Wainui Beach Management Strategy for Coastal Erosion:

Background & Discussion Document

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GISBORNE DISTRICT COUNCIL

Acknowledgements

Council thanks Sheryl Smail, Aileen Lawrie, Amber Dunn and Richard Reinen-Hamill for acting as peer reviewers of this document and for their thoughtful and detailed comments.

In addition, Council acknowledges the members of the Key Stakeholder Forum and Working Group, for the time they have given to the Strategy development so far.

Contents

1 Executive Summary

1.1 Introduction

This is a background and discussion document to outline progress to date and to assist with the next stage of development of the Wainui Beach Management Strategy for Coastal Erosion (the Strategy).

The major part of this document is dedicated to collating information about the coastal erosion hazard and risk at Wainui Beach, as well as the policy and issues relevant to its management; to prepare stakeholders for detailed discussion and consideration of options.

Gisborne District Council (Council) aims for broad stakeholder acceptance in the development of the Strategy and agreed an engagement process to bring together stakeholder perspectives. This involves a Key Stakeholder Forum, which has guided the process that has informed this document; and a Working Group of Key Stakeholder Forum members, who have undertaken the detailed review work. The Key Stakeholder Forum will make recommendations to Council on the content of the Strategy. As a Council document, it is the Council that will ultimately determine the content of the Strategy.

1.2 Coastal Erosion Processes at Wainui Beach

Taking the cue from the past, one would expect future erosion processes at Wainui Beach to continue to be dominated by storms and rip currents. This results in a dynamic coastline with rapid erosion events followed by slow accretion. Climate change may increase the severity of storms and result in an even more dynamic shoreline.

Multi-decadal climatic and lunar cycles (including the Interdecadal Pacific Oscillation or IPO) will also continue to impact on the severity and frequency of storms, resulting in cycles of erosion and accretion.

Sea level rise due to climate change is expected to cause shoreline retreat over the long term.

1.3 What is at Risk?

Erosion at Wainui Beach is primarily seen as a risk for property rather than human safety.

113 beachfront properties south of Hamanatua Stream are affected by Council's mapping of the hazard in the District and Coastal Plan. These properties have a total capital rating value (based on 2011 valuations) of $102 million. Nearly three-quarters of the capital value is attributed to land value.

28 properties have dwellings substantially affected by the Extreme Hazard Zone. The Extreme Hazard Zone is intended to show the area that is, or is likely to be, subject to adverse effects from short-term duneline fluctuations and storm cuts, with a high probability of being adversely affected at any point in time but more particularly during negative IPO phases.

A further 11 properties are substantially affected by the High Hazard Zone and 31 properties by the Moderate Hazard Zone.

In other words, 70 properties have dwellings that are likely to be susceptible to erosion, according to Council's current hazard zone assessment, in the next 100 years.

The Wainui Surf Club is also located in the Extreme and High Hazard Zones.

1.4 Key Considerations

The Resource Management Act 1991 and the policies and plans written under this Act (particularly the New Zealand Coastal Policy Statement 2010) are fundamental to development of the Strategy.

Council is required to apply them when developing the local RMA policies and plans and when performing its regulatory functions of assessing activities for resource consent. The NZCPS and other RMA provisions also guide Council in its core service of avoiding or mitigating natural hazards and in providing any infrastructure.

In summary, the RMA and related documents require a focus on management approaches that reduce or avoid the risk through locating development away from harm; hard protection structures are discouraged. The RMA and related documents also contain a range of other objectives and policies to guide the development of the Strategy, including those relating to the natural character of the coastal environment; public access to and along the coast; Maori cultural values and participation of Maori in decision making; and surf breaks of national significance. Importantly, "Wainui – Stock Route – Pines – Whales" is included in the list of surf breaks of national significance.

Workshops and surveys have been used to identify and prioritise the values and issues important to the Key Stakeholder Forum members. The ten most important issues, in order or priority, related to:

- a Strategy informed by research-based evidence,
- long-term relevance,
- affordability,
- protecting surf breaks of national significance,
- broad community acceptance,
- maintaining natural beach processes, including the natural movement of sand,
- a holistic perspective to inform prioritising of issues,
- protecting beachfront properties from erosion,
- balancing individual rights with collective rights,
- protecting the foredune.

1.5 Developing a Future Strategy

The last part of the document is an initial discussion of possible options for developing the Strategy, which is intended to provide a basis for further discussion with stakeholders. A possible vision for the strategy is also provided as a starting point for discussion.

A variety of tools could be used to manage the risk of coastal erosion. These include:

- hard protection structures – rock revetments, cobble revetments, training groynes, geobag structures;
- beach nourishment to add sand to the beach system;
- dune enhancement to support the natural process of dune repair following erosion events and provide an erosion buffer between the shore and critical property;
- landuse planning to restrict development in areas at-risk and potentially even require removal of existing development;
- regulation and covenants to prevent the construction of hard protection structures in favour of other management options;
- financial instruments to provide economic incentive to encourage relocation or removal of assets;
- education and awareness.

Key Stakeholder Forum members are now asked to take a step back and consider a broad strategy for managing erosion at Wainui Beach. Five high level options are suggested:

1. **Protecting Properties** – Aim to protect properties (particularly dwellings) for as long as possible, while minimising adverse effects on the environment and seeking to avoid additional development in areas at risk in the long term.
2. **Buy Time** – Protect properties for a finite period (20 to 50 years) and use this time to avoid and reduce risk in the long term. Review regulation to ensure no additional development adds to the risk.
3. **Maintain Structures** – Maintain structures until they provide no real benefit. Add no new structures and focus instead on dune enhancement. Review regulation to ensure no additional development adding to the risk. Community-led retreat to address short-term risk that cannot be addressed by dune enhancement and long-term risk due to sea level rise
4. **Soft Management and Community-led Retreat** – Council withdraws from the hard protection scheme and the focus is on dune enhancement. Review regulation to ensure no additional development adds to the risk. Community-led retreat to address short-term risk that cannot be addressed by dune enhancement and long-term risk due to sea level rise
5. **Retreat Focus** – Relocation and removal of assets away from harm before the situation becomes critical. May be forced by regulation and possibly incentivised by financial instruments.

We recognise that there may be overlaps between each of the options and the final Strategy may draw on aspects of various options; or it may be quite different. They are intended only as a starting point and we expect further refinement.

2 Context

2.1 Purpose and Scope

This is a background and discussion document to assist with the development of the Wainui Beach Management Strategy for Coastal Erosion (the Strategy). The Strategy will be a Gisborne District Council strategy, adopted after engagement with stakeholders, on the management of erosion at Wainui Beach.

The major part of this document is dedicated to collating information about coastal erosion hazard at Wainui Beach and the policy and issues relevant to is management; to prepare stakeholders for detailed discussion and consideration of options. This document also provides a record of the consideration of issues and stakeholder engagement to-date. The last part of the document is an initial discussion of possible options for developing the Strategy, which is intended to provide a basis for further discussion and refinement with stakeholders.

Initially the Strategy was conceived as a strategy for the management of all coastal hazards affecting Wainui Beach. However, it became clear that stakeholders were focused on erosion and that consideration of this hazard, alone, was a significant challenge. Therefore, the focus was narrowed to the management of coastal erosion. The project remains part of Council's broader stream of work on reviewing coastal hazards to give effect to the NZCPS. This broader work package includes a review of landuse planning for coastal flooding and tsunami, which is being progressed alongside this project.

The Strategy will replace the previous Wainui Beach Management Strategy adopted in 2003 (WBMS 2003), which also focused on the management of coastal erosion at Wainui Beach.

The Key Stakeholder Forum (a group formed to develop the Strategy) adopted a purpose categorised into sustainability, broader context and broad acceptance as follows:

Sustainability	To develop a sustainable strategy that identifies the preferred management of coastal erosion hazards affecting Wainui Beach.
Broader Context	We will be taking into consideration the wider economic, environmental, social, recreational and cultural context.
Broad Acceptance	Our goal is to achieve a Wainui Beach Management Strategy that has broad acceptance amongst the community because it will provide a framework for future development and decisions related to Wainui Beach.

Stakeholders also identified specific issues or tasks within the scope of developing the Strategy as follows:

- reviewing the WBMS 2003
- understanding the natural coastal processes
- understanding and consideration of divergent community and expert views
- identification of and compliance with related legislation/national policies/strategies
- consideration of existing hazard information and relevant planning controls
- understanding the existing and alternative solutions.

This document brings the results of exploring and analysing these matters together to inform the next part of the Strategy development.

Specific issues or tasks that are not within the scope of the project have also been defined with stakeholders to ensure the project is achievable. These are:

- the Wainui/Okitu Community Plan
- stormwater/wastewater and water reticulation
- on-site wastewater disposal
- quality of stormwater discharge into Wainui and Hanamatua Streams
- flood hazard overlays for Lloyd George Road.

2.2 Structure of this Document

This discussion document is divided into Sections 1 to 5. The major part of the document (sections 1 to 4) could be described as background information. Section 5 is considered the most important for the remainder of the project as it begins to explore options for the future Strategy.

Section 1 is the Executive Summary.

Section 2 provides context to the document and development of the Strategy. It sets out the purpose, scope and study area for the Strategy and how stakeholders are being engaged. It describes the coastal erosion processes at Wainui Beach, the property exposed to erosion, as well as how the hazard has been managed.

Section 3 discusses the key considerations for developing the Strategy. This consists of those identified by statute and policy, as well as those important to stakeholders.

Section 4 assesses current erosion management approaches against the key considerations outlined in Section 3 to provide information about remaining with the status quo and a baseline against which to compare alternative options.

Section 5 begins by outlining a possible vision for the Strategy, then discussing the range of tools that might be used within the Strategy. Section 5 ends by asking Key Stakeholder Forum members to take a step back and consider a broad strategy for managing erosion at Wainui Beach in light of the key considerations identified. Five high level options are given as a starting point for further discussion.

Following are a series of appendices.

2.3 Study Area

The study area for the Strategy is Wainui Beach, which is located on the outskirts of Gisborne City. Wainui Beach extends about 6km between Tuaheni Point to the south and Makorori Point to the north. It has an approximate northeast-southwest alignment to the Pacific Ocean. The beach consists of a predominantly sandy shoreline, backed by a substantial dune system between the two rocky headlands. Two streams flow out onto Wainui Beach; Wainui Stream to the south, and Hamanatua Stream in the middle.

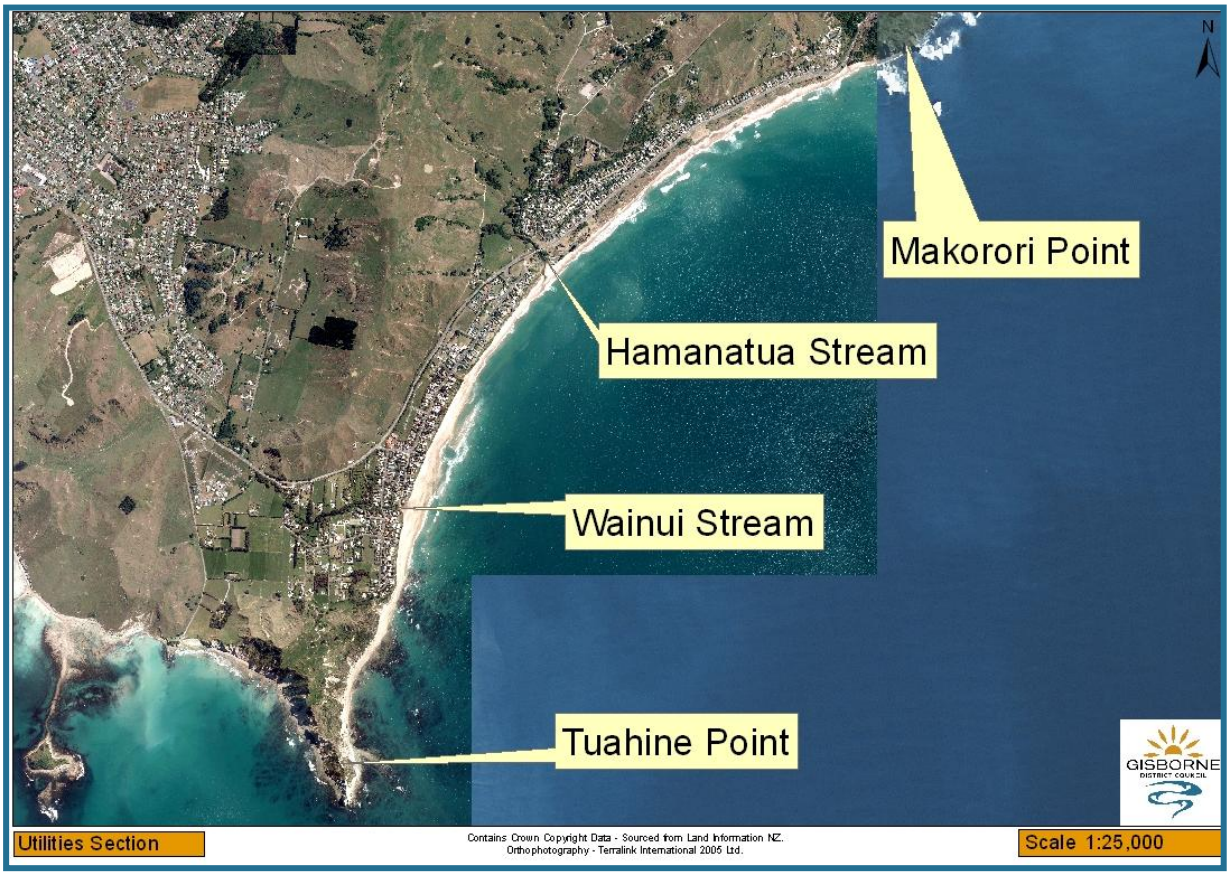


Figure 1 – Wainui Beach

2.4 Stakeholder Engagement

2.4.1 Strategy Participants and Roles

Council engaged Sheryl Smail (Pivotal) to design and facilitate an engagement process, with the intention of developing a Strategy with broad stakeholder acceptance.

Smail surveyed stakeholders and used the results to develop a draft engagement process, which was workshopped and refined at a public meeting on 22 August 2012.

This resulted in the following structure and roles for the WBMS process.

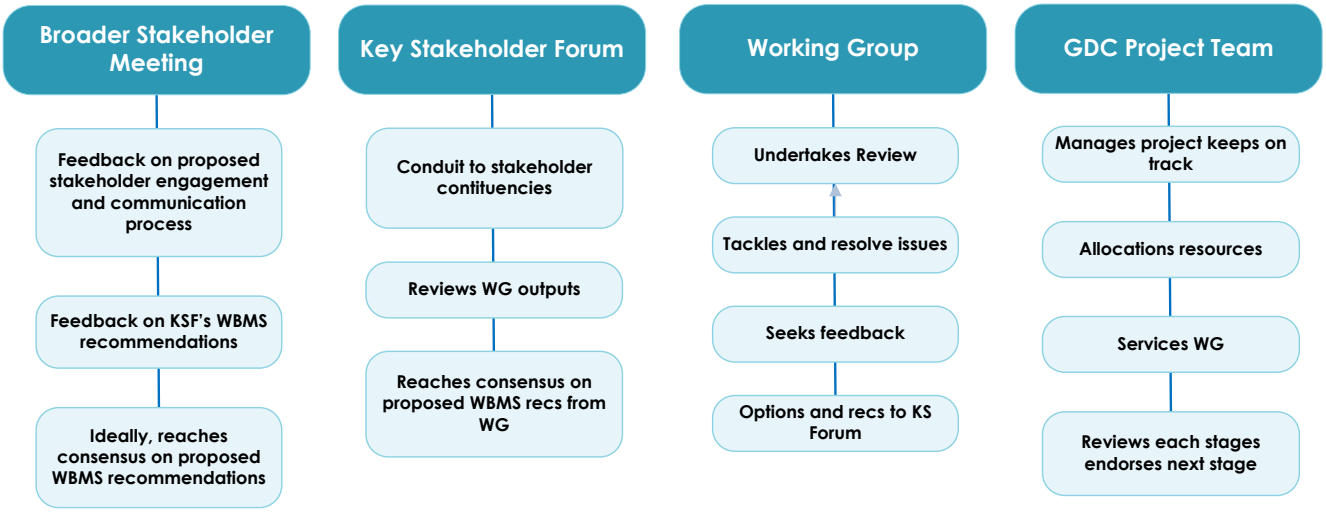


Figure 2

2.4.2 Key Stakeholder Forum (KSF)

The Key Stakeholder Forum is intended to bring together multiple stakeholder perspectives. An overview of the Key Stakeholder Forum is provided below. Its full Terms of Reference and membership are included in Appendix 1.

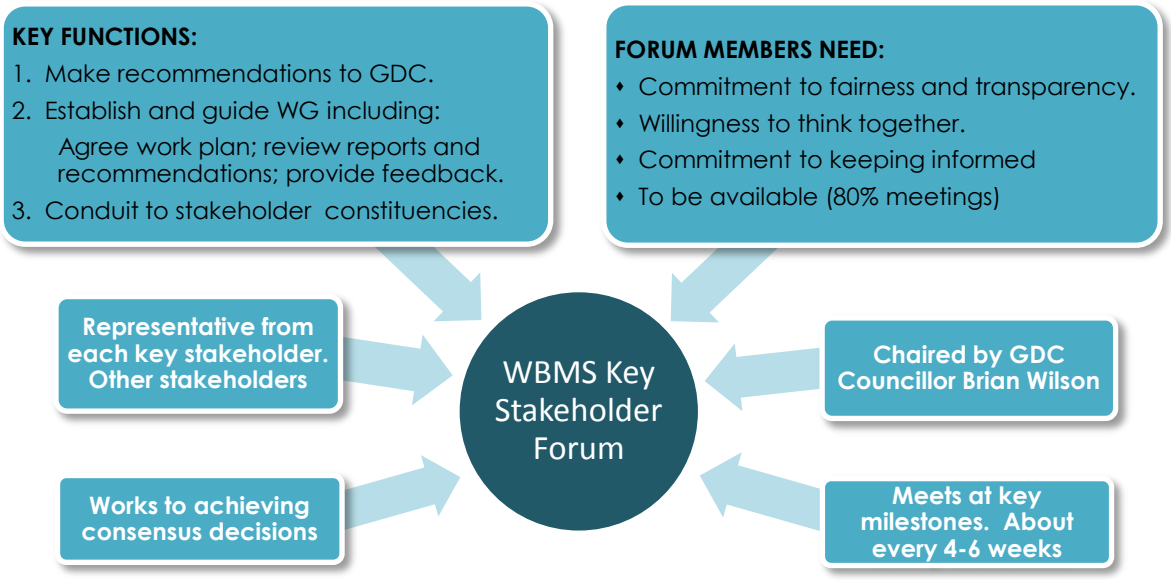


Figure 3

The Key Stakeholder Forum members agreed a formal consensus decision process based on Kaner's Gradients of Agreement (Kaner et al. 2007), which enables all views, particularly minority dissenting views, to be well heard before decisions are made.

2.4.3 Working Group (WG)

The Working Group was formed from Key Stakeholder Forum members. Its role is to integrate the perspectives of multiple stakeholders in the development of the Wainui Beach Management Strategy; work through the important and substantive issues; and to make recommendations to the Key Stakeholder Forum.

Perspectives represented include: GDC; Beachfront ratepayers; Beachfront residents; Wainui residents (Non-beachfront); Ngati Oneone; Wainui/Okitu Residents & Ratepayers Association; Wainui Coast Care Group; Previous Wainui Beach Management Strategy Committee; Surfing community; Life stage. All of the members live in Wainui; five are beachfront residents.

Members of the Working Group also adopted the consensus Kaner's Gradients of Agreement decision process.

An overview of the Working Group and the perspectives represented is provided below. Its Terms of Reference and membership are included in Appendix 1.

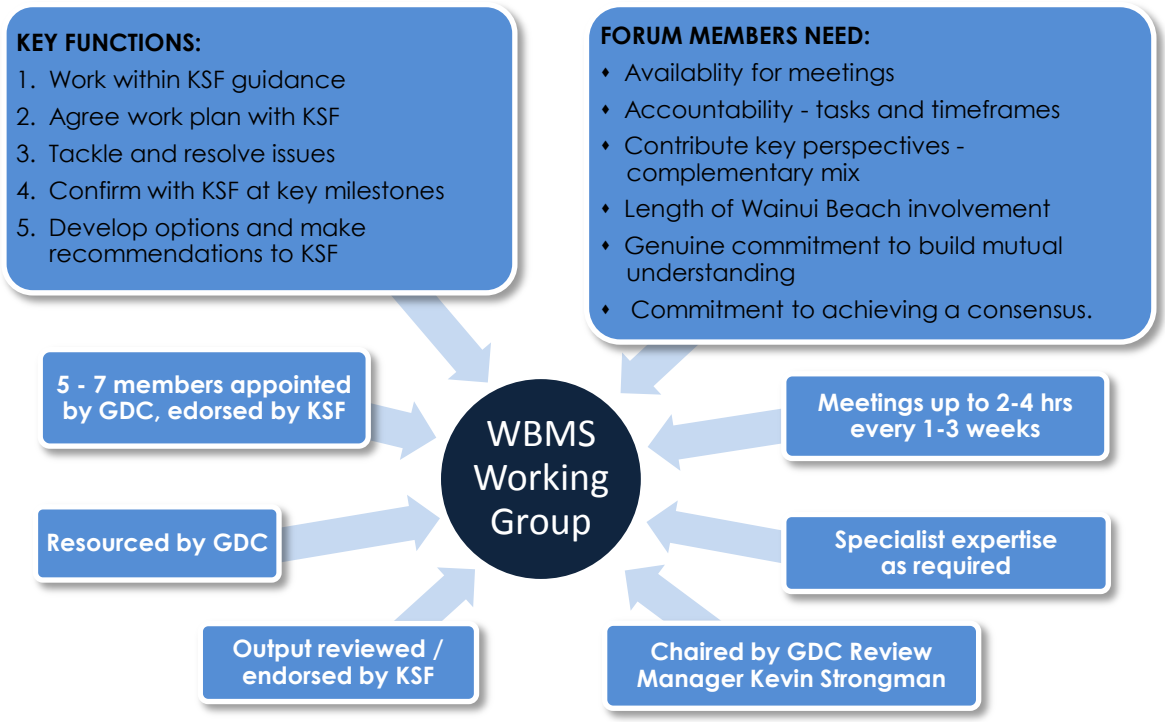


Figure 4

2.4.4 Overview of Engagement

Public engagement was initiated with a survey of stakeholders followed by a public meeting on 22 August 2012 to introduce the project, proposed process, project scope and agree the engagement and communication process. This was followed by a second public meeting on 12 September 2012, at which coastal engineer Richard Reinen-Hamill and coastal scientist Amber Dunn presented on "How Wainui Beach Works". A third public meeting was held on 5 December 2012 to provide an update on progress.

The Key Stakeholder Forum met three times prior to the preparation of this document. The matters covered are summarised in table 1 below.

MATTERS COVERED	DATE
Confirming the terms of reference and membership for the Key Stakeholder Forum and Working Group	17 Sep 2012
Confirming the decision-making process	17 Sep 2012
Confirming the project communications plan	17 Sep 2012
Agreeing and monitoring the Working Group's work programme	17 Sep 2012; 17 Oct 2012; 28 Nov 2012
Identifying key considerations for the Strategy to address and what is important for Key Stakeholder Forum members	17 Oct 2012;
Considering Working Group recommendations on key understandings including:	
• on how the beach works and the significance of cyclical versus long term erosion;	17 Oct 2012; 28 Oct 2012
• the effectiveness of current hard protection structures;	28 Nov 2012
• the impact of remaining with the status quo.	17 Oct 2012
Hearing presentations on planning interventions to manage coastal hazards and agreeing to further investigation of planning interventions.	28 Nov 2012
Receiving a report on a preliminary assessment of options (Richard Reinen-Hamill, Tonkin & Taylor, 2012) and agreeing which options to consider in more detail.	28 Nov 2012

Table 1

The Working Group met five times prior to the preparation of this document. During these meetings the Working Group confirmed their own processes and workshopped issues before making recommendations to the Key Stakeholder Forum.

Council's website has also provided opportunity for the community outside of the Key Stakeholder Forum to be informed. Meeting minutes, presentations and reports were available through the website.

This discussion document was prepared by Council staff over the subsequent months.

2.5 Erosion at Wainui Beach and its Management

2.5.1 Introduction

This section of the document describes coastal erosion processes at Wainui Beach; the property exposed to coastal erosion; as well as the current and historic management of the hazard to protect this property.

