chip (that will not blow away) will help plants establish. • In these sandy soils organic matter will break down rapidly. To recreate the old forest fertility

we need to replenish soils regularly with organic compost.

Design interest: Kanuka and akeake, if left unpruned, have attractive, wind-shaven forms that have become key visual focal points in this landscape.

Prunable hedges: taukata, akeake, olearia

Street trees: karaka, akeake, ngaito, mahoe, kanuka



mall plants & Ground Covers
 slako, sickle spleenwort Asplenium
 dyodon

ruhuwhenua, shining spleenwort
 splenium oblongifolium

ingimingi Cyathodes fasciculatus
 ingimingi Coprosma propinqua

aprosma rigida

upala Coprosma repens

astal tree daisy Olearia solanifolia

ihinu Cassinia leptophylla

roko Corokia cotoneaster

ucus australis (tolerates dry conditions)

viscus Hibiscus trionum

igarenga Arthropodium cirratum

utukaka, kakabeak Clanthus puniceus

uhuru

whiria, native lamino Parsonsia capsularis

ataua Clematis forsteri

Trees - on younger dunes & dry sand plains
 ngalo Myoporum laetum

kanuka Kunzia ericoides - survives best

planted in groves

akeake Dodonaea viscosa

taupata Coprosma repens

rautini, Cintham la.nkenko Sonchello humil

whau* Entolas nitroscens

Trees - older dunes with soils. As above, plus:

iloki* Alecylon excelsus

akiraho Olearia paniculata

mahoe Melicytus ramiflorus

kowhai Sophora microphylla

mapou Myrsine australis

kalkomako Panninella corymbosa

malai Pinninophrys latifolia

Moist sand plains & hollows - low stature ...

