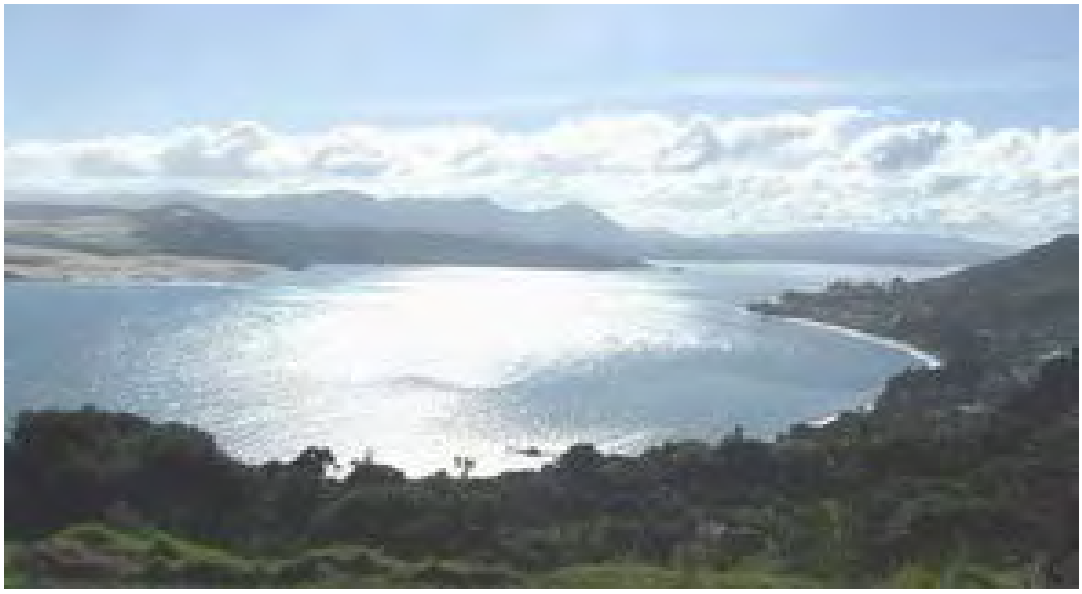
DUNE RESTORATION STRATEGY FOR THE OMAPERE-OPONONI SHORELINE



A strategy for the restoration of the Omapere-Opononi shoreline and dunes as a means of mitigating the effects of coastal erosion on property and infrastructure and enhancing the amenity and biodiversity of the shoreline.

Report Prepared for:

Hokianga Harbour Foreshore Restoration Society

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FOREWORD

This report should be considered a living document, as to reflect the dynamic nature of coastal processes and the need for adaptive management strategies in response to change in the coastal environment and the Omapere-Opononi community.

As such, this report should be updated, as proves necessary, to reflect changes in the coastal environment which may refocus priorities and/or the management options proposed in the report.

This report is also not intended to be used as an overarching management strategy for the Omapere-Opononi shoreline, but will form part of an overall management strategy that the HHFRS is working towards.

CONTENTS

EXECUTIVE SUMMARY

The Omapere-Opononi shoreline has an average long-term trend for shoreline erosion, which is enhanced, in part, by the compromised state of the extensively modified dune system.

The Hokianga Harbour Foreshore Restoration Society (HHFRS), aided by the Northland Regional Council, has undertaken substantial investigation into the erosion, protection, and management options over the last several years, in order to aspire to its management goal to protect land and infrastructure from coastal erosion while maintaining a high tide beach for recreational use, in a cost effective manner.

From these investigations it has been determined that the restoration of the degraded dune system is a feasible management option for mitigating coastal erosion in areas of the Omapere-Opononi shoreline. The restoration of natural features (i.e. dunes) in the coastal environment to protect land use from coastal hazards is a preferred management option where practicable due to cost benefit and minimal associated adverse environmental effects and where extreme erosion threatens.

An assessment was undertaken to determine the suitability of areas of the Omapere/Opononi/Koutu shoreline for dune restoration. An assessment of the shoreline and other relevant data was undertaken and priority sites were identified for dune restoration and generic restoration options identified and described for each site. Sites considered a low priority or not suitable for dune restoration were also identified.

Five priority sites were identified for dune restoration. The location of these, priority status, and the estimated materials and machinery costs for dune restoration works at each of these sites, are summarised in the following table:

Site	Cost	Priority	Shoreline Length (m)	Shoreline Area (m^2)
Site 1: Copthorne.	$21,900	3rd	160	1200
Site 2: Freese Park.	$10,850	2nd	72	620
Site 4: North of No.9 Freese park road to first stream (No. 296 SH12).	$9,750	5th	85	550
Site 8: North of third stream (from No.244 to No.228 SH12).	$9,800	1st	160	1000
Site 12a: Adjacent Opononi shopping centre.	$10,000	4th	110	600
Site 12b: Opposite campground (No.43 SH12)	$6,200	6th	70	350

The costs of the proposed dune restoration work average $100 per lineal metre of shoreline or $16 per square metre. This is considerably cheaper than other options, such as engineered seawalls and beach nourishment which are likely to be of the order of $1000 per lineal metre of shoreline and also have greater adverse impacts on the environment and amenity value of the beach.

There are a number of potential sources that are available for funding of the works, including the NRC's Environment Fund, MfE Sustainable Management Fund, the ASB Community Trust and others.

It is recommended that planning for giving effect to restoration of the priority areas is commenced now and that the restoration is commenced in the order of the priorities identified, and that these are staged for completion over a period of 3 – 6 years, with staging also done within some of the individual sites to maximise potential for success.

Once priorities and timeframes are agreed and identified a concise plan should be drafted and used to drive the implementation of the restoration of priority areas.

A number of recommendations are made at the conclusion of the report which should be considered and given effect to.

1. BACKGROUND

1.1 INTRODUCTION

The Omapere-Opononi foreshore has an average long-term trend for shoreline erosion. This erosion is primarily driven by episodic short-term erosion events and assisted via sea level rise, net sediment loses and the compromised state of the dune system. This erosion is causing concern for the community as property is lost and dwellings become threatened by retreating shorelines.

In an effort to manage the erosion the local community formed the Hokianga Harbour Foreshore Restoration Society (HHFRS) in 2005 with the management goal and aim to protect land and infrastructure from coastal erosion while maintaining a high tide beach for recreational use, in a cost effective manner.

The purpose of the Society is to liaise with other organisations such as the Northland Regional Council, Far North District Council and the Department of Conservation in order to restore, maintain and monitor historic features within the foreshore environment and to re-establish and maintain the beach and dune system and protect the land and infrastructure from coastal erosion. The Society also aims to increase public awareness of the issues facing the area as well as the uniqueness of the Hokianga Harbour and the need to care for and protect it from natural and human erosion[1].

[1] Objectives of the Society as stated in the Society Rules as registered with the Registrar of Incorporated Societies: 'Hokianga Harbour Foreshore Restoration Society Incorporated 1819146'.

1.2 WORK TO DATE

Significant progress has been made toward achieving the management goal and aim of the HHFRS. This includes:

- Beach nourishment investigations
  - *Long Term Implementation Report* - LaBonte Associates Ltd
  - Sediment sampling – Fabia Wilson (Auckland University) /NRC
  - Seabed survey - NRC

- Short term management options investigations
  - *Omapere Coastal Erosion Works* - Tonkin & Taylor Ltd

Public meetings have also been held to determine how the community would like to see the coastal erosion issue best managed. Surveys completed by community members enabled the Society to assess the community's understanding of the erosion process.

Work has also begun on dune restoration with assistance from the NRC Environment Fund and the Far North District Council and involvement from the local community and school. Pingao and spinifex have been planted and fencing erected to protect these plants and the dune. Opononi Area School pupils are designing signs to encourage people to keep off the plants and carved posts have been erected at official exit points from the beach.

1.3 RESTORATION OF NATURAL FEATURES FOR EROSION MITIGATION

The use of natural features in the coastal environment to protect land use from coastal hazards is a preferred management option, where practicable, due to cost benefit and minimal associated adverse environmental effects.

The restoration of natural features for mitigation of natural coastal hazards is well documented and readers are referred to Appendix 1 for more detail (*Community Based Dune Management for the Mitigation of Coastal Hazards and Climate Change Effects: A Guide for Local Authorities*).

1.4 RESTORATION METHODOLOGY

The restoration methodology typically involves reforming dunes to a smooth contour to limit the amount of variability in the dune profile as to prevent wind channelling from causing erosion of the dune or landward sand drift causing a loss of sand from the system, and to enable revegetation with sand binding vegetation.

This may range in scale from the recontouring of small dune blowouts to the remobilisation and reshaping of large areas of dune.

This methodology will typically involve:

- Reshaping of the existing dune profile to a natural profile and may include the filling of blow outs, remobilisation to remove scarp faces and removal of foreign materials such as clay and soil and non native sand binding vegetation.
- Establishment of native sand binding vegetation and shrubs/trees to trap sand on the dune complex.
- Provision of public accessways, fences and signage at restored areas to prevent damage occurring to restored areas from foot and vehicular traffic. It is noted that fence structures are not intended to inhibit public access to the beach and sufficient access structures and signage must be provided to enable clear and easy public access to the beach.
- Maintenance and monitoring of restored areas.

2. PURPOSE OF THIS REPORT

At the May 2008 Annual General Meeting of the Hokianga Harbour Restoration Society (HHFRS), the Northland Regional Council reported on the outcome of progress and work to date since the formation of the HHFRS. In summary the key points of this presentation were that:

- Beach nourishment for 1 kilometre of shoreline would likely cost in excess of $900k and may last for 10 – 15 years.
- There is no 'one size fits all' solution that could be applied to the management of the foreshore erosion.
- Generally, dune reshaping & planting appears the best option, where practicable.
  - However, some properties are too close to the foreshore or streams for this to be effective – other solutions may be required.
  - Also, the shape and geology of some areas of foreshore exclude the reshaping and replanting as an option.
- Sand accumulation as a natural barrier and defence mechanism will slow erosion rate & enhance the beach and its use, and accumulation can be enhanced through the reshaping of the dune/shoreline and replanting with native sand binding vegetation.

Following this presentation the Northland Regional Council offered to undertake an assessment and provide a report on dune restoration at Omapere, Opononi and Koutu shorelines.

2.1 RESTORATION ASSESSMENT & RECOMMENDATIONS

This report provides a generic baseline assessment of restoration options for different sections of the foreshore. The report is not intended to be used as technical guide from which to undertake works, rather as a reference document which the HHFRS and wider community should use to focus and prioritise dune restoration works.

An assessment of the foreshore and other relevant data (i.e. beach profile, historic shoreline positions, historic photographs etc) was made when considering the suitability of areas for restoration.

In the following sections of this report recommendations are made with regard to areas that are considered suitable for restoration and areas where restoration is not recommended.

3. PRIORITY SITES FOR DUNE RESTORATION

In the following section those sites that are identified as a priority for restoration are identified and a number of factors relating to restoration are identified. These include:

Priority ranking
An indication of the priority of the site for restoration works, in comparison to other sites within the Omapere/Opononi/Koutu area.

Shoreline length and area for restoration
The alongshore distance of shoreline for restoration and the area (calculated by assessing alongshore distance by width of area for restoration). The area for restoration will typically involve mechanical reshaping of the dune/bank and revegetation with native sand binding vegetation.

Minimum shoreline setback from development
The distance from the location of the shoreline to any development or infrastructure (i.e. dwellings or roads).

Recommended restoration
A basic summary of the type of restoration recommended for the site, which will typically involve mechanical reshaping of the dune/bank and revegetation with native sand binding vegetation.

Provision of public access
The identification of any requirements for accessways to enable pedestrian access through the restoration site. This is critical to the success of a project.

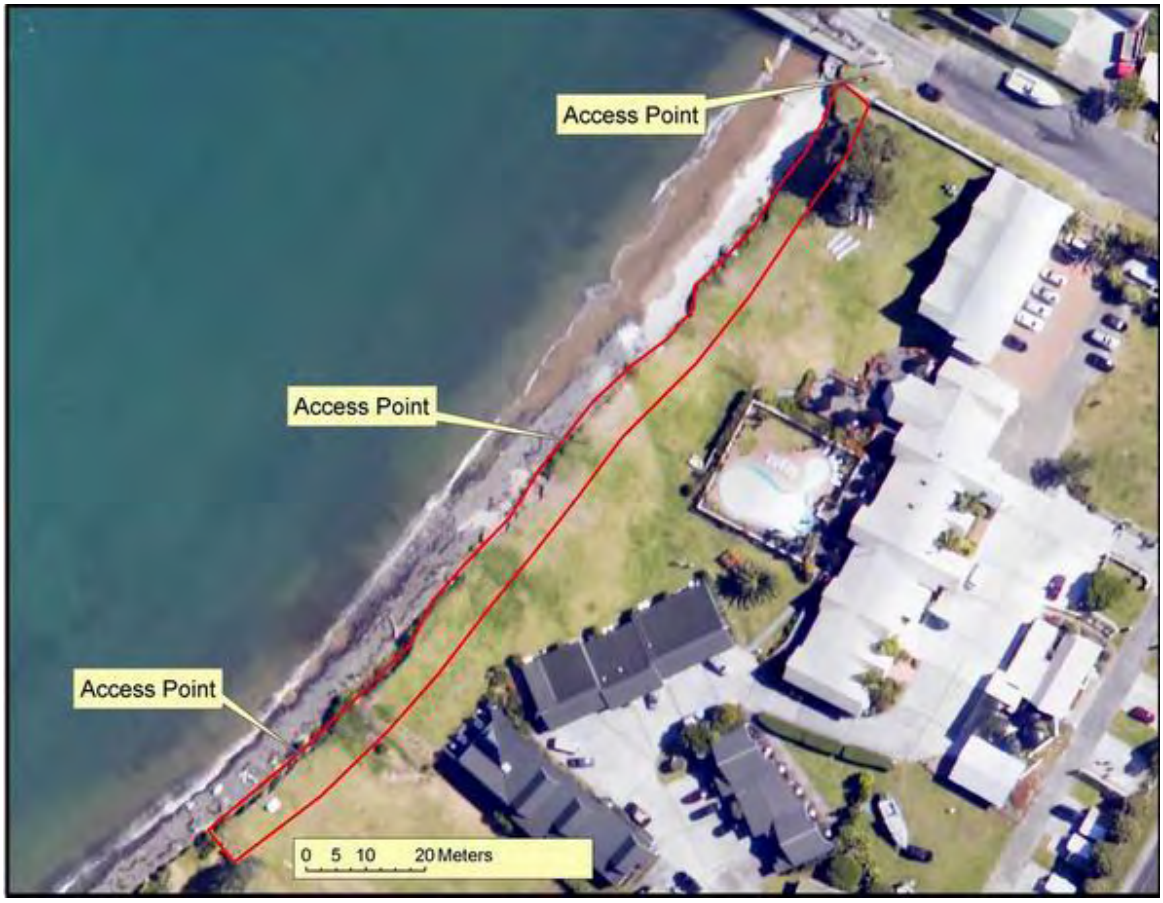
Fencing
This is usually needed to provide plants with some protection from damage by feet and vehicles. In some cases this fencing can be temporary to protect the plants until they are established and can then be removed. In high use areas long term fencing might be appropriate.