The potential consequences of erosion that are of concern primarily relate to property rather than to human safety.

2.5.2 Coastal Erosion Processes

Coastal erosion is the wearing away of land and the removal or redistribution of beach or dune sediments. It takes place mainly during storm conditions and strong onshore winds, and results in coastline retreat and loss of land (see for example www.coastalwiki.org). While defining coastal erosion is relatively straightforward, understanding the process is complex. It requires insight into multiple factors that interact along the shoreline and the processes that inter-connect the beach. It also requires an awareness of different timescales.

In shorter time scales (days, seasons and years), severe storms with high waves and elevated water levels cause erosion by allowing waves to run up the beach to erode the toe of the bluff and sand dunes. The shape of the beach is important, which in turn, depends on the composition of the sand and movement of sand by currents and waves. In the medium term, erosion trends can be influenced by climatic and tide cycles. On longer timescales of (decades, centuries and millennia) coastal retreat or accretion is determined by sand supply and loss (sand budget), as well as changes in the level of the sea relative to the land.

A large volume of research is relevant to the erosion processes at Wainui Beach. This includes research into the past geological evolution of the coast as a key to future processes; quantifying long term tectonic uplift rates; studies of sediment supply and sand budget; measurements of short term shoreline fluctuations and storm cut; studies of beach profiles and morphology; and analysis of wave, tides, currents and sediment movements. National and international research in areas such as sea level rise are also important.

The most significant reports include Dr Paul Komar's on the causes and mitigation of erosion at Wainui Beach (Komar 1996); Dr Jeremy Gibb's coastal hazard zone reports (Gibb 1995 and 2001), which draw on a wide range of studies on geological and coastal processes affecting the erosion of Wainui Beach; and the studies of Dr Amber Dunn on shoreline behaviour and coastal processes at Wainui Beach (Dunn 2001) and coastal storm activity for the eastern North Island (Dunn 2010).

The Working Group and Key Stakeholder Forum had the benefit of Dr Amber Dunn's direct assistance with helping to understand the coastal processes. Alongside Dunn, renowned coastal engineer Richard Reinen-Hamill also assisted the Working Group.

As coastal erosion processes are complex, it is difficult to do them justice by summarising. However, the following reflects some of the key points made in various research. Also included is a summary of the Key Stakeholder's understanding of the research.

(i) The beach needs to be considered as a whole

Research and the advice of the assisting experts, Dr Amber Dunn and Richard Reinen-Hamill, promotes understanding of erosion by looking at beach processes as a whole. Large scale processes inter-connect all parts of the beach so changes in one part of the beach may impact on another.

(ii) Beach morphology, sediment and sediment movement

Gibb (2001) states that nearly all the sand is derived, approximately in equal proportions, from volcanic eruptions in the central North Island and the breakdown of sea shells. The volcanic material is likely to have been deposited into the ocean and carried into the beach by waves. A small proportion of the sand is supplied by erosion of the tertiary rocks that form the headlands, shore platforms and offshore reefs. However, only the larger fragments eroded from the tertiary rocks contribute to the beach and the smaller fractions are transported offshore by wave action to settle at greater depths.

In some places cobbles underlie sand. These are exposed from time to time in severe erosion. They are derived mainly from erosion of the Tertiary sandstone layers of Tuaheni Point (Komar 1996).

Gibb's stratigraphical samples show that in other places along the beach silts underlie the sand (Gibb 2001).

Dunn mapped the seafloor morphology and distribution of major geomorphological units using a side-scan sonar survey (Dunn 2001). She found the seafloor complex and consisting of a shore-parallel rocky bank (Coopers Bank), two SE-trending reef systems, rocky outcrops in the immediate nearshore, and several smaller rocky patches. One of the most important findings was that these structural features on the seafloor appeared to confine a localised sand belt within the nearshore, and that both the onshore and offshore portion of the beach is essentially a thin veneer of sand on a predominantly rocky basement.

Sand extends further out to sea at the northern end of the beach and sand cover is patchy offshore at the southern end of the beach (Gibb 2001).

As is obvious to residents of Wainui Beach, beaches are constantly changing. Dunn and Reinen-Hamill assisted the Working Group and Key Stakeholder Forum to understand that "the nature of sand is to move". During storms, waves take sand from the visible beach offshore, flattening the profile of the beach and forming offshore sand bars. During calm weather smaller waves return sand from the storm bar to the visible beach surface and wind blows the sand up onto the dunes.

In severe or successive storms, the waves can erode the foredunes, causing property damage. However, the erosion of sand from the dunes also helps to protect the property behind from further erosion as the flattening of the beach profile and creation of sand bars help to dissipate wave energy offshore (Dunn comms). Dunes, therefore, are a valuable reservoir of sand for the beach, which can be added to the beach during times of erosion and later rebuilt by waves and wind.

In addition to this cross-shore movement, sand can also be transported long-shore down the beach. This can result in redistribution of sand from one part of the beach to another.

Komar says "various lines of evidence demonstrate there is a north-south oscillation of longshore sand movement within the Wainui Beach embayment in response to changing wind directions" (Komar 1996). Gibb (2001) said during south-easterly conditions sand moves from the south to the north, narrowing the southern end of the beach and enlarging the northern end. Thus, the southern end of the beach is most vulnerable to erosion during prolonged south-south-easterly storms when the beach is narrowed. Dunn (comms) states that waves must arrive obliquely to the shoreline to be capable of inducing long-shore sand transport and therefore it is southerly (not south-easterly) conditions that are capable of inducing long-shore sand transport from the south of the beach to the north.

(iii) Short-Term Erosion - Storms

Erosion occurs during storms, particularly when high tides, high waves and strong onshore winds combine. Accordingly, the "laws of the coast" Dunn explained to strategy participants include "the history of the coast is a history of storms".

Gibb studied the occurrence of large erosion events and concluded that major localised short-term erosion events have a return period of about 20 years (Gibb 1998, in Gibb 2001).

Storms coincide with rip currents, which are a result of imbalances in the wave energy and are an important cause of erosion. The formation and migration of rip currents can cause differential and localised erosion up to 15-20m at unpredictable places along the foredune (Gibb 1998, in Gibb 2001; Dunn 2001).

Dunn (2001) explains erosion is attributable to the interaction of several coastal processes (high storm waves driving energetic rip currents and longshore currents, coincidence with extreme water levels, infragravity energy in rip channels and wave refraction that focuses energy at the shoreline). The extent to which each of these processes operates varies for different parts of the beach.

Due to the complexity of the contributing processes we do not know where erosion will occur during a storm. Dunn (2001) states that, considering all erosion events for 1900-2002 it is apparent that there are several parts of the beach that can be categorised as erosion-prone. They include south of Wainui Stream, Cooper Street to Oneroa Road and around the mouth of Hamanatua Stream. However, anywhere along the 4km of sandy beach can undergo significant erosion and no part of this beach can be thought as free from erosion (Gibb 1998, Dunn 2001).

In Wainui most waves arrive from the northeast, east, southeast and south but the largest waves tend to approach from the south-southeast and direct south (Komar 1996; Dunn 2010). Gibb (2001) explains that Wainui Beach is cradled between the arms of two major reef systems that extend southeast from Tuaheni and Makorori Points out to at least 30m depth, which provide some protection from heavy seas from the south, east and northeast but leave open a window for direct attack from the southeast. In addition, the seabed morphology has an effect on incident wave attack by refracting deep sea waves. Komar (1996) also discussed the effect of Ariel Bank, off the coast of New Zealand, providing partial protection from the east but not from the south east.

Severe or successive storms from one direction can result in the seasonal redistribution of sand from one end of the beach to the other as discussed by Gibb (2001) and Komar (1996).

Climate change may increase wave heights and storm surge due to changes in winds and storminess, but this is expected to have a lesser impact than the projected rise in mean sea level discussed below (Bell 2013).

(iv) Medium-Term Influences on Erosion

Reinen-Hamill explained the importance of the tidal cycles to the Working Group and Key Stakeholder Forum. The tidal astronomical cycle causes changes in the magnitude of high tides and therefore enhances the potential for erosion. The astronomical tidal cycle of approximately 18.6 years coincides remarkably with extreme erosion events at Wainui. The peak of the cycle's impact on tides at Wainui Beach passed in around 2006 and the cycle's impact on tides should be less pronounced in the coming years. Previous peaks in the tidal astronomical cycle occurred in the late 1980's and in the late 1960's to early 1970's.

Also important are the climatic cycles associated with the El Nino Southern Oscillation (2-5 years) and the Interdecadal Pacific Oscillations (IPO) (20-40 years). The IPO has positive (warm) and negative (cool) phases. Positive phases tend to be associated with an increase in El Ninos, and negative phases with more La Ninas. These can drive patterns of erosion and recovery or accretion over periods of decades but do not necessarily represent a permanent change in the average shoreline position (Bryan et al. 2008 in Ramsay et al. 2012 and www.niwa.co.nz).

During the positive phase of the IPO, with a tendency for more La Nina events, one would expect a higher incidence of easterly (onshore) conditions for Wainui, and therefore a higher chance of erosion events - or a corresponding phase of coastal erosion. In contrast, the negative phase is dominated by westerly winds - corresponding to offshore conditions - and would have an associated accretionary trend for Wainui (Dunn comms).

(v) Long-Term Determinants of Coastal Erosion

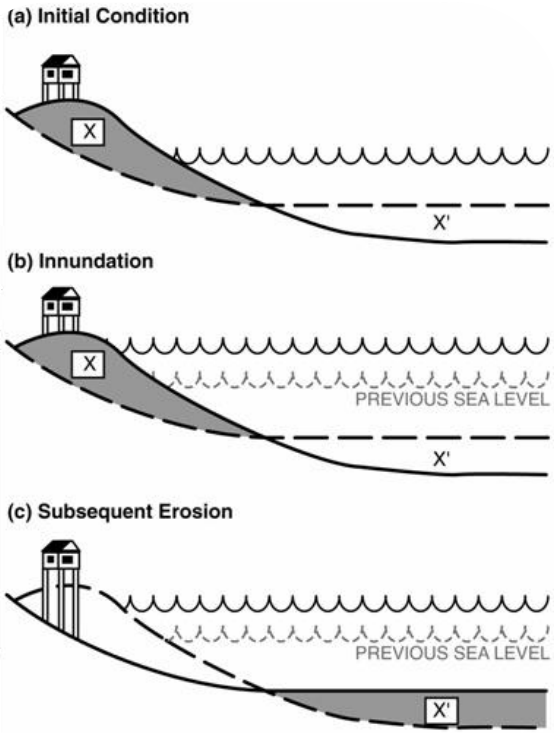
Accretion and erosion trends over multiple decades or more have a sense of permanence in human time-scales.

Experts discuss three types of drivers for these longer term changes in the location of the coastline:

1. the level of the sea relative to the land
2. the sand or sediment budget, i.e. whether the total amount of sand/sediment in the beach system is increasing or decreasing
3. erosion of the headlands and reefs that confine sediment in the beach system and control energy entering the system.

1. Sea level

A higher sea level relative to the land enables high-energy waves to reach farther up the beach to cause erosion. The impact of sea level rise is expected to be more than the loss of land from inundation alone. Scientists and engineers often use the "Bruun Rule" to explain why (refer to figure 5 below). A rise in sea level directly inundates a relatively small portion of the beach. However, the cross section of a given beach tends to follow a given profile relative to the sea. As storm waves erode the beach and deposit sand nearby and the summer swell rebuilds the beach, the offshore area tends to retain a particular depth. As sea level rises, the nearshore bottom must rise as well to keep that profile and unless sand is brought in from elsewhere, the beach and dunes provide the land that elevates the bottom. Some have criticised the Bruun Rule as a predictive tool, but while it may not be a complete explanation of erosion caused by sea level rise, it illustrates why shore erosion should be greater than just inundation alone.



THE BRUUN RULE

A rise in sea level immediately results in shoreline retreat due to innundation, as shown in (a) and (b). However, a one-meter rise in sea level implies that the offshore bottom must also rise one meter. The sand requires to raise the bottom (X') can be supplied by beach nourishmemt. Otherwise, the beach and dunes will supply that sand (X) as shown in (c).

Source: Titus (1991)
www.papers.risingsea.net/
erosion.html

Figure 5

The level of the sea relative to the land is influenced by both sea level rise and tectonic uplift or subsidence of land.

Dr Robert Bell, a leading New Zealand scientist on sea level rise recently provided advice on past and projected future sea level rise (Bell 2013). In terms of historic trends, his monitoring around New Zealand indicates a sea level rise similar to global average calculations of about 1.7mm per year since the early 1900s.

Ministry for the Environment (2008) guidance on future sea level rise (to which Bell contributed) suggests assessment of a base increase of 0.5m by the 2090s relative to 1980-1999 average levels and further consideration of the impacts of at least 0.8m increase relative to 1980-1999 levels. For planning and decision timeframes beyond 2100 where, as a result of the particular decision, future adaptation options will be limited, an allowance for sea-level rise of 10 mm per year beyond 2100 is recommended (in addition to the above recommendation). In his recent evidence Bell confirms that emerging international research is showing the Ministry's 2008 guidance is not overly conservative. This equates to approximately 5 to 8mm per year. Bell recommends Councils adopt the more conservative projection for adaptation of existing development due to the degree or risk aggregated across the region.

Gibb (2001) estimated past tectonic uplift rates at an average of 2.6mm per year for northern Wainui Beach and 1.5mm per year for south of the Hamanatua Stream (Gibb 1998 in Gibb 2001).

Therefore, one could assume sea level is at least 3-4mm/year greater than average tectonic uplift over the next 100 years. In any case, tectonic uplift is likely to occur in major events, between which land subsidence may occur to enhance coastal erosion (Gibb 2001).

2. *Sand Budget*

Long term trends are also influenced by sediment losses or gains from the beach system. For Wainui Beach, there are some differences in expert opinions around whether the total amount of sand is stable.

Gibb (2001) believes that the geological evidence and the long term-trend of shore line retreat suggest a long-term net loss of sand and that unknown amounts of fine sand may be transported from Wainui Beach around Makorori Point during southerly storms. He refers to previous beach profile studies by himself (Gibb 1993 and 1998) and Air Logistics Limited to estimate the loss of sand at 5,000-6,000m^3/year. However, he suggests sand volumes may have remained constant from the early 1970's to late 1990's with erosion of the retreating foredune adding to the sand budget.

Komar (1996) places less emphasis on sand loss. Noting that Makorori Beach has finer sand with mineralogical differences, he argues that, while sand movement cannot be ruled out, Makorori Reef appears to act like a giant groyne to isolate the two pocket beaches. He says that while no sand budget has been established for Wainui Beach, it is apparent that input of new sand is small and, for the most part, Wainui Beach is a closed cell with minimal new sediment suitable to build a beach.

Dunn (2001) also concluded that the beach can be considered as an essentially closed system. Although she could not rule out sediment transport pathways out of the beach compartment, she believed several factors support only a small leakage of sediment out of the Wainui compartment. Dunn (2003) also commented that it is likely, and research is needed to confirm this theory, that the Wainui compartment could in fact be a closed system between Tuaheni and Tatapouri Point, and not Tuaheni and Makorori Point as previously thought.

Working Group members questioned whether the removal of cobbles has contributed to erosion at Wainui Beach. According to resident accounts, a large volume of cobbles were removed by the Gisborne Harbour Board (no primary source found, but noted in Komar 1996). Cobbles were also added to the beach in 1962 by a large landslide (Adye et al., undated, in Komar 1996). Reinen-Hamill's advice (comms) is that the removal of the cobbles is one of several factors (along with sea level rise and the erosion of the reef off Tuaheni Point) that are likely to have contributed to long term erosion, particularly at the southern end of the beach. He speculates it may not be possible to find out how much was removed and there may have also been some balancing by the large landslide in 1962.

3. *Erosion of the Headland and Reefs*

Gibb (1981, 1995 and 1998 in Gibb 2001) suggests erosion of the headlands also plays an important role for the long-term stability of the beach and, as the headlands retreat, so does the beach.

He explains "the relatively hard headlands act as strong points that hold the line of the 4.2km-long Wainui Beach slung between them. As the "strong points retreat, then it follows that Wainui Beach can be expected to retreat at similar rates". He found that Tuaheni Point has retreated at a rate of 0.27m/year and Makorori Point by 0.21m/year since 1942. This theory appears to relate to the issue of sand budget - the headlands are holding the beach (i.e. the sand) between them.

Dunn, does not agree that eroding headlands will equate to an eroding sandy beach (Dunn, comms). She points out that if sediment leaks around to Makorori then it could also leak back (Dunn comms; Dunn 2003).

A different theory, which Reinen-Hamill discussed with strategy participants, was the possibility that erosion of Tuaheni Point and the reef off the Point could cause an increase in wave energy from the south, resulting in a redistribution of sand from the south to the north of the beach. This process could be described as a more permanent or long-term form of "beach rotation" than that experienced due to climatic cycles, i.e. a re-orientation of the beach to face the direction of the predominant waves.

Dunn (comms) advises that her analysis of the 1942 to 1999 beach surveys may support a slight clockwise rotation of the beach to face the direction of the most powerful storms and waves. However, she notes that rotation processes are complicated by the wide swell window for Wainui Beach.

(vi) Stream Erosion

Beach erosion by stream flows is in addition to wave erosion. Historically the stream mouths have migrated up and down the beach, depending upon the incident wave direction balanced with the volume of water discharging through the outlet. The resulting meanders can cause dune tow erosion when the stream outlet is pushed up against the shoreline due to wave conditions and alongshore drift. The wetted sand at the outlet can also erode more rapidly during storm events and results in lower beach levels and higher wave energy at the dune toe.

Stakeholders noted that stormwater pipe and drain outlets near the stream mouths can cause their own localised erosion. Due to the location of this erosion the normal beach processes can take longer to restore any loss of sand.

2.5.3 Analysis of Historic Erosion Trends

Gibb (2001), Dunn (2001, in Dunn 2003) and Tonkin & Taylor (2013a) have all analysed beach survey data to estimate historic shoreline trends.

Gibb (2001) compared the duneline position from historic aerial photos from 1942 and 1999. However, for the area south of Hamanatua Stream, he compared the 1942 photos to 1982 photos. He believed the 1982 duneline provided a more accurate measure of the long-term trend for this area as a "temporary incipient foredune had grown at the base of the main fordune and to use this would create an erroneous trend of significant long-term advanced based almost entirely on a short-term duneline fluctuation". He found a trend of net retreat for the beach, at an average rate of 0.15m per year and retreat of Tuaheni and Makorori Points at rates of 0.27 and 0.21m per year respectively.

Dunn (2001, in Dunn 2003) compared the seaward line of the dune. Like Gibb, she used the 1942 and 1999 aerial photos, but for different beach sections, except for the headlands. She found Tuaheni Point was retreating at a rate of 0.25m per year, while Makorori Point had a very slow accretion trend of 0.07m per year (she assumes this is most likely due to landslide events and measurement error). Dunn estimated average accretion rates of 0.32 and 0.25m per year for the beaches at Wainui (south of Hamanatua Stream) and Okitu (north of Hamanatua Stream), respectively. She noted great spatial and temporaral variability in the rate-of-change statistics. Most of the shoreline advance was found in the central sector of the beach (approximately from Wainui School to Hamanatua Stream) and this accretion tapered off to the north and south. There was also accretion at the northern end of the beach. For Wainui Stream to Tuahine Crescent the shoreline was stable or a very slow rate of accretion (0.06m per year). Dunn concluded that this rate of accretion was within the error limits and therefore assumed the shoreline was stable.

Tonkin & Taylor (2013a) used a different "regression analysis" approach to analyse shoreline trends. This analyses the horizontal distance of the 1m and 2m depth contours along the upper beach from a fixed bench mark in the beach profile, as surveyed by Gisborne District Council and its predecessors. 17 profile locations were analysed, as shown in Appendix 3. It provides an indication of the fluctuation of beach position at that level. For the southern profiles the analyses was of data from 1974 to 2012. For the northern profiles (8A to 14) data was limited to 1999, when Council discontinued the beach profiling. Tonkin & Taylor found a more dominant erosion trend at the southern areas of the beach (between profiles 1 to 7), with the remaining beach area more prone to fluctuation rather than a clear erosion trend.

Dunn (comms) notes her concerns about the use of beach profile data to infer erosion or accretion trends. She explains that beach profile data only captures a tiny portion of the system (the subaerial beach) and does not capture activity in the offshore region. Sand can be redistributed and sitting offshore underneath the waves at the time of measurement. She also notes Dean (1994) had concerns about discrepancies in the beach profile dataset and that the engineering structures at the southern end of the beach can act to exaggerate the erosion signal.

In summary, all of the analyses found great variability in the data between sites and over time. Tonkin & Taylor did not analyse data for the headlands but Gibb and Dunn had good agreement for erosion rates at Tuaheni Point. Gibb also found net retreat for Makorori Point while Dunn noted the apparent accretion in her analyses is probably due to landslides or measurement error. Gibb and Dunn found different trends for Wainui (south of Hamanatua Stream) for the same period: Gibb found erosion while Dunn found a general trend of accretion, with accretion highest from the School to Hamanatua Stream and a stable shoreline south of Wainui Stream. Tonkin and Taylor's regression analysis for the shorter time period found a net retreat at the southern end of the beach with the remainder of the beach more subject to fluctuation than a clear trend.

Maximum Short-term variability

In addition to these analyses of the long-term trend, Gibb and Dunn have also commented on the historic short-term fluctuations.

Gibb (2001), using various data sources, concluded maximum short-term duneline fluctuations are typically 10 to 20m. In the area of the incipient foredune, fluctuations of 20 to 25m occur increasing to 30m near the mouth of the Hamanatua Stream. North of the Stream duneline fluctuations of 15 to 20m occur. He uses these estimates to create assumptions of maximum volumes of sand involved in short-term fluctuations (per m length of duneline): 105m^3/m from Tuahine Crescent to Wainui School; 110m^3/m from Wainui Stream to Wainui School; 155m^3/m from Wainui School to Hamanatua Stream; and 110m^3/m for northern Wainui Beach.

Dunn (2003) cautioned that the records place more emphasis on the southern more developed parts of Wainui compared to the undeveloped Okitu region. As a result, the magnitude of erosion north of Hamanatua Stream has not been completely captured to the same extent, or to the same extent, as the southern region.

Dunn's research (Dunn 2001, comms) shows that the magnitude of episodic storm erosion (i.e. short-term variability due to storm events) is significantly greater than the long-term shoreline trends. These temporary changes occur regardless of the long term trend and drive the most destructive shoreline departures at Wainui Beach. She cautions against interpreting the large episodic fluctuations of the shore line as long-term erosion. She advises that the rapid bursts of erosion created during storms should be viewed as temporary redistribution of sand as, in general, rapid sand loss (erosion) during storms is followed by slow sand return (accretion).

Reinen-Hamill advises (comms) that while there are various drivers that are likely to have contributed to long term erosion, he agrees that erosion processes are dominated by rip currents during storms.

The Key Stakeholder Forum, on the basis of the expert advice, summarised their understanding of erosion processes and trends as follows.

Key Stakeholder Forum understanding on HOW BEACHES WORK:

- No parts in nature only WHOLES – beach is only part of a system.
- Sand is meant to move and is a vital part of the protective system of a beach.
- Moving sand offers natural protection.
- Sand dunes act as a store of sand for beach.
- Storms, rips, surges will strike and cause erosion.
- Sea level rise occurring at faster rate than tectonic uplift.

Key Stakeholder understanding on HOW WAINUI BEACH WORKS:

- Beach needs to be considered as a whole (part of a broader whole) although geometric variances [Tauheni Point to Makorori Point].
- Beach (as modified by man) is thin sand veneer over a variable rocky basement with thin layer of cobbles for some parts of beach.
- Beach considered to be mostly closed.
- Generally sand movement is "in and out" as well as along beach.
- Cyclic cut and fill of sand occurring along beach from storm events.
- Southern end more sand movement than northern end in southerly storms.
- Large storm events have caused significant erosion.
- Astronomical (tidal) cycles coincide with significant erosion.
- Sea level rise occurring at faster rate than tectonic uplift.

Key Stakeholder understanding on LONG TERM EROSION v SHORT TERM EROSION:

- There is cyclical erosion with storm events and long term erosion.
- Predominant effect of waves from the south which, in conjunction with lowering of the reef, impacts on beach rotation.
- If one holds the control point between the beach and cliff it has the potential to slow the long term land retreat but will not prevent long term rotation of the beach. But there is also cyclical erosion from a NE swell.
- Tuaheni Point is eroding over time (about 1 to 2 metres per decade landward retreat – Gibb Report 2001).
- There is short term erosion of Makorori Point that may increase sand movement to the north and loss from the beach system.
- Also noting: When there is a lot of stormwater runoff from the land, which permanently erodes property, the beach takes a long time to rebuild.