remuremu Selliera radicans

shore plimporol Samolus repens

gunnom aronaria

sand buttercup Ranunculus acaulis

panakenaka Pratia angulata

libertia Libertia perigrina

Carex flagellifera

sand sedge Carex pumila

blue wheat grass Agropyron scabrum

tootoo Coriaria toetoe

harakeke, swamp flax Phormium tenax

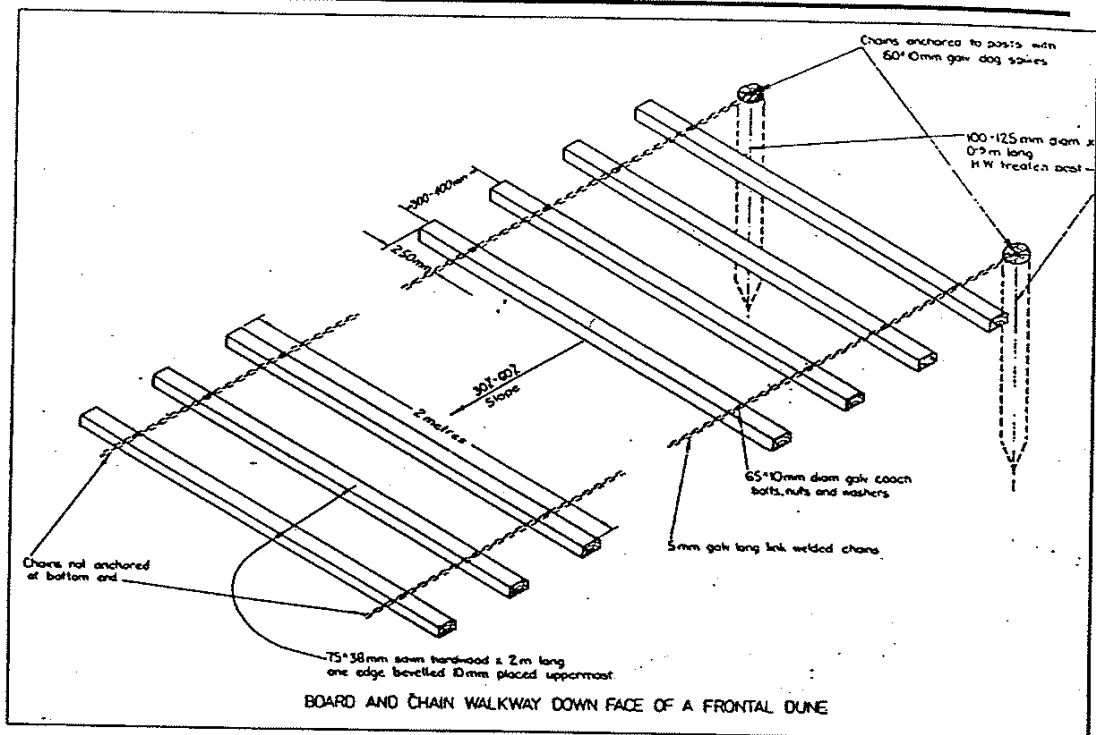
reingrango Arthropodium ciliatum

shore fuchsia* Fuchsia procumbens

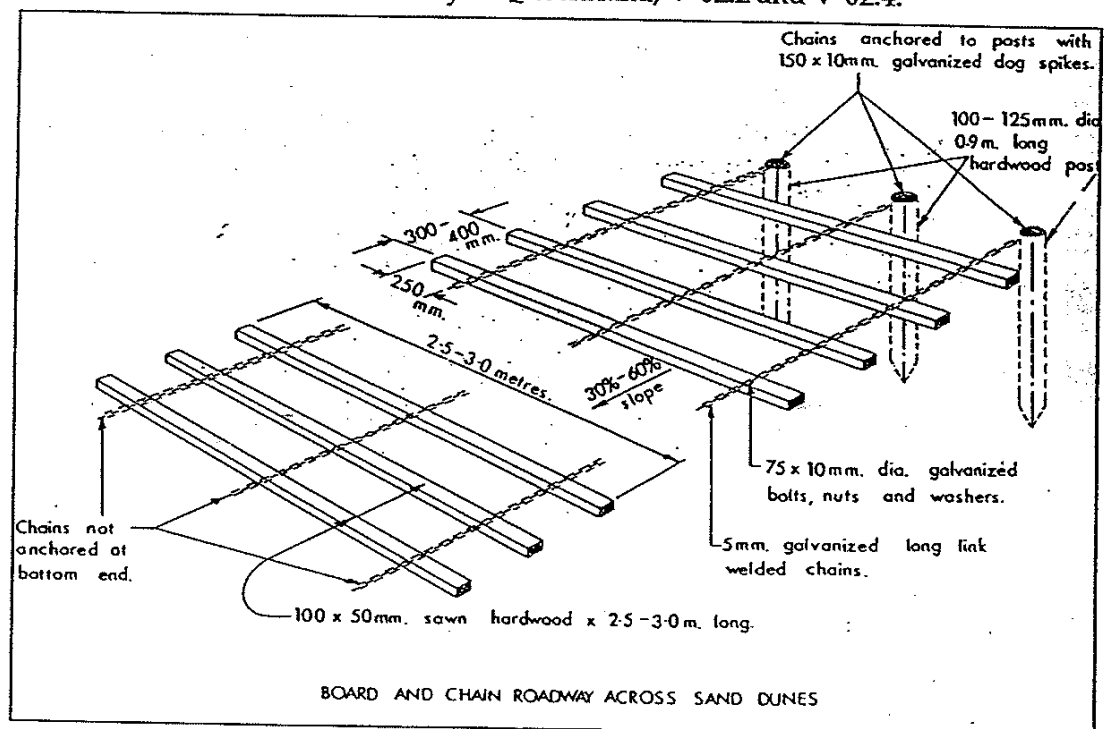
The copper butterfly is abundant on the coast because that's where its native host plant poluelue or Althibetia grows densely. • it even makes a great hedge when grown along a wire netting fence - and is a popular pot plant overseas.

... and taller species
 cabbage tree Cordyline australis
 karaka Corynocarpus laevis
 kahikatea Dacrydium dacrydioides

APPENDIX 7

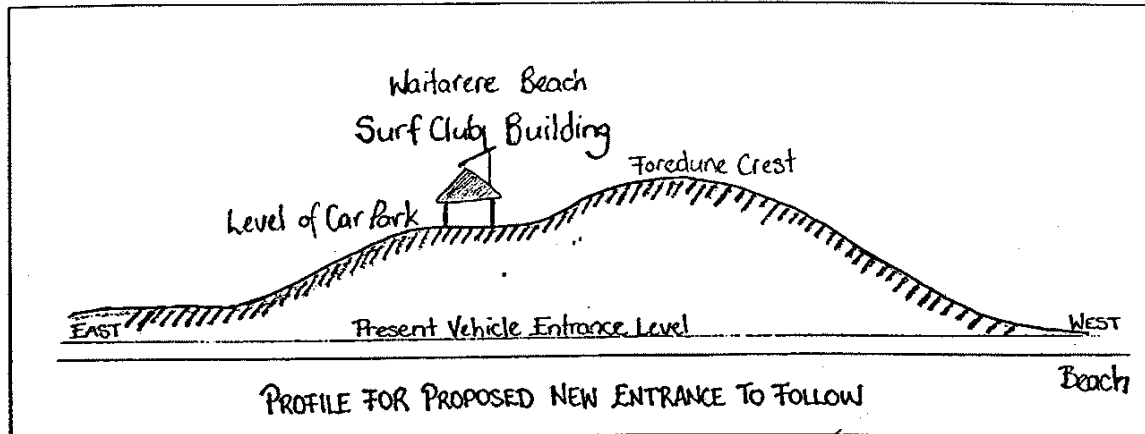


Construction diagrams of Board and chain roads and walkways.
Source: Beach Protection Authority of Queensland, V-02.2 and V-02.4.