Cost estimates (assuming volunteer labour costs for planting, fencing and construction of access structures).
Estimates of the likely costs for restoration of the site as per the recommended restoration.

Land ownership
Indication of the type of land ownership in the site where recommendation is recommended.

Notes
Any other comments relevant to the particular site.

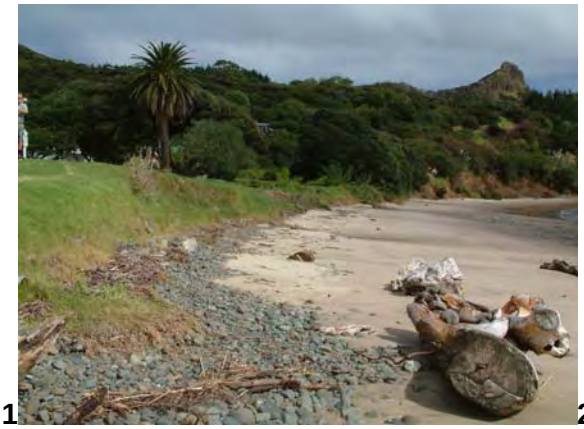
3.1 SITE 1: FORESHORE ADJACENT TO COPTHORNE HOTEL (SOUTH OF WHARF ROAD).

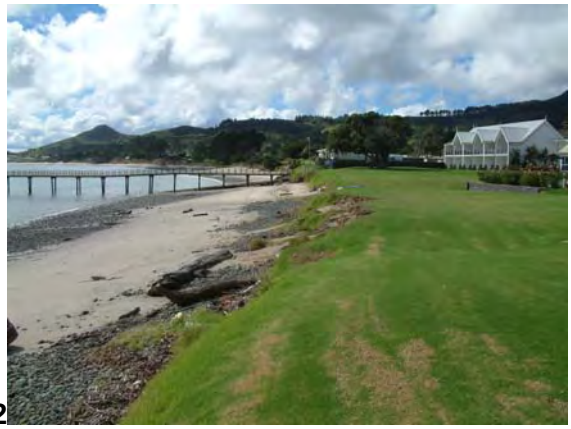


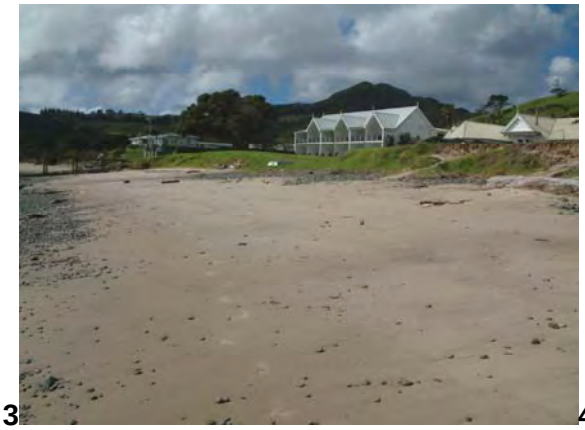
Site 1: Site diagram indicating approximate area and extent where restoration is proposed and suggested location of access points.

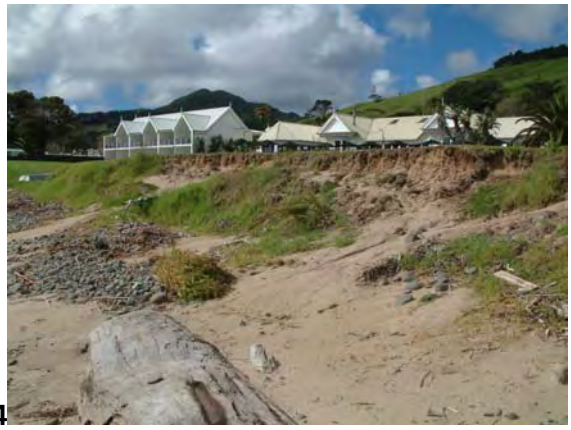
Site 1 Restoration Assessment.

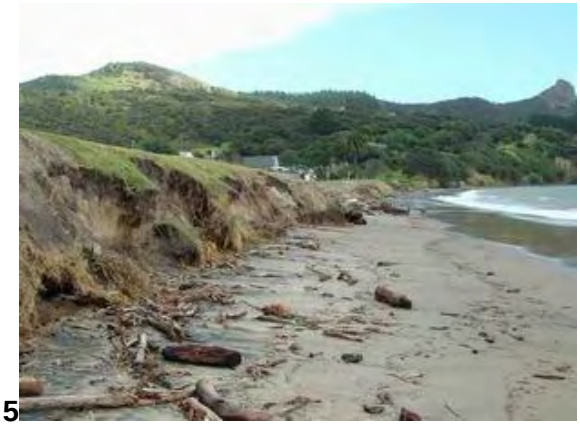
Priority ranking	3rd priority as restoration of this bank will stabilise foreshore reserve in front of Copthorne. Stabilisation of foreshore in this area will enable any future management of the Wharf Road boat ramp to be done in a manner that has less impact on this site (to reduce the extent of sediment bypassing in the lee of the structure).
Shoreline length and area for restoration	160 metres (from pohutakawa trees to Wharf Road boat ramp) & 1200 m^2.
Minimum shoreline setback from development	15 metres from Copthorne chalets.
Recommended restoration	Retire a minimum of 7 metres of foreshore reserve/land for dune vegetation to provide a sufficient erosion buffer. Remove non-sand material and non-native plants. Reshape first 1 – 3 metres of shoreline bank to bring slope of dune face back to 25 – 30 degrees. Plant first 7 metres of reshaped area with spinifex/pingao mix. Low growing shrubs/trees can be planted landward of fenced off area if desired.
Provision of public access	Provision of two access structures within restored area and one step type structure at the Wharf Road boat ramp end.
Fencing	Temporary fencing (post & wire) to enclose plants and restored area.
Cost estimates (note assumes volunteer labour costs for planting, fencing and construction of access structures)	Access structures ~ $3,000. Fence ~ $1,600. Plants ~ $13,800. Machinery ~ $3,000. Other miscellaneous ~ $500. Sum of costs ~ $21,900.
Land ownership	Predominantly FNDC reserve, although some private title near the Copthorne.
Notes	Need to assess suitability of existing dune/bank sediment/geology for reshaping, particularly in the south area as there appears to be an extensive uncemented cobble conglomerate in the southern extent of this site. Recommend that the approach is staged in either two or three individual stages. This will mitigate risk of failure from extreme storm events and will allow success to be monitored before committing to full restoration.

1 

2 

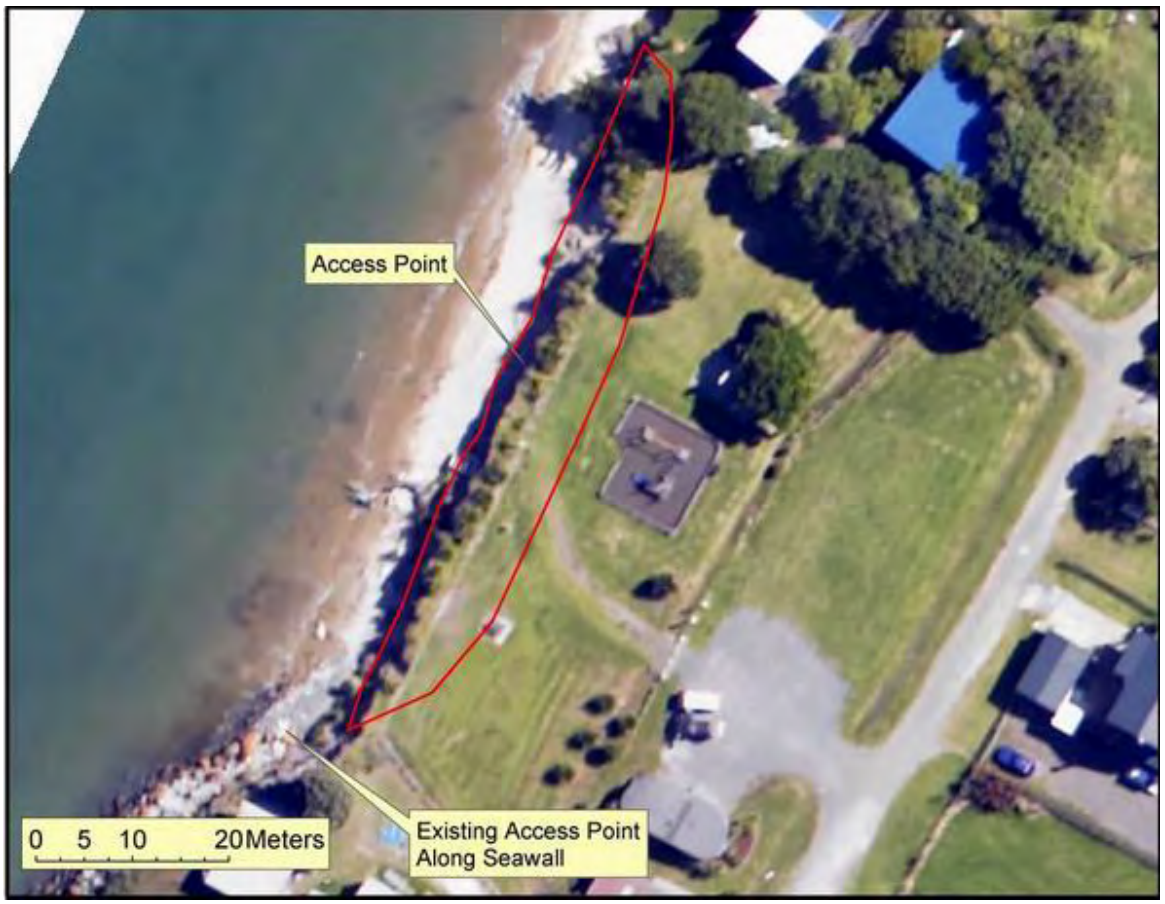
3 

4 

5 

Site 1 photographs: Image 1 – 4 circa April 2008. Image 5 circa September 2005 following significant storm event.

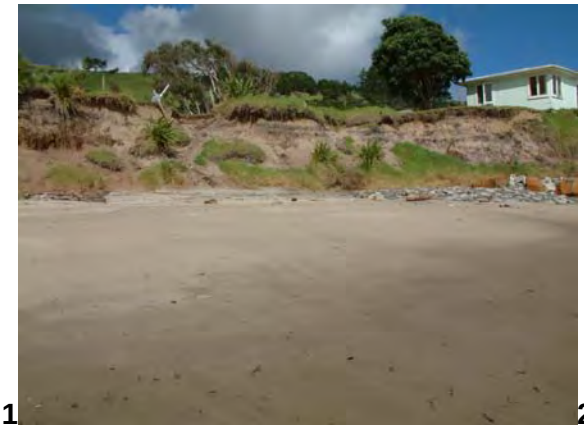
3.2 SITE 2: FORESHORE ADJACENT TO FREESE PARK (NORTH OF WHARF ROAD BOAT RAMP).

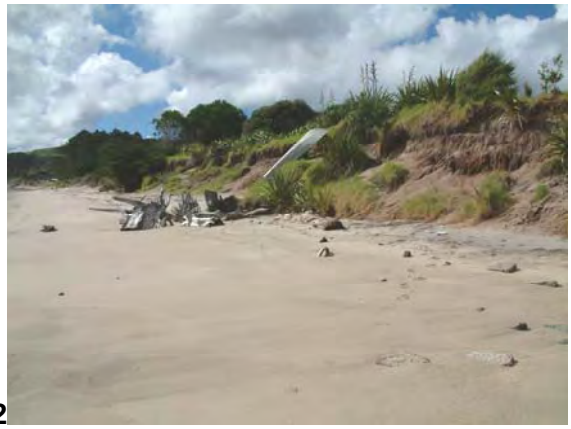


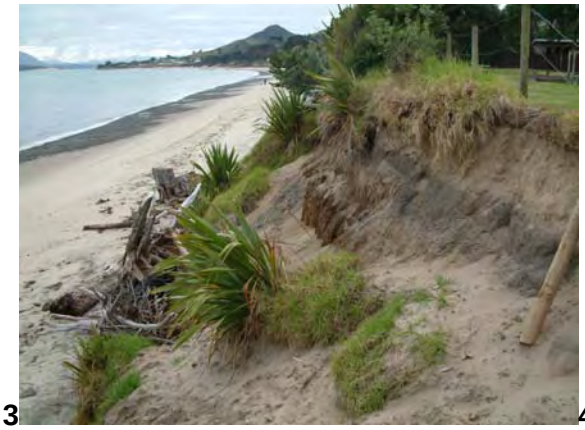
Site 2: Site diagram indicating approximate area and extent where restoration is proposed and suggested location of access point.

Site 2 Restoration Assessment

Priority ranking	2nd priority. Restoration of this bank will aid in stabilisation of foreshore reserve by reducing failure of over steep bank face. Public access will also be enhanced through Freese Park to the beach. Management of potential erosion adjacent to the seawall will also be enhanced.
Shoreline length and area for restoration	72 metres (from seawall to end of park) & 620 m^2.
Minimum shoreline setback from development	27 metres from public toilets, 12 metres from playground
Recommended restoration	Retire a minimum 10 metre margin of foreshore reserve for dune vegetation to provide a sufficient buffer. Reshape the first 6 – 8 metres of bank to bring slope of dune face back to 26 – 33 degrees. Reshaping should focus on the upper profile whilst leaving a toe buttress of the cemented sandstone to resist toe erosion. Care should be taken during any reshaping to minimise disturbance of the lowest 2 metres of bank. Plant first 10 metres of reshaped area with spinifex/pingao mix. Low growing shrubs/trees can be planted landward of fenced off area if desired.
Provision of public access	Provision of one sand ladder access structure adjacent to playground.
Fencing	Temporary fencing (post & wire) to enclose plants and restored area.
Cost estimates (note assumes volunteer labour costs for planting, fencing and construction of access structures)	Access structure ~ $1,000 Fence ~ $720 Plants ~ $7,130 Machinery ~ $1,500 Other miscellaneous ~ $500 Sum of costs ~ $10, 850
Land ownership	FNDC reserve
Notes	Cemented sandstone will need to be crushed (track rolled) during reshaping. As little disturbance as possible should be undertaken at the toe of the bank to try and preserve a sandstone buttress which will be more resistant to toe erosion. Profile data show height of erosion scarp is 4 metres from toe of bank to crest, with 2 – 4 metres horizontal setback between toe to crest – indicate a slope face of 45 – 63 degrees which is maintained by the cemented sandstone geology. To achieve a slope face of 26 – 33 degrees it is necessary to achieve a horizontal setback from toe to crest of 6 – 8 metres from current toe (whilst maintaining a 4 metre vertical elevation from bank crest to toe).