2.5.3 Future Erosion Projections

Taking the cue from the past, one would expect future erosion processes at Wainui Beach to continue to be dominated by storms and rip currents; resulting in large short-term variability with rapid erosion events followed by slow accretion. Climate change may increase the severity of storms and result in an even more dynamic shoreline. Multi-decadal climatic and lunar cycles will also continue to impact on the tides and the severity and frequency of storms. In addition, sea level rise due to climate change is expected to cause shoreline retreat over the long term and in excess of the area directly inundated.

As discussed above, erosion of the reefs and headlands may also be altering the wave energy and currents, perhaps causing rotation of the beach and/or enhancing the potential for loss of sand from the system to enhance long term erosion. However, there remains uncertainty and differences of opinions between experts on these possible processes.

In terms of quantifying and mapping the risk, in 2003 Gisborne District Council adopted Gibb's 2001 hazard zone assessment in its RMA Plans. This consists of four hazard zones representing, as shown in figures 6 and 7. The hazard zones are described as follows:

- **Extreme Risk** – is or is likely to be subject to adverse effects from short-term duneline fluctuations and storm cuts. A high probability of being adversely affected at any point in time but more particularly during a 20 to 30 year-long negative IPO phase. This essentially represents the risk due from episodic erosion.
- **High Risk** – is likely to be subject to a net shoreline retreat from the combination of sea level rise by 2050 and any historical long-term retreat.
- **Moderate Risk** – is likely to be subject to a net shoreline retreat from a sea level rise by 2100 and any historical long-term retreat.
- **Safety Buffer** - likely to be affected beyond 2100.

The hazard zones average about 50m in width but in some places extend up to 83m inland. The coastal hazard zones affect all the properties fronting the beach south of Hamanatua Stream. North of the stream the reserves are affected.

Gibb's methodology for developing the hazard zones relies on several factors including: his calculation of historic shoreline erosion from aerial surveys; his estimate of the maximum storm cut for different parts of the beach, an estimate of long term erosion from sea level rise for the 50 and 100 year timeframes (based on the "Bruun Rule"), and a safety factor.

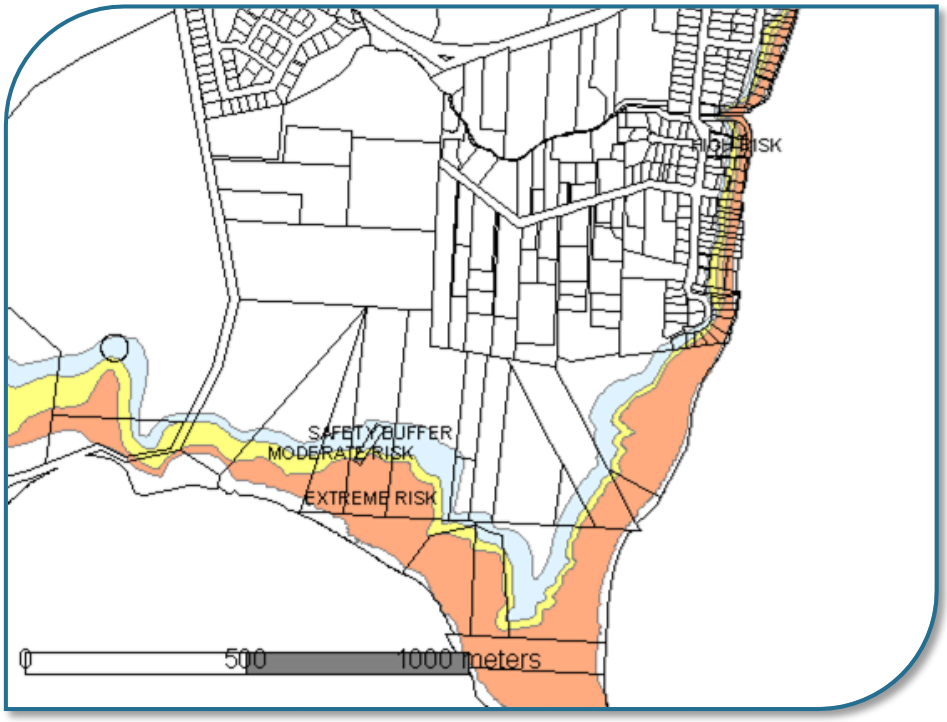


Figure 6

Figure 7

Strategy participants have questioned whether Council remains confident of the hazard zones and some pointed out the large reduction in the width of the hazard zones from the 1995 assessment to the 2001 assessment (in some places the width of the coastal hazard zones decreased by up to 60%). There appears to be common acceptance among the experts of the large magnitude of episodic, storm-drive erosion. However, some strategy participants questioned whether the hazard zones over-project long term erosion over the 100-year timeframe.

The commissioners for the 2010 rock revetment application, who heard evidence from Dunn and other scientists, recommended that the hazard zones be reviewed. The commissioners thought the primary risk was from episodic storm events and were less convinced that the beach was experiencing any long term trend for retreat (although accepting that climate change may result in some net retreat).

We note that Dunn expressed significant concerns about Gibb's review of the hazard zones in her submission on the plan change and evidence at the hearing in 2003. She felt there were several shortcomings in the analysis and recommended that larger coastal hazard zones be retained under a precautionary approach.

Reduced sea level rise projections were the primary reason for the large reduction in the width of Gibb's hazard zones in 2001. Gibb's 1995 assessment used the International Panel on Climate Change's (IPCC) 1990 "most likely" mid range projections for sea level rise of 0.3m above 1990 levels by 2050 and 0.66m by 2100. Gibb's 2001 assessment allowed for the IPCC's reduced 2001 sea level rise projections of 0.14m-0.18m above 1990 levels by 2050 and 0.31m-0.49m by 2100. Gibb also reduced his allowance for long-term erosion trends in his 1995 assessment.

As discussed in section 3 of this report, Policy 24 of the NZCPS sets out the basic formula for assessing coastal hazards. This requires consideration of the physical drivers and processes that cause coastal change including sea level rise; short-term and long-term natural dynamic fluctuations of erosion and accretion; geomorphologic character; the effects of climate change on these considerations as well as storm frequency and coastal sediment dynamics.

It also requires consideration of other factors related to coastal flooding and tsunami rather than erosion. Council must also take into account national guidance and the best available information on climate change in assessing the hazard risks.

Reinen-Hamill was asked to provide a high-level review on Gibb's 2001 hazard zones (Reinen-Hamill, 2013). He found that the deterministic type approach used by Gibb to evaluate areas that may be subject to coastal hazards is still appropriate today and can be considered good practice. However, he would recommend refinement of the detail of the approach to provide a consistent and transparent process. He also found an issue with the description of the [high and moderate] hazard zones in the District Plan, saying the zones should be described as areas of erosion susceptibility and are not predictions of where the shoreline will be within a certain time period.

Reinen-Hamill (2013) says there is additional information that can be used to review and update the assessment, including new sea level rise projections. The Ministry for the Environment's current (2008) guidance on sea level, (based on IPCC projections) recommends planning for at least 0.5m and up to 0.8m by the 2090s, relative to 1980-1990 average levels (Ministry for the Environment, 2008). These are greater than the projections incorporated into Gibb's 2001 hazard zone assessment.

Reinen-Hamill reports that the IPCC's fifth assessment report, which is expected in September 2013, is likely to identify sea level rise in the same order as identified in the Ministry's 2008 guidelines for the lower bound level but potentially higher. He also says there is new information on historic cliffline retreat (R) and the extent of seaward slope subject to failure (S) incorporated in Gibb's assessment. Reinen-Hamill believes these factors, particularly the increased allowance for sea level rise, are likely to result in changed (larger) hazard zones.

It is noted that increased sea level rise projections would not affect the Extreme Hazard Zone as it does not include an allowance for sea level rise, but would affect the High Hazard Zone and Moderate Hazard Zone.

Reinen-Hamill (2013) also commented on the extent to which protection works should influence the hazard zone assessment. He comments that adequately designed protection works can provide protection from shoreline retreat for a period of time. However, the existing infrastructure along Wainui Beach comprises a range of construction techniques and types and generally would be considered under-designed for the environment. He recommends that hazard zone assessments be undertaken without consideration of the protection works.

2.5.5 What is at Risk?

The coastal erosion risk arises from the interaction of coastal processes with human use, property and infrastructure.

The settlement of Wainui began to establish from about 1912, with the construction of the first European domestic structures. Overtime, the character of the community changed, from a holiday resort with small baches to a residential district with larger houses (Komar 1996). South of Hamanatua Stream, on the primary dune, is now about 2km of intense residential development interspersed with public beach access reserves. North of the stream the beach is bordered by a 50-60m wide public recreation reserve. Houses to the north of the stream are located landward of State Highway 35 and the reserve and are well set back from the beach.

The coastal hazard zones extend over 113 properties south of Hamanatua Stream. Table 2 sets out the area of land within the hazard zones in these properties.

HAZARD ZONE	AREA (HA)	% OF TOTAL AREA
Extreme Hazard	3.42	26%
High Hazard	1.41	11%
Moderate Hazard	2.07	15%
Safety Buffer (estimate)	1.5	11%
Outside Hazard Zones (estimate)	4.9	37%
TOTAL	**13.26**	**100%**

Table 2

The 2013 rating valuation database records the total capital value of these 113 properties as $102 million. Of this, $75 million (73%) is attributed to land value. It is noted that these valuations are for rating purposes only and calculated using mass appraisal techniques; the actual market value may be quite different.

All but two properties are developed with dwelling units. The two undeveloped properties are severely affected by the coastal hazard zones and appear to be held in association with neighbouring properties.

Council staff have estimated the number of dwellings primarily affected by each hazard zone (i.e. with at least 25% of the floor area in the hazard zone), as shown in table 3.

HAZARD ZONE	NUMBER OF DWELLINGS	% OF DWELLINGS
Extreme Hazard	28	25%
High Hazard	11	10%
Moderate Hazard	31	27%
Safety Buffer (estimate)	31	27%
Outside Hazard Zones (estimate)	10	9%
No dwelling	2	2%
TOTAL	**113**	**100%**

Table 3

Figure 8 below, shows the location of properties (shaded red) with dwellings in the Extreme Hazard Zone. We have estimated from aerial photos that around 10 of the 28 properties with dwellings in the extreme hazard zone have sufficient land area outside the Extreme and High Hazard zones to allow for relocation.

About 4 of the 11 properties with dwellings in the High Hazard zone have sufficient land area outside of the Extreme and High Hazard zones to allow for relocation.

Figure 8 – Properties with houses in the Extreme Hazard Zone

The capital value of the 39 properties with at least 25% of the floor area in the Extreme or High Hazard zones is $35 million.

Another asset in the Extreme and High Hazard zones is the Wainui Surf Club north of Hamanatua Stream. Council reserves are also at risk of erosion, but no significant built assets are at risk.

2.5.6 Management of the Erosion Risk

(i) Protection Works

In response to erosion and its threat to properties, there has been a long history of the construction shore-protection structures; with the earliest structures dating back some 90 years. A summary of protection structures from 1920's to 1990's follows (Komar 1996, Dunn and de Lange 2003, 2003 WBMS, *Gisborne District Council v Falkner* (1994)):

- ***Late 1920's***
  - The "Pyke's" (Kryzanich) concrete wall built south of the Stock Route.
- ***1940's***
  - Sand or cobble filled Tar Drums placed at various places north of Pare Street to Wainui School.
- ***1950's***
  - Timber walls and drums filled with cobble/sand/concrete tied together.
  - Manuka Fascines are used at various parts of the central beach in times of severe erosion.
- ***1960's***
  - 28 sheet pile spur groynes (18m long and 100m apart) installed south of Hamanatua Stream.
  - Rail iron-log seawall (backfilled with rock) constructed between the 2 southernmost groynes and then extended almost to Lloyd George Road.
  - A similar seawall was constructed near Wainui School to replace the manuka/willow branch wall.

- ***1970's***
    - Railway iron and longitudinal log walls.
    - Gabion baskets filled with cobbles and held by timber posts placed along the length of the beach from Lloyd George Road to Hamanatua Stream as well as additional rail iron-log walls. The groynes were later reinforced with iron rail tracks following collapse of 40m of the protection works.
    - Timber stream trainer groyne placed at Wainui Stream, "The School" and Hamanatua Stream.
- ***1980's***
    - Quarry rock placed behind rail iron-log walls.
- ***1990's***
    - Various private and public rock works undertaken.
- ***2000's***
    - Wainui Beach Management Strategy adopted to identify management options.
    - First rock revetment promoted by the Wainui Beach Management Strategy installed in 2007 to replace the rail iron-log wall in front of Tuahine Crescent properties.
    - Temporary private protection sandbagging was used at the "No access" area of central Wainui Beach.

A plan of the protection works from 1974 to 2007 is included in Appendix 2. As can be seen, layers of protection works extend from Tuahine Crescent in the south to the training groyne by the Hamanatua Stream.

Prior to 1960, all works were privately sponsored but in the 1960s central government and local government (first was Cook County Council) began to support erosion works. The 28 groynes were the first public scheme and were funded by central government subsidy, a loan secured by rates from the developed area and a contribution from general county funds (*Gisborne District Council v Falkner* (1994)). In the 1970's the East Cape Catchment Board incorporated the best of the existing works into a protection works schemes for maintenance. However, private property protection works have continued including rip rap rockworks following the storms of the 1990s (Dunn and de Lange 2003, *Gisborne District Council v Falkner* (1994), GDC LTCCP 2004-2014).

Following the damaging storms of 1992 protection works became more contentious and through 1992 to 1999 there were a series of Environment Court and High Court hearings and appeals over protection works. In December 1997 the Council resolved to discontinue all beach works within the framework of the protection scheme. However Council re-entered the protection scheme in 2000 and reintroduced a rating area, initially as a one-off rate for works in 2000, in response to a favourable poll of property owners. A working party was formed to look at options and this ultimately led to the adoption of the Wainui Beach Management Strategy in 2003.

Council's Revenue and Finance Policy now collects two rates relating to the protection works: 1) a targeted rate on 6 Tuahine Crescent properties to recover the loan for constructing the 2007 rock works; and 2) a targeted rate for general maintenance of the protection scheme and associated minor capital works. Council's Ten Year Plan anticipates collecting around $18,000 per year (plus inflation) for general maintenance and associated minor capital works.

(ii) Planning Responses to Restrict Development

In recent decades there have also been planning responses to coastal erosion that seek to identify the hazard and limit further at risk development. The first coastal hazard assessment for planning was carried out in 1980 by Dr Jeremy Gibb for the Cook County Council. The resulting hazard zones were adopted in the District Planning Scheme in 1982 with associated rules to restrict subdivision and building.

In 1995 Dr Gibb produced a further assessment, which was reviewed in 2001. The 2001 hazard zones (refer above) remain in the Council's RMA plans with associated rules to restrict development:

- Extreme Risk – Subdivision for new development and new buildings are prohibited; and coastal protection works and building alterations or additions require resource consent as a discretionary activity.
- High Risk – Subdivision for new commercial or residential development is prohibited. New commercial or habitable development and alterations or additions to buildings require resource consent as a discretionary activity.
- Moderate Risk - Subdivision and residential or habitable development requires resource consent as discretionary resource consent.
- Safety Buffer – Subdivision needs resource consent.

(iii) Wainui Beach Management Strategy 2003

The Wainui Beach Management Strategy 2003 (WBMS 2003) sets out a management strategy for the future of the Wainui Beach foreshore/foredune areas and Tuaheni Point/Headland under the following vision statement:

> *"The protection and enhancement of Wainui Beach and adjoining reserves for the use and enjoyment of future generations."*

The WBMS 2003 recognises that different parts of the beach have different characteristics that require different management. Recommendations include:

- retirement from grazing on Tuaheni Point,
- removal of some existing beach protection works,
- construction of new and modification of existing rock revetments,
- use of a cobble berm/dynamic revetment with rock revetments,
- geotextile bag protection works,
- retreat of existing dwellings most at risk from erosion,
- beach scraping trials to facilitate dune development,
- dune and bank planting and dune care education,
- carparking restrictions.

A draft of the WBMS 2003 was peer reviewed by Dr Paul Komar, a consulting oceanographer, and the final WBMS 2003 incorporates changes as a result of this peer review; notably a cobble/"dynamic" berm addition to the proposed revetment.

While focusing on erosion issues, the WBMS 2003 also includes recommendations relating to other beach management issues such as the development of additional horse accesses.

Following adoption of the WBMS 2003 its recommendations were pursued by Council. Significant was the replacement of the rail iron-log wall at Tuahine Crescent south of the concrete groyne in 2007.

However, in 2010 Council's Rivers & Land Drainage Section was refused resource consent for removal of the rail iron-log wall south of Tuaheni access way and replacement with a sloping rock revetment as promoted by the WBMS 2003 (although the design differed in some matters to the design promoted by Dr Komar and incorporated in the 2003 WBMS).

As the rock revetment was a major component of the 2003 WBMS the refusal of resource consent placed uncertainty over the WBMS 2003 and was a major impetus for this review.

The concerns of the commissioners that heard the application for the rock revetment included:

- Insufficient information and analysis of the potential impacts of the structure.
- Analysis of the hazard – the commissioners questioned long-term erosion and thought the hazard zones should be reviewed.
- Public access - access along the beach may be reduced because of the structure when beach widths and sand levels are low.
- Natural character – the structure would be bigger and generally more visible than existing structures when sand levels are low; the rocks would not be in sympathy with the beach when exposed.
- Impacts on the beach – potential for scouring/erosion of the shelf underlying the sand.
- Design of and location of the structure – the scale was not designed for the largest events and the commissioners were worried that there would be scale "creep" (i.e. future enlargement of the structure); not all the houses were at immediate risk along the proposed length of the structure; the design was not consistent with Komar's recommendations.
- Public support – not all the property owners supported the application.
- Lack of consideration of alternatives, in particular dune enhancement.

(iv) Asset Relocation or Abandonment (Retreat)

Removal or relocation of assets away from the beach front reduces exposure to the hazard and is, therefore, another method to manage the risk. Assets may also be abandoned in recognition of their vulnerability to erosion.

Public policies of retreat have been discussed for nearly 40 years, if not longer. In 1975 the Soil Conservation and Rivers Control Council (a central government regulatory body established under the Soil conservation and Rivers Control Act 1941) wrote to the Poverty Bay Catchment Board stating it could give no guarantee of permanent protection and was unwilling to enter into further commitments. The chairperson of the Council later issued a public statement in 1974 to the effect that this body firmly opposed the issuing of more building permits on such coastal areas and would encourage the eventual withdrawal of residences from Wainui Beach (*Gisborne District Council v Falkner* (1994)).

In 1992, the Council (and the Department of Conservation) voiced concern that a coastal protection scheme was not an effective long-term option for the area and that managed retreat was a more appropriate long-term policy. The Council then resolved to discontinue all beach works within the framework of the Wainui Beach Foredune Protection Scheme (*Gisborne District Council v Falkner* (1994)). While Council later re-entered the scheme and adopted the 2003 WBMS, retreat is still promoted in the 2003 WBMS, particularly for the section of the beach from Wainui Stream to Oneroa Road ("Stock Route").

According to resident accounts, two or three houses are thought to have been relocated on their sections (including one in Pare Street following the severe storms in 1955 and another following the severe storms of the early 1990's). Only one house is thought to have been lost to the sea (during the 1955 storm).

(v) Dune Enhancement

Dunes provide an erosion buffer to help protect properties behind and provide a sand store for the beach system. The most significant dune enhancement initiative at Wainui Beach is the Wainui Beach Coast Care Group.

The initial group was formed in 2010, following a meeting with Bay of Plenty Coast Care representatives facilitated by Gisborne District Council in response to actions adopted in its WD Lynsar and Wainui Beach Reserves Management Plan. The group comprises beachfront residents and interested beach users. Its primary interest is mitigation of beachfront erosion by planting to encourage dunes to form. It is accepted that the dunes may be eroded from time-to-time: the group's work aims to increase dune volume and encourage dunes to rebuild more quickly.

Initial pilot planting was completed south of the Hamanatua Stream with plants provided by Gisborne District Council (and extending private planting that had already begun). Nearly 4,000 grasses have now been planted between the Hamanatua Stream and the School Dip and on the bare faces in Lysnar Reserve. "Keep off the Dunes" signs have also been installed. They group intends to continue restoration work to be progressed successively in incremental steps north and south of Hamanatua Stream. The work plan involves planting native sand binding grasses on the front dunes, native flaxes and shrubs higher up the dunes and minimizing damage to the plants by human traffic with fencing, flax barriers, signage and education.

Council has budgeted about $10,000 per annum (plus inflation) in its Ten Year Plan to support dune care initiatives in the region with planting, signage materials, etc. Currently around $5,000 per year is being directed to Wainui Beach.

(vi) Education and Information

Information on coastal hazards for public education is provided in various ways, including through implementation of Council's statutory responsibilities, landuse planning and advocacy. Some of the main activities are discussed below.

- Council has facilitated presentations by experts on coastal hazards and coastal processes – e.g. during the establishment of the Wainui Coast Care Group and initiating the WBMS review.
- Notices informing of the risk of coastal hazard (section 72 notices under the Building Act) are placed on titles of properties undertaking building works in the coastal hazard zones.
- The District Plan and Coastal Plan provide information about hazards, including the coastal hazard zones.
- Land Information Memorandums (LIMs) and Project Information Memorandums (PIMs) are a key method for people purchasing property or contemplating a building project to find out about hazards. These reports are issued by Council and provide information about known hazards. Council uses the Gibb coastal hazard zones as the trigger to inform of erosion hazard at Wainui Beach.

  It is standard practice is to inform the applicant of the hazard zones and the availability of the Gibb report. It also informs the applicant that section 72 notices may be lodged on the title in relation to future building consents and that these may affect resale values and the ability to gain insurance.

(vii) Insurance

Insurance is another method to manage risk; it enables the risk to be spread or transferred.

In New Zealand, the Earthquake Commission (EQC) provides natural disaster insurance for residential land. A property owner automatically has EQC cover for their land if they have a current private insurance policy for their home that includes fire insurance (and most do). "Natural Disasters" that are covered by the insurance are defined in the governing legislation (s2, Earthquake Commission Act 1993). In the case of residential land, this includes a storm or flood. When asked for clarification EQC advised that when they have a claim for land damage at a coastal property caused by the action of the sea, there must be an identifiable storm that caused the damage. The storm must be of sufficient velocity to cause larger than normal waves to damage the land. This damage must all be from an identifiable storm at the site of the damage. Ongoing surge damage is not from the identifiable storm and would be excluded. The landowners are compensated only for that land that has been damaged by the storm and not for any land that was subject to previous coastal erosion (EQC comms).

The land insured under the EQC Act is also defined in section 2 of the Earthquake Commission Act 1993. EQC advise that essentially it covers the 8 metres under and around the dwelling and structures appurtenant, and the main access way up to 60 metres from the dwelling. The cover is limited to the value of that land subject to limitations set out in section 19 of the legislation (EQC comms).

Private insurance generally does not provide any additional cover for land.

EQC also provides natural disaster insurance for residential homes and contents. However, it appears that the legislation's definition of natural hazards does not extend to coastal erosion in the case of loss to homes and contents. While "natural landslip" is identified as a natural hazard for the purpose of the legislation, this specifically excludes the movement of ground due to erosion (s2 Earthquake Commission Act 1993).

Private insurance may also be limited for losses to homes along Wainui Beach and their contents. Members of the insurance industry told us that disclosure of a risk such as erosion is likely to result in its specific exclusion in an insurance policy. The risk of erosion at Wainui is a known issue and insurance policies generally require disclosure of such material facts; and failure to disclose can result in declining of any claim. In any case, some standard policies examined specifically exclude losses arising from erosion. However, these are general comments and actual cover will depend on the contracts between each property owner and insurance company.

2.6 Statutory and Policy Framework

2.6.1 Introduction

The Wainui Beach Management Strategy will be a non-statutory document i.e. it is not developed as a specific strategy envisaged in legislation. However, it must be consistent with the planning and policy framework that governs Council and the management of the environment and natural hazards.

The key legislation, policies and plans for the development of the Strategy are shown in figure 9 and discussed further below.