APPENDIX 8

Proposed New Vehicle Entrance - Road Crown Diagram



Not to Scale

APPENDIX 9

Table of Advantages and Disadvantages for Design Solutions

CHANGE	ADVANTAGE	DISADVANTAGE
EXTEND DRAINS BEYOND TOE OF FOREDUNE	<ul style="list-style-type: none"> • reduce likelihood of blowouts continuing • allow foredune to be replanted, stabilised, and the ideal dune shape re-established 	<ul style="list-style-type: none"> • cost - it may eventually need to be redone if beach keeps moving • drains will stick out and may be restrict people's movements (like at Raumati Beach)
STORMWATER PUMPED BACK DOWN TO THE MOTOR CAMP	<ul style="list-style-type: none"> • would allow the drains to be covered on the beach, dunes would be restored and vegetation established • drains wouldn't need to be continually unblocked • no more blowouts, natural dune shape is not being compromised 	<ul style="list-style-type: none"> • would probably need to be an early stage in the development • may not be possible straight away - cost - new infrastructure required • will need to be budgeted for and contractor organised • can the stream outlet to the beach handle the increase, or will this cause problems some where else
RETAIN CURRENT VEHICLE ACCESS ROUTE ONTO THE BEACH - NO CHANGE	<ul style="list-style-type: none"> • less expensive option - retains current infrastructure • allows cars access on and off the beach • there will be no disturbance to traffic as there is no construction required • view off the beach as your drive up Waitarere Beach Road is retained 	<ul style="list-style-type: none"> • the access way will continue to act as a major funnel for sand laden wind • entrance will continue to get blocked by sand build up • problems stabilising vegetation on the dune near the entrance • people will continue to bypass the surf club car park and park on the beach • access to surf club remains difficult

CHANGE	ADVANTAGE	DISADVANTAGE
FERTILISER ON DUNE VEGETATION	<ul style="list-style-type: none"> • helps regenerate areas of thin vegetation and establish new plantings • helps prevent sand drift by improving vegetation cover 	<ul style="list-style-type: none"> • cost - labour hours and fertiliser • poisonous to animals, kids ?? • leachate to the beach - potential for adverse effects on the littoral zone ecology • needs to be used in conjunction with other restoration methods to a be worthwhile
ACCESS FENCES	<ul style="list-style-type: none"> • can act as sand accumulators helping build or shape dunes • restricts and controls pedestrian movements and prevents haphazard movement across dunes and vegetation • more effective at controlling pedestrian movement than brush matting 	<ul style="list-style-type: none"> • fences unsightly - beach can begin to lose its natural character • costs - materials and construction, repairs and maintenance • not 100% effective as a small minority will still climb over the fence
CHANGE ACCESS ONTO THE BEACH TO PASS BY THE SURF CLUB	<ul style="list-style-type: none"> • stop the wind funnel - less sand drift and a better chance to stabilise the foredune • less work required in terms of unblocking the entrance way • people would be made aware of the car park and facilities and may use them • foredune would not have a major gap in the foredune (perpendicular to the foredune) • most suited to the creation of a vehicle free zone during the busy times of the year 	<ul style="list-style-type: none"> • costs in terms of - new access route and earthworks to fill in the existing entrance • new entrance onto the beach would require another breach of the foredune - destabilising vegetation • may not be successful in attracting people to use the car park • car park may need up-grading to cope with the increased traffic