1 

2 

3 

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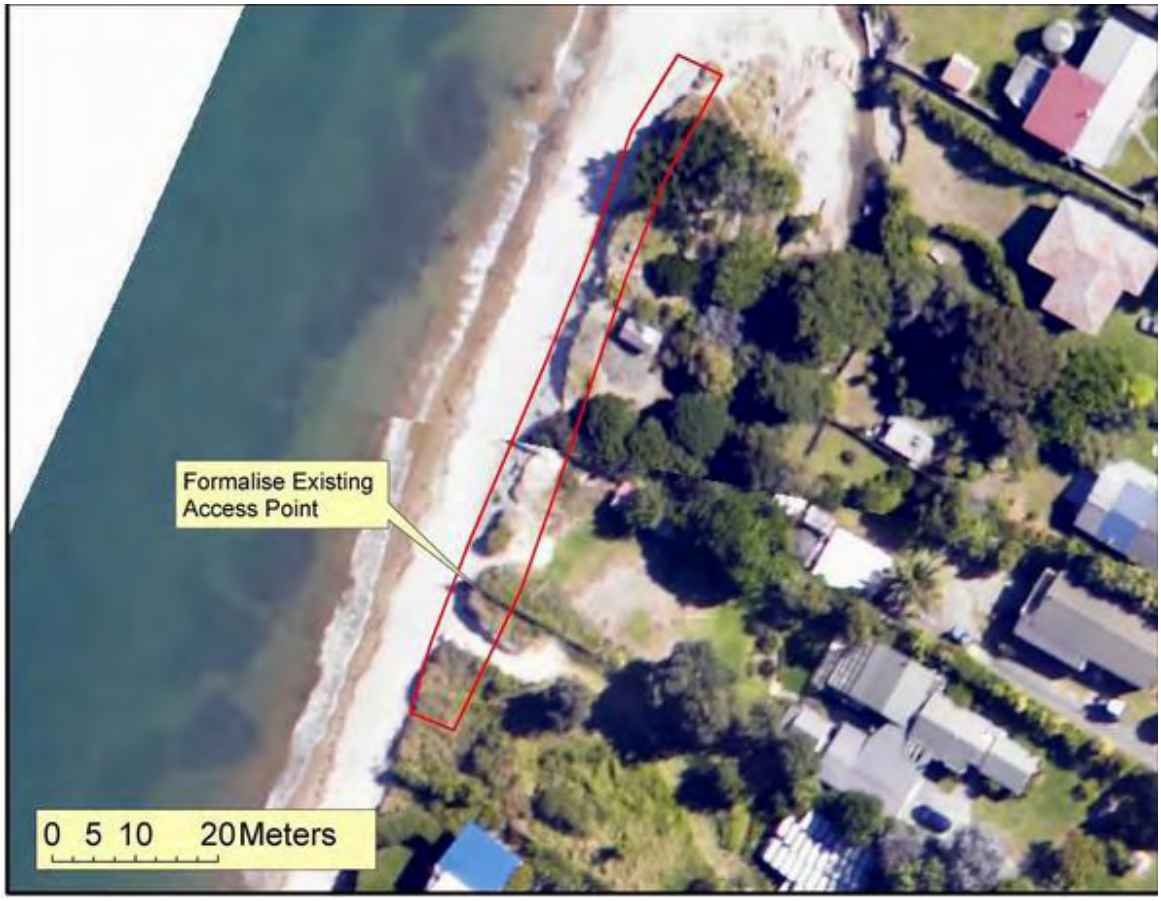
Site 2 photographs: Image 1 – 3 circa April/June 2008. Image 4 circa October 2005.

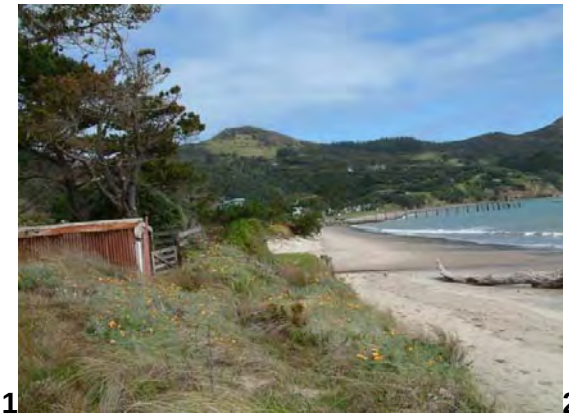
3.3 SITE 4: FORESHORE NORTH OF NO.9 FREESE PARK ROAD TO FIRST STREAM (NO. 296 SH12).

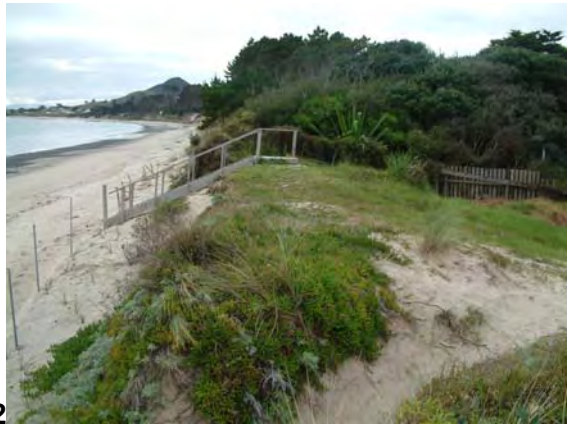


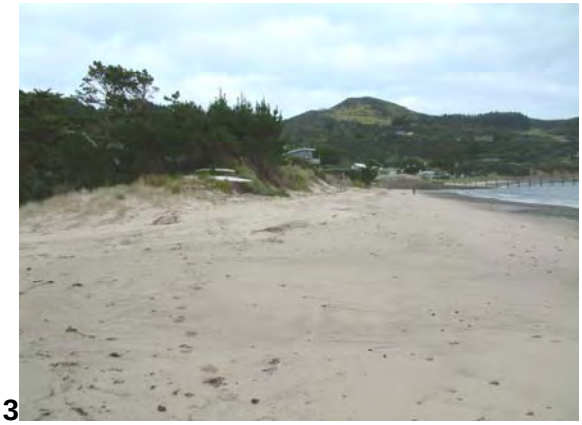
Site 4: Site diagram indicating approximate area and extent where restoration is proposed and suggested location of access point.

Site 4 Restoration Assessment

Priority ranking	5th priority. Restoration of this bank will stabilise foreshore and allow for continuation of restoration works. Public access will also be enhanced.
Shoreline length and area for restoration	85 metres & 550 m^2.
Minimum shoreline setback from development	4 - 10 metres from garden sheds.
Recommended restoration	Reshape first 3 - 5 metres of bank to bring slope of dune face back to 26 – 33 degrees & smooth out the contour of dune profile. Remove non-native vegetation including pine trees. Plant first 5 metres of reshaped area with spinifex/pingao mix. Care should be taken to minimise disturbance of areas of dune already vegetated with spinifex & pingao.
Provision of public access	Provision of one sand ladder access structure adjacent to the existing foreshore access point.
Fencing	Temporary fencing (post & wire) at the base of restored area only (foot traffic should not be too heavy through private property) and along access point.
Cost estimates (note assumes volunteer labour costs for planting, fencing and construction of access structures)	Access structure ~ $1,000 Fence ~ $425 Plants ~ $6,325 Machinery ~ $1,500 Other miscellaneous ~ $500 Sum of costs $9,750
Land ownership	Private title.
Notes	The area contains some spinifex and pingao that should be maintained.

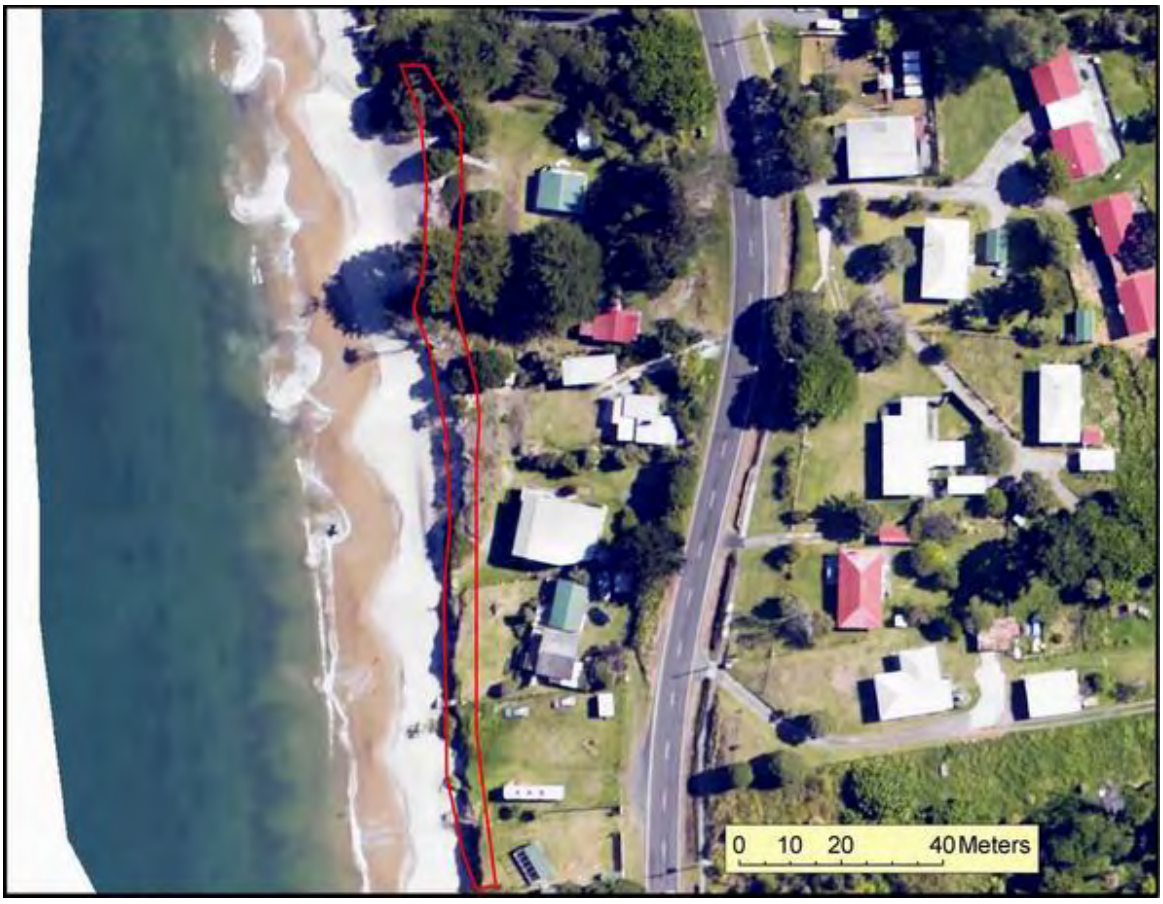
1 

2 

3 

Site 4 photographs: Image 1 – 3 circa April/June 2008.

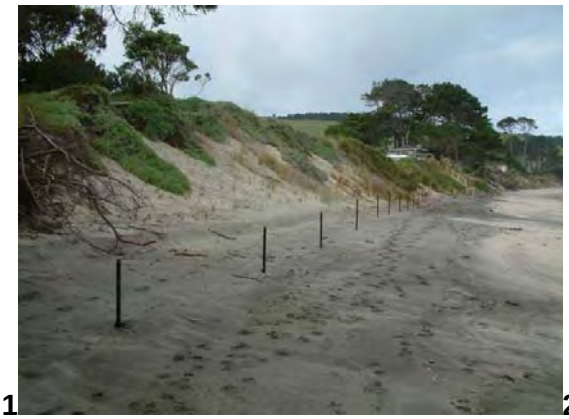
3.4 SITE 8: NORTH OF THIRD STREAM (FROM NO.244 SH12 TO NO.228 SH12).

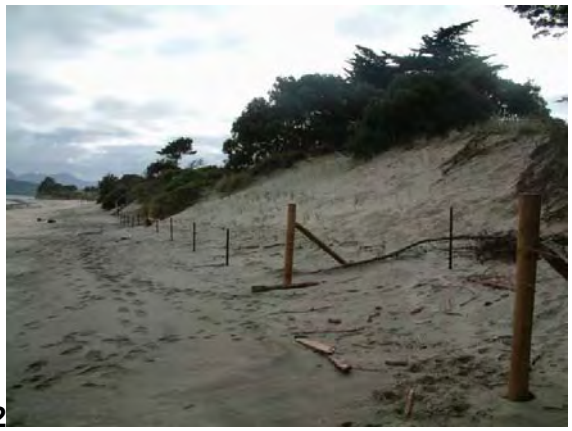


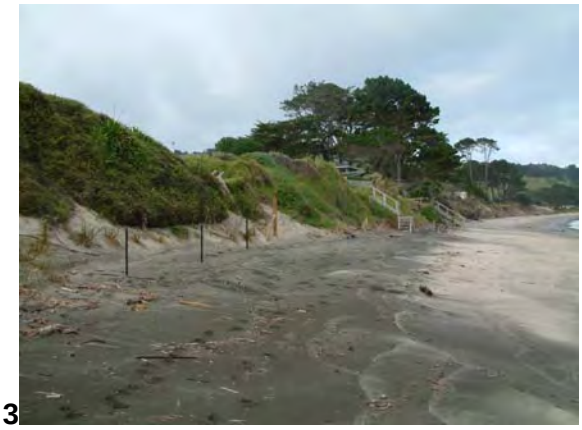
Site 8: Site diagram indicating approximate area and extent where restoration is proposed.

Site 8 Restoration Assessment

Priority ranking	1st priority. Restoration of this bank will stabilise foreshore. The restoration will enable any erosion adjacent to the seawall to be managed.
Shoreline length and area for restoration	160 metres (from seawall to end of park) & 1000 m^2.
Minimum shoreline setback from development	10 metres from closest dwelling.
Recommended restoration	Reshape first 2- 4 metres of bank to bring slope of dune face back to 26 – 33 degrees & smooth contour of dune profile. This is not required in some parts where existing profile slope is sufficient. Plant first 10 metres of reshaped area with spinifex/pingao mix. Care should be taken to minimise disturbance of areas of dune already vegetated with spinifex & pingao.
Provision of public access	Provision of two sand ladder access structures adjacent to existing foreshore access point for access to private properties. The location of these needs to be determined by the residents at this is mostly private title with no public access.
Fencing	Temporary fencing (post & wire) at the base of restored area only (foot traffic should not be too heavy through private property) and along access point.
Cost estimates (note assumes volunteer labour costs for planting, fencing and construction of access structures) *Costs will be lower as work has begun on this project.*	Access structures ~ $1,500 Fence ~ $800 Plants ~ $5,000 Machinery ~ $2,000 Other miscellaneous ~ $500 Sum of costs ~ $9,800
Land ownership	Private title with one part FNDC reserve.
Notes	The area contains some spinifex and pingao that should be maintained. Work has already begun on this project: • Post and wire fence erected along the toe of the dune along a portion of this area (see photos 1-3 below). • Spinifex and pingao planted on areas of the dune suitable for planting without reshaping.