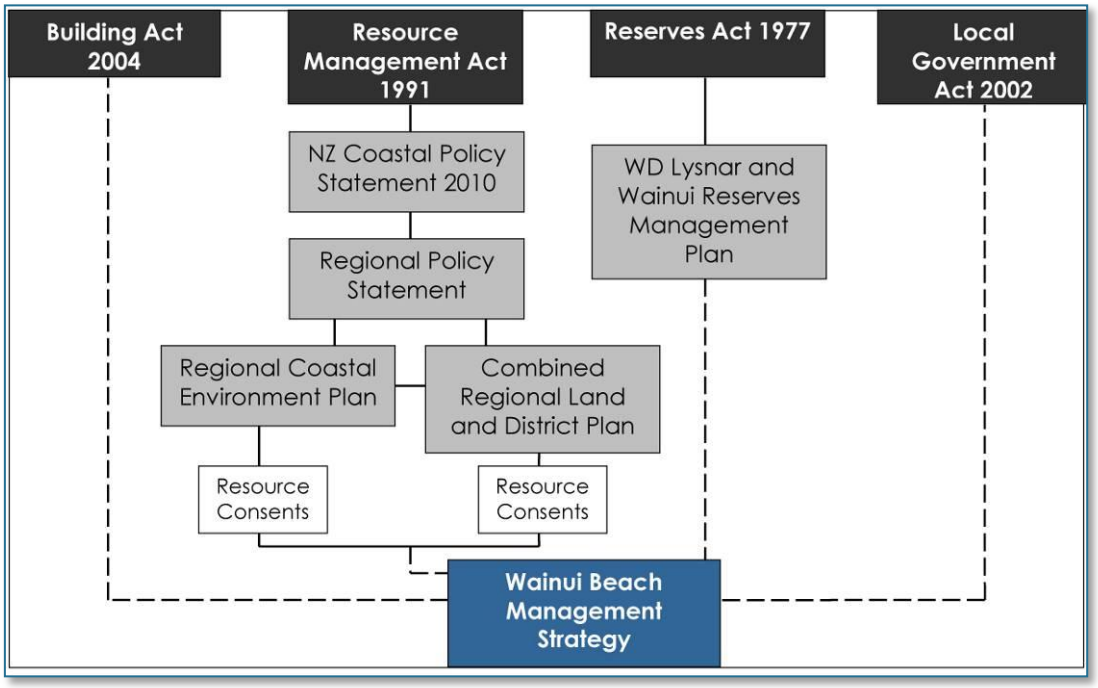


Figure 9 - Legislative and Policy Framework

2.6.2 Resource Management Act 1991; Associated Plans and Policy Documents

The Resource Management Act 1991 (the RMA) is New Zealand's leading piece of environmental management legislation. Plans and policy documents developed under the RMA are a critical component of how the RMA manages the environment. These set out the principles that guide decision-making, as well as rules that establish when a resource consent must be sought from Council for an activity. Plans and policy documents are developed by both central and local government. Council's plans and policy documents help Council to achieve its specific RMA functions, including those relating to the management of natural hazards (ss30 and 31 RMA).

Plans and policy statements include:

- **New Zealand Coastal Policy Statement (NZCPS)-** developed by the government to guide the day-to-day management of the coastal environment.
- **Regional Policy Statement (RPS)**- developed by the Council to set the basic direction for environmental management in the region.
- **Regional Coastal Environment Plan (Coastal Plan) –** developed by the Council and provides more detailed policy and rules for the Coastal Environment
- **Combined Regional Land and District Plan (District Plan)–** developed by the Council to provide detailed policy and rules for landuse.

Figure 10 illustrates the jurisdiction of the plans and policy statements.

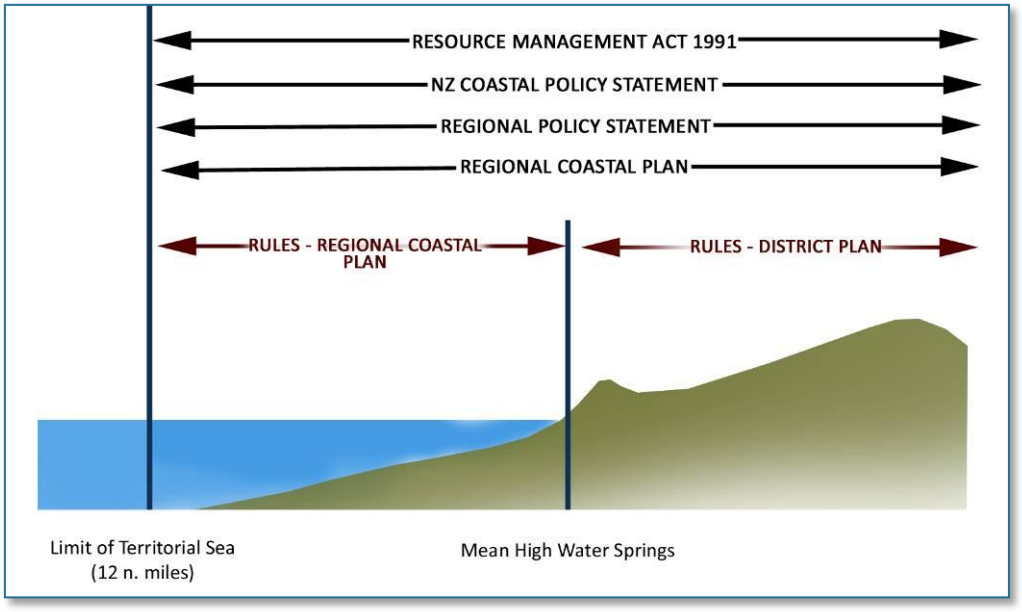


Figure 10 - Jurisdiction of RMA Documents

Key parts of the RMA and RMA plans and policies points are outlined below by topic.

(i) Natural Character

Preservation of natural character of the coastal environment and its protection from inappropriate subdivision, use and development is a matter of national importance that must be recognised and provided for under the RMA (s6 RMA). Adverse effects on natural character must be avoided in areas with outstanding natural character and avoided, remedied or mitigated in other areas (policy 13 NZCPS). The restoration or rehabilitation of natural character must be promoted (policy 14 NZCPS).

The natural character of the coastal environment is not defined by the RMA. However a widely-quoted definition indicates there is a spectrum of natural character from highly modified to pristine (Boffa Miskell, 2000-2002):

> *The degree or level of natural character within an area depends on:*
>
> 1. *The extent to which natural elements, patterns and processes occur;*
> 2. *The nature and extent of modifications to the ecosystems and landscape/seascape.*
>
> *The highest degree of natural character (greatest naturalness) occurs where there is least modification.*
>
> *The effect of different types of modification upon natural character of an area varies with the context, and may be perceived differently by different parts of the community.*

Natural character does not just relate to visual elements but can include natural elements, process and patterns and the natural movement of water and sediment, etc (policy 13 NZCPS; policy 2.1.4C Coastal Plan). All parts of the coast have some degree of natural character that is required to be preserved, unless doing so would not meet the purpose of the Act (intro 2.1.1 and policy 2.1.4A Coastal Plan). Landforms such as coastal dunes contribute strongly to natural character because of their appearance (policy 2.1.4L Coastal Plan). Development should be set back from the coastal marine area where practicable and reasonable to protect natural character, open space, public access and amenity values (policy 6 NZCPS).

Use and development should respect the natural landform and avoid modification of the landforms, strong visual contrasts and visually obtrusive buildings and structures (policy 2.1.4L Coastal Plan).

(ii) Surf Breaks

Protection of surf breaks is a matter of general relevance under the RMA, as surf breaks contribute to the natural character of the coastal environment and also social and economic wellbeing. For Wainui beach, surf breaks are of particular importance as "Wainui - Stock Route – Pines – Whales" is included in the list of surf breaks of national significance. The NZCPS requires protection of the surf breaks by ensuring that activities in the coastal environment do not adversely affect the surf breaks; and avoiding adverse effects of other activities on access to, and use and enjoyment of the surf breaks (NZCPS policy 16).

There is local confusion about the extent of the surfbreak of national significance and why stock route, pines and whales have been specifically identified from a much larger group of common names for referring to breaks along the beach. A report for Council on surf break identification suggests the NZCPS references may be "token representations of the entire beach system as a whole" (Perryman 2011).

(iii) Outstanding Landscapes and Features.

The protection of outstanding natural features and landscapes from inappropriate subdivision, use and development is also a matter of national importance (s6 RMA).

Outstanding natural landscapes are also not defined by the RMA. However, case law identifies a number of matters relevant to the assessment of the importance of a landscape, such as aesthetic values, historical associations, and its expressiveness in terms of how well it shows the processes leading to its development (*Wakatipu Environmental Soc Inc v Queenstown Lakes DC* [2000], Pigeon Bay (2003)).

Natural features and landscapes identified by the Boffa Miskell (1995) study as outstanding in terms of the RMA are mapped in the Coastal Plan. These include Tuaheni Point at the south end of the beach. Specific rules apply to these outstanding landscapes (rules 4.3.6-4.3.1.3).

The government is currently considering combining sections 6 and 7 of the RMA into one list of matters for which persons exercising functions shall recognise and provide. Proposed changes include limiting the matters relating to outstanding landscapes and areas of significant indigenous vegetation / significant habitats to those that are "specified" (which, presumably, would include those specified in the District Plan and Coastal Plan).

(iv) Ecosystems; Habitats and Indigenous Vegetation

The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna is another matter of national importance (s6 RMA). The RMA also identifies "other" matters that, although not stated as matters of national importance, must be given particular regard, including the intrinsic value of ecosystems (s7 RMA).

Areas of significant conservation value are mapped in the Coastal Plan and include Makorori Point, Okitu Reserve, Wainui Beach Esplanade and Tuaheni Point. Specific rules apply to these areas (rules 4.3.6 - 4.3.1.3).

Both the NZCPS and the Coastal Plan promote restoration of the natural character by using indigenous species, preferably of local genetic stock (policy 14 NZCPS; method 2.2.5F Coastal Plan).

(v) Public Access to and along the Coast

The maintenance and enhancement of public access to and along the coastal marine area is another matter of national importance of relevance to the Strategy (s6 RMA).

The NZCPS objectives include to maintain and enhance public open space qualities and recreational opportunities of the coastal environment. Ways this is to be done include recognising that the coastal area is an extensive area of public space for the public to use and enjoy; and recognising the potential for coastal processes, including those likely to be affected by climate change, to restrict access to the coastal environment and the need to ensure that public access is maintained even when the coastal marine area advances inland (objective 4 NZCPS).

Policies in the NZCPS elaborate that provision for public open space is to be made by, amongst other things, considering the likely impact of coastal processes and climate change so as not to compromise the ability of future generations to have access to public open space (policy 18 NZCPS).

Policies for maintaining or enhancing public walking access include requiring avoidance or mitigation of any loss of public walking access resulting from subdivision, use or development (policy 19 NZCPS). Policies also include identifying opportunities to restore public walking access, for example where physical access for people with disabilities is desirable; or the long-term availability of public access is threatened by erosion or sea level rise; or access to areas or sites of historic or cultural significance is important; or subdivision, use, or development of land adjacent to the coastal marine area has reduced public access, or has the potential to do so.

(vi) Participation and Values of Maori; Treaty of Waitangi

The RMA also identifies the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga, and the protection of protected customary rights, as matters of national importance. The "other" matters that, although not stated as matters of national importance, must be given particular regard, include "Kaitiakitanga" (s7 RMA). The RMA also requires that the principles of the Treaty are taken into account (s8 RMA).

Opportunities must be provided for Maori involvement in decision making and the continuing cultural relationships of tangata whenua with areas of the coastal environment must be recognised (policy 2 NZCPS).

(vii) Natural Hazards

Council's functions under the RMA include management of the control of the use of land for the purpose of avoidance or mitigation of natural hazards (s30) and the control of the actual or potential effects of the use, development or protection of land, including for the purpose of the avoidance or mitigation of natural hazards (s31). The "other" matters that must be given particular consideration in performing this function include "the effects of climate change" (s7 RMA). The government is currently considering including "the risk and impacts of natural hazards" as a one of the list of key matters Council for which must recognise and provide in a new combined principles section of the RMA.

The New Zealand Coastal Policy Statement (NZCPS), Coastal Plan and District Plan all contain objectives and policies relating to coastal hazards or natural hazards in general. Policies 24 to 27 of the NZCPS are particularly important.

Policy 24 requires Council to identify areas in the coastal environment that are potentially affected by coastal hazards, giving priority to areas at high risk of being affected. (Risk is related to the level of development and the probability of the event effecting the development). Hazard risks over at least 100 years are to be assessed having regard to a range of factors:

(a) physical drivers and processes that cause coastal change including sea level rise;

(b) short-term and long-term natural dynamic fluctuations of erosion and accretion;

(c) geomorphological character;

(d) the potential for inundation of the coastal environment, taking into account potential sources, inundation pathways and overland extent;

(e) cumulative effects of sea level rise, storm surge and wave height under storm conditions;

(f) influences that humans have had or are having on the coast;

(g) the extent and permanence of built development; and

(h) the effects of climate change on:

(i) matters (a) to (g) above;

(ii) storm frequency, intensity and surges; and

(iii) coastal sediment dynamics;

taking into account national guidance and the best available information on the likely effects of climate change on the region or district.

Policies 25 to 27 deal with management of coastal hazards. These are to be read in light of objective 5 of the NZCPS:

To ensure that coastal hazard risks taking account of climate change are managed by:

- *locating new development away from areas prone to such risks;*
- *considering responses, including managed retreat, for existing development in this situation; and*
- *protecting or restoring natural defences to coastal hazards.*

One might summarise that, as a general principle, these policies and objective 5 require Council, in performing its RMA regulatory and policy functions, to focus on management approaches that reduce or avoid the risk through locating development away from harm. These provisions also guide Council in its provision of infrastructure. New development or redevelopment that would increase the risk must be avoided; and redevelopment/landuse changes that would reduce the risk (such as managed retreat by relocating or removing structures and abandonment of structures in extreme circumstances) are to be encouraged (policy 25 NZCPS). The local RMA documents contain similarly aim for development patterns that avoid or mitigate risk (objectives 2.3.1 RPS; 3.8.3 Coastal Plan; 5.3 District Plan).

Importantly, policy 25 explicitly requires that hard protection structures are discouraged and alternatives, including natural defences, are promoted.

Policy 27 deals specifically with areas such as Wainui where significant existing development is likely to be affected by coastal hazards. It requires consideration of a range of options for reducing the risk including promoting long term sustainable risk reduction approaches including the relocation or removal of existing development or structures at risk; comparison of strategic options to the "do-nothing" option; and planning for transitional mechanisms and timeframes for moving to more sustainable options. Policy 27 is explicit on the need to focus on risk management that reduces the need for hard protection structures and similar engineering interventions. It also recognises that "hard protection structures may be the only practical means to protect existing infrastructure of national or regional importance, or to sustain the potential of built physical resources to meet the reasonable foreseeable needs of future generations" but this should be read in light of the other provisions that require a focus on risk reduction and discouragement of hard protection structures.

It is also critical to protect those features, including the dunes in Wainui/Okitu, that provide a natural defence against hazards (policy 26 NZCPS; objectives 3.8.3 Coastal Plan; and 5.3 District Plan; policy 5.4(8)).

A precautionary approach must be taken towards any activity whose effects on the coastal environment are uncertain, unknown, or little understood but potentially adverse (policy 3 NZCPS).

Coastal hazard zones and their associated objectives, policies and rules, are the primary method for giving effect to the NZCPS and other RMA policies and objectives for coastal hazard management. Four Hazard Zones (Extreme, High, Moderate and Buffer) were developed by Dr. Jeremy Gibb as explained above. These are mapped in the Coastal Plan and District Plan and the District Plan regulates new development in these zones. The coastal hazard overlays also help to protect natural defences by requiring consent for any activity that will alter the natural dune formation, beaches, wetlands or sand spits.

Structures to protect property or life from coastal hazards in the coastal marine area will require consent under the Coastal Plan and/or District Plan for a variety of reasons. The associated policy framework establishes that hard protection structures are to be discouraged and any hard protection structure will be subject to a rigorous test of costs v benefits, environmental impacts, etc (policies 25, 27 NZCPS; policy 3.8.4O Coastal Plan; policy 5.4(5) District Plan). Hard protection structures should not be located on public land "if there is no significant public or environmental benefit in doing so" (policy 27 NZCPS). For the Protection Management Area (which includes the outstanding landscapes and areas of significant conservation value at Makorori Point and Tuaheni Point, Okitu Reserve, Wainui Beach Esplanade and Tuaheni Point) property protection works must not be constructed that will adversely affect their values, unless such use better meets the purpose of the Resource Management Act (policy 3.8.4L Coastal Plan).

2.6.3 Local Government Act 2002 and other Local Government Acts

The Local Government Act 2002 (the Local Government Act) provides the general framework and powers for local government and is therefore a critical guiding document for the Strategy.

(i) Purpose of and Principles for Local Government

The Act provides a clear purpose for local government, which recognises that local authorities are able to provide community governance at the local level and make a significant contribution to social, economic, environmental and cultural well-being (s10 LGA):

(1) The purpose of local government is –

(a) to enable democratic local decision-making and action by, and on behalf of, communities; and

(b) to meet the current and future needs of communities for good-quality local infrastructure, local public services, and performance of regulatory functions in a way that is most cost effective for households and businesses.

*(2) In this Act, **good-quality**, in relation to local infrastructure, local public services, and performance of regulatory functions, means infrastructure, services, and performance that are—*

(a) efficient; and

(b) effective; and

(c) appropriate to present and anticipated future circumstances.

In considering its role a number of "core services" are listed to which a local authority must have particular regard. The list includes "the avoidance or mitigation of natural hazards" (s10 LGA).

The Act provides local authorities with "full capacity" to undertake activities and "full rights and privileges" for the purposes of undertaking its activities (s11A LGA). However, those powers are subject to the other provisions of the Act that impose some specific prohibitions, limitations, and requirements, including requirements for consultation and accountability. The powers are also limited by other Acts.

A series of principles are given to govern local authority actions. These include principles relating to the conduct of business in an open and transparent manner; making itself aware of community views; providing opportunities for Maori to participate in decision-making processes; collaborating and cooperating with other local authorities as appropriate; ensuring prudent stewardship of resources; and taking account of the likely impact on current and future communities (s14 LGA).

The Act also promotes accountability between local authorities and their communities and a long-term focus for decisions. It requires local authorities to prepare a ten-year plan, which is to be reviewed every three years. The plan describes Council activities, how its activities are to be funded, and includes key policies of the local authority.

(ii) Local Government Decision-Making

Part 6 sets out specific decision-making requirements. Local authorities must be structured in their decision-making by identifying all reasonably practicable options for achieving the objective of a decision and assessing those options by considering the benefits and costs in terms of the present and future well-being of the community. Local authorities are also required to consider the impact of each option on their capacity to meet present and future needs in relation to their statutory responsibilities (s77 LGA).

When a local authority undertakes public consultation, it must do so in accordance with the principles of consultation in Part 6 (s82 LGA). In brief, these principles require councils to -

- Provide easy-to-understand summaries of proposals and plans.
- Identify who will be affected by decisions and encourage them to make their views known to the council - councils also must give reasons for their decisions.
- Find out what all the practical options are for dealing with issues and carefully assess them.

Local authorities must ensure that they have processes in place for consulting with Maori. The Act also requires councils to establish and maintain opportunities for Maori to contribute to decision-making processes, consider ways in which they can foster the development of Maori capacity to contribute to decision-making processes, and provide relevant information to Maori (s81 LGA).

The extent to which local authorities comply with decision-making requirements can be proportional to the significance of the matter under consideration (s79 LGA). Council has a significance policy to provide guidance on the level of significance of a decision. It is considered that Council's decision on erosion management options for Wainui Beach has a moderate to high level of significance due to the potential affect on members of the public (particularly owners of beachfront properties and beach users), a history of wide public interest and controversy in erosion management at Wainui Beach and because some erosion management options have substantial cost.

(iii) Funding Local Government Activities

The Local Government Act 2002 also sets the powers and requirements with respect to funding Council activities. Council must manage its revenues, expenses, assets, liabilities, investments, and general financial dealings prudently and in a manner that promotes the current and future interests of the community (s101(1)).

For each activity it undertakes, Council has discretion as to funding sources but must consider a number of factors (s101(3)):

> *The funding needs of the local authority must be met from those sources that the local authority determines to be appropriate, following consideration of,—*
>
> *(a) in relation to each activity to be funded,—*
> *(i) the community outcomes to which the activity primarily contributes; and*
> *(ii) the distribution of benefits between the community as a whole, any identifiable part of the community, and individuals; and*
> *(iii) the period in or over which those benefits are expected to occur; and*
> *(iv) the extent to which the actions or inaction of particular individuals or a group contribute to the need to undertake the activity; and*
> *(v) the costs and benefits, including consequences for transparency and accountability, of funding the activity distinctly from other activities; and*
> *(b) the overall impact of any allocation of liability for revenue needs on the … community.*

Specific rating powers are provided in the Local Government (Rating) Act 2002. This Act is intended to provide flexibility to set, assess and collect rates, while also ensuring that rates are set in a transparent way and that ratepayers have processes and information to understand rates. The Act provides different methods for setting rates.

Rates can be levied from the whole community as general rates (a percentage of the property value) or annual general charges (fixed amount per rating unit). General rates can also be set differentially for different categories of land on the basis of factors including whether it is subject to rules in an RMA plan (e.g. hazard zone rules), provision of a service, or where the land is located. Rates can also be targeted for a specific purpose or function and calculated on the basis of factors such as floor space, value of improvements, the extent to which a service is provided. Council's can also invite ratepayers to make a lump sum contribution towards a capital project as an alternative to targeted rates.

Council must set out its policies for funding capital and operating expenses in a Revenue and Financing Policy adopted under the Local Government Act 2002 (s103).

(iv) LIMS

The Local Government Official Information and Meetings Act 1987 establishes the Land Information Memorandum (LIM) process. LIMs are reports issued by the Council providing information, known by the Council, about the land.

2.6.4 Building Act 2004

The Building Act 2004 (the Building Act) provides the framework for New Zealand's building control system and is supported by the Building Code. The Act does not guide the development of the Strategy to the same extent as the RMA or Local Government Act. Nonetheless, it provides a further piece of the puzzle of coastal hazard management, and is therefore relevant context.

Sections 71 to 74 deal with building on land subject to natural hazards, such as erosion (including coastal erosion) and inundation (including flooding, overland flow, storm surge) (s9 Building Act). Council must refuse to grant consent for a building or major building alteration if the land is subject to a natural hazard unless:

- adequate provision has been made to protect the building from the natural hazard; or
- the building won't accelerate or worsen the hazard and it is reasonable to grant a waiver, in which case a "section 72" notice will be registered on the title.

A section 72 notice records that the building work was granted on land subject to a natural hazard and details of the natural hazard concerned. Such notices may have implications for insurance.

Council uses local information including the coastal hazard overlays in RMA plans to identify land subject to natural hazards. Most consents issued for buildings within the coastal hazard overlays (extreme, high, moderate and buffer overlays) are issued subject to a section 72 notice.

The Building Act 2004 also governs the issue of Project Information Memorandums (PIMs). These are reports issued by Council prior or in conjunction with a building consent. Like LIM's, these provide known site and hazard risk information but in the context of a specific building proposal.

2.6.5 Civil Defence and Emergency Management Act 2002 and CDEM Group Plan

The Civil Defence Emergency Management Act also deals with hazards. While its focus is emergency management, it also deals with management of hazards in a broad sense. The Act requires that a risk management approach be taken when dealing with hazards. In considering the risks associated with a particular hazard, both the likelihood of the event occurring and its consequences must be considered. Civil Defence and Emergency Management (CDEM) Groups are established under the Act for each region. Their function is to coordinate emergency management and recovery, but also to plan for and promote risk reduction and readiness.

Each CDEM group produces a plan. This includes a prioritisation of hazards. Coastal erosion is not included as one of the 14 hazards presenting the most significant risks to the District and on which efforts should be focused.

2.6.6 Reserves Act 1977 and WD Lysnar and Wainui Beach Reserves Management Plan

The coastal strip along Wainui Beach contains thirty five parcels of reserve land managed by the Council. North of the Hamanatua Stream and seaward of the state highway are a number of larger parcels totalling 3.4ha, including Makorori headland.

Together these are referred to as "Lysnar Reserve", which reflects the gifting of a large portion of the reserve to Council by the Lynsar family. South of the stream are a series of small reserve parcels in between or in front of residential housing and jointly referred to as Wainui Reserve. These parcels were part of the Kaiti Block titled by the Maori Land Court to Ngati Rakai hapu of Te Aitanga a Hauiti and Te Wanau a Iwi hapu of Te Aitanga a Mahaki and have been acquired by the Council over the last 100 years.