CHANGE	ADVANTAGE	DISADVANTAGE
DRAINAGE OF CAR PARK - NO CHANGE	<ul style="list-style-type: none"> • money saved by not spending it on utility infrastructure 	<ul style="list-style-type: none"> • water will continue to pool - attracting mosquitoes
PROVISION OF SIGNS	<ul style="list-style-type: none"> • educational sign - can be used to explain about beach protection, the Hydrabad and accretion • informative sign - can be used to inform beach users about the development process or typical weather patterns for the region • reminds people of where they are, or where they have been • welcoming sign - can be used as part of the entrance to the beach • the sign is not dependent of any parts of the development process 	<ul style="list-style-type: none"> • costs - materials and labour • can become another target for vandalism and graffiti
SURF CLUB - GRASS THE AREA BETWEEN THE DUNE AND THE BUILDING	<ul style="list-style-type: none"> • creates a pleasant and attractive link between building and beach • allows surf club users easier and safer access across the car park (no glass and loose gravel) • will prevent the buildings becoming traffic islands by preventing circular movement • area has potential to be used as a pentanque court 	<ul style="list-style-type: none"> • difficult to maintain and to retain the appearance of the area • costs of materials and mechanisms to restrict vehicles - bollards or planter boxes
DRAINAGE OF CAR PARK - CAR PARK UPGRADED/LEVELLED/SOAK PIT INSTALLED	<ul style="list-style-type: none"> • pooling water would drain away • no more mosquitoes • water would not undermine dunes, car park would be a more pleasant and attractive place to park 	<ul style="list-style-type: none"> • cost of infrastructure • soak pit may block up and malfunction or require servicing (on going costs difficult to compile)

CHANGE	ADVANTAGE	DISADVANTAGE
PROVISION OF PICNIC/PARKING AREA	<ul style="list-style-type: none"> provides an area for beach users to enjoy the beach without actually going on to the beach stabilisation of an area of hind dune turns the area of wasteland into a useable and accessible area achievement of a long term community desire allows people to stay in their cars and enjoy the view of the beach parking area could use timber instead of tarseal, which would make it cheaper to maintain 	<ul style="list-style-type: none"> requires some earthworks to level the dune costs - earthworks, materials, and labour ongoing maintenance work will be required to ensure this area remains attractive and well used will require some shrubs or fences to direct users (pedestrians and vehicles) to appropriate access points and restrict inappropriate pedestrian and vehicle movement
USE OF MARRAM GRASS FOR REPLANTING AREAS	<ul style="list-style-type: none"> establishes quickly and builds dunes grows on the tops of foredunes costs half the price of spinifex is the only species that can be established with certainty 	<ul style="list-style-type: none"> exotic species dies out after 6-8 years builds tall hummocky dunes, which are prone to blowouts
USE OF PINGAO FOR REPLANTING AREAS	<ul style="list-style-type: none"> native sand binding species grows on the upper slopes of foredunes creates a low and aerodynamically shaped dune grows best where there is sand movement and exposed unstable foredunes 	<ul style="list-style-type: none"> costs > \$1 per plant to buy from commercial nurseries slow to establish and is at times out-competed by exotic species is only found in few places at Waitarere Beach