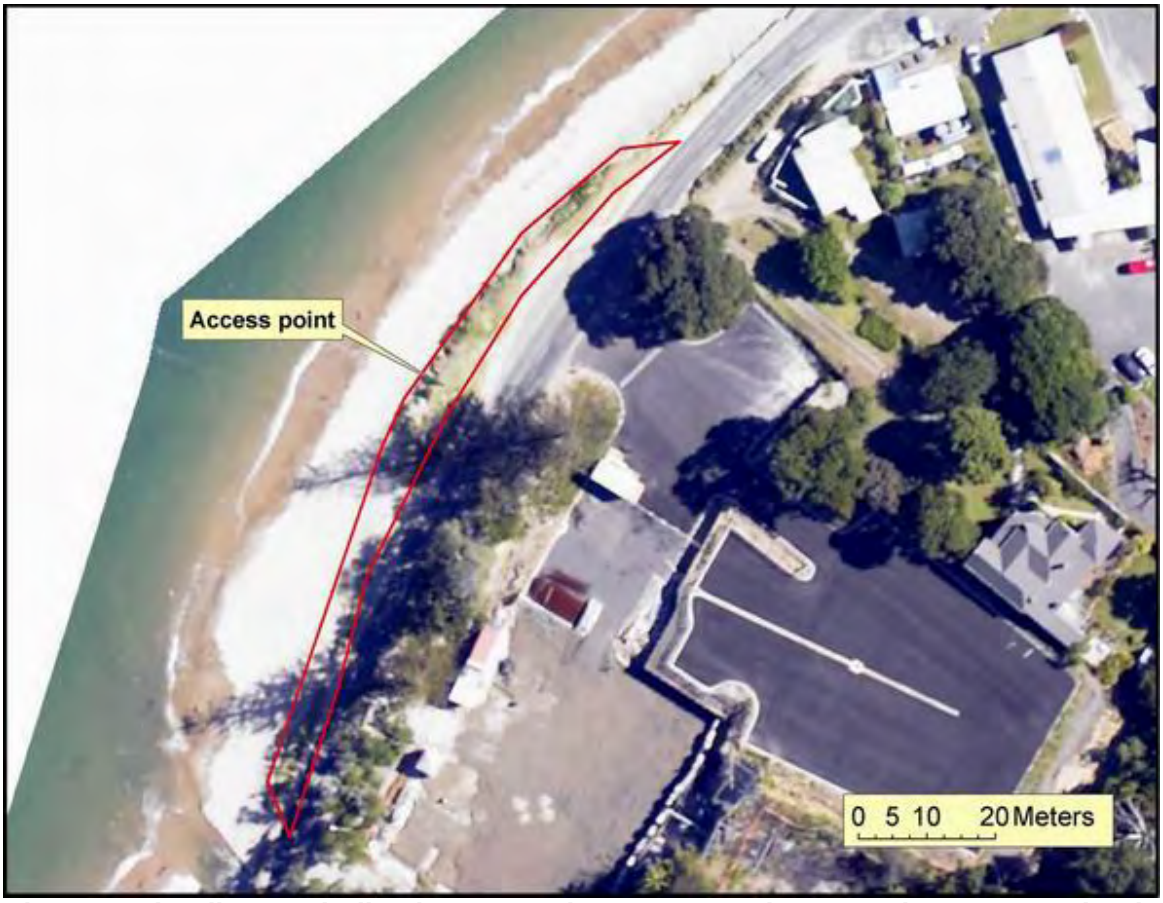
1 

2 

3 

Site 8 photographs: Image 1 – 3 June 2008.

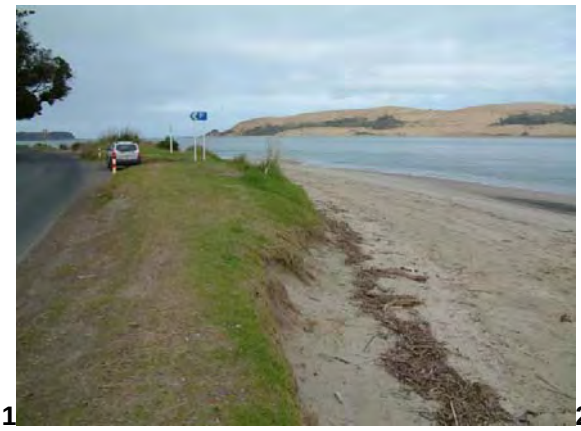
3.5 SITE 12A: ADJACENT OPONONI SHOPPING CENTRE



Site 12a: Site diagram indicating approximate area and extent where restoration is proposed and suggested location for an access structure.

Site 12a Restoration Assessment

Priority ranking	4th priority. Restoration of this bank will stabilise foreshore and minimise risk of erosion to the road and the need for future protection works.
Shoreline length and area for restoration	110 metres (from seawall to end of park) & 600 m^2.
Minimum shoreline setback from development	2 – 5 metres from road.
Recommended restoration	Reshape first 2- 3 metres of bank to bring slope of dune face back to 26 – 33 degrees & smooth contour of dune profile. Remove existing marram grass and other non-native vegetation. Plant reshaped area with spinifex/pingao mix.
Provision of public access	Provision of one access structure to enable access through fenced area. This should be placed opposite the new carpark/shopping centre area to enable/ encourage use of the access structure. It is critical that public access through these proposed restoration areas is provided in a manner that enables clear and easy access through to the beach.
Fencing	Temporary fencing (post & wire) to enclose restored area. Note the need to enable public access in a clear and easy manner. Possibly consider a series of small fenced off sections as to enable easy access.
Cost estimates (note assumes volunteer labour costs for planting, fencing and construction of access structures)	Access structure ~ $1,000 Fence ~ $600 Plants ~ $6,900 Machinery ~ $1,000 Other miscellaneous ~ $500 Sum of costs ~ $10,000
Land ownership	Road reserve.
Notes	Some care will need to be taken in any reshaping that is taken in close proximity to the road so as to minimise the risk of destabilising the dune/bank.



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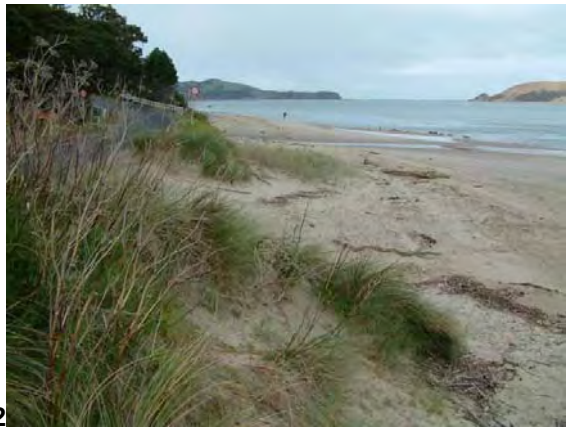

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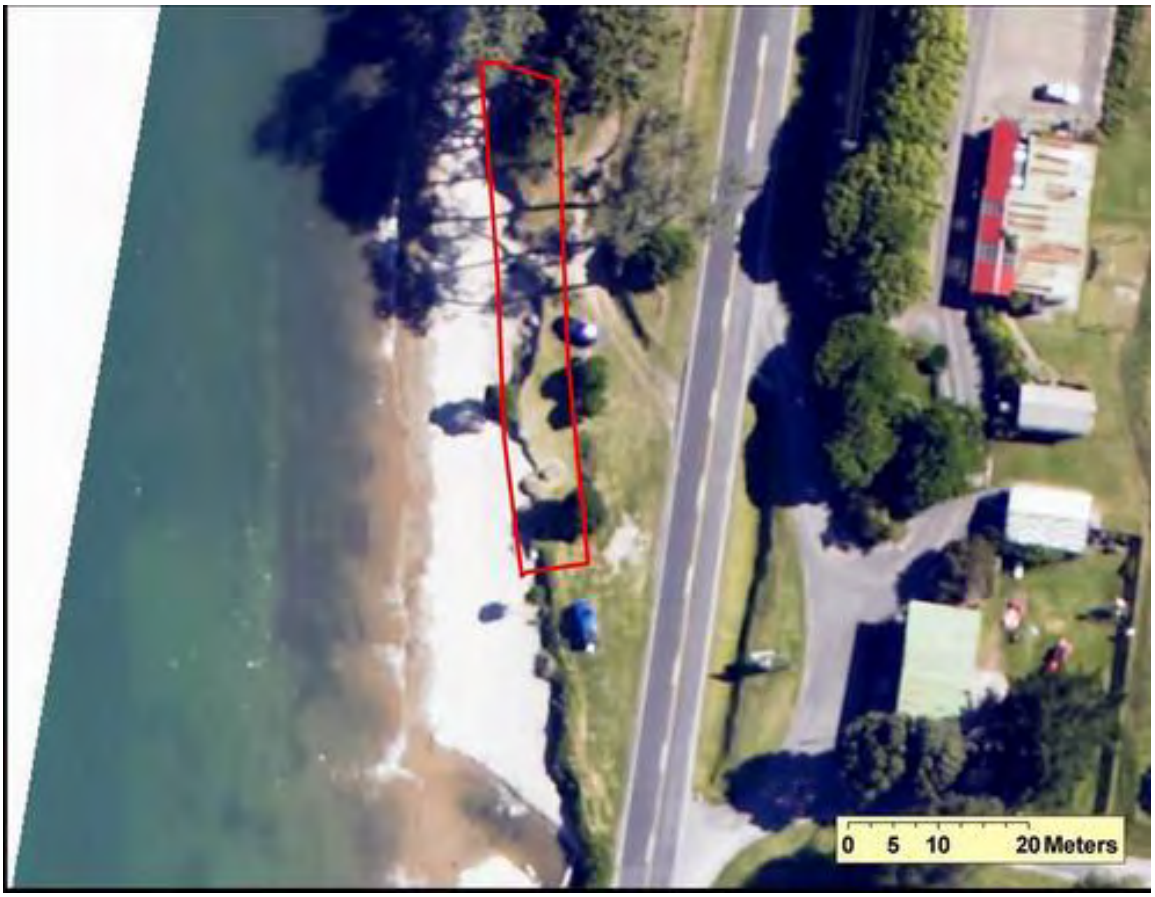
Site 12a photographs: Image 1 – 2 June 2008.

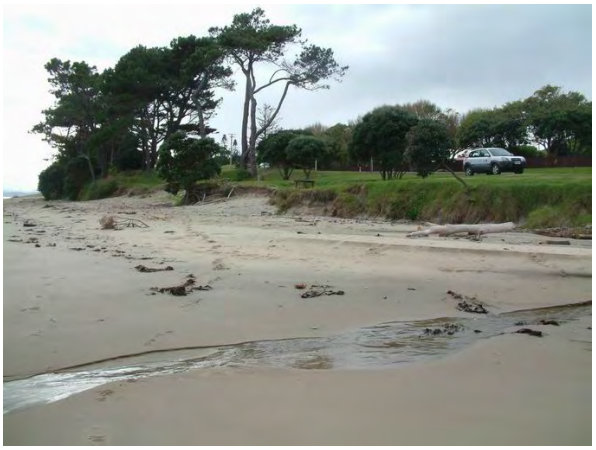
3.6 SITE 12b: OPPOSITE CAMPGROUND (No.43 SH12)



Site 12b: Site diagram indicating approximate area and extent where restoration is proposed.

Site 12b Restoration Assessment

Priority ranking	6th priority. Restoration of this bank will stabilise foreshore and minimise risk of erosion to the reserve and the need for future protection works. This is seen as a good site for establishment of successful planting in a high public use area and will provide a model for further work that might involve similar bank reshaping and boardwalk accessways.
Shoreline length and area for restoration	65 metres (from storm water outlet north to pine trees) & 350 m^2.
Minimum shoreline setback from development	14 – 28 metres from road. FNDC plan to relocate picnic table.
Recommended restoration	Reshape front edge of bank to bring slope of dune face back to 26 – 33 degrees & smooth contour of dune profile. Remove non-native vegetation. Plant reshaped area with spinifex/pingao mix.
Provision of public access	Provision of one boardwalk access structure to enable access through fenced area. This should be placed opposite the new car-park/shopping centre area to enable/ encourage use of the access structure.
Fencing	Temporary fencing (post & wire) to enclose restored area.
Cost estimates (note assumes volunteer labour costs for planting, fencing and construction of access structures)	Access structure ~ $1,000 Fence ~ $900 Plants ~ $2,300 Machinery ~ $2,000 Other miscellaneous ~ Sum of costs ~ $6,200
Land ownership	FNDC
Notes	



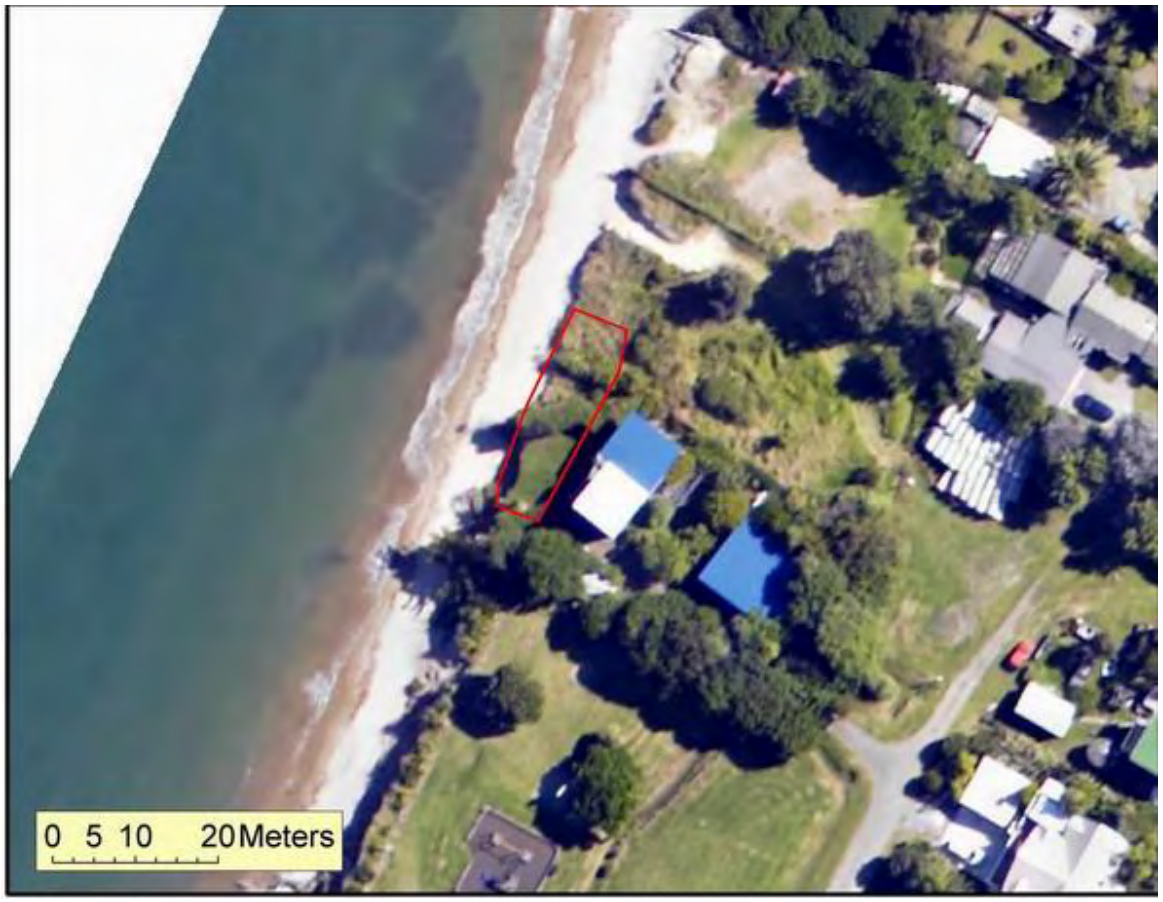
Site 12b photograph: Image June 2008.