All parks administered by Council under the Reserves Act 1977 require a reserve management plan (s41). Reserve management plans contain objectives and policies for the management, protection and future development of a reserve, and must:

> *"…provide for and ensure the use, enjoyment, maintenance, protection and preservation….and the development, as appropriate, of the reserve for the purpose for which it was classified…"(s41(3)).*

Development of reserve management plans help to ensure that Council's reserves are managed on sound principles and that, through consultation, the needs of the public are clearly identified.

For ease of reference and cohesive management Council developed a single management plan for the coastal strip– the WD Lysnar and Wainui Beach Reserves Management Plan.

The plan does not specifically address coastal hazards, but recognises that while providing critical foreshore protection, Wainui Beach Reserve and WD Lysnar Reserve have significant amenity values and are important recreation and tourism assets for Gisborne and the East Cape region. Relevant aspects of the management objectives and policies include:

- Identification of high use recreation nodes for management priority (Stockroute, Hamanatua Stream, Wainui Surf Club, Pines, Chalet and Northern Carpark).
- Facilities should be visually sensitive and appropriate within the coastal environment setting.
- Keep WD Lysnar Reserve in a natural state, consistent with the intention of the Lysnar family for the gifted portion of the reserve.
- Landscape Wainui Beach Reserve with native vegetation to enhance amenity values, mitigate foredune erosion and provide shade; help mitigate erosion and stabilise foredunes through planting native sand-binding grasses. Aim to extend the dune care programme along the length of Wainui Beach foreshore.
- Enhance biodiversity and mitigate erosion through planting riparian margins (Wainui and Hamanatua Streams) with native vegetation, in partnership with adjoining landowners.
- Design criteria for private accessways that cross the public reserve (encourages unpainted structures that follow the lay of the land and not built in a straight line)
- Develop a coast care programme in partnership with other groups to educate the public on the need to protect dune ecosystems.

In addition, the plan records important information about the reserves history, landscape, history, vegetation, wildlife and recreational uses.

Most of the strategy has been, or is being, implemented.

3 Key Considerations

3.1 Introduction

This section of the document outlines the key considerations in developing the Strategy and describes the process used to translate these considerations into criteria for evaluating Strategy options.

It then provides a general discussion of each criteria as it applies to Wainui Beach.

3.2 Process for determining criteria

The key considerations for developing a strategy for the management of erosion on Wainui Beach consist of a) those identified by statute and policy; and b) those that are important to stakeholders.

A workshop with and survey of Key Stakeholder Forum members was used to identify what stakeholders thought was important to the WBMS, their key issues, and the priority of issues. This resulted in 22 priority considerations which were ranked as illustrated in the graph below.

Wainui Beach Management Strategy: The 22 Issues in Order of Average Priority Received (where 1 is the highest priority)

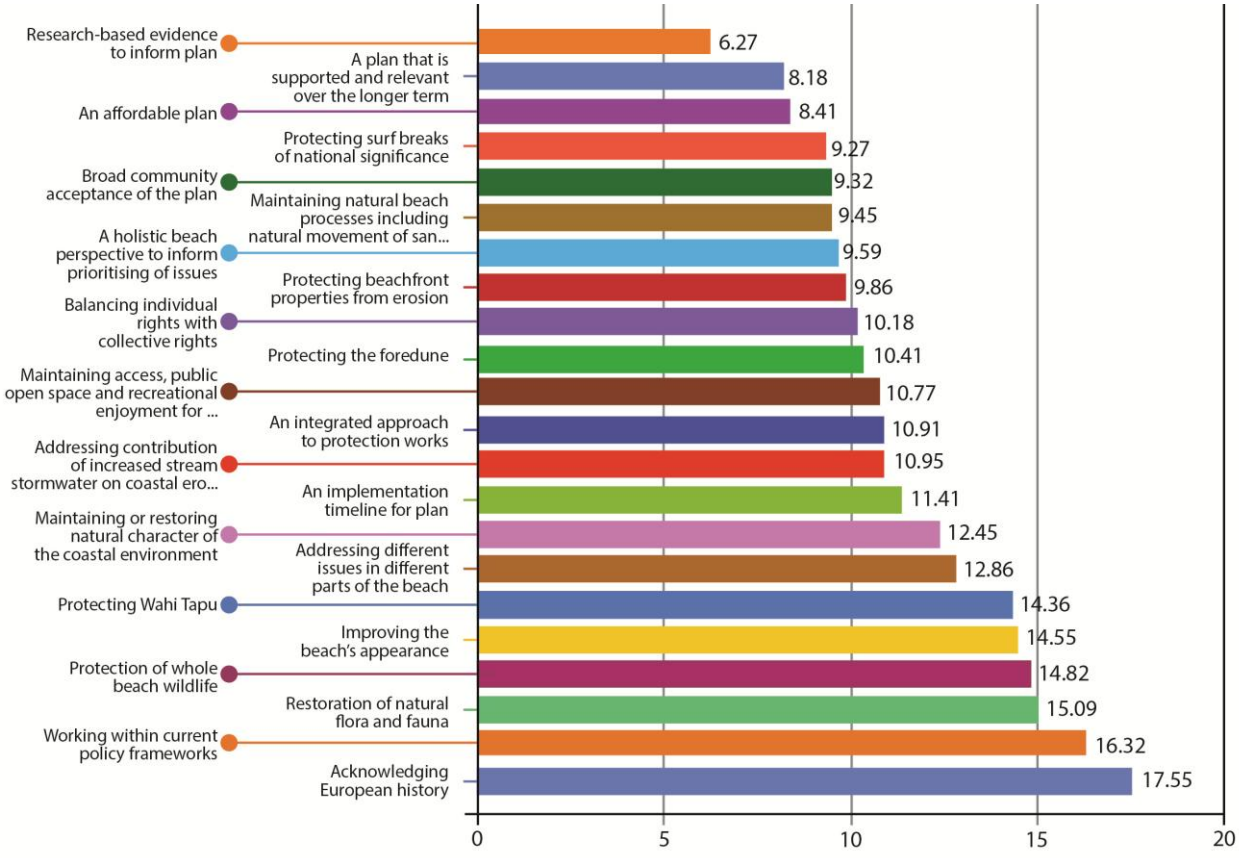


Figure 11 – Key Stakeholder Forum Prioritisation of Issues

With assistance from Richard Reinen-Hamill the Working Group clustered these 22 areas into the following general criteria, which were accepted by the Key Stakeholder Forum:

- Implementation timescale (0-20, 50-100 and 50-100)
- Effective life
- "Laws of the coast" (consider the whole beach)
- "Laws of the coast" (Maintain/enhance sand flow)

- Enhance/maintain access (Public and Private)
- Property Protection (Public and Private)
- Protection of the natural environment (backshore, beach and offshore)
- Cultural heritage values acknowledged
- Relative cost
- Based on research evidence.

Alongside these criteria are those principles, policies and objectives established in statute, plans and policy documents (refer to section 2). In particular, those in the RMA and associated plans and policy documents relating to issues of:

- management of coastal hazards
- natural character
- outstanding landscapes
- surf breaks
- ecosystems, habitats and Indigenous vegetation
- public access to and along the coast
- participation and values of Maori and Treaty of Waitangi.

The RMA and related policies and plans (including the NZCPS) are fundamental to the Strategy as Council is required to apply them when developing the local RMA policies and plans and when performing its regulatory functions of assessing activities for resource consent. The NZCPS and other RMA provisions also guide Council in its core service of avoiding or mitigating natural hazards and in providing any infrastructure.

As can be seen, there are large overlaps in the criteria of Key Stakeholder Forum and those identified by statute and policy.

3.3 Discussion of Criteria

Below is further general discussion of the criteria as they apply at Wainui Beach. This provides an introduction to the consideration of options to manage the erosion hazard.

(i) Coastal Hazard Management and Property Protection

As stated above, the coastal erosion risk arises because of the interaction of coastal erosion processes with human use, property and infrastructure. Management of this interaction is the question for this Strategy. In the Wainui context, it is primarily the private property south of Hamanatua Stream that is at risk.

Private property has considerable value and its protection from erosion is, understandably, an issue that scored highly in the survey of Key Stakeholders.

Protection of property is not *per se* an objective in the legislative and policy framework. However, it is relevant in terms of the LGA and RMA's requirements to consider costs and benefits of options, and to social and economic wellbeing in terms of the underlying purpose of the RMA.

The effectiveness of options at reducing or avoiding the risk is considered under this criterium, as well as compliance with general policy for management of hazards.

There are three broad approaches:

1) "protection" by intervening in coastal processes or protecting those features that provide natural protection (hard protection structures, dune care)
2) avoiding or removing property in areas subject to the hazard
3) spreading or transferring the risk through insurance.

As discussed in section 2 of this report, RMA legislation and policy, particularly the NZCPS, requires a focus on the second type of risk management approach and discourages hard protection structures. It also promotes protection of the natural features that provide natural protection (dunes).

(ii) Effective Life and Implementation Timescales

Erosion management approaches can also be considered over various timescales from short term to long term, with some measures being relevant over different timeframes to others. The Key Stakeholder Forum adopted an analysis framework of short term (0-20 years), medium term (20-50 years) and long term (50-100 years).

(iii) Natural Character

According to the "definition" of natural character in the NZCPS, the natural character of Wainui Beach consists of various interconnected elements. This includes but is not limited to the visual elements of the landscape (headlands, dunes and beach). Natural character also includes ecological elements as well as the natural coastal and geomorphologic processes such as the movement of sand and water. The surf breaks, which are a manifestation of natural processes, are part of the natural character of Wainui Beach.

Protecting the surf breaks and maintaining natural beach processes and the natural movement of sand were some of the top two ranking priorities identified by the Key Stakeholder Forum. The natural character of the coastal environment also has special status and protection under the RMA and related policies including the NZCPS.

A 1995 landscape assessment for Gisborne's coastal environment (Boffa Miskell Limited 1995) and a more recent landscape study (Sue Dick, Eastern Earth Landscape Architects 2007) are the principal documents by which the natural character of Wainui Beach has been reviewed. Despite over ten years separating the two studies, their findings are generally in alignment.

Boffa Miskell's assessment identifies Wainui / Okitu as a landscape character unit, an area of homogenous visual character based on landform, vegetation cover and landuse patterns. The assessment determines the area to have high visibility, indicating the degree to which it is able to be viewed from moving traffic as well as surrounding residential areas. This criterion is made significant due to the aesthetic value of the headlands to the north and south, the distinctive coastal foredune running the length of the bay, the prominent sandstone extension of Tuaheni Point and the contrasting form of an abandoned lighthouse at its rocky margin. The assessment defines the area's visual quality (inherent character of the landscape) and its visual absorption capability (its ability to absorb change) as being moderate. The influence of human landuse for residential, subdivision, agriculture and amenity planting is likely to have influenced this evaluation.

Dick's study determines natural character to be highest around Tuaheni Point. It also identifies the foredune environment north of Hamanatua Stream, where residential houses have not impinged on the dunes fronting the beach, as having a high degree of natural character. The coastal plan includes this as an area of significant conservation value. It describes the area as a dune system covered with a sward of native and exotic vegetation. Council's reserve management for WD Lysnar Reserve also recognises the naturalness of this location and aims to preserve its natural state.

Natural character between Hamanatua Stream and Tuaheni Point is lower due to the effect of landscape modification (Dick 2007). The Coastal Plan identifies significant conservation value in the narrow esplanade reserve between residential buildings and the beach but also recognises extensive modification to the duneland from intensive development.

Fauna is mainly introduced although remnant indigenous species such as the Blue Penguin can still be found here. This area clearly is not one of outstanding natural character where adverse effects must be avoided under Policy 13 of the NZCPS. However, significant adverse effects on natural character should be avoided in all areas and other adverse effects avoided, remedied or mitigated.

Strong visual contrast and visually obtrusive structures should be avoided; and use and development should respect the natural landform and avoid modification of the landforms (policy 2.1.4L Coastal Plan). The dune landform is a major visual component of the area's natural character. The land-water interface, which consists of a long, uninterrupted linear beach profile, is particularly sensitive to built form and its open character and general lack of a strong backdrop tend to make visual integration of structures difficult in this landscape (Slupski comms).

Council also has a general obligation to promote restoration or rehabilitation of the natural character of the coastal environment, including by identifying areas an opportunities for doing so (Policy 14 NZCPS).

As landscape studies, the Boffa Miskell and Eastern Earth studies primarily focus on the visual elements of natural character. However the other aspects of natural character, such as ecological and geological and geomorphological aspects, must not be overlooked. Below if further discussion of the surf breaks.

(iv) Laws of the Coast

The Key Stakeholder Forum adopted "Laws of the Coast - consider the whole beach and maintain/enhance sand flow" as key considerations. This discussion document does not discuss Laws of the Coast separately because it is covered by other key considerations such as surf breaks, the contribution of natural movement of sand to natural character and the need for detailed consideration of the impact of any property protection options. Nonetheless, it remains a useful reminder of the connectedness of beach systems and issues.

Large scale processes interconnect all parts of the beach so changes in one part of the beach may impact on other parts of the beach.

(v) Surf Breaks

Protection of surf breaks is a key concern of stakeholders: it was one of the highest ranking issues in the prioritisation of Key Stakeholder issues.

As explained previously, the NZCPS includes "Wainui - Stock Route – Pines – Whales" in its list of surf breaks of national significance and has policies to ensure protection of and access to the surf breaks. Protection of surf breaks is also of relevance to natural character and to social and economic wellbeing in terms of the purpose and principles of the RMA. Arguably the intention of the NZCPS is to protect the breaks of the entire Wainui Beach not just those near the locational references of "Stockroute", "Pines" and "Whales".

Dunn has provided a brief summary of surf break processes to assist the development of the Strategy (Dunn 2013). She explains that the main coastal processes responsible for surf break formation are the alongshore (from one headland to the other and back) and across-shore (from dunes to sandy dry beach to under the water and vice versa) movement of sand; in particular, the alongshore and across-shore movement of sand to form underwater sandbars. It is these sandbars that create the nationally and internationally recognised Wainui surf breaks. Said another way, the underwater sandbars *are* the surf breaks.

According to Dunn, the recognition of the breaks at Wainui as surf breaks of national significance indicates that these are locations whereby underwater sandbars are near permanent features that wax and wane under different storm/swell conditions and are shaped in a way to create consistent high-quality surfable breaking waves year-round.

Throughout the entire Wainui Beach system, sand is put in constant motion by breaking waves and near-shore currents. All parts of the Wainui Beach system are connected by the alongshore and across-shore sand movement. Sand is shared between the dunes, dry beach and seabed. It tends to move from the dunes and the sandy dry beach during storms (or periods of storms) and return onto beaches after storms as wave size decreases (and eventually be wind-blown into the dunes).

Dunn also points out that the sand movement processes that form the underwater sandbars not only create surf breaks, but also provide natural coastal protection. Sandbars force the large incoming storm waves to break and release their energy offshore on the sandbar so that little of the original wave energy arrives near the dry beach to cause erosion.

Sand movement needs to be safeguarded not only in the designated surf break area, but for the entire sandy shoreline of Wainui Beach because sand is locally sourced and distantly sourced (being dependent on wave and storm conditions). Using the Stockroute as an example, under north-easterly storm waves this surf break receives sand from upstream locations i.e. say from the Pines area southwards; in southerly storm conditions, this surf break receives sand from Tuaheni Point northwards to Stockroute.

Dunn suggests one option for surf break protection would be to apply a chosen storm cut parameter for the entire Wainui Beach sandy shoreline within which the natural movement of sand would be protected.

Dunn also refers to insights from peer-reviewed journal articles on coastal management or protection and implications for surfing. A study by Corne (2009) suggests wherever coastal protection is constructed in proximity to a surfing resource there is usually an impact; changes in sand movement can lead to changes in bathymetry, which flows on to changes in wave quality; structures can cause changes in local hydrodynamics and bathymetry to such an extent that waves can change from the plunging type to the lesser quality spiller type. Valverde (1994) states shoreline structures such as seawalls, revetments, jetties, groynes and other structures may destroy surfing areas by reflecting, refracting or blocking waves and can compromise wave quality or create dangerous surfing conditions. Scarfe et al. (2009a) found that small engineered structures (boat ramp, and short breakwater) have negatively impacted the Manu Bay surfbreak in Raglan through alterations in seabed morphology (or bathymetry) and at a distance from the site of the engineering. Therefore, engineered structures do not have to be immediately adjacent to surf breaks to have a negative impact. Studies suggest once surf breaks are destroyed it is virtually impossible to replicate or repair them (Nelsen et al. 2013; STC 2011).

Dunn also refers to an article by Scarfe et al. (2009b), which discusses the formation of surf breaks at Wainui Beach. They infer complex offshore wave transformations (or wave focussing) create the sandbars and associated rips. The article also reveals that at different surf breaks the contributions of offshore processes and near-shore features (sandbars) varies. The near-shore features are the main focus for this project given that coastal management and shoreline engineering is the aspect that may impact surf breaks.

(vi) Outstanding Natural Landscapes

Outstanding landscapes and features must be protected from inappropriate development (s6 RMA). This includes Tuaheni Point, which is identified as an outstanding natural landscape in the Coastal Plan and District Plan.

Boffa Miskell described Tuaheni Point as an isolated and rocky finger of sand stone projecting out from the coast, the extent of its character delineated by the edge of built development. Other than this brief description, no explanation as to why Tuaheni Point is considered outstanding is made.

Dick's (2007) landscape study concurs with Boffa Miskell's evaluation and provides further description of its salient qualities. It recognises Tuaheni Point as being significant for:

- Natural science (ecology);
- Expressiveness (landform, geomorphology);
- Aesthetics (prominence / visibility);
- Value to Tangata whenua.

The land-water interface at Tuaheni Point is a critical consideration because it is a highly visible and a dramatic part of the coastline. Visual continuity along the beachfront toward the headland is also an important component of the area's character (Slupski comms). Tuaheni Point also has important cultural values e.g. the deposition of sacred taonga in caves (WD Lysnar and Wainui Beach Reserves Management Plan).

(vii) Public and Private Access

The maintenance and enhancement of public access to and along the coastal marine area is a matter of national importance under the RMA (s6) and the NZCPS requires maintenance and enhancement of public open space qualities and recreational opportunities of the coastal environment (objective 4 NZCPS). The NZCPS objectives also discuss ensuring maintenance of public access even when the coastal marine area advances inland.

NZCPS policies require avoidance or mitigation of any loss of public walking access resulting from subdivision, use or development (policy 19 NZCPS) and identifying opportunities to restore public walking access e.g. as a result of erosion or development.

Council's Senior Policy Advisor for reserves recommends that the following be taken into account when considering options for erosion management in the context of the public access and open space policies in the NZCPS's:

- Access to Wainui Beach mostly requires an ascent and/or descent – any protection/dune works should be designed to ensure a reasonable slope for all abilities and mobility apparatus.
- Ideally, all ability access (pedestrians/cycles/wheelchairs/buggies, horses, as well as boat ramp/emergency services access) should be available from the high recreation nodes identified in WD Lysnar Reserves Management Plan –from the end of Pare St and the Wainui Surf Club.
- In addition to the public access at the "recreation nodes" public access to the beach is also provided at another 14 access points along the beach.
- Any protection works/development on the beach should aim to ensure access to and along the coastal marine area, and open space, is available during standard tidal movements (this may not always be achievable during spring tides or storm events).

Protection of private access to and along the coast is not promoted by statute but is valued by adjoining properties (regardless of Council/Crown land in between) as was included in the criteria of the Key Stakeholder Forum. Private accesses have been developed and maintained at the expense of each private landowner but design guidance is included in the WD Lysnar and Wainui Beach Reserve Management Plan.

While private access has been identified as a valued by adjoining properties, consideration could be given to rationalisation of accesses in order to minimise impacts on issues such as natural character and to help protect the dunes.

(viii) Cultural Values

A kuia of Ngati Oneone / Rakaitane, Mrs Ingrid Searancke, is a member of the Key Stakeholder Forum and the Working Group. She and her daughter, Nikki Searancke, have provided the Working Group with information about the history of tangata whenua in the Wainui Beach area. Some of their history is also recorded in the W.D. Lysnar and Wainui Beach Reserves Management Plan. This includes:

- Burial of sacred taonga from the Horouta Waka in caves in the Maungaroa Hills (Tuaheni Point) and the loss of burial caves on Tuaheni Point to erosion.
- Settlement of Uenuku Whakarongo, a chief on the Horouta Waka at Wainui, at the base of Maungaroa and his establishment of the Wharekorero House of Learning, a place of supernatural powers.
- Development of a pa on Maungaroa.
- Battles between Te Aitanga Mahaki and Rakaiatane at Okitu, Hamanatua Stream and Makorori Headland.
- The traditional departure of fishing trips from the coastline.
- The many burials along the beach and their frequent unearthing. The practice of planting trees when burials are found.
- Allocation of land at Wainui and Okitu by the Maori land court and loss of land from Maori ownership as it was sold or lost due to economic hardship.
- Temporary residence of Ngati Oneone at Wainui Beach, followed by permanent settlement when Ngati Oneone moved away from the Gisborne harbour area.

Staff also sought feedback from kaumatua of Ngati Oneone on the values and issues relevant to the development of the Strategy. Important to Tangata Whenua is their loss of access and recreational opportunities at Wainui Beach with its residential development. They spoke of Ngati Oneone's traditional gathering at the southern end of the beach "at least twice a year" for picnics and recreation. Although they still use Hamanatua Stream for "hikoi", they no longer feel they can gather at the southern end of the beach without intruding on nearby houses. They suggest Council look to develop a wider reserve in the area that could serve as a gathering point.

Tangata Whenua are also concerned about impacts on the waahi tapu site on both sides of Wainui Stream (an old fishing village). Options that stop erosion of the banks may be positive. They are also concerned about recreational activities in this area.

Tangata whenua also promoted the following general principles for developing the Strategy:

- recognition of the beach as a community asset and protection of the beach from actions for private benefit
- balancing any adverse impacts of protection works with enhanced public access or other public benefit
- protecting and enhancing the naturalness of the beach and caring for the beach.

(ix) Ecosystems, Habitat and Indigenous Vegetation

The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna is a matter of national importance under the RMA. The intrinsic value of ecosystems must also be given particular regard under the RMA.

Areas of significant conservation value are mapped in the Coastal Plan and include Makorori Point, Okitu Reserve, Wainui Beach Esplanade and Tuaheni Point. Specific rules apply to these areas (Protection Management Areas 4.3.6 – 4.3.13).

In terms of the terrestrial environment, the Coastal Plan states that Tuaheni Point is the best and largest example of coastal herbfield and shrubland on coastal cliffs and terrace remaining in the district. There are also many roosting sites for sea birds (Coastal Plan, Unit 15). The narrow esplanade reserve at the southern end of the beach is described as extensively modified by insensitive human development and having a range of exotic and indigenous plants typical of suburban coastal settlements. Fauna is mostly exotic, with remnant indigenous species (blue penguin and others) negatively impacted by introduced pests. Vegetation in WD Lysnar Reserve north of Hamanatua Stream is also a mix of native and exotic (Coastal Plan, Conservation Areas TP & TPL)).

A study of macrofauna on Wainui Beach was completed for the Department of Conservation in 1993 (Stephenson 1993). He notes that south of Hamanatua Stream the general environmental conditions on Wainui Beach are such that the natural pattern is for macrofauna of low species diversity and relatively low abundance.

No study of the ecology of the marine environment specifically at Wainui Beach is known.

Both the NZCPS and the Coastal Plan promote restoration of the natural character by using indigenous species, preferably of local genetic stock.

(x) Relative Cost

The Key Stakeholder Forum identified "relative cost" as one of their key considerations. This is taken to mean the monetary cost of any erosion management option.

Cost is also an important consideration under legislation, for example, in relation to "efficiency and effectiveness" and the purpose of local government (section 10); in relation to economic wellbeing in terms of the purpose of the RMA (section 5); the requirement for Council to consider the benefits and costs of its decisions under the LGA (section 77); and the requirement to consider "efficiency and effectiveness" and "costs and benefits" when reviewing RMA plans (section 32).

Cost includes capital and maintenance costs of any protection works, but also a wide range of other possible costs e.g. costs associated with consent application and monitoring, enforcement of plans, and possible loss of private property value.

There is also a long time frame to consider, giving that the strategy is looking forward around 100 years.

In addition to the quantum and timing of costs, the incidence of the cost (i.e. who pays) is also critical. However the approach taken in this discussion document is to delay consideration of funding erosion management options until a later stage. Therefore, funding is not considered in this document. Questions of funding are often controversial, it is hoped delaying discussion on this matter will promote full consideration of the options.