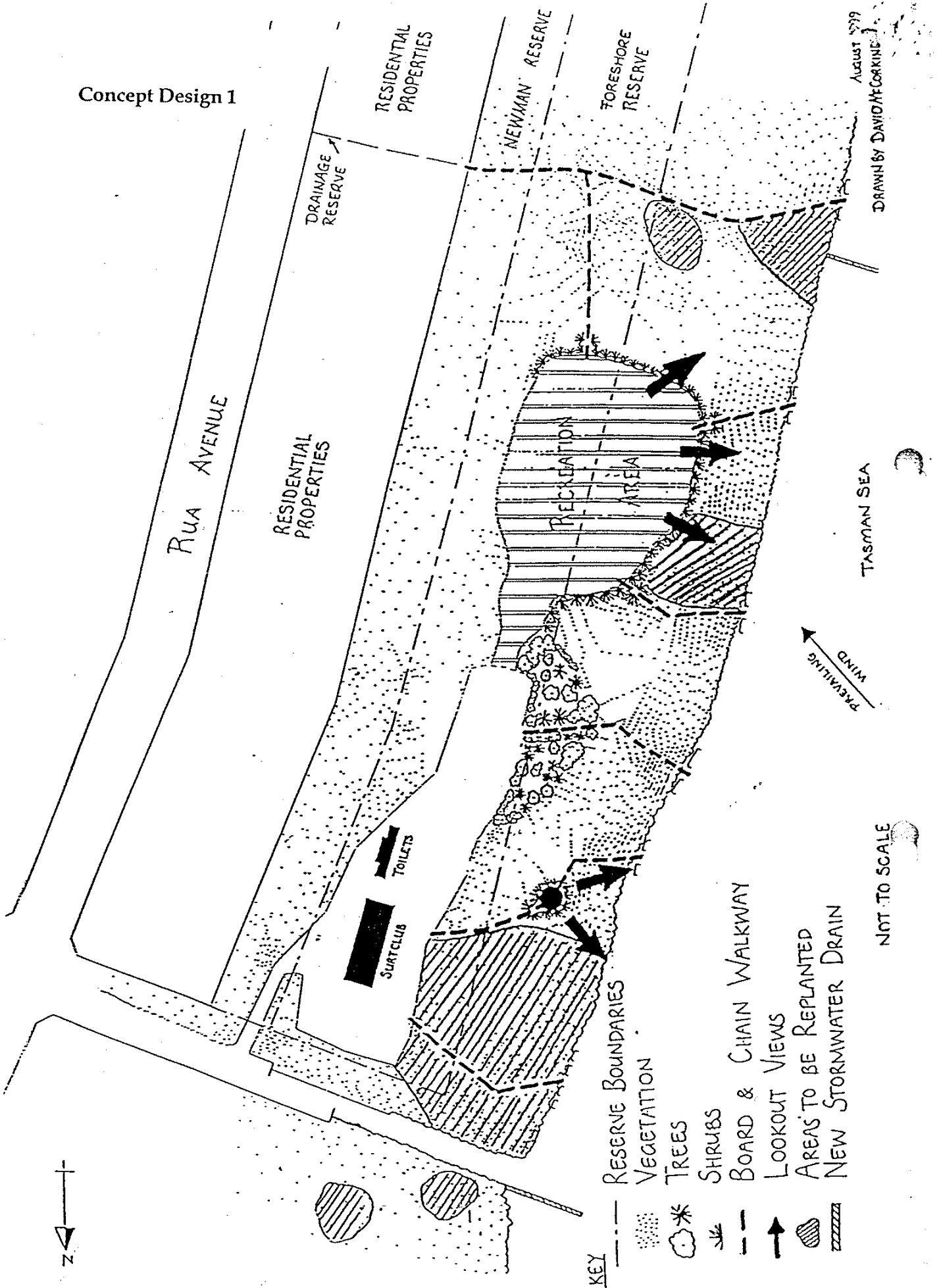
CHANGE	ADVANTAGE	DISADVANTAGE
CHANGE ACCESS TO THE HYDRABAD MONUMENT	<ul style="list-style-type: none"> gives the opportunity to redesign and construct a board and chain walkway, which is unlikely to be buried as easily as the current walkway - different alignment board and chain walkway can be lifted as it becomes buried which allows permanent access including wheel chair access permanent access may help prevent haphazard move across the dunes in an attempt to get to the monument 	<ul style="list-style-type: none"> costs of labour, materials and construction of walkway other means may be necessary to prevent people walking over the dunes to get to the monument (ie. - plants, fences and signs) ongoing costs of repair and maintenance to the walkway - clearing the access
BOARD AND CHAIN WALKWAYS	<ul style="list-style-type: none"> creates a identifiable path for people, encouraging access at these points rather forging a new path and destroying further vegetation walkway is not in a permanent position, it can be lifted or moved as required useful where slopes of dunes are 17 - 31° (Waitare approx 25°) walkway is not as hot as sand during summer 	<ul style="list-style-type: none"> cost - materials and labour hours short term change in mind-set needed as people start using only walkways for beach access other means may be necessary to prevent people haphazardly causing damage to dunes and vegetation - (ie. fences and signs) ongoing costs of repair and maintenance to the walkways and uplifting and clearing the walkways as they become buried

CHANGE	ADVANTAGE	DISADVANTAGE
USE OF SPINIFEX FOR REPLANTING AREAS	<ul style="list-style-type: none"> • native species • creates a low and aerodynamically shaped dune • recovers quicker than marram grass • plants can be propagated for the project 	<ul style="list-style-type: none"> • costs \$1.30 per plant to buy from commercial nurseries • sensitive to browsing animals during establishment • less certainty than with marram when establishing it
PLANTING VEGETATION ON BARE AREAS	<ul style="list-style-type: none"> • regenerate dunes making them more stable, and prolonging the life and appearance of the dunes • less sand drift • beach remains an attractive and aesthetically pleasing place, less reflection off dunes 	<ul style="list-style-type: none"> • will require time and monetary input - plants can be expensive • will also require measures to protect the vegetation while growing • planting should only be carried out during winter months
BRUSH MATTING OF REPLANTED AND BARE AREAS	<ul style="list-style-type: none"> • effective method to withstand strong winds and to help sand retain moisture for plants • effective in stabilizing dunes and helping plants get established • acts as a deterrent, protecting the newly established vegetation • uses cheap natural materials which are easily accessible 	<ul style="list-style-type: none"> • requires labour hours • some what unsightly • requires maintenance and some education to be effective
JUDDER BARS	<ul style="list-style-type: none"> • increased safety for beach users due to speed reduction, for vehicles entering and leaving the beach and car park • may act as a deterrent for young 'hoons' 	<ul style="list-style-type: none"> • costs of constructing signs and judder bars • can make it difficult for elderly drivers to negotiate • could act as a deterrent for the elderly