4. SITES OF LOWER PRIORITY OR NOT SUITABLE FOR DUNE RESTORATION

In the following section those sites that are identified as a low priority or not suitable for restoration are identified. Typical factors for sites being deemed a low priority or not suitable include sufficient shoreline setback from development to mitigate erosion risk to development or infrastructure, infrastructure or development too close to shoreline to enable reshaping, existing shoreline protection works or unsuitable geomorphology or geology (i.e. very high/steep bank that would require extensive reshaping and/or bank comprised of mudstone).

Whilst these sites are identified as a low priority or not suitable for restoration, for the aforementioned factors, dune restoration in these areas should still be considered by residents as a means to mitigate the rate of erosion. Accumulation of sand at the toe of the bank/dune, trapped by dune binding vegetation, will aid in resisting the rate of toe undercutting and erosion. However, within these areas the success of restoration may not be as achievable as at the identified priority sites due, primarily, to the lack of space available to establish a sufficiently wide buffer of sand-binding dune vegetation.

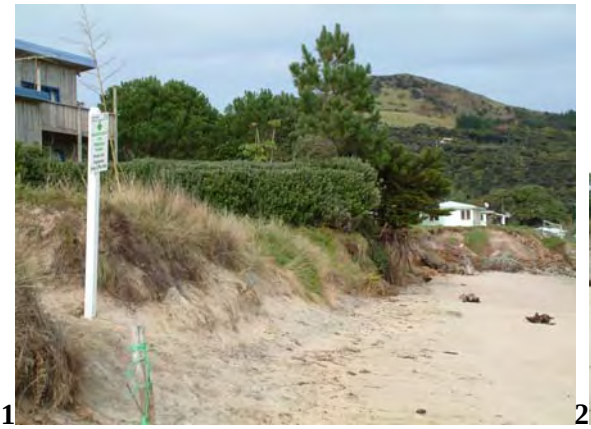
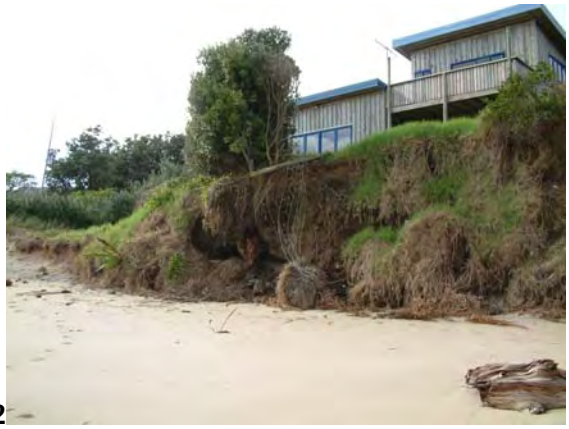
4.1 SITE 3: IMMEDIATELY NORTH OF FREESE PARK.



Site 3: Site location diagram.

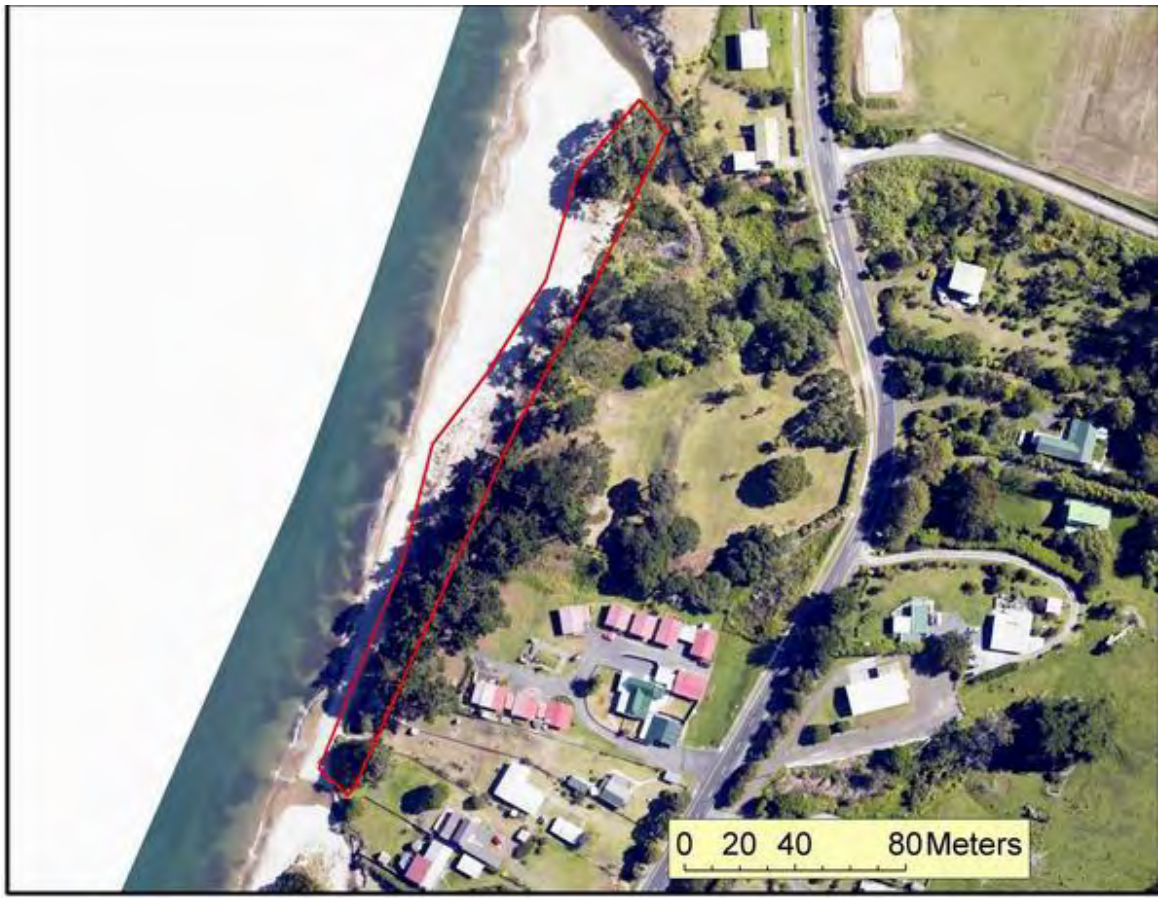
This area is located immediately north of Freese Park. There is insufficient setback from the dwelling to the shoreline to enable restoration of the dune. The dune also contains soil fill that would require removal.

Alternative management options should be considered for this site which may involve protection works (require consent and would likely be problematic when placed in isolation on the foreshore) or landward relocation of the dwelling, which, unless the garage was removed from the property, appears unlikely given space restrictions.

1  2 

Site 3 photographs: Images 1 – 2 June 2008.

4.2 SITE 5: FROM FIRST STREAM (NO. 296 SH12) TO SECOND STREAM (NO. 270 SH12).



Site 5: Site location diagram.

Whilst restoration would benefit this site, this is considered a low priority as there is sufficient setback of dwellings from the shoreline to buffer effects of erosion. Furthermore, the dune in this area appears healthy and well accreted, not requiring any intervention in the form of reshaping, replanting or fencing. As such, restoration in this area is not recommended. However, this area would benefit from some occasional maintenance (weeding and fertilising of spinifex/pingao) to encourage strong growth of the dune.

The south extent of this section could benefit from some reshaping and restoration, which would aid in the continuity of the dune complex at this site. This is in the area immediately north of the first stream. In this area the dune complex has been removed and capped with soil to create a gently sloping lawn. This land is slowly eroding, due to the combined effects of the stream outlet migration and coastal erosion. Removal of the soil and existing non-native vegetation and replanting with spinifex and pingao would aid in the stability of this area. This would only be necessary in a small section that is approximately 20 metres in length (refer to Site 5 photos 5 & 6). This subsection of Site 5 could be afforded priority status for restoration, particularly if done in conjunction with other works to stabilise the right bank of the stream (as discussed below).

Erosion of the right (north) stream bank at this site is of concern to at least one adjacent property owner. This bank has eroded due to combined coastal and river processes cutting into the toe of the bank causing this to erode. Dune restoration is not recommended at this stream bank, due to the river processes and lack of sediment supply to the right bank. However, a small rock revetment seawall structure (designed in accordance with professional engineering standards) could be implemented to address erosion of the stream bank. This will likely only have minor adverse effects on coastal processes, the main being potential for increased erosion where the structure terminates. This activity would require a coastal permit, obtained prior to commencing work.

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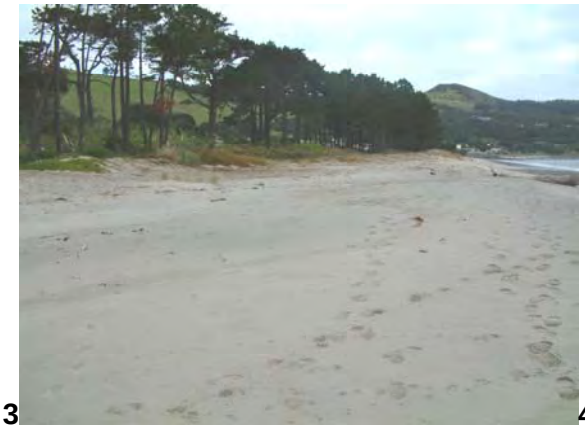
3 

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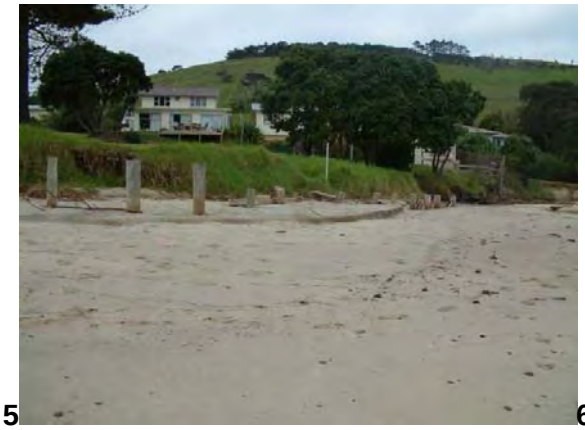
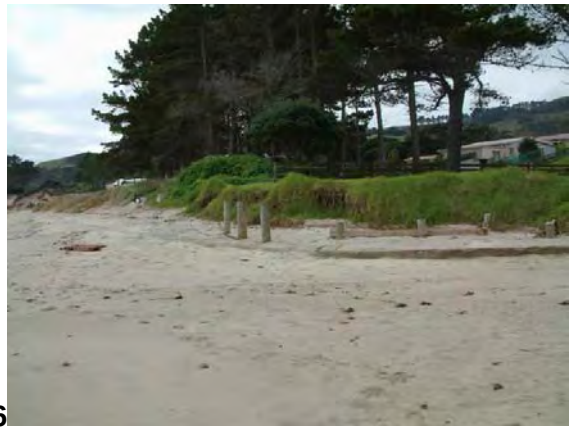
5 

6 

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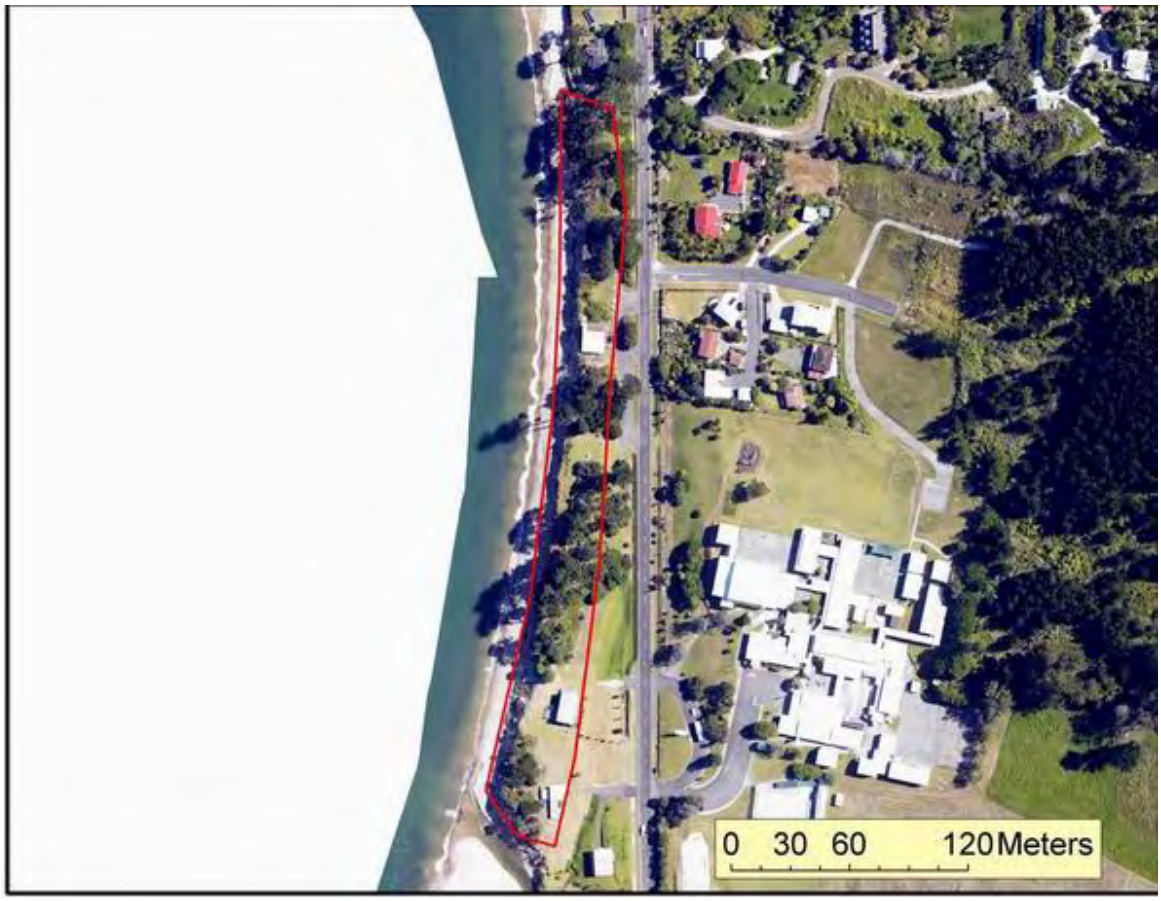
Site 5 photographs: Images 1 – 7 June 2008.

4.3 SITE 6: FROM SECOND STREAM (NO. 270 SH12) TO THIRD STREAM (NO. 246 SH12).



Site 6: Site location diagram.