(xi) Other Considerations

In addition to the specific considerations identified by the Key Stakeholder Forum and in legislation/policy, other issues may be relevant to assessing erosion management options. For example, Strategy participants have mentioned aesthetic considerations. A broad consideration of options is consistent with Council's decision-making obligations under the LGA and RMA.

4 Assessment of Current Approaches

This section of the document discusses current erosion management approaches with reference to the key considerations outlined in the previous section. The discussion draws on the reports and the opinions of experts, as well as stakeholder views.

The intention is to provide information about the implications of remaining with the status quo and a baseline against which to compare alternative options. This is also intended to represent the "do-nothing" assessment required by the NZCPS: i.e. "do-nothing" is assumed to equate to "do-nothing more".

4.1 Coastal Hazard Management and Property Protection

4.1.1 Protection Approaches – Hard Protection Structures and Dunes

Protection approaches consist of the hard protection works that aim to hold the line of the shore, as well as dune enhancement that encourages dunes to build to provide a erosion buffer for the property behind. The District Plan restrictions on altering dunes are also relevant in terms of protecting a feature that provides natural defence.

Various reports comment on the ad hoc nature and ineffectiveness of Wainui protection works in general terms. For example, Komar commented (1996) "A variety of structures have been used in shore protection efforts at Wainui Beach. Although some may temporarily have succeeded in reducing property erosion, nearly all structures eventually have failed. Of concern, some may actually have enhanced the erosion".

A recent report analysing surveys of Wainui Beach profiles (Tonkin & Taylor 2013a) provides insight into the effectiveness of existing protection works. The report assesses profile data collected by the Council from cross-section beach surveys since 1974 and provides a trend analysis. Tonkin & Taylor suggest the protection work at the profiled locations can be seen to reduce the landward retreat of the beach profile, but there are still periods where the beach accretes. They believe structures typically have not been designed with full understanding of the wave forces and beach profile change and therefore tend to require reasonable levels of maintenance to maintain their effectiveness. Therefore, in most cases, it is the ongoing maintenance works of the structures, not just the structures themselves that holds the line of the shore.

Set out in the boxes below are the Key Stakeholder Forum's understandings of the success of existing hard protection works. These findings were made on the advice of the Working Group, which workshopped the issue with Reinen-Hamill and Dunn. A summary of the supporting discussion is also provided. Refer to Appendix 2 for a map and numbering of the protection structures.

The effectiveness of dune enhancement has not been considered by the Key Stakeholder Forum. To date, only a relatively small area of the beach has been targeted. This appears very successful with about 5m of horizontal accretion gained south of the Hamanatua Stream, which provided an excellent buffer against recent storms, losing up to two to three metres (Logan, comms).

(i) Groynes

Groynes are structures built perpendicular to the shoreline. There is a "groyne" located beside the Hamanatua Stream. Reinen-Hamill advised that it does not act as a traditional coastal groyne (i.e. is not trapping the longshore transport of sand).

However, it benefits the adjacent area by stopping the stream from cutting into the dunes and allowing sand to build up.

Buried south of the Hamanatua Stream are further groynes remaining from the series installed in the 1960's. The working group were unsure of whether these buried groynes have any benefit, but felt they were not doing any harm. Reinen-Hamill agreed that these groynes do not appear to have any significant influence on coastal processes. Dunn also supported the position that they are achieving little but not currently doing any harm.

At the south of the beach is another concrete groyne (groyne 2) and assessment of its effectiveness is more complex. Working Group members questioned whether it helped protect the beach from south easterly swells. Reinen-Hamill pointed out that, in any case, the southern abutment of rock armour extends further to the south than the concrete groyne. Others in the Working Group were concerned that groyne 27 was causing erosion of neighbouring areas. According to Reinen-Hamill, localised erosion to the lee (north) of the groyne is occurring but is small scale (10's of metres) and is more likely a local perturbation of what would have occurred with ongoing shoreline retreat.

KSF understanding of Effectiveness of Existing Hard Protection Structures:

Groynes

- Hamanatua Stream training wall works in terms of controlling the stream.
- Southern groynes 2, 3 & 4 buried since training wall constructed and are ineffective.

Groyne 27 at the southern end periodically causes beach scouring to the north locally, lowering the beach sand levels (eddy effect) and adds to the backshore erosion pressure (Note: expert advice is that groyne 27 is not having an impact on the Stockroute area).

(ii) Seawalls

Seawalls are the vertical structures built parallel to the shore. The Working Group thought seawalls help to protect the properties behind them but were concerned about scouring at the toe and impacts on sand movement and erosion nearby. There was also discussion about the need to maintain seawalls and return fill when the sea gets underneath and undermines them.

Reinen-Hamill commented that seawalls, when adequately designed, will protect the land behind them but do not protect beach or beach systems and can have localised impacts with regard to scour and end effects.

KSF understanding on the Effectiveness of Existing Hard Protection Structures:

Seawalls

- Help protect properties directly behind them.

Negative in terms of sand on the beach – cause scouring

(iii) Rip-rap / Revetments

Rip-rap refers to piles of rock used to armour the shore. The term may also be used to describe the sloping revetment structures built of rocks.

The Working Group thought rip rap has led to sand retention at the southern end of the beach.

Reinen-Hamill commented on his general knowledge of rip-rap structures – they have ability to absorb energy but scour and end effects have also been observed with rip-rap structures.

KSF understanding on the Effectiveness of Existing Hard Protection Structures:

Rip Rap

- May help to protect properties directly behind them.
- Improved performance (relative to seawall) on coastal processes enhanced by flatter slope and porosity.
- Positive (relative to seawall) in terms of sand on beach (does not prevent sand coming back) – minimal scouring.
- Take a bigger footprint on the beach (relative to seawall).

[noted that the end of Lloyd George Road (no. 23) is the best example – built to specific Dave Peacock specifications].

(iv) Gabions

Gabions are the open cages filled with rocks or other material. The Working Group thought they assist with protecting the properties behind by providing some protection at the toe of the dunes, but that they have a short life and require regular maintenance. The Working Group also discussed their short vertical elevation – means they allow sand movement from behind the structure, but also that they provide limited protection to the properties behind.

Reinen-Hamill responded that gabions may have a place along Wainui Beach as a largely buried "backstop". However, he also referred to maintenance and failure issues associated with the use of gabions in a high energy environment.

Dunn noted that Gabions are ill-suited to high-energy, open-ocean beach environments. There have been many examples during past storm events of waves eroding the dunes for meters behind the line of gabion baskets; therefore, their effectiveness in terms of protecting the land behind them is questionable.

While not a focus of the Working Group discussion, there have been concerns raised in the past about the gabions inducing scour of the old estuarine mud layer that underlies the beach sand. Komar (1994) explained that water flows around and beneath gabions is increased during storms and apparently enhances the local generation of turbulence and causes greater scour of the mud.

KSF understanding on the Effectiveness of Existing Hard Protection Structures:

Gabions

- Work short term – property protection at toe.
- Similar characteristics to a seawall.
- Because of height are overtopped.
- Most of time buried therefore minimal effect on natural sand flow.
- Have a limited effect in storm situations.

Can use small rock (that may be more readily available).

4.1.2 Reducing or Avoiding Property at Risk

The District Plan hazard zones and associated rules are the primary method for reducing and avoiding the exposure of property/assets to the erosion hazard. This includes rules for subdivision that prohibit of subdivision for development in the Extreme Hazard Zone and require consent in the High and Moderate zones, and the requirements for resource consent for new buildings and building alterations/additions in the Extreme to Moderate zones.

In addition, individual action enhances or reduces exposure e.g. through investment in property or relocating houses back from the beach. Therefore, education on coastal hazard risks that may influence individual decisions, e.g. LIMs or through the District Plan, is also relevant.

Property values and their breakdown into land value and improvement value are possible indicators of exposure (total capital value = land value + improvement value). While we note other reports advise against using property value to monitor risk because it is dependent on a number of factors (Hill Young Cooper et al. 2003), it is nonetheless a measure of the assets at risk. According to Council's 2001 and 2013 rating databases (based on 1999 and 2011 valuations) the capital value of the 113 properties affected by coastal hazard zones south of Hamanatua Stream increased by $67 million, from $35 million in 2001 to $102 million in 2013.

Most of the increase has been in the land value, which increased by $54 million, from $20 million in 2001 to $75 million in 2013 (266%). The value of improvements (which includes new buildings, alterations and additions) has increased by $13 million, from $14 million in 2001 to $27 million in 2013 (94%).

Table 4 below shows and that this increase was greater than average for Gisborne residential properties.

DATA SOURCE	% INCREASE IN CAPITAL VALUE
Change in capital value of the 113 Wainui properties according to Council's 2001 and 2013 database (based on 1999 and 2011 valuations)	191%
Small sample of residential properties in Gisborne City	115%
Increase in QV's residential house price index for the Gisborne District from 1999 to 2011	113%

Table 4

It is noted that the value of the Wainui properties reduced at a greater rate than city properties sampled during the property downturn from 2008. However, over the whole period, their value grew more than the city properties. In absolute terms, the capital value of the 113 properties increased by an average of $590,000 over the 12 year period and the land value by an average of $478,000 per property.

There is no local study on the impact of hazard zones on property values. A local valuer asked for comment found no evidence that hazard zones in Wainui are having a significant effect on values and that absolute beachfront remains prime real estate in a static market. However, he cautions there have only been limited sales from which to draw conclusions (Inder comms 2013). A 2006 study for Waikato Regional Council, which looked at data from Waihi, Omaha, Mount Maunganui-Papamoa and Wainui Beach, found that the existence of known coastal hazards is not having any obvious effect on the increasing value that the market places on shorefront property value in New Zealand; and that the rapid drop in property values with distance from the shorefront also suggests that coastal hazard risk does not affect property value significantly. The report also suggested that historical attachment of hazard notices under the Building Act do not appear to affect property valuations either (Turbott et al. 2006). It would be interesting to see whether identification of hazards has more of an impact on property values in areas that have experienced significant and recent events such as Christchurch.

Another indicator of the exposure of assets is the area of buildings within the hazard zones. Council's rating valuation database collates floor area information from building consents and can be used to compare exposure over time of the 113 properties along Wainui Beach, as shown in table 5. It is noted that the data does not identify whether these buildings are within the hazard zones but, given that 63% of the land of these properties is within hazard zones and only 10 properties have dwellings outside of the hazard zones, it is expected that most of these buildings are affected.

FLOOR AREA OF BUILDINGS 2003	FLOOR AREA OF BUILDINGS 2013	% INCREASE
17,600m^2	19,800m^2	13%

Table 5

Resource consents provide further information about whether the exposure of property to erosion is increasing through development. A search of Council's property files found 18 resource consent applications relating to proposals to construct new buildings or alter existing buildings on land affected by coastal hazard zones south of Hamanatua Stream over the period 2000 to 2012. Three of the consents related to buildings in the Extreme Hazard Zone.

CONSENT TYPE	NUMBER ASSESSED	NUMBER GRANTED
Extensions to buildings	12	12
New garages	2	2
Demolition of existing building and replacement with new building	3	3
Other structures e.g. decks, verandahs, pergolas	Not audited	

Table 6

Council granted all the consent applications and Council gave a variety reasons, e.g. extensions would not protrude closer to the sea than neighbouring dwellings; extensions were on the landward side of the building and therefore "shielded" from the coastal hazard; the buildings were not habitable (in the case of garages) or for sleeping and therefore presented minimal risk to life; the replacement dwelling would not be located closer to the beach than the existing dwelling; extensions were only minor in terms of scale; and that it would be possible to relocate the building.

Overall, these indicators show that the risk to property from erosion has increased rather than reduced under current management approaches. The values of beachfront properties affected by coastal hazard zones south of Hamanatua Stream have increased significantly, and at a faster rate than average for the District. The gross floor area of the buildings on these 113 properties has also increased by 13% over the last ten years. It would be reasonable to assume that exposure would continue to increase under current management approaches.

It is more difficult to conclude whether there has been any avoidance of risk. It may be that the hazard zones and information help to discourage development or encourage development better designed for the erosion hazard (e.g. on the landward side of properties). The prohibition of new dwellings in the extreme hazard zone and of subdivision in the extreme and high hazard zones may have also helped to avoid increasing the risk. However, all building consents relating to these 113 properties were approved.

4.1.3 Risk Spreading (Insurance)

The extent to which insurance products are available to properties at risk of coastal erosion and affordable depends on the contracts between each property owner and insurance company. However, general discussions and examination of standard insurance policies suggest the extent to which insurance can be used to manage the risk for damage to properties along Wainui Beach from coastal erosion is limited.

4.2 Effective Life and Implementation Timescales

There is no specific assessment of the effective life of the existing protection structures. Tonkin & Taylor (2013) advise that, with ongoing erosion trends, it is likely that the existing protection works will become periodically more exposed to wave forces as, at the southern end of the beach levels will not return to the previous levels. Therefore, they anticipate increased damage and requirements for maintenance.

In addition, in areas where there is more sandy dune along the backshore, rather than weak cliff geology, the structures may begin to have an impact on the adjacent shoreline, either through impoundment (holding back sediment from the backshore that would otherwise be in the system) or by end wall or groyne effects where there is additional localised erosion as a result of the protection structures (Tonkin & Taylor 2013a).

As discussed above, there are concerns about the present effectiveness of some of the protection structures (especially the gabions and groynes).

Landuse planning approaches have been developed on a basis of a 100-year assessment of the hazard (although they have not been reviewed for over ten years). However, as discussed above, analysis of development trends suggests they may be having limited impact on avoiding or reducing the risk to property.

4.3 Natural Character

Brief commentary on the impact of existing hard protection structures and dune enhancement on natural character, in terms of visual impacts, has been provided by Council's staff (Slupski comms). Dunn's commentary on the impact of hard protection structures and dune enhancement on coastal processes and surf breaks is also relevant (Dunn 2013).

Dunn found, in general terms, that rip-rap and seawall-type structures act to interfere with natural sand movement and cut-off sand supply from the dunes behind them during extreme storm events. In some areas (in the vicinity of the Stockroute – Oneroa Road) sand is still moving from behind the structures. However, south of the Stockroute, the structures act to translate the volumetric sand requirement during large storm events onto the fronting sandy beach; that is, the locally-sourced sand comes from immediately in front of the structures. As a result, sections of the beach will lose sand cover and expose the underlying cobble or rocky basement. Interference with sand movement processes can affect the formation of sandbars and large-scale coastal processes such as re-orientation of the beach when storm waves arrive obliquely at the shore. The vertical nature of some of the structures can also cause wave reflection and local eddy formations that enhance scouring and can affect sandbar formation and wave quality. She also comments that "there will, no doubt, be other complexities associated with these structures given the dynamic nature of the coasts".

The long history of shore protection structures is a prominent visual feature along much of Wainui Beach. The structures are most prominent, and the impact on natural character greatest, south of Oneroa Road where these structures form a continuous line of structural defence along the toe of the foredune.

The concrete groyne further south represents a break in the continuity of the beachfront and also contributes toward a reduction in the naturalness of the area. The height of the foredune is generally lower in the southern section, which serves to emphasise the visual prominence of the protection structures in terms of scale as well as allowing adjacent properties to be more visible from the beach (Slupski comms).

The visual impact of hard protection structures on natural character of the beach environment is likely to be more pronounced, as it is currently, when sand is taken from the beach during storm events and exposes protection structures further (Slupski comms).

The presence of beach protection structures is less marked along more northern sections of the beach, where the foredune rises and becomes more prominent. Here, the beach retains more if its natural character but residential buildings and private and public accessways continue to have a presence (Slupski comms).

Dune enhancement was found to have a positive impact by both Dunn and Slupski. Slupski notes stabilisation of the dune system with native vegetation preserves a landform pattern which constitutes a major visual component of the area's natural character. Dunn explains that dune planting will build up sand dunes but not impede the offshore movement of sand during storms.

4.4 Surf Breaks

Dunn was asked to provide a brief assessment of whether the existing hard protection works and dune enhancement is impacting on surf breaks (Dunn 2013). She could not make a conclusive statement on the impacts of current structures and notes that no methodology could be found to assess the impacts of hard coastal protection works on surf breaks of sand-bottomed beaches. Her comments are based on visual analyses and personal experience only.

Dunn does not believe the structures in the vicinity of the Stockroute (Oneroa Road) are having a negative affect on surf breaks as the waves are still able to erode behind the low-lying rocks to source the required sand.

Further south (south of Cooper Street to Tuahine Crescent) she found it impossible to conclude whether the mix of solid wooden walls, rip-rap and log-rail are affecting surf breaks. Blocking of sand from the dunes could lead to imbalances in offshore bathymetry and sandbar formation, and this would impact the surf breaks and surf quality. However, the separation of this effect from natural variability would be extremely difficult to quantify (if not impossible). The structures are, at least, acting to translate the volumetric sand requirement needed during large storm events onto the fronting sandy beach. This results in a loss of sand cover and exposing of the underlying cobbles and rocky basement. Said another way, the locally sourced sand that would, under natural conditions, flow from the backing dunes is now sourced from the next best location – the fronting beach (and any nearby unprotected sections of sand dunes and any distant sources). This acts to lower the beach profile and can lead to increased incidence of wave reflection (backwash) and local eddy features, which can change the sandbars and wave characteristics (wave quality).

4.5 Outstanding Natural Landscapes

Council's planner and landscape architect (Slupski comms) provided brief comment on the impact of hard protection structures and dune care work on the outstanding landscape of Tuaheni Point, from a visual perspective. He believes that while the structures have some impact on the visual quality of the broader Tuaheni landscape, the effect of amenity planting, the natural character of the beach itself and Tuaheni Point, together help to mitigate that impact.

Dune enhancement work has a positive impact as it strengthens the natural character of the beach profile and contributes to integration with the outstanding landscape of Tuaheni Point.

4.6 Public and Private Access

Council's Senior Policy Advisor for reserves has assessed the impact of the existing protection works and dune enhancement on public access to and along the coastal environment and public open space (Sutherland comms).

Sutherland finds that, in terms of the beach as a whole, existing protection works and dune enhancement have had minimal impact on public access and open space. However, protection works at the southern end from Lloyd George Road to Shark Bay have had a moderate impact as these works restrict available open space at high tide or during storm events and the concrete groyne restricts access and connectivity along the beach from mid to high tide.

She also finds that the training groyne at Hamanatua Stream has an impact on access as it restricts connectivity along the beach. On the other hand, it also provides access from public reserve to the beach via a walking track along the side and, at times along the top, of the groyne. Dune enhancement also restricts public access using barriers and signage but is accompanied by controlled pedestrian access in close proximity.

4.7 Cultural Values

Ngati Oneone kaumatua concerns about the current management approaches include (Searancke comms):

- Visual impact of protection structures – appear untidy and lack integration with each other and the natural landscape.
- The state of the protection structures – some are hazardous and they give a sense of neglect.
- Loss of access to and enjoyment of the beach caused by protection structures (along with residential development generally)

4.8 Ecosystems, Habitat and Indigenous Vegetation

A report commissioned by the Department of Conservation on the impacts of erosion and protection works on macroinfauna at Wainui Beach (Stephenson 1993) found that where protection works interfere with natural beach processes by preventing the rebuilding of the upper beach after erosion they reduce the range, extent and nature of the habitats available. The upper intertidal beach slope is decreased, the sandy supralittoral zone is eliminated and the drift line is confined to the base or interstices of the protection works. This results in a decrease in species diversity and abundance. However, Stephenson also notes the overall effect is small since general environmental conditions on Wainui Beach south of the Hamanatua Stream are such that the natural pattern is for there to be a macroinfauna of low species diversity and relatively low abundance.

We know of no assessment of the impact of existing erosion management approaches on the marine environment.

4.9 Relative Cost

Limited time has been given to gathering data on the capital cost of existing structures as this is now a sunk cost and probably provides little insight into the cost of any future structures.

However, we can report that the 2007 rock revetment (including the additional works in 2010) cost $165,000.

Council's maintenance budget for the whole protection scheme is $20,000 per year and around $5,000 per year is directed to dune enhancement.

Other costs relating to current management approaches, e.g. community time given to dune enhancement and the costs of the RMA plan development and consenting processes, have not been quantified.

4.10 Other Considerations

The Key Stakeholder Forum and Working Group were particularly concerned about appearance of protection structures. They were described as "piecemeal and not aesthetically appropriate" by the Working Group and "aesthetically not acceptable" by the Key Stakeholder Forum.

This possibly relates to poor integration of structures into the coastal landscape (natural character). The varied appearance of the structures also seems to contribute to concerns as the structures are described as lacking uniformity and integration.

Strategy participants were also concerned about the degrading structures presenting safety issues.

5 Developing a Future Strategy

5.1 Introduction

This section of the report provides an introduction to developing a strategy for the future management of erosion at Wainui Beach. It is intended to provide a basis for further assessment and discussion with stakeholders.

It begins by outlining a possible vision as implied by the Key Stakeholder Forum feedback and decisions to date.

It then outlines the range of potential tools to manage the erosion hazard at Wainui Beach. This includes a discussion of regulatory options, hard protection structures, dune enhancement, financial instruments and education options.

In the last part of this section we ask Key Stakeholder Forum members to take a step back and consider a broad strategy for managing erosion at Wainui Beach. Five high level options, along with a discussion of potential tools that would be used to achieve each option, are given. A brief summary of the key issues relating to each option in terms of the key considerations in section 4 of this report is also provided.

We recognise that there may be overlaps between each of the options and the final Strategy may draw on aspects of various options. They are intended only as a starting point and we expect further refinement.

5.2 Possible Vision

Key Stakeholder Forum feedback and decisions to date, in the context of the regulatory and policy framework, have informed a draft vision statement:

> ***Vision***
>
> *Integrated management of coastal hazards that conserves and enhances the environment of Wainui Beach for current and future generations.*

5.3 Range of Tools

5.3.1 Regulatory Options

RMA plans and policy documents contain a multitude of provisions relating to the management of coastal erosion. However, consideration should be given to more effective use of regulation; in particular, how landuse planning could better avoid or reduce the exposure of property/assets to erosion into the future in accordance with the NZCPS. Council is required to amend its plans and policy statements to give effect to the NZCPS "as soon as practicable".

Following is a summary of the range of potential regulatory options and their possible application at Wainui Beach.

(i) Restricting Additions/Alterations to Existing Buildings

Consideration could be given to developing a stricter regime for alterations and additions to buildings in order to limit investment in property at risk. While alterations or additions to buildings in the Extreme Risk Zone and High Risk Zone already requires resource consent under the District Plan, we found that all consents applications had been approved.

For example, Council could limit additions in areas landwards of the existing building, or even restrict any increase in the floor area of buildings on each site. This could be achieved by

clearer, more directive policies in the District Plan and, perhaps, "tougher" consent categories.

Consideration could also be given to extending restrictions into the Moderate Risk Zone and Safety Buffer in order to limit investment in property that will be at risk in the longer term.

(ii) Restricting Location of New Buildings

Consideration could also be given to developing a stricter and more directive regime for new buildings. The District Plan already prohibits new buildings in the Extreme Risk Zone. Commercial buildings need consent in the High Risk Zone as a discretionary activity. Habitable development needs consent in both the High Risk Zone and Moderate Risk Zone. However, as with additions, there is no specific guidance on how to assess applications for new buildings.

Possible options include a minimum set back from the sea or toe of the dune. Another option is policies and assessment criteria to encourage locating of buildings as far back from the sea as possible within each site. Consideration could also be given to extending the prohibition of new buildings into other hazard zones.

(iii) Designing for Relocatability

The District Plan includes a specific policy to consider the desirability of residential buildings being relocatable so they may be moved if the risk of damage becomes imminent; and relocatability has been a factor that Council has considered in approving applications for new buildings or building extensions in the coastal hazard zones.

However, consideration should be given to whether designing for relocatability is an appropriate long term approach for all properties (especially given the limited ability to relocate many dwellings within their site) or whether avoiding development is more appropriate.

Consideration could also be given to more specific building design requirements to ensure buildings are truly relocatable and to set limits for when designing for relocatability is an appropriate approach.

(iv) Forced Retreat Options

RMA plans can also be used to force the relocation of a building within a site back from the sea (micro-retreat) or completely off a site.

One option is for Council, when approving new dwellings or dwelling alterations, to require a notice to be inserted on the title of the property that the dwelling must be relocated if a certain trigger point is reached (e.g. if the toe of the dune is a certain distance from the dwelling). We are aware that other Councils have required such notices, but we are not aware of any Council that has actually had to enforce the relocation condition. In contrast to the next option discussed property owners would have the option of avoiding the relocation requirement by choosing not to carry out building alterations or build new buildings. Consideration could also be given to combining the relocation condition with a covenant against complaining about the hazard or seeking protection works. Such conditions could help to send a message about the risk and the expected response over time. However, the end result could be a situation where one land use would be subject to a regulatory obligation to retreat but neighbouring land uses with a similar risk would not. As redevelopment occurs a more consistent framework would develop but this would take many years.