CHANGE	ADVANTAGE	DISADVANTAGE
PROVISION OF LOOKOUT AREA	<ul style="list-style-type: none"> • gives access to additional and advantageous to the views of the coast • may prevent some haphazard movement across dunes in search of better views • another positive pull factor for beach users 	<ul style="list-style-type: none"> • may to some seem an unsightly 'blob' on the horizon, as the lookout point requires a high point on the tops of dunes • costs of materials and construction of lookout and walkway • disturbance to the dune during construction • may become buried and poorly used like the Hyderabad monument
VEHICLE ACCESS - ANGLED AND CROWNED AT THE HEIGHT OF THE CAR PARK	<ul style="list-style-type: none"> • crowned and angled design should help minimise the wind funnel effect and sand drift • would allow a suitable sized no vehicle zone on the beach between the two entrances • entrance to the car park will be easier to negotiate for drivers • new design would allow the inclusion of jdder bars • provides access to the recreation area and the car parks with views of the beach • the recreation area will experience less disturbance from vehicles than the option which takes the access down past it 	<ul style="list-style-type: none"> • difficulty in staging the development of the new entrance without first closing the current entrance • cost of materials and major earthworks required • the design does not take the cars past the carpark and recreation area, so the links between these facilities and the beach are weakened • will require stabilisation of fore and hind dunes • would require some immediate work to be done on the storm water drain at the entrance