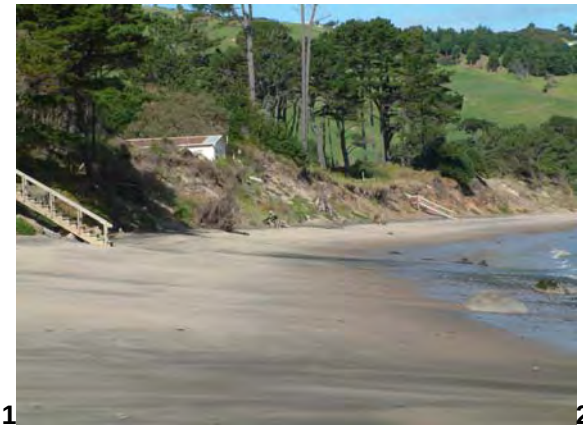
Some vegetation removal and minor reshaping could be undertaken near the top of the bank profile in parts of this site, to enable a clear area and gentle slope for planting with pingao and spinifex. In any case, the sandstone of the lower 2 – 3 metres of the bank profile should not be disturbed as this offers some resistance to erosion in areas where spinifex and pingao establishment is difficult.

Wholesale reshaping of the bank/dune is not recommended for the majority of this site, given the high elevation of the bank (approx 5 – 6 metres from toe to crest) and steep face (greater than 50 degrees). To sufficiently correct the over steep profile, some 9 – 12 metres of bank, extending from the shoreline landwards, would need to be reshaped to bring the profile face back towards 26 – 33 degrees.

Whilst replanting with spinifex and pingao is to be encouraged by property owners, as this will reduce the rate of erosion in this area, the over steep profile and steep face will continue to erode as the toe of the bank is undercut and the upper profile slumps and fails. However, spinifex and pingao establishment will aid in retention of sand at the toe of the bank and will aid in mitigating the rate of undercutting and failure and should be undertaken where this is a concern.

To the south of this site the stream is causing substantial erosion to the right (north) stream bank/dune complex (Refer Site 6 photo 6). The stream bank/dune complex is comprised of cemented sandstone and the eroded face has a slope over 50 degrees and an elevation of approximately 6 metres. This bank/dune complex will continue to erode as the stream discharge undercuts the toe and causes the over steep profile to collapse.

Realignment of the stream outlet to a location approximately 40 metres south of the existing outlet would mitigate this erosion. To achieve this, a new outlet, which could be done in the place of an old channel, could be cut through the dune/berm with a hydraulic excavator and excavated sand placed against the bank/dune complex and used to infill the old outlet. The adverse environmental effects of this realignment would likely be minor, although this could result in some impoundment of the stream waters as the flow is unlikely to be sufficient to keep the new outlet open under all flow conditions. However, this effect currently occurs at the existing outlet location and should not be too great a concern.

1 

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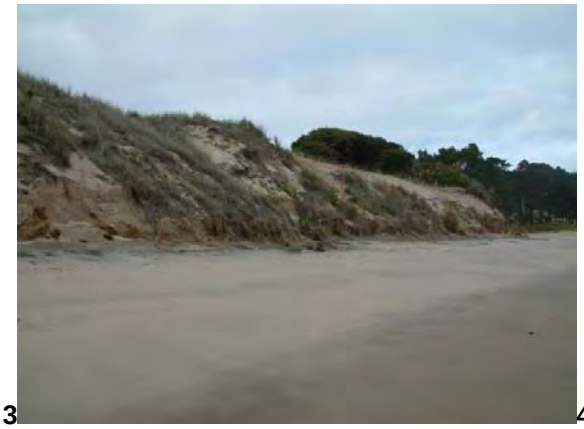
3 

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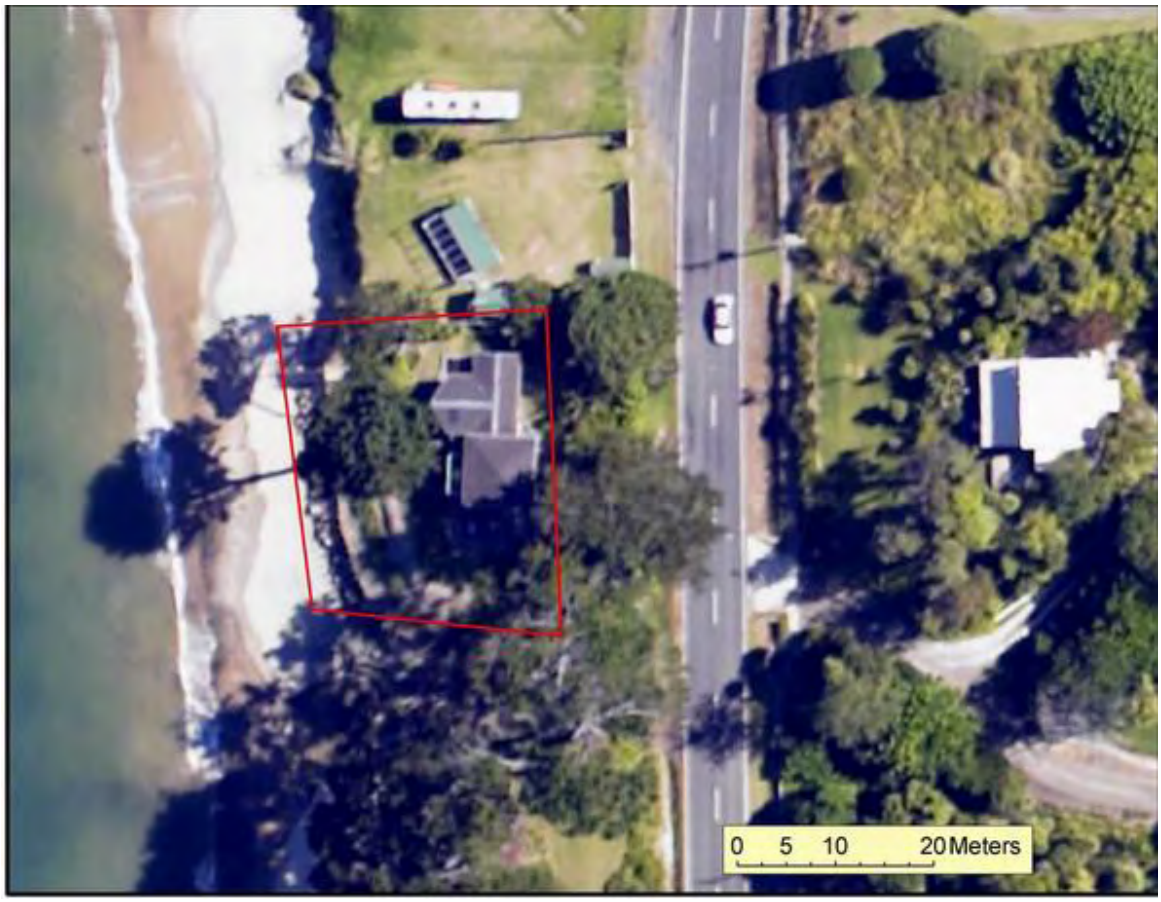
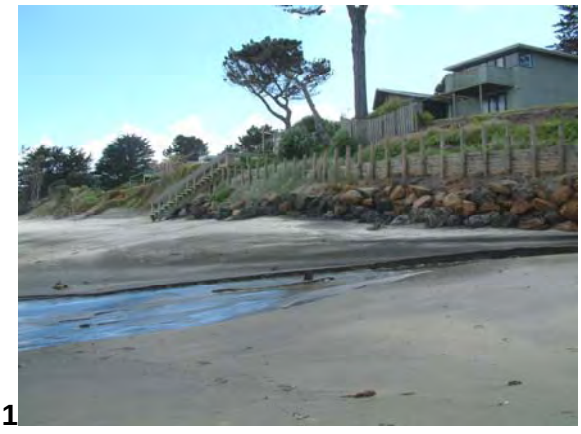
Site 6 photographs: Images 1 – 6 June 2008.

4.4 SITE 7: IMMEDIATELY NORTH OF THIRD STREAM



Site 7: Site location diagram.

This site is protected with a seawall, hence there is no requirement for dune restoration.



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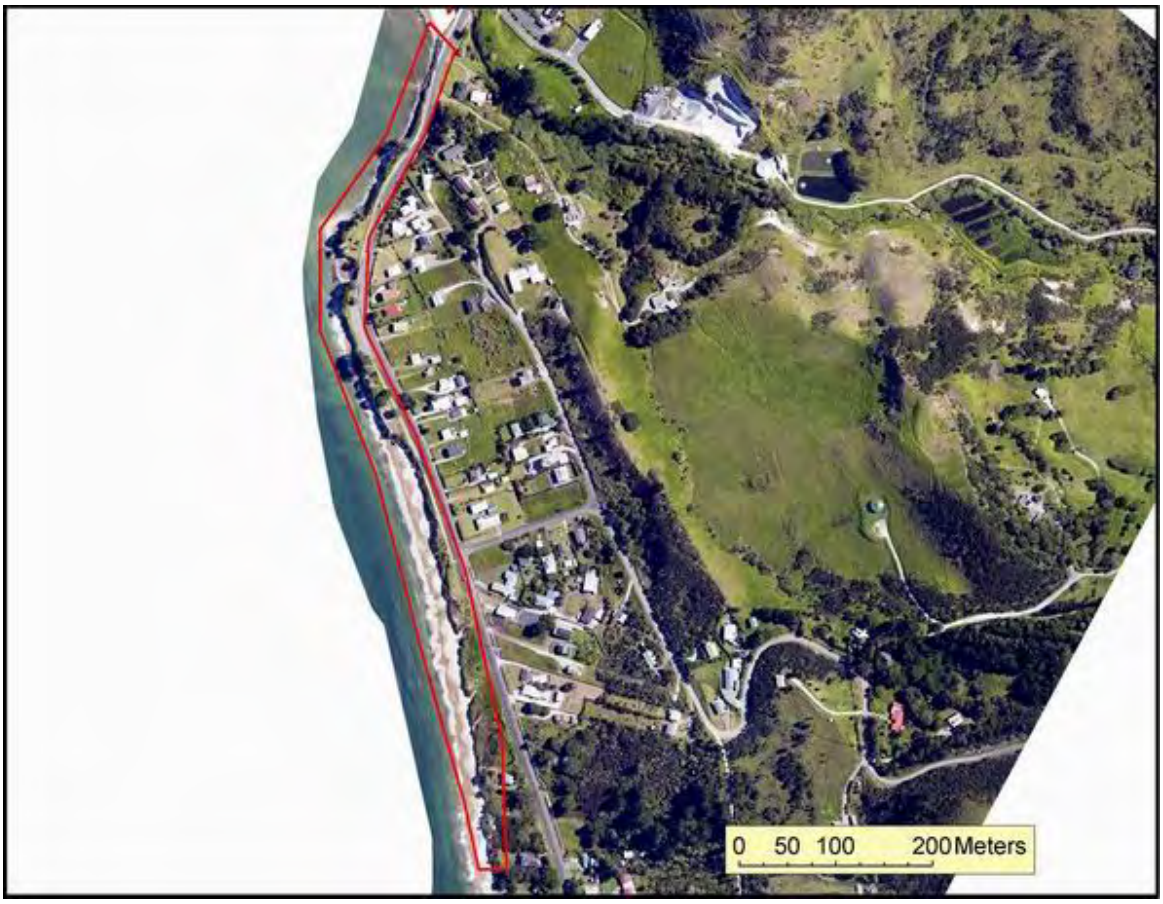
Site 6 photograph: Images 1 June 2008.

4.5 SITE 9: NORTHERN OMAPERE THROUGH TO WAIAROHIA STREAM.



Site 9: Site location diagram.

This area of foreshore is comprised of three distinct geomorphologies. The northern half of the site is comprised of mudstone cliffs and a shore platform that with a transient sand veneer, no restoration works are feasible in this part (Refer Site 9 images 1-2). Parts of the area are also protected with seawalls.

The next quarter south of this features a friable mudstone and weakly cemented sandstone layer overlain by relict dune sands (Refer Site 9 images 3-4). Restoration in this part is compromised by the underlying mudstone and the close proximity of shoreline to road, and restoration is therefore not recommended.

The southern quarter of this site appears to be mostly comprised of dune sands, however patches of mudstone were apparent which would need to investigated further prior to proceeding with any restoration in this area (Refer Site 9 image 5). Nevertheless, restoration of this southern area could be undertaken in the form of reshaping and planting with pingao and spinifex and should be considered in the future to enable continuation of the dune restoration recommended for site 8.