Council could potentially also use its powers as a Regional Council to override existing use rights and develop a rule requiring relocation of any dwellings if a certain trigger point is reached (e.g. if the toe of the dune is a certain distance from the dwelling or when a certain percentage of the dwelling is damaged). Compulsory retreat is used in the United States but we are not aware of any New Zealand council that has taken this approach (Turbott et al. 2006). The closest New Zealand example is Canterbury Regional Council, which prevents rebuilding if a dwelling is destroyed.

Alternatively, regional rules could be used to create a set time limit for residential use of the at-risk land (Turbott et al. 2006). The intention would be to both regulate for retreat and to specifically alter market perceptions about the permanence of shorefront land at risk. For example, Council could create a rule that would require resource consent for residential use of the properties along Wainui Beach. Consents would be granted subject to a condition limiting use to a maximum number of years, after which a further consent would have to be sought or residential use stopped. In practice it will be difficult to develop an accurate estimate of the remaining useful life of the land upon which to set conditions. This will also place the onus of monitoring and enforcement on the Council.

(v) Restricting Subdivision to Create Additional Residential Lots

Restricting subdivision to create new lots for use and development is another common approach to managing hazards around the country. The District Plan already prohibits subdivision in the Extreme Risk Zone and for new commercial or residential development in the High Risk Zone.

(vi) Restricting Construction of Hard Protection Works

Consideration could also be given to making hard shoreline protection works a prohibited activity, especially if the overall strategic direction is one of reducing and avoiding the risk through property location. While rules for hard protection structures do not directly address the property behind, the argument is that prohibiting protection works is needed to ensure a focus on property location over physical protection.

According to Turbott et al. (2006) existing rules that require resource consent for protection works (as in the Gisborne District) create a tendency towards armouring of shorelines. They explain that Councils face pressure to grant consents, which are often sought in semi crises conditions. Furthermore, they believe the consent process is inadequate for making broad strategic decisions about the appropriateness of protection works compared to other options.

Tauranga City Council is an example of a Council that prohibits hard protection structures on land zoned conservation or recreation for the purpose of protecting private property.

(vii) Covenants

As explained by Turbott et al. (2006), covenants on titles can potentially be used to prevent property owners from complaining about erosion; lobbying for protection works; lodging applications for protection works; building protection works; and can set penalty payments for any of the above.

However, they note some unresolved questions about their legal weight if enforcement is required.

The covenants could be imposed as a condition in a resource consent application (e.g. for building additions or alterations). Alternatively, Council could possibly purchase the property, apply the convenant, and resell the property.

5.3.2 Hard Protection Structures

As a first step to considering a future strategy, the Working Group did a high level "traffic light" screening of options with the assistance of Richard Reinen-Hamill to remove those that were not appropriate or relevant to Wainui Beach. The focus of this preliminary assessment was primarily engineered (hard) protection structures.

Table 7 below shows the results of the high level screening. The green indicates where the option scores well for the initial criteria; red indicates where the option does not score well; and brown is best described as acceptable against the criteria. A rudimentary scoring system was used to apply some relativity to each of the options.

Richard Reinen-Hamill, for Tonkin & Taylor, wrote a report to support the analysis (Tonkin & Taylor 2012). From this preliminary assessment the Key Stakeholder Forum agreed that more detailed analysis take place on 7 options (from beach nourishment and above).

As can be seen, beach scraping was discounted in the initial assessment. However, having now heard presentations by dune restoration specialist Jim Dahm, Council staff suggest the beach scraping should not be discounted but considered as part of dune restoration options.

OPTIONS	Relative Cost/100m (H,M,L)	Fit for Purpose (H, M, L)	Proven technology (open coast)	Statutory Appropriateness (H, M, L)	Life (yrs)	Scoring: Green = 1 Brown = 3 Red = 5
Prohibiting to 100 HZ	L	H	Y	H	50	5
Cobble berm revetment	M	H	Y	M	50	9
Dune enhancement	L	H	Y	H	10	9
Emergency Geobag protection	L	M	Y	H	25	9
Asset relocation/abandonment	H	H	Y	H	100	9
Rock revetments	M	H	Y	L	50	11
Beach nourishment	H	H	Y	M	25	13
Seawalls	M	M	Y	L	50	14
Beach scraping	L	M	U	M	5	15
Geobag walls	M	L	Y	L	25	17
Off-shore reefs	H	M	N	L	50	19
Beach drainage management	M	L	N	M	25	19
Under-current stabilisers	M	L	N	M	25	19
Groynes	H	L	N	L	50	21
Status Quo	L	L	N	L	10	21
Gabion baskets	M	L	N	L	10	23

Table 7

Reinen-Hamill (for Tonkin & Taylor) then provided a more detailed report on the hard protection options identified as relatively better (Tonkin & Taylor 2013b). This provides further information to identify potential better options for further consideration. The report divides the beach into 10 sections for the analysis (1 to 7B), as shown in Appendix 3. The main findings and a description of each of the protection options are summarised below.

(i) Emergency geobag protection

Geobag walls are stacked sand filled geotextile containers. Due to their relatively low impermeability they perform similarly to a near vertical impermeable seawall constructed from grouted rock, concrete or timber. Like conventional seawalls, they would also require adequate foundations, end details to prevent end effects and a reasonable crest elevation to prevent overtopping scour and toppling failure. They are more suitable in areas of a reasonably low wave height. They have a shorter design life compared to conventional seawalls due to fabric deterioration. They are also more prone to damage and vandalism.

Construction costs are estimated as reasonably high; in the order of $2,500 to $3,500 per linear metre.

While noting their concerns on construction and cost, Tonkin & Taylor suggest this option could be considered for short term applications as part of an overall management strategy to address localised rip and storm erosion effects in sections 2 to 7A (all the way from the Tuahine Crescent to immediately past the Hamanatua Stream). They do not believe this approach would be necessary in sections 1 (Tuaheni Point) or 7B (north of Hamanatua Stream), where there is a lack of built property to protect. Tonkin & Taylor note that short-term application is consistent with their short design life and would have a relatively low cost because they would only be applied to critical erosion areas over a short time frame.

Tonkin & Taylor note that this option would need a significant stock pile of bags filled with from a land-based source, i.e. not from the beach. They estimate at least 180 to 230 bags would be required for a 100m length. For emergency response they would need to be stored in close proximity with ready access to machinery for lifting. Installation would need to be done during the storm events at periods of low tide when access is possible.

A construction risk would be high tide damage of the placed bags and the need to restack/protect the placed bags.

They also note that it is likely that the emergency structures would be retained, rather than removed when sand returned to the system, in effect becoming permanent installations.

(ii) Cobble berm revetment

Tonkin & Taylor explain that a cobble berm revetment replicates the natural cobble beach that exists under parts of the beach at present and, based on historic record, was more significant towards the southern end of the beach. Komar (1996) also proposed a cobble berm revetment in his peer review of the WBMS 2003 but Tonkin & Taylor propose a more dynamic revetment constructed with uniform rocks that could deform and adjust with the wave climate. They explain the advantage of this option is that it can adjust its profile to the wave energy and provides a dynamically stable energy dissipater at the top of the beach.

Rocks must be of a suitable size, durable and preferrably rounded, but they are likely to be quarried and therefore more angular than sea cobbles. This may have a negative impact on public access when beach levels are low.

Tonkin & Taylor estimate the capital cost at $1,500 to $2,500/ linear metre. This assumes a crest elevation of around 2.5m, a 5m wide berm and a slope of 5 (horizontal) : 1 (vertical) extending to around a 1m depth contour, and location of the structure along general alignment of the scarp/bank. The estimate also allows for forming the subgrade and placement of a geotextile filter fabric prior to placing the rock. Planting of the bank above the revetment is recommended. This is not included in the cost estimate but is anticipated to be a similar cost range to dune planting.

Tonkin & Taylor believe that a dynamic revetment option more closely represents the natural system than conventional structural protection options. They also believe it has the potential to comply with the majority of requirements, provided it was used along areas with a relatively small sand storage landward (i.e. adjacent to sea cliff or predominantly sea cliff material) or was of sufficient height to provide dune toe support, rather than full protection against wave forces.

In other words, Tonkin & Taylor envisage it would be of a height that would be overtopped in large storms to result in erosion behind; but it would assist in protecting properties from the cumulative erosion that occurs in successive smaller storms. Where used in areas of sand planting above the structure would also help to build a dune immediately behind, which will hopefully extend to cover the structure for the majority of the time. Where used in areas of limited sand planting would still help to reduce weathering of the bank to improve its stability and would assist with visual integration of the structure into the landscape.

Tonkin & Taylor recommend the option is most appropriate in those sea cliff backed areas of Section 2 and 3A (i.e. from Tuahine Crescent to south of Wainui Stream) in the short term (year 0 to 10 years). They also note possible extension to areas 3B to 4B (immediately north and south of the Wainui Stream) in years 10 to 20 depending on whether stream training works reduce the need for other structures in the vicinity of the stream mouth. They consider that if erosion continues as a result of ongoing sea level rise, and this is not offset by dune enhancement works, the approach may need to be extended further to the north providing time for land based management approaches to occur.

(iii) Rock revetment

Tonkin & Taylor describe revetments as a traditional solution to managing shoreline erosion, which are widely used internationally with detailed standards for their design. These are formed from geotextile filter fabric overlain by a cushioning layer of small rock and protected from wave energy by rock armour placed on a slope.

The high porosity provided by the voids between the rock, together with the slope, provide a form of energy dissipation to wave energy reducing the reflected wave and wave overtopping. Tonkin & Taylor say rock armour slopes of around 3(horizontal):1(vertical) to 4 (horizontal) : 1 (vertical) perform similarly to natural beach systems in terms of dissipating wave energy at the top of the beach.

Capital cost estimates are slightly greater than for the cobble berm revetment because the grading for the larger rock may be more time consuming. A rate of between $2,000 to $3,000 per linear metre is assumed. Based on the available rock properties, it is likely that these structures will also need more frequent maintenance as densities are relatively low and wearing of rock may be an issue.

They consider the revetment compliant with assessment criteria in areas where erosion is acting on the sea cliff sediments, but less appropriate in areas where dunes and sandy backshores are present. Their proposed timing and locations for implementing this option are the same as for a cobble revetment. That is, they see it most appropriate in the sea cliff backed areas of Section 2 and 3A (i.e. from Tuahine Crescent to south of the Wainui Stream) in the short term (year 0 to 10) with extension to areas 3B and 4B (immediately north and south of Wainui Stream) depending on whether stream training works reduce the need for the revetment in the vicinity of the stream mouth. They consider that if erosion continues as a result of ongoing sea level rise, and this is not offset by dune enhancement works, the approach may need to be extended further to the north and south providing time for land based management approaches to occur.

(iv) Training groynes

Tonkin & Taylor advise training groynes are possible options around the mouths of existing streams to reduce the range of movement at the stream mouth. This will assist in dune development adjacent to the structures, as evident from the southern training of the Hamanatua Stream. The structures should not extend significantly onto the beach system but preferably to the toe of the adjacent dune systems to reduce design forces and effects on adjacent coastal processes. Costs are expected to be in the order of $1,000 to $2,000 per linear metre.

They consider the structures are relatively neutral in terms of coastal process effects and have a localised benefit to neighbouring property. Consideration of training works in the first 10 years of the Strategy is recommended.

5.3.3 Beach nourishment

Tonkin & Taylor also provide an initial assessment of the "soft" engineering approach of beach nourishment. This involves importing sand from outside the beach system to increase the volume stored on the beach and dunes.

They comment that it could be suitable in conjunction with other works, such as dune enhancement and emergency response. However, the volumes needed to provide an erosion buffer would be significant and, as there is no readily available source of sand, costs would be high. They estimate $4,500 to $6,500 per linear metre if a reasonable source of sand can be found. Otherwise, rates could be considerably higher. It would be necessary to have an ongoing supply to provide protection against sea level rise effects.

While they believe it a proven option that meets the majority of the Key Stakeholder Forum's assessment criteria, it may have an impact on existing bars and shoals; nearshore ecology and cultural value impacts would need to be carefully considered.

Tonkin & Taylor also note that storm and rip induced erosion would still occur.

They conclude this option is unlikely to provide an immediate solution. Taking into account the required studies, analysis and consent process, consideration of this approach as part of the Strategy would take place 20 to 50 years from the present, although it is possible that it may prove impractical.

5.3.4 Dune Enhancement and Beach Scraping

Dune enhancement work involves planting with sand trapping species (notably native pingao and spinifex), weed control and access control to support the natural process of dune repair following erosion events. It can also involve earthworks to clear pest vegetation and reshape the contour to support growth of dune restoration planting.

Beach scraping (perhaps more positively called "dune repair" or "dune shaping") can be used as part of dune enhancement work. This involves moving sand from the intertidal zone to the dune or upper beach by mechanical means (diggers) (see for example Carley, 2010). Accompanied with dune restoration planting, beach scraping can more quickly rebuild the dune after an erosion event.

David Bergin from Scion was commissioned by Gisborne District Council, as part of an Envirolink funded project, to provide advice on the potential of indigenous coastal plant species to address erosion issues while enhancing indigenous biodiversity at Wainui and Makorori Beaches (David Bergin 2010). Bergin inspected the beaches, held discussions with council staff and undertook a field-based meeting with the local community at Wainui Beach.

Bergin's report advises that there needs to be realistic expectations of the role of vegetating dunes regarding erosion issues at Wainui. There are areas along Wainui where there is insufficient space between properties and infrastructure and the high tide mark to develop a fully functioning natural dune system. However, wherever practical, restoration of sand dunes using appropriate indigenous sand binding plants is essential to reinstate natural dune form and function and there is highly worthwhile restoration work already underway.

For the area south of the Hamanatua Stream Bergin advised that there is scope for continuing to plant good quality spinifex plants with some pingao within bare sand areas along seaward faces of foredunes above high tide. However, restoration of an incipient dune along the beach further south where a steep slope dominated by exotics occurs at or near high tide will be difficult if not impossible to achieve. Nevertheless, any small areas of bare sand immediately above high water marks could be planted to assist in building an incipient dune.

Bergin also provided general advice for planting, weed control and fertilising and recommend preparation of detailed plans including a five-year programme of restoration covering the dune systems to help the council and local communities to prioritise inputs and resources.

Tonkin & Taylor also provided brief comments on the potential to use dune enhancement (Tonkin & Taylor, 2013). They consider dune enhancement is only viable in areas where there are reasonable sand volumes and space landward of the existing dune toe, although they note this space could be private or public land. They believe using dune enhancement as the main option is primarily limited to areas north of the Wainui Stream. They estimate cost ranges between $100 and $300 per linear metre are possible.

The Wainui Beach Coast Care Group recently met with Jim Dahm, a coastal scientist specialising in dune restoration. Members report they got great value from the visit and that there may be greater potential for dune rehabilitation at the south of Wainui Beach by using beach scraping to form a starter dune (Logan comms).

For the Wairere Road section from about the intersection with Ocean Park Road to the playground reserve opposite Beach Cove Road, a starter dune could be formed behind the gabions, or ten metres above normal tide, and up to the foot of the main bank; and vegetation cleared about a third of the way up the bank before being planted with spinifex and pingao. Members suggest this technique may be able to be used further south as far as Cooper Street, although limited available beach space may make it impractical. From Cooper Street to Wainui Stream they suggest beach scraping to form a starter dune behind the gabions, over the existing wooden vertical walls and into the front lawns of properties. The same technique could also be used south of Wainui Stream to Lloyd George Road with residents losing some of their lawn. South of Lloyd George Road the same could apply although private walls could be left until they started to fail. It was recognised that the final strip of the beach currently protected by the log and rail walls would probably require hard protection.

Dahm advised that costs vary significantly from site to site but sites in other regions have cost under $100 per linear meter, allowing for minor earthworks and basic weeding but assuming community planting. Importantly, he noted that the cost is significantly cheaper than protection structures. Pest management, including landward of the restored area, needs to continue to prevent invasion by weeds that do not assist dune restoration.

Dahm suggested Council ensure their planning rules facilitate dune enhancement, e.g. consider allowing for associated minor earthworks (with appropriate standards) without the need to seek consent.

5.3.5 Financial Instruments

Financial instruments provide an economic incentive to encourage relocation or removal of assets from areas at-risk. They may be accompanied by regulation to force relocation or removal of assets. The following summary of financial instruments is adapted from the work of Turbott et al. (2006) with additional comments about the potential application at Wainui Beach. We have excluded options that require central government funding or creation, as no such opportunities are known.

It is noted that the following discussion focuses on possible ways to incentivise action rather than who would fund these incentives, as funding is not addressed in this report. However, some initial comments are made about potential funding issues.

(i) Convert Properties to Public Reserve

Council could purchase at-risk properties, remove the houses and convert the land to public recreation reserve.

Turbott et al. suggested that this option appeared unaffordable in their 2006 assessment for the Waikato region, but that there may be isolated exceptions. They also comment that public purchase of land (at market rates) sends a signal to property investors that it is relatively safe to invest in high risk areas. Therefore purchase of at-risk properties may compound the overall risk problem. "Any decision to purchase at-risk property needs to be carefully considered in terms of its precedent setting effect, and in terms of its effect on property owner perceptions of council responsibility for hazard risk." Council would need to consider not just the signal sent in Wainui, but also to property at risk in other parts of the District.

There would also be difficulties negotiating purchase prices and property owners may be unwilling to sell. Further research is needed of whether this could be overcome with compulsory acquisition at market price.

(ii) Purchase Properties and Lease / Rent

Instead of converting land to public reserve Council could purchase the properties and lease back or rent the properties until such time as the risk is unacceptable. Lease-for-life to existing owners, or until erosion makes the property unusable, could be considered.

Turbott et al. explain that fee simple titles create a significant barrier to the implementation of retreat, as market values do not currently reflect the potential impermanence of the land. People are understandably reluctant to abandon their investment, particularly when shorefront property values continue to increase in value. A form of land tenure with a fixed term of use, equivalent to the projected remaining safe useful life of the land, would be better than fee simple title to areas at long term risk from coastal hazards.

This option allows some of the costs to be recovered through the lease / rent but further analysis is needed to determine the extent to which the costs could be recovered. Again, there would be difficulties negotiating purchase prices and property owners may be unwilling to sell. Opportunities for compulsory acquisition would need further investigation.

Council would still need to be wary of the signal it sends about investment in high risk areas and the precedent effect for other areas affected by hazards.

(iii) Purchase Properties and Relocate Dwellings

Where there are opportunities for dwellings to be relocated on their site a further opportunity exists for Council to purchase the property and relocate the dwelling away from the shore to reduce the risk before leasing or reselling the property. Reselling the property would probably be the least cost option as a larger amount of the cost may be recovered. There may also be the potential for capital gains if property prices keep increasing. However there would be financial risk for Council that the expected returns are not achieved.

Again, there would be difficulties negotiating purchase prices and property owners may be unwilling to sell. Opportunities for compulsory acquisition would need further investigation.

(iv) Purchase Properties, Covenant and Sell

Properties could be purchased at market prices, covenanted to require retreat, and then resold at market prices. This is an alternative to using regional rules to the same effect. The opportunity could also be used to relocate some buildings as discussed above.

(v) Subsidies for relocation

A subsidy scheme could assist with the costs of relocation. This could target both relocation within existing properties and relocation to other properties. Subsidies for relocation of buildings on existing sites would cost considerably less than purchase of properties. However, the cumulative cost of such a subsidy scheme could still be high.

The subsidy scheme would need to be established through Council's Ten Year Plan process. Potentially funding of the scheme could be sourced through a special rate on properties in the affected area or funded more broadly.

(vi) Pre-paid relocation fund

Instead of a subsidy scheme Council could establish a system for property owners to pre-pay directly over time to eventual relocation costs. According to Turbott et al. it is unlikely that agreement could be reached to set up and run such a fund on a purely private and voluntary basis and a mandatory regime would be required. Contributions could take the form of a special rate administered by the local authority.

Careful consideration would need to be given to setting the contribution amount and allocating payouts fairly given the different level of risk for different properties and that some properties do not have alternative building sites for relocating dwellings.

Turbott et al. note that all pre-pay options represent a form of compulsory saving, without a market return on investment (a bank return would be a normal minimum) that could have been generated if the money was invested elsewhere. They also recommend further investigation of any local authority liability e.g. for any losses to scheme fund.

Overall, they suggest it may be more cost-effective and administratively simpler to use a subsidy as discussed above.

(vii) Transferrable development right

Transferable development rights use rules in plans to create an economic incentive to undertake development in a way that will mitigate an adverse effect. As a method for managing coastal erosion, a transferable development right would need to incentivize removing at-risk development and transferring that development right to less vulnerable types of development.

The use of transferable development rights is relatively common in some countries. They are becoming more common for some issues in New Zealand, but we are not aware of any examples of their use for natural hazards. Turbott et al. suggest that transferrable development rights are unlikely to be a viable stand-along mechanism in most locations because the high cost of shorefront real estate would make it difficult to provide a sufficient financial incentive.

It may be most feasible for properties where dwellings could be relocated out of the hazard area but within the same property. Turbott et al. explain that the relocation of buildings may not have a large impact on the overall property value so the financial incentive may not need be that high to encourage relocation – it would only need to offset the relocation cost, transaction costs, the cost of implementing the additional development right, plus an acceptable rate of return. They suggest exemptions to existing rules controlling the size or use of buildings may be sufficient. An issue in Wainui, however, is that onsite wastewater reticulation perhaps limits development scale to a greater extent than planning rules.

For properties where relocation of a dwelling within the site is not feasible or provide the desired level of risk mitigation the transferrable development right would need to focus on development opportunities inland, for example, with subdivision opportunities that would not otherwise be available. There would be many practical difficulties of bringing together and implementing suitable development opportunities that may be a substantial barrier.

5.3.6 Education and Awareness

We have not focused on exploring options to improve education and awareness as part of the management of coastal erosion. Much of Council's work in this area is in performance of its statutory responsibilities (e.g. LIMs, PIMs, hazard information in RMA plans). No doubt, there are opportunities to improve information and awareness and this should be further explored as the project progresses.

5.4 Possible Options

This section of the report sets out five possible high level options or strategies for managing coastal erosion at Wainui Beach over the next 100 years, focusing on the first 20 years. Each option would involve a package of tools or responses, which is also discussed at a high level.

These are not intended as final options but rather to promote further discussion and refinement. The final Strategy may be a mixture of the ideas presented in these options; or may be something quite different.

A table is also included on the significant issues relating to each option in terms of the key considerations. These are the authors' initial thoughts only and further assessment is anticipated with Key Stakeholder Forum members and specialist advisers.

5.4.1 Discussion of Options

Option 1 - Protecting Properties

Under this option the focus is protecting properties for as long as possible, while also seeking to avoid or mitigate the adverse effects of any interventions on matters such as natural character, surf breaks, public open space and access to and along the coastal marine area. To help avoid such adverse effects, it is suggested that the focus of property protection would be the dwellings rather than any private land seaward of dwellings.

A mix of interventions is likely to be needed in the next few decades in order to protect the dwellings. According to Tonkin & Taylor's advice, the best option for the southern end of the beach between the concrete groyne and Wainui Stream is replacement of existing structures with a rock revetment or cobble revetment. These structures would better dissipate wave energy than the current vertical walls and groynes in this area to reduce wave reflection, wave overtopping and erosion behind the structures. If a rock revetment is used, it is also likely to be taller and offer greater protection than the existing gabions and the lower sections of walls and rip rap.

As it is the properties closest to both ends of this section (i.e near the stream and Tuahine Crescent) that have dwellings in the Extreme Hazard Overlay, consideration could be given to limiting the initial structure to these areas. On the other hand, stakeholders have been concerned about the lack of uniformity and haphazard appearance of structures and a uniform continuous structure may improve the appearance. A continuous structure rather could also help to avoid "end effects" in the middle. It is also noted that the current structures in this area already effectively form a continuous structure and replacing them with a revetment that better dissipates wave energy.