APPENDIX 10

Concept Design 1



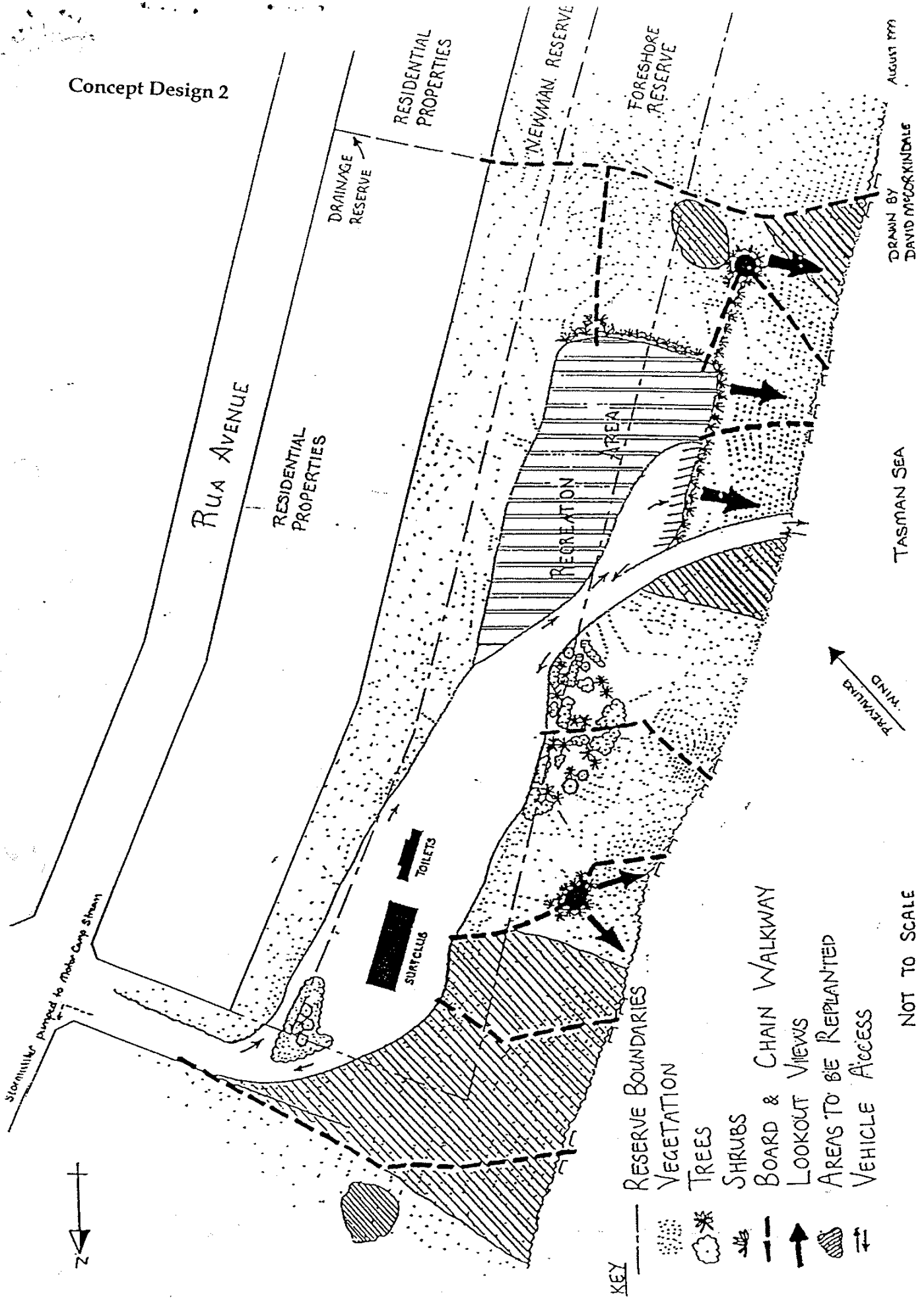
August 1979
DRAWN BY DAVID HOCKING

TASMAN SEA

PREVAILING WIND

NOT TO SCALE

Concept Design 2

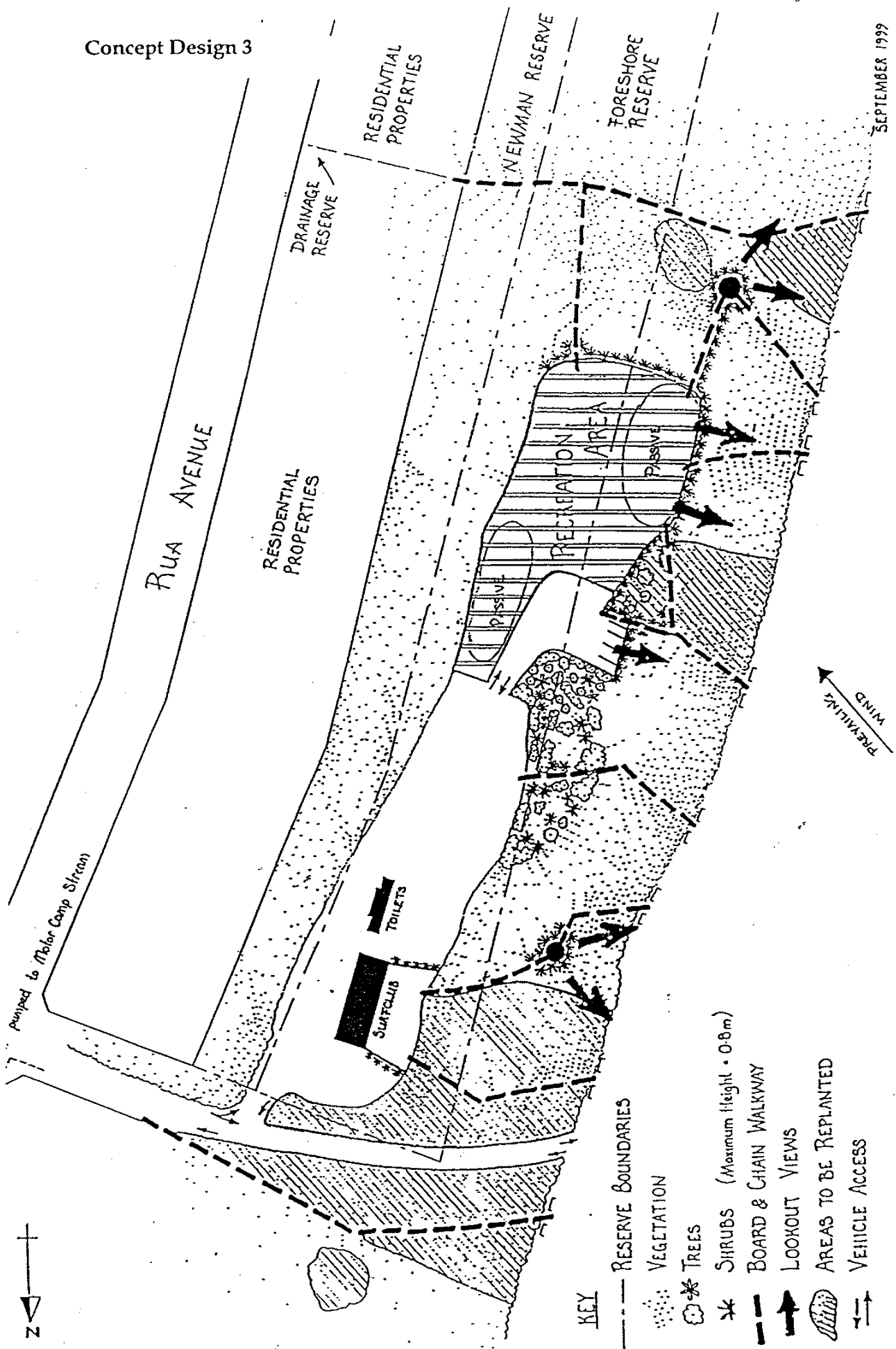


DRAWN BY
DAVID MCCORMICK DALE
AUGUST 1979

TASMAN SEA

NOT TO SCALE

Concept Design 3



SEPTEMBER 1999

DRAWN BY DAVID MCCORMICK

TASMAN SEA

NOT TO SCALE

REFERENCES

Bergin, D.O. and Herbert, J.W. (1998) *Pingao on coastal sand dunes - Guidelines for seed collection, propagation and establishment*. Rotorua: New Zealand Forest Research Institute Limited.

Beach Protection Authority of Queensland (BPAQ) *Coastal sand dunes; Their vegetation and management: Management Guidelines for Dune Usage*.

BPAQ.(-) *Dune usage for coastal protection*; V-01.1

BPAQ.(-) *Pedestrian control fences, access tracks*. V-02.1

BPAQ.(-) *Board and chain walkways, steps, advisory signs*. V-02.2

BPAQ.(-) *Specifications for vehicle access to beaches*. V-02.4

BPAQ.(-) *Repair of damaged dunes*. V-03.1

BPAQ.(-) *Re-establishment of dunes: a basic approach*. V-03.2

BPAQ.(-) *Re-establishment of dunes: sand dune design*. V-03.3

BPAQ.(-) *Sand accumulators: semi-permeable dune forming fences*. V-03.5

BPAQ.(-) *Surface stabilizing agents: plant materials*. V-03.6

BPAQ.(-) *Use of vehicles on beaches*. V-07.1

Church, I. (1978). *The wreck of the Hydrabad*. Palmerston North: Dunmore Press Ltd.

Department of Conservation, Forests and Lands & Ministry for Planning and Environment Victoria (1995) *Vegetation and erosion in coastal landscapes*. Planning & Managing Landscape Series (2), pp.1-7.

Department of Conservation, Forests and Lands & Ministry for Planning and Environment Victoria (1995) *Siting and design of small structures on the coast*. Planning & Managing Landscape Series (3) pp.1-7.

Kapiti Coast District Council (1999) *Growing Native Plants in Kapiti*. (pp.1 -17).