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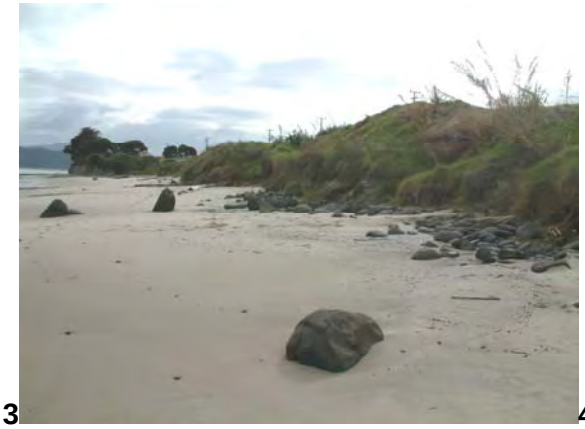
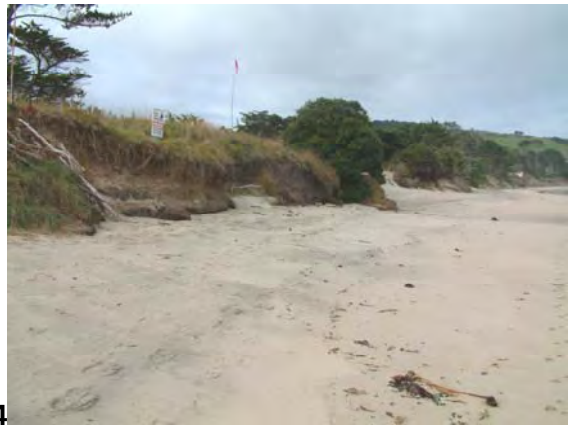
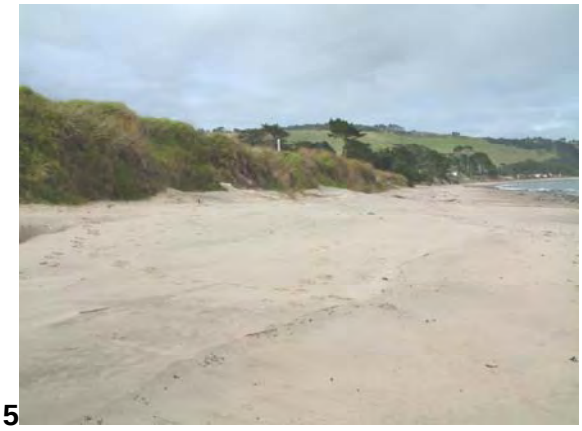
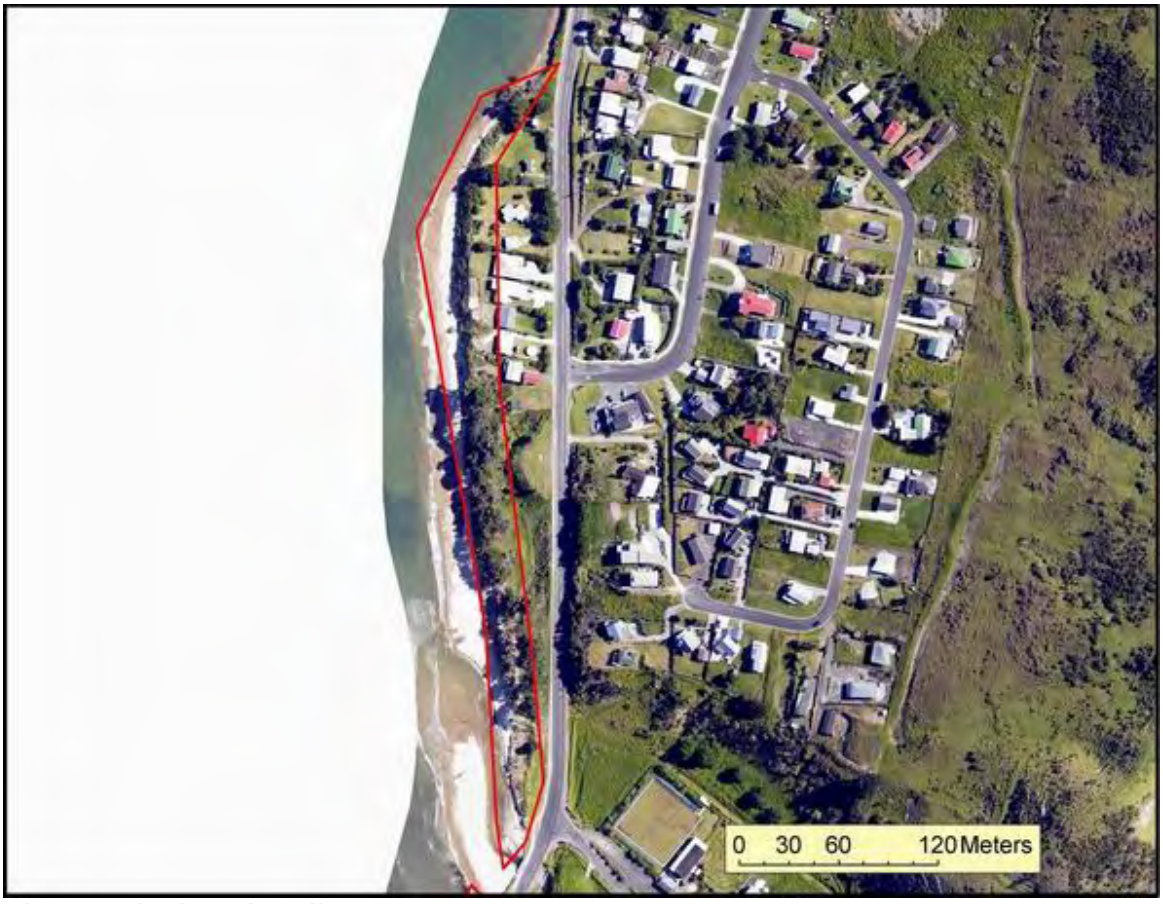
3 

4 

5 

Site 9 photographs: Images 1-5 circa 2004 and June 2008.

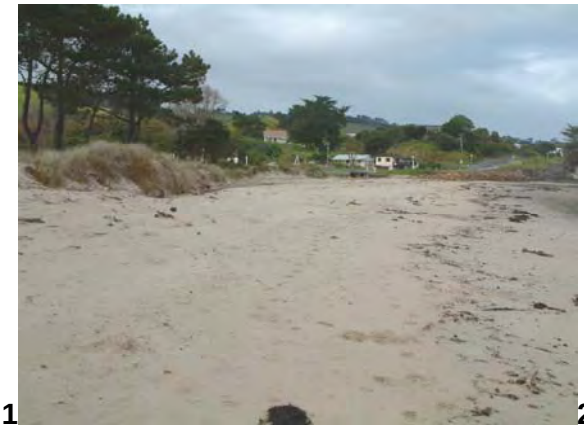
4.6 SITE 10: WAIAROHIA STREAM THROUGH TO No.89 SH 12

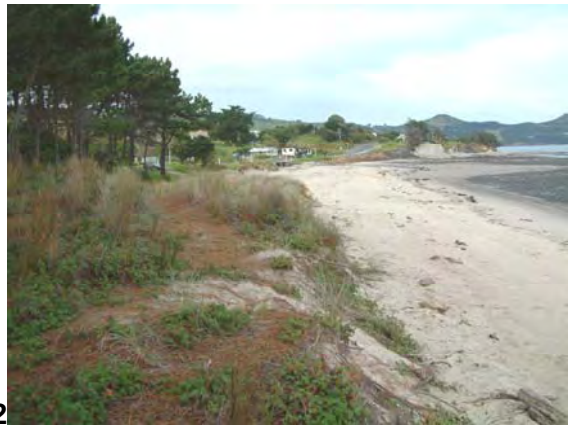


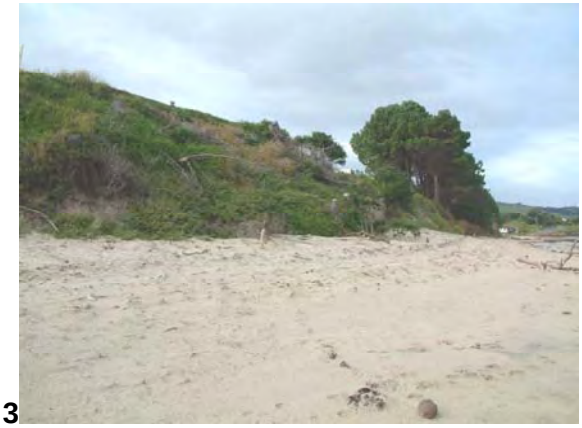
Site 10: Site location diagram.

The stability of the foreshore in the south half of this site is predominantly influenced by the Waiarohia Stream outlet, which meanders northwards on occasions causing erosion of the shoreline and dune and impacting on sediment supply to the north half of the site. Restoration is not recommended in the south half of this site due to the influence of the Waiarohia Stream and the fact that no dwellings or infrastructure are at immediate risk if the area erodes. However, removal of the pine trees and enhancement of the back dune area by replanting with spinifex and pingao would aid in enabling dune recovery following episodes of erosion.

In the north half of this site the foreshore is comprised of a large transient sand berm which banks onto a steep dune relict. The heavy vegetation on the dune face in this area indicates that this area has been stable in recent times, however the steep profile indicates substantial past erosion events. Reshaping of the bank in this area is not recommended due to the height of the bank (< 6 metres) and steep bank face, meaning that any reshaping would encroach upon the location of the dwellings that are located close to the top of the bank. Nevertheless, successful vegetation of the transient berm fronting the bank would aid in stabilising the bank toe and may enable formation of an incipient dune if the pingao and spinifex were to successfully establish over a period of several years if only minor erosion episodes occur.

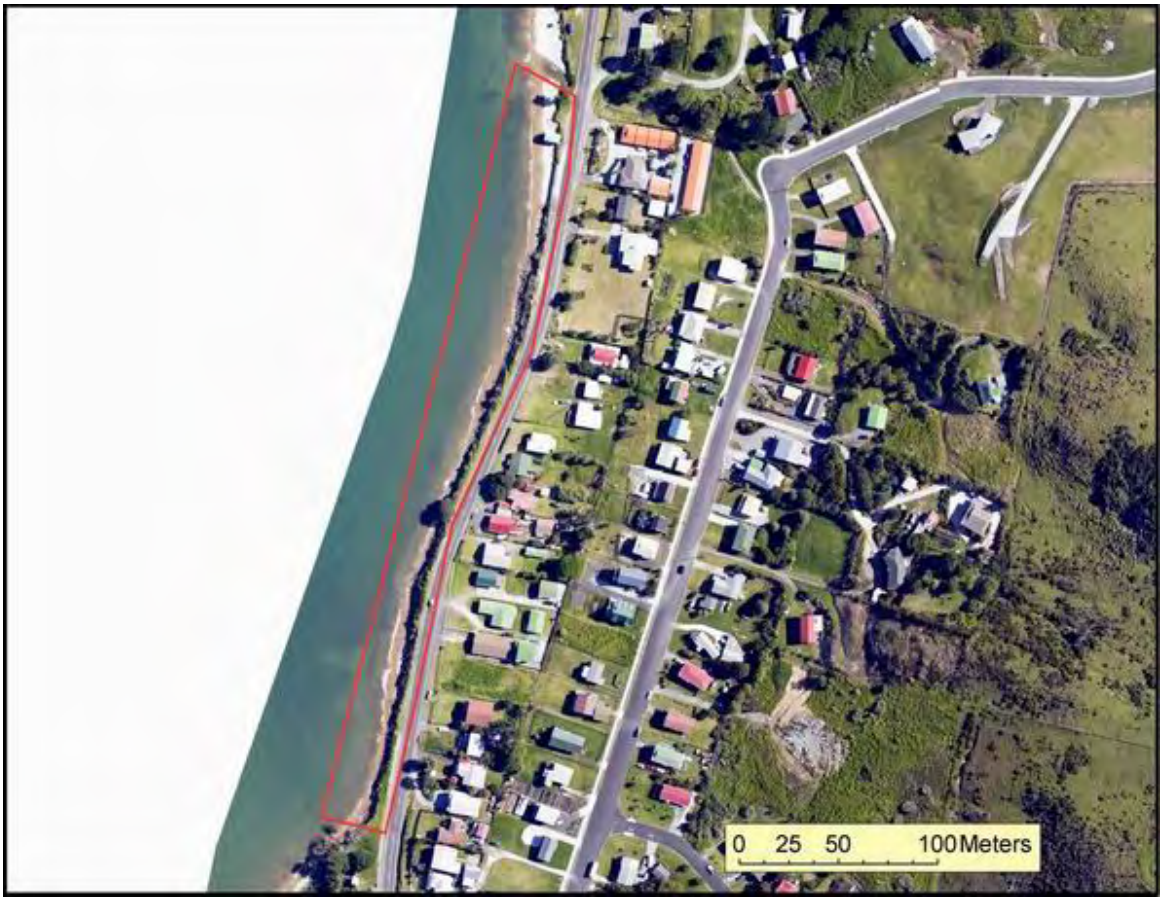
1 

2 

3 

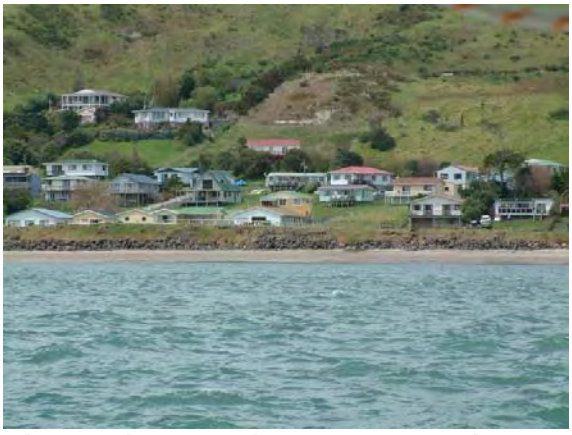
Site 10 photographs: Images 1-3 June 2008.

4.7 SITE 11: NO.89 SH 12 THROUGH TO NO. 45 SH 12



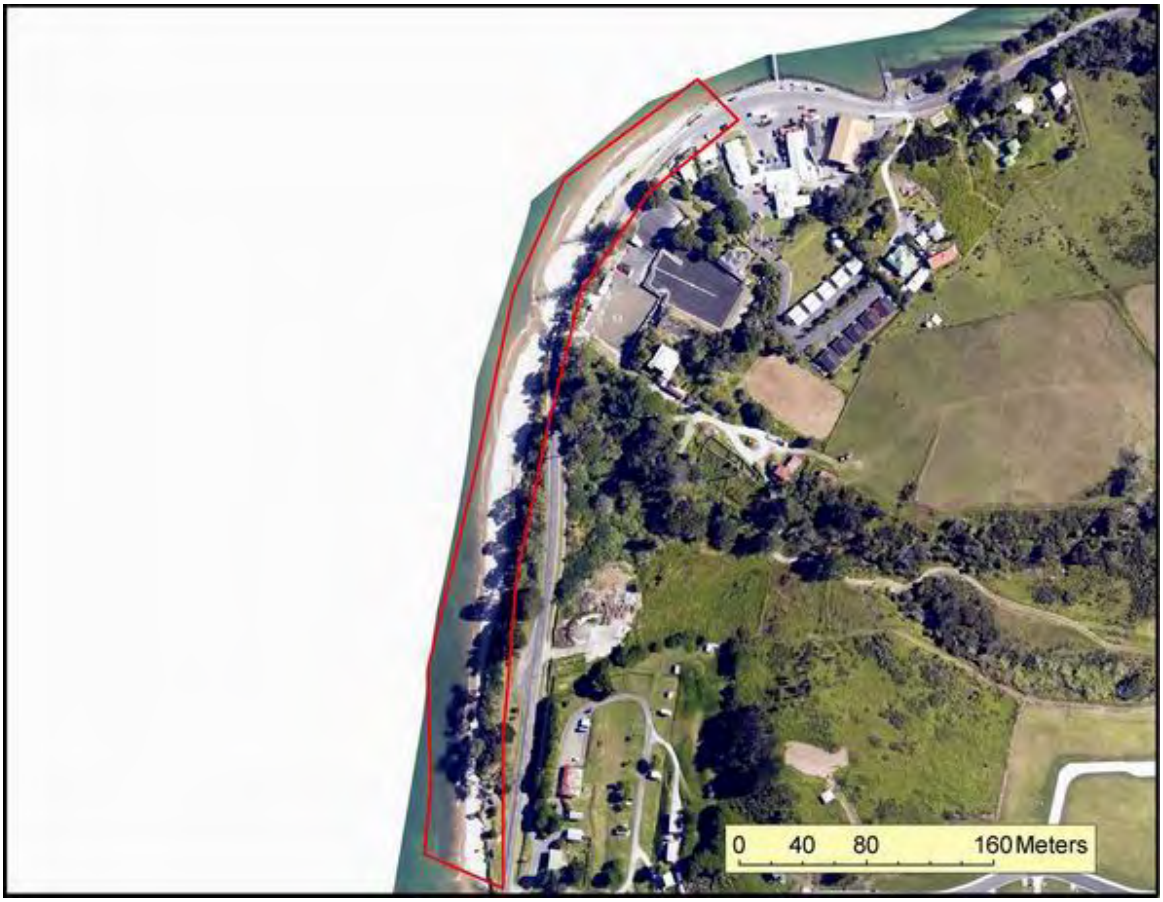
Site 11: Site location diagram.

The shoreline in this site is located in close proximity to the road, and is for the most part protected with rock sea walls. No restoration works are recommended for this area of shoreline.



Site 11 photograph: Image 1 October 2005.