To minimise impacts on public access and beach processes consideration could also be given to moving the structure landward and further into private property, particularly in the middle section where dwellings are located further back. This "back stop" approach has the advantage of relocating structures to where they are less visible and interact with foreshore processes less frequently. In areas of sand this is particularly important, as interfering less in the cross shore movement of sand may help to protect natural character and surf breaks. However a "back stop" structure may add to the cost as Tonkin & Taylor's cost estimate assumed location along the general alignment of the bank. If it is possible to shift protection works to a position where they rarely interact with the foreshore it also begs the question of whether a protection work is needed at all. Reinstating protection works landwards would be expensive but may not yield any readily quantifiable risk reduction benefits. A rock revetment will also have a wide footprint and could occupy a substantial area. Furthermore, if the shoreline is retreating in the long-term, then the backstop wall will eventually become the fixed position of the shoreline.

Consideration would be given to replacing the gabions north of Wainui Stream with a cobble revetment. This could offer increased protection to the cluster of properties north of the stream with dwellings in the Extreme Hazard Zone.

Council would also consider installing training walls at Wainui Stream. Accompanied with dune rehabilitation work, this may help to accrete dunes in the immediate vicinity. The training wall near Hamanatua Stream would also be reconstructed.

Dune enhancement may provide sufficient protection over the next few decades for the majority of properties further north but there are half a dozen or so properties with dwellings in the Extreme Hazard Zone that are perhaps particularly vulnerable. Beach scraping and emergency geobags could perhaps be used to provide additional protection if needed.

In the longer term, with sea level rise, there are likely to be questions about extending protection works north along the beach and increasing the scale of protection works. At this time the issue of the extent to which properties should be protected would need to be revisited.

This option acknowledges there is a legacy of protection works at Wainui that may have created a perception of confidence and security for the properties behind. However, it is suggested that this option would embody a review of RMA plans to more effectively avoid additional development that would add to the risk in the long term with sea level rise; particularly in the Extreme Hazard Zone and High Hazard Zone, but also perhaps extending to the Moderate Hazard Zone and Safety Buffer.

Option 2 - Buy Time

Buying time is about seeking to protect properties (focusing on the dwellings) for a finite period (say 20 or 50 years) using dune enhancement and hard protection where appropriate. The "bought time" would be used time to review plans to ensure future development does not increase the risk and to come to terms with an eventual withdrawal from hard protection and the likely need to remove or abandon some property (retreat). This approach is along the lines of that promoted by Tonkin & Taylor (2013b) in their assessment of hard and soft protection options.

As with the "Protecting Properties" option, any interventions in coastal processes would seek to avoid or mitigate the adverse effects on matters such as natural character, surf breaks, public open space and access to and along the coastal marine area. However this option may err further to soft management over hard structures given the limited protection period.

South of Wainui stream the choice of interventions may be similar to that for the "Protecting Properties" but smaller cobble revetments may be favoured over higher rock revetments where possible.

Training walls would be considered for north and south of the Wainui Stream. Accompanied with dune rehabilitation, this may assist with extending dunes in front of areas that are particularly vulnerable due to the location of the dwellings in the extreme hazard zone.

North of the Wainui Stream it may be sufficient to rely on dune enhancement. Beach scraping could potentially be used as part of the dune enhancement programme and a beach-wide consent should be investigated. The Hamanatua Stream training wall would also be reconstructed.

Geobag structures could also be considered as an emergency response during storm events or to prevent further erosion from successive storms.

RMA plans would be reviewed to more effectively avoid additional development that would add to the risk in the long term with sea level rise; particularly in the Extreme Hazard Zone and High Hazard Zone, but also perhaps extending to the Moderate Hazard Zone and Safety Buffer.

Option 3 - Maintain Structures

Under the "Maintain Structures" option Council would continue to repair and maintain the principal components of the existing protection scheme (consisting of the newer structures) until such time as they are provide no real property protection benefit. Maintenance would happen intermittently when the structures are exposed, as happens now. A position would be taken not add any additional hard protection structures along the beach but rather use dune enhancement and look to adapt to over time by relocation and removal of property.

It is noted that the concrete groyne would not be maintained but is likely to remain in the environment for many years due to its slow deterioration. Council would look at reconstructing the training wall around the Hamanatua Stream to provide similar protection, but a more durable structure.

There would continue to be some risk to land and dwellings, even in the short term. As discussed previously, large storms and/or successive storms can result in significant erosion that can impact anywhere along the beach. Those areas with lesser designed structures (e.g. gabions) and/or dwellings within the Extreme Hazard Zone are most vulnerable in the short term.

Dune enhancement should be promoted wherever viable to increase and more quickly recover the buffer between the beach and the dwellings. Beach scraping could potentially be used as part of the dune enhancement programme and a beach-wide consent should be investigated. Further consideration is needed of the extent to which dune enhancement is likely to be successful at the southern end of the beach.

Geobag structures could also be further considered as an emergency response during storm events or to prevent further erosion from successive storms. However, clear arrangements would be need to be in place to ensure they do not become permanent structures, which would contravene the intent of this option.

In the longer term it is expected that structures will become less effective at holding the line of the shore due to sea level rise and the potential rotation of the beach. As with previous options, RMA plans would be reviewed to ensure avoidance of further development that would add to the risk; particularly in the Extreme Hazard Zone and High Hazard Zone, but also perhaps extending to the Moderate Hazard Zone and Safety Buffer.

RMA plans would also be reviewed to further discourage and perhaps prohibit the construction of any private protection works or emergency rip-rap, etc.

Option 4 - Soft Management and Community-led Retreat

This option would see Council withdraw from the protection scheme. Structures would no longer be maintained and would be left to degrade. Council would actively remove structures if they are a hazard to human safety or present visual or other concerns.

Dune enhancement would be the primary method to protect the property behind. As with other options, this could potentially include beach scraping to provide an appropriate slope for encouraging dunes.

As with previous options, RMA plans would be reviewed to ensure avoidance of further development that would add to the risk. RMA plans would also be reviewed to further discourage and perhaps prohibit the construction of any private protection works or emergency rip-rap, etc.

All of the options are likely to involve retreat in the long term, as sea level rise and potentially the rotation of the beach are expected to cause long term erosion. As with previous options, retreat would not be forced through regulation but the need to remove or relocate assets may become more widespread, more quickly. Further consideration should be given to the potential to use financial instruments (e.g relocation subsidies) to encourage relocation or removal of assets.

Option 5 - Retreat Focus

Under this option the focus is on relocating and removing assets (particularly dwellings) away from potential harm before the situation may become critical and pressure may arise to install hard protection works (including illegal protection works).

Council could either withdraw from the protection scheme as with the previous option, or alternatively decide only to maintain existing structures until they are no longer effective. Council would also take a formal policy position not to develop any new protection works.

As with other options, RMA plans would be reviewed to ensure avoidance of further development that would add to the risk. RMA plans would also be reviewed to further discourage and probably prohibit the construction of any protection works or emergency rip-rap, etc.

In addition, Council would look to develop rules to require removal or relocation of assets if a certain trigger point is reached. This could be applied as a condition on approving any dwelling that is altered or extended and perhaps combined with a covenant against complaining about the hazard or seeking protection works. Alternatively, Council could consider more broad-reaching rules (using its regional powers) that would require relocation or removal of any dwelling once a trigger point is reached.

Careful consideration would need to be given to developing the trigger point for retreat to ensure that assets are removed before they are at immediate risk but retreat is not forced while dune enhancement is a reasonable option.

Further consideration should be given to the potential to use financial instruments (e.g relocation subsidies) to encourage relocation or removal of assets.

5.4.2 Issues Relating to Each Option

To assist discussion and analysis of these five possible options, the tables on the following pages compare issues arising for each of the options relative to each of the key considerations discussed in Section 3 of this document. These general criteria are:

1. Coastal Hazard Management and property protection
2. Effective Life and implementation timescales
3. Natural Character
4. Surf Breaks
5. Outstanding natural landscapes
6. Public and private access (onto and along the beach)
7. Cultural values
8. Ecosystems, habitat and indigenous vegetation
9. Relative cost (monetary)

For ease of reference the key elements of the five options presented are summarised below.

COASTAL HAZARD MANAGEMENT AND PROPERTY PROTECTION				
Commentary: Coastal erosion risk arises from the interaction of coastal processes with human use, property and infrastructure. For Wainui Beach, it is primarily the private property south of Hamanatua Stream that is at risk. Private property along Wainui Beach has considerable value – this criterium considers the effectiveness of options to reduce or avoid the risk. Legislation/policy (NZCPS) requires a focus on avoidance of the risk and risk reduction through avoidance and removal / relocation of property and discouragement of hard protection structures.				
Option 1 ***Protect Properties***	**Option 2** ***Buy Time***	**Option 3** ***Maintain Structures***	**Option 4** ***Soft Management & Community-led Retreat***	**Option 5** ***Retreat Focus***
Choice of protection approach (e.g. cobble revetment v traditional revetment v dune enhancement)				
Location of structures; both along the beach and within the beach cross section.				
Effectiveness of regulation to avoid additional property that may be at risk in the long term - may be difficult to implement when aiming to 'hold the shore'.				
Vulnerability of and level of protection provided to properties – in the short term esp. for the 28 properties with dwellings in the Extreme Hazard Zone; particularly those protected by 'lesser' structures.				
Meeting the NZCPS – discourage hard protection structures and promote alternatives; precautionary approach; structures in public land, etc.				
Community acceptance of long term retreat in relation to sea level rise.		High value of beachfront property and community acceptance of retreat, even potentially in the short term for those properties at risk of erosion during storms.		
Implementing regulation to avoid development that may add to the risk. Likely to be pressure to allow full use and development of property.				
Effectiveness of dune enhancement and the extent to which it can be used at the south of the beach.				
		Feasibility of financial instruments to encourage retreat.		
				Interference with existing use 'rights' to enjoy property.

Table 8

EFFECTIVE LIFE AND IMPLEMENTATION TIMESCALES				
Commentary: NZCPS requires consideration of how the hazard risk might change over at least 100 years. Effectiveness of management approaches may vary over different time periods, particularly due to sea level rise.				
Option 1 ***Protect Properties***	**Option 2** ***Buy Time***	**Option 3** ***Maintain Structures***	**Option 4** ***Soft Management & Community-led Retreat***	**Option 5** ***Retreat Focus***
Long term effectiveness of protection approaches with sea level rise and possible beach rotation.				
Design life of structures – 50-100 years?		Life of structures v protection period		
			Determining when protection structures are no longer providing any real benefit	
				Community deciding to use soft management v retreat.

Table 9

NATURAL CHARACTER				
Commentary: Natural character includes coastal processes, visual elements, ecology. Landscape south of the Hamanatua Stream is more significantly modified by residential development, which suggests greater potential to absorbe change. However adverse effects must be avoided.				
Option 1 ***Protect Properties***	**Option 2** ***Buy Time***	**Option 3** ***Maintain Structures***	**Option 4** ***Soft Management & Community-led Retreat***	**Option 5** ***Retreat Focus***
Impact of structures on coastal processes.				
Visual integration of structures into the landscape.		Visual impact of degrading protection structures.		
Risk of incremental increase in scale extent of structures that may impact on natural character.				
Managing geobag structures impact on natural character esp. as risk of being left as permanent structures.				
Development of appropriate standards for beach scraping.				
		High risk of illegal protection works that could impact natural character?		
		Impact of any abandoned property.		

Table 10

SURF BREAKS				
COMMENTARY Wainui – Stock Route – Pines- Whales = surf breaks of national significance (NZCPS). Surf breaks require along-shore and across-shore movement of sand to form sand bars. The sand is sourced from local and distant parts of the beach.				
Option 1 ***Protect Properties***	**Option 2** ***Buy Time***	**Option 3** ***Maintain Structures***	**Option 4** ***Soft Management & Community-led Retreat***	**Option 5** ***Retreat Focus***
Impact of structures with sand movement processes may affect surf breaks but assessment of any impact will be complex.				
Long term impact of sea level rise and associated changes in coastal processes.				

Table 11

OUTSTANDING NATURAL LANDSCAPES				
COMMENTARY Tuaheni Point is an identified outstanding natural landscape and must be protected from inappropriate development. Land-water interface is critical because it is visible and dramatic. Visual continuity along the beachfront toward the headland is an important consideration.				
Option 1 ***Protect Properties***	**Option 2** ***Buy Time***	**Option 3** ***Maintain Structures***	**Option 4** ***Soft Management & Community-led Retreat***	**Option 5** ***Retreat Focus***
Impact of structures on the visual continuity along the beachfront toward the headland.		Impact of degrading structures on the visual continuity along the beachfront toward the headland.		

Table 12

PUBLIC AND PRIVATE ACCESS (onto and along the beach)				
COMMENTARY Must avoid or mitigate any loss of public walking access and identify opportunities to restore public walking access. Maintenance and enhancement of public open space qualities also an objective (NZCPS) Structures must not be located on public land unless there is significant public or environmental benefit in doing so (NZCPS). Approx. dozen existing public access points providing access to the beach. Ideally, all-ability access should be available. Private access onto the beach also important to stakeholders.				
Option 1 ***Protect Properties***	**Option 2** ***Buy Time***	**Option 3** ***Maintain Structures***	**Option 4** ***Soft Management & Community-led Retreat***	**Option 5** ***Retreat Focus***
Potential encroachment of structures into the public beach and loss of public access, especially at high tide.				
Location of any structures on public land – must be significant public or environmental benefit.				
Integration of protection approaches with public access points.				
Private access across any protection structures.				
Managing access to help protect dunes.				
Long term impact of sea level rise on coast and public access.				

Table 13

CULTURAL VALUES				
COMMENTARY Tangata whenua are concerned about impacts on the waahi tapu site alongside the Wainui Stream and seek enhanced access to the beach, especially at the southern end. Tangata whenua also value naturalness and working with nature, protection of the recreational values of the beach and offsetting any impact on public values for private benefit.				
Option 1 ***Protect Properties***	**Option 2** ***Buy Time***	**Option 3** ***Maintain Structures***	**Option 4** ***Soft Management & Community-led Retreat***	**Option 5** ***Retreat Focus***
Potential impacts of structures on natural character.				
Potential impacts of structures on public access – any ability to offset?				
Visual integration of structures with the environment and each other		Degrading structures – appearance of neglect.		
Stream training walls could help protect waahi tapu at Wainui Stream – to be further explored.		Erosion of waahi tapu site adjacent to Wainui Stream.		
Opportunities to enhance public access at southern end of the beach?				

Table14

ECOSYSTEMS, HABITAT AND INDIGENOUS VEGETATION				
COMMENTARY Terrestrial habitats are extensively modified by human development. Some native species remain. Should restore natural character and habitat by using indigenous species, preferably of local genetic stock.				
Option 1 ***Protect Properties***	**Option 2** ***Buy Time***	**Option 3** ***Maintain Structures***	**Option 4** ***Soft Management & Community-led Retreat***	**Option 5** ***Retreat Focus***
Given the existing level of modification any new structures may have little additional impact.				
Opportunities to enhance through dune enhancement.				
Long term impact of sea level rise and climate change.				

Table 15

<table>
<tr><th colspan="5">RELATIVE COST (monetary)</th></tr>
<tr><td colspan="5">Indicative costs only have been estimated.</td></tr>
<tr><td colspan="2">Option 1
Protect Properties</td><td>Option 2
Buy Time</td><td>Option 3
Maintain Structures</td><td>Option 4
Soft Management & Community-led Retreat</td><td>Option 5
Retreat Focus</td></tr>
<tr><td colspan="2">New structures have relatively expensive initial capital costs and ongoing maintenance costs.</td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Maintenance costs of existing structures that continue to be supported as part of the protection scheme.</td><td></td><td></td></tr>
<tr><td colspan="5">Costs of reviewing plans to ensure more effective avoidance of the risk in the long term.</td></tr>
<tr><td colspan="5">Potential loss or costs to private property in the short term – esp for the 28 properties with dwellings in the Extreme Hazard Zone; particularly those protected by ‘lesser’ structures.</td></tr>
<tr><td colspan="2">Potential loss of property in the long term as sea level rise may make continued shore protection unviable.</td><td colspan="3">Potential loss of property in the long term due to sea level rise.</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Costs of any financial instruments to support retreat.</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td>Enforcement costs for forced retreat – could be significant for Council.</td></tr>
</table>

Table 16

Terms of Reference Key Stakeholder Forum and Working Group

Terms of Reference - Key Stakeholder Forum

Overview

Gisborne District Council (GDC) is engaging with stakeholders to develop a Wainui Beach Management Plan (WBMP). The planning process is being managed by a GDC WBMP Project Team. GDC's engagement with stakeholders is through a Key Stakeholder Forum (KSF) supported by a Working Group (WG). This document provides the Terms of Reference for the KSF.

Wainui Beach Management Plan Purpose

Gisborne District Council seeks to develop a sustainable Wainui Beach Management Plan that:

- Identifies the preferred management of coastal hazards affecting Wainui Beach
- Takes into consideration the wider economic, environmental, social, recreational and cultural context
- Has broad acceptance amongst the community
- Provides a framework for future development and decisions related to Wainui Beach

Key Stakeholder Forum Purpose

The Key Stakeholder Forum brings multiple stakeholder perspectives together to ensure the development of a sustainable Wainui Beach Management Plan that takes into consideration the wider economic, environmental, social, recreational and cultural context and that has broad acceptance amongst the community.

Key Forum Functions

1. To ultimately recommend a Wainui Beach Management Plan to GDC
2. To endorse the membership of a Working Group that will undertake the detailed planning work, represent and integrate perspectives, tackle and resolve issues, and make recommendations to the Key Stakeholder Forum.
3. To monitor and guide the Working Group, including:
    a) Agree the Working Group's work plan
    b) Review the Working Group's outputs at agreed key milestones
    c) Review the Working Group's reports and recommendations
    d) Provide feedback to the Working Group
4. To act as a conduit to stakeholder constituencies including:
    a) Communicate in advance the agenda for Key Stakeholder Forum meetings
    b) Keep informed of WBMP progress
    c) Seek feedback on key issues
    d) Consulting on proposed recommendations to GDC

Membership

1. Members will be self-selected
2. Brian Wilson, GDC Councillor will chair the Key Stakeholder Forum
3. Representation sought from all key stakeholder groups
4. Other Wainui Beach stakeholders who can commit to the following membership expectations

It is expected that members will:

- Be fair and transparent – Have a genuine commitment to fairness and transparency
- Be willing to think together – Have a willingness to think together to resolve issues
- Make an informed contribution - Have a genuine commitment to keep up to date with WBMP information in order to make an informed contribution
- Provide continuity - Be available for the full project term; able to commit to meetings (80%)

Meetings

Meetings will be approximately each 4 to 6 weeks at key WBMP milestones.

Decision Making

Key Stakeholder Forum decisions will be made by consensus; with the definition and process for achieving consensus to be agreed at the first Key Stakeholder Forum.

Term

The Key Stakeholder Forum is a fixed term forum. Its term is for the WBMP planning period and terminates when the GDC approves a new Wainui Beach Management Plan.

Terms of Reference – Working Group

Overview

Gisborne District Council (GDC) is engaging with stakeholders to develop a Wainui Beach Management Plan (WBMP). The planning process is being managed by a GDC WBMP Project Team. GDC's engagement with stakeholders is through a Key Stakeholder Forum (KSF) supported by a Working Group (WG). This document provides the Terms of Reference for the Working Group.

Wainui Beach Management Plan Purpose

Gisborne District Council seeks to develop a sustainable Wainui Beach Management Plan that:

- Identifies the preferred management of coastal hazards affecting Wainui Beach
- Takes into consideration the wider economic, environmental, social, recreational and cultural context
- Has broad acceptance amongst the community
- Provides a framework for future development and decisions related to Wainui Beach

Working Group Purpose

The Working Group's purpose is to integrate the perspectives of multiple stakeholders in the development of the Wainui Beach Management Plan; work through the important and substantive issues; and to make recommendations to the Key Stakeholder Forum for a sustainable WBMP that takes into consideration the wider economic, environmental, social, recreational and cultural context and that has broad acceptance amongst the community. E.g. analysing tough problems, creating innovative options

Working Group Functions

1. To work within the guidance and oversight of the Key Stakeholder Forum
2. To agree a work plan with the Key Stakeholder Forum
3. To work through the important and substantive issues that need to be addressed in the WBMP e.g.analysing tough problems; generating innovative solutions
4. To seek confirmation from the Key Stakeholder Forum at key milestones
5. To develop options for consideration by the Key Stakeholder Forum and to make recommendations to the Key Stakeholder Forum on preferred options
6. To report monthly to the Key Stakeholder Forum on progress against the agreed work plan

Membership

1. GDC will appoint members (5 – 7)
2. Kevin Strongman, GDC's WBMP Project Manager will chair the Working Group
3. Members will be part of the Key Stakeholder Forum and endorsed by the Key Stakeholder Forum
4. Important perspectives to be covered by the members are: GDC; Beachfront ratepayers; Beachfront residents; Tuahine Crescent residents; Wainui residents (Non-beachfront); Ngati Oneone; Wainui/Okitu Residents & Ratepayers Association; Wainui Coast Care Group; Previous Wainui Beach Management Strategy Committee; Surfing community; Life stage

Key criteria for selection:

- Availability - Able to commit to regular meetings over the length of the project
- Accountability – Commitment to meet agreed between meeting tasks and timeframes
- Identified perspectives – Able to bring one or more key stakeholder perspectives
- Complementary mix of perspectives – That the mix of members covers all important perspectives
- Length of Wainui Beach involvement – Experience of the changes in Wainui Beach over time
- Genuine commitment to build mutual understanding – Bring an ongoing commitment to represent and listen to the perspectives of multiple stakeholders; integrate the perspectives of multiple stakeholders when addressing substantive issues and generating solution options.
- Commitment to consensus – A willingness to take a consensus Working Group view to the KSF

Meetings

Meetings will be for approximately for 2-4 hours every 1 – 3 weeks.

Decision Making

Working Group recommendations to the Key Stakeholder Forum will be made by consensus; with the definition and process for achieving consensus to be agreed at the first Working Group meeting.

Term

The Working Group is a fixed term group. Its term is for the WBMP planning period and terminates when the GDC approves a new Wainui Beach Management Plan.

APPENDIX TWO

Plan of Protection Works at Wainui Beach

GISBORNE DISTRICT COUNCIL

WAINUI BEACH PROTECTION SCHEME FOREDUNE PROTECTION WORKS 1974 to 2007

SCALE–1:2000		
SURVEYED		
DESIGNED	D.PEACOCK	3–01
DRAWN	D.HEMM	9/08
CHECKED:		

AMENDMENTS		
NAME	DETAIL	DATE

RECOMMENDED : _____

APPROVED : _____

FILE: EW244/1

SHEET 2 OF 2 SHEETS

APPENDIX THREE

Beach Profile Locations and Beach Sections

(Tonkin and Taylor)

NOTES:

1. Aerial photo supplied by Gisborne District Council

SCALE 1: 10,000

0 100 200 300 400 500 (m)

Tonkin & Taylor
Environmental and Engineering Consultants
105 Carlton Gore Road, Newmarket, Auckland
www.tonkin.co.nz

DRAWN	EAA	Jul 13
DRAFTING CHECKED		
APPROVED		
CADFILE \\28735-F11.dwg		
SCALES (AT A3 SIZE) 1: 10000		
PROJECT No. 28735		

GISBORNE DISTRICT COUNCIL
WAINUI BEACH MANAGEMENT STRATEGY

Plan – Sheet 1

FIG. No. Figure 11 REV. 0

NOTES:

1. Aerial photo supplied by Gisborne District Council

SCALE 1: 10,000

0 100 200 300 400 500 (m)

Tonkin & Taylor
Environmental and Engineering Consultants
105 Carlton Gore Road, Newmarket, Auckland
www.tonkin.co.nz

DRAWN	EAA	Jul. 13
DRAFTING CHECKED		
APPROVED		
CADFILE : \\28735-F 12.dwg		
SCALES (AT A3 SIZE) 1: 10000		
PROJECT No. 28735		

GISBORNE DISTRICT COUNCIL
WAINUI BEACH MANAGEMENT STRATEGY

Plan – Sheet 2

FIG. No. Figure 12

REV. 0

NOTES:

1. Aerial photo supplied by Gisborne District Council

SCALE 1: 10,000

0 100 200 300 400 500 (m)

Tonkin & Taylor
Environmental and Engineering Consultants
105 Carlton Gore Road, Newmarket, Auckland
www.tonkin.co.nz

DRAWN	E.A.A	Jul. 13
DRAFTING CHECKED		
APPROVED		
DATAFILE :	\\28735-F 12.dwg	
SCALES (AT A3 SIZE)	1: 10000	
PROJECT No.	28735	

GISBORNE DISTRICT COUNCIL
WAINUI BEACH MANAGEMENT STRATEGY

Plan – Sheet 2

FIG. No. Figure 12 REV. 0

APPENDIX FOUR

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