Land Conservation Council April (1995) *Marine and coastal special investigation - proposed recommendations*. Victoria: Land Conservation Council.

Loone, P. (1989). Planning and design of recreation facilities. *Australian Parks and Recreation*, 25(3), pp.9-10.

Lynch, K., & Hack, G. (1984). *Site planning* (3rd ed). London: MIT Press.

Manawatu Wanganui Regional Council (1999) *Dune management report for Waitarere Beach; Draft report*.

New Zealand Meteorological Service (1982) *Summaries of climatological observations to 1980*. Wellington: Ministry of Transport.

O'Brien, R. (Guest editor) (1987) *Coastal Planning* Australian Planner 25 (3) p.4.

O'Brien, R. and I, MacRae (1992) *Planning for western Australia's 12,000 km coastline*. Australian Planner 30 (2) pp.86-91.

Oma, V.P.M., Clayton, D.M., Broun, J.B. and Keating, C.D.M. (1992) *Coastal Rehabilitation Manual*. Western Australia: Department of Agriculture.

Statistics New Zealand (1998) *1996 Census of population and dwellings: standard tables: Manawatu-Wanganui*. Wellington: Statistics New Zealand.

Viles, H. and T. Spencer (1995). *Coastal problems; geomorphology, ecology and society at the coast*. London: E. Arnold.



ADDENDUM

Waitarere Beach Foreshore Reserve Management Plan

1. Four submissions were received on the above Plan during the consultation process under Section 41 of the Reserves Act 1977 and are appended to this addendum.
2. Submissions were considered at a special meeting of the Development Committee on 19 June 2000 and the following resolution ratified by Council on 19 July 2000.

(See attached).

3. The Waitarere Beach Foreshore Reserve Management Plan was adopted by Council on 19 July 2000 and publicly notified on 12 & 16 August 2000.
4. A copy of the Management Plan was forwarded to the Department of Conservation on 16 August 2000.