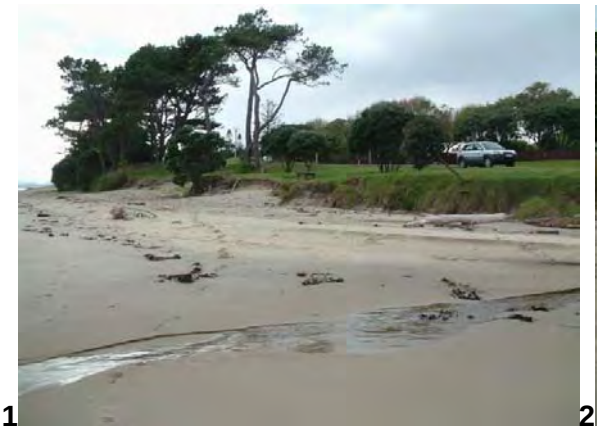
4.8 SITE 12: NO. 45 SH 12 THROUGH TO OPONONI SHOPPING CENTRE

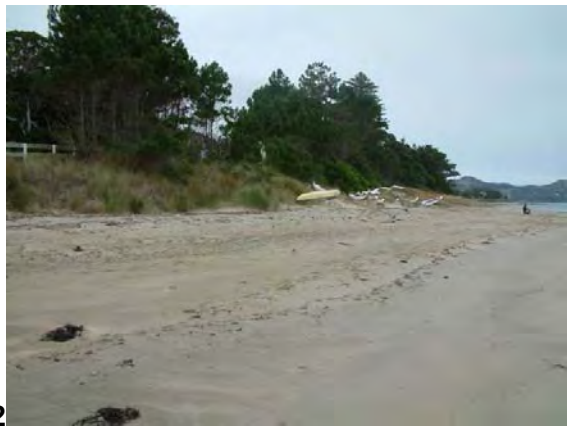


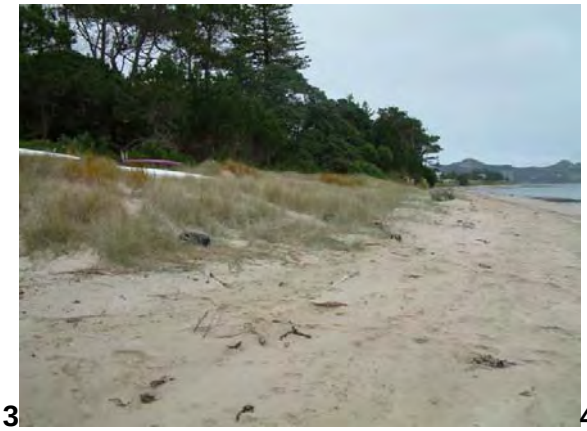
Site 12: Site location diagram.

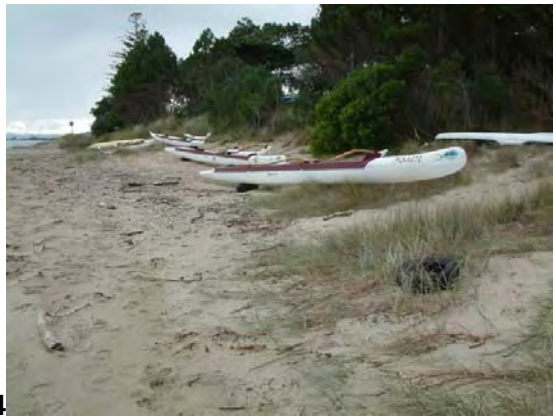
The mid-south extent of this site features a well vegetated incipient dune and no restoration is recommended in this part of the site. Restoration could be undertaken at the very southern extent of this site and would require reshaping of the eroded bank and revegetation of the first 2 – 4 metres of the bank with pingao and spinifex. However, as no infrastructure or dwellings are immediately at risk from erosion in this area, this is not seen as an immediate priority for restoration.

The north extent of this site is recommended for restoration and is addressed separately in this document and referred to as site 12a.

1 

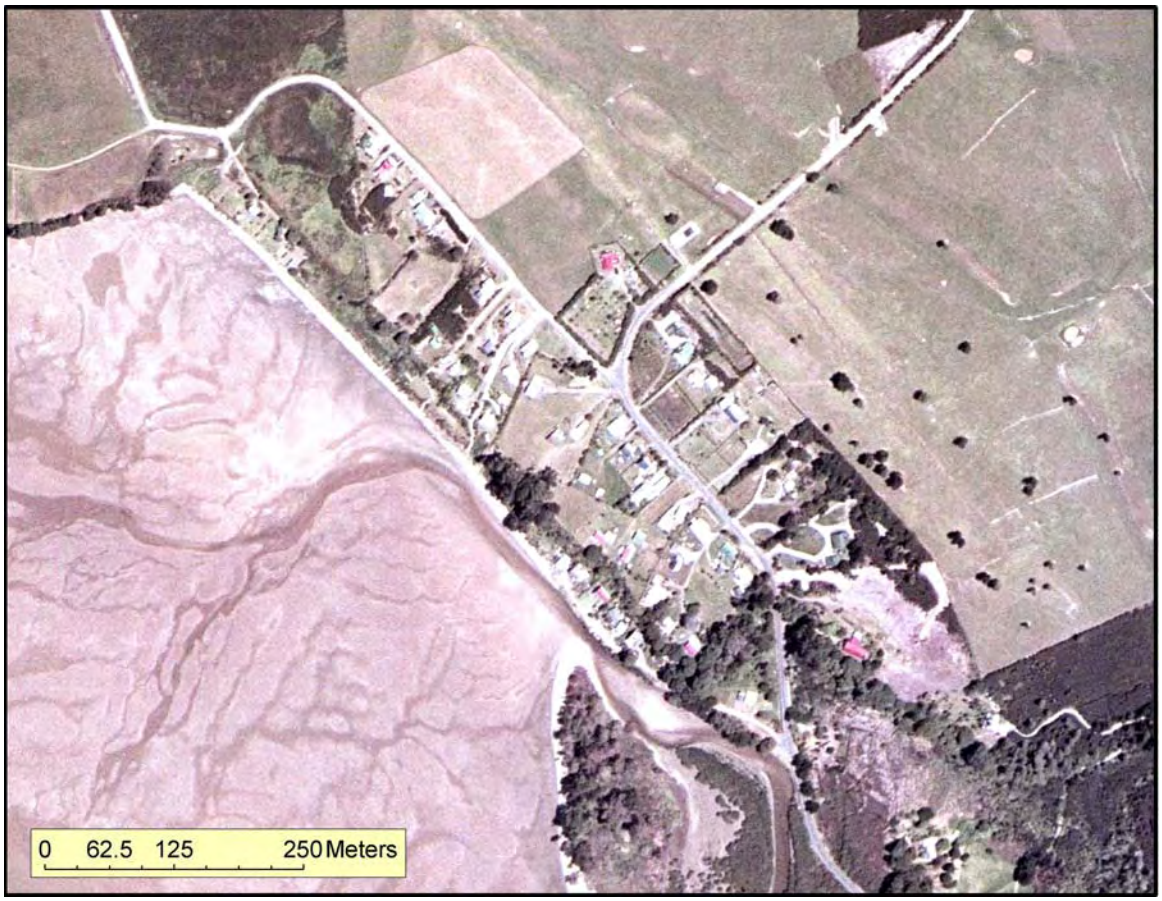
2 

3 

4 

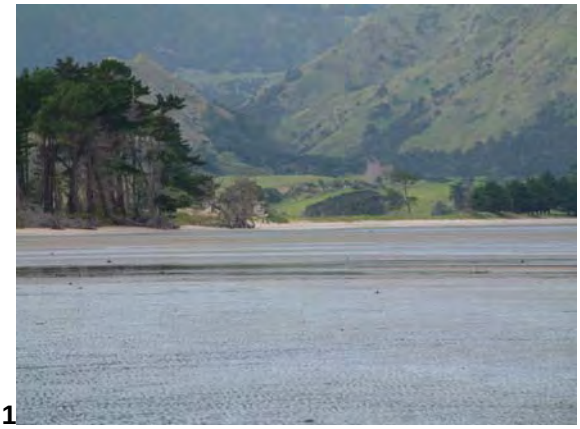
Site 12 photographs: Images 1-4 June 2008.

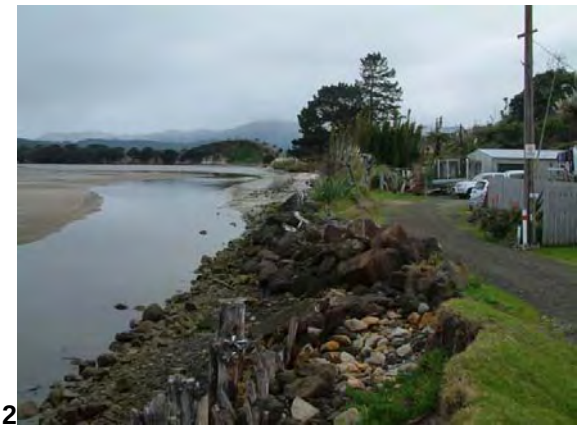
4.9 SITE 13: KOUTU



Site 13: Site location diagram.

The Koutu shoreline is comprised of two distinct geomorphologies. In the area north of the Koutu estuary the shoreline is comprised of a weekly cemented mudstone or soil backed by mixed vegetation. No restoration is recommended in this area as there insufficient sand or suitable dune relict. The area within the estuary is similar in character and a derelict seawall is located between the road and the dwellings. The estuary spit is comprised of sand, and whilst restoration may be feasible in this location, it is not recommended as the area is currently grazed by cattle and there appears to be little risk, if any, to dwellings (although one dwelling appears to be located close to the shoreline).

1 

2 

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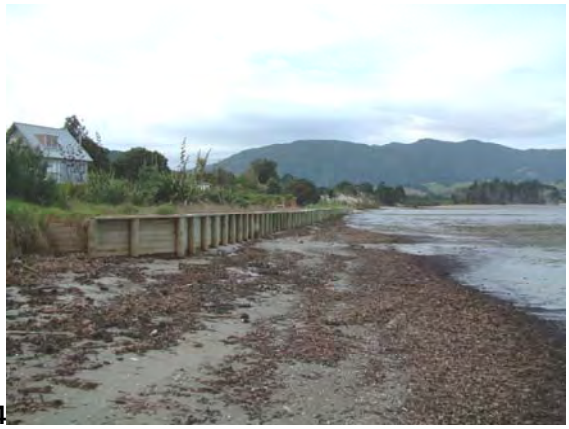
4 

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Site 13 photographs: Images 1-5 June 2008.

5. COSTS & FUNDING OPTIONS

5.1 RESTORATION COSTS

The costs of the proposed works average out to a rate of $100 per lineal metre of shoreline or $16 per square metre. This is considerably cheaper than other options, such as engineered seawalls and beach nourishment which are likely to be of the order of $1000 per lineal metre of shoreline.

The estimated total materials and machinery costs of the dune restoration works at the identified priority sites are summarised in the following table:

Site	Cost	Priority	Shoreline Length (m)	Shoreline Area (m^2)
Site 1: Copthorne.	$21,900	3rd	160	1200
Site 2: Freese Park.	$10,850	2nd	72	620
Site 4: North of No.9 Freese park road to first stream (No. 296 SH12).	$9,750	5th	85	550
Site 8: North of third stream (from No.244 to No.228 SH12).	$9,800	1st	160	1000
Site 12a: Adjacent Opononi shopping centre.	$10,000	4th	110	600
Site 12b: Opposite campground (No.43 SH12)	$6,200	6th	70	350
SUM	**$68,500**	**-**	**657**	**4390**

5.1 POSSIBLE FUNDING OPTIONS

The Northland Regional Council Environment Fund has a portion set aside for dune restoration projects. Part of this would be available to fund the restoration recommended in this proposal. However, there are insufficient funds to finance the entire project, unless it is staged over a number of years. At present $25,000 is available annually for dune projects throughout Northland.

It is therefore recommended that applications also be made to other funding agencies, such as the MfE Sustainable Management Fund and ASB Community Trust. The research that has been conducted would provide a strong foundation for any funding application as most funding agencies require a proven 'issue' and clear solution for dealing with this issue. This proposal should also be used to support any applications for funding to undertake the restoration works.

6. TIMEFRAMES

The optimum planting season for dune vegetation is during the months of June and July, so any timeframes need to be planned around this period.

Furthermore, project planning also needs to give consideration to ensuring that spinifex and pingao plants are 'booked' in advance of the project. Spinifex or pingao contract grown from seed supplied by the customer general require 18 and 15 months, respectively, before they are ready to plant out. Alternatively, if plants are to be simply purchased then orders generally need to be made in the September preceding the following June/July planting season.

The timeframes for giving effect to the restoration of the priority sites should consider, in particular:

- Budgetary constraints (i.e. is it feasible to obtain funding in a single year, or would several years be more achievable?).
- The size and availability of the volunteer workforce to implement the planting, fencing, access structures and maintain (weeding, fertiliser, fence repair/removal etc) the restored areas.
- Staging for success (i.e. staging restoration over several years will minimise the risk of an extreme erosion event causing significant to damaged areas in one occasion).

It is not feasible in this report to dictate a timeframe, as the above factors need to be assessed in conjunction with the Hokianga Harbour Foreshore Restoration Society. **However, it is recommended that planning for giving effect to the priority areas is commenced now.** It is also recommended that the restoration is commenced in the order of the priorities identified, and that these are staged for completion within the next 3 – 6 years, with staging also done within some of the individual sites (i.e. Site 1) to maximise success.

Once priorities and timeframes have been agreed and identified, then a brief plan (2-3 pages) should be written up and used to drive the implementation of the restoration of priority areas.

7. RECOMMENDATIONS

- Dune restoration activities along the Opononi/Omapere foreshore should focus on giving effect to the sites identified within this proposal as priorities for restoration activities.

- Prior to progressing any of the restoration priorities the affected or adjacent land owners should be consulted and their agreement obtained prior to implementing any physical works. Where agreement (following negotiation and discussion) can not be obtained, then the restoration should not proceed. Restoration should not proceed if negotiation requires modifying the proposed restoration to an extent that would adversely impact on the likely success of the restoration.

- Restoration should be undertaken in general accordance with the principles outlined in this proposal and the enclosed appendix.

- Restoration in those sites identified as low priority or not suitable for dune restoration should still be supported where the restoration may result in some benefit, although this should be carefully considered prior to undertaking restoration.

- Planning for giving effect to the priority areas should be commenced now and attempts made to secure funding to enable implementation of restoration at the priority areas.

- Restoration should be commenced in the order of the priorities identified, and these should be staged for completion within the next 3 – 6 years, with staging also done within some of the individual sites (i.e. Site 1) to maximise success.

- Priorities and timeframes need to be agreed and identified, and a brief plan (2-3 pages) needs to be written up and used to drive the implementation of the restoration of priority areas.

- Other foreshore management issues identified in this report (i.e. management of erosion in front of dwelling at Site 3 and stream erosion at the southern extent of Site 60) should be further considered by the Hokianga Harbour Foreshore Restoration Society and affected land owners should be consulted.

- A concise funding plan for implementation of the restoration works should be determined now and given effect to.

APPENDIX 1

Copy of report:

Community Based Dune Management for the Mitigation of Coastal Hazards and Climate Change Effects: A Guide for Local Authorities