

Environment Waikato Technical Report 2006/20

Buffalo Beach Coastal Erosion Management Strategy : Part II – Technical Appendices

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Appendix A

Background to Project and Methodology

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1 Background to Project

1.1 Background

This site specific CEMS for Buffalo Beach lies within a wider joint Coastal Erosion project EW and TCDC are currently working on. The wider project is considering District-wide issues associated with coastal erosion. The project purpose is twofold, namely to develop a joint agency approach to managing coastal erosion hazards on the Coromandel Peninsula and to develop an associated funding system for the management of coastal erosion issues. The focus of the project lies in a wider Local Government Act (Long-term Council Community Plan) approach, going beyond the Resource Management Act.

Recommendations from the joint Coastal Erosion project will be combined with other natural hazard related recommendations, such as the Coastal Erosion Hazard Lines and planning recommendations from the Peninsula Project, and these will form the basis of a review to provisions in the Proposed Thames Coromandel District Plan (TCDP) and possibly the Proposed Waikato Regional Coastal Plan (WRCP). An outcome of the Coastal Erosion project is to identify issues and options for managing the coastal erosion at Buffalo Beach and selecting the most technically feasible and affordable mitigation option with stakeholders. The options for managing coastal erosion at this site must be assessed from a sustainable development perspective to identify an outcome that results in the least adverse effects on the environment, society and the economy - in other words achieve a triple-bottom line outcome.

The coastal environment is under greater pressure as development in marginal areas increases and conflicts arise between the human use system and the coastal system. Buffalo Beach is one area where development has occurred in this interface and where long-term strategic management can provide a balance between both systems. Property owners and users of council reserves are pressuring councils to take remedial actions following recent severe storm erosion.

This project is designed to provide information and tools that will facilitate and support the identification of the best approach to managing coastal erosion by EW and TCDC, the Buffalo Beach community, the regional and district communities, tangata whenua and other stakeholders.

1.2 Outcomes of the Project

The outcomes of the project identified by the project brief are:

- Identification of options for managing coastal erosion in the context of Sustainable Development;
- Assessment of environmental, social and economic impacts of options;
- Evaluation of impacts in qualitative, quantitative or monetary terms where appropriate;
- Development of generic impact categories/criteria/indicators (social, economic and environmental) to allow for the comparison of options of any project;
- Comparison and prioritisation of preferred options to their contribution of Sustainable Development; and
- Development of a generic matrix for evaluating options to inform decision-making.

Assumptions and Limitations

- The boundaries of the Buffalo Beach Coastal Management Strategy are between Tarapatiki Stream to the north and the wharf at the southern end of Buffalo Beach.
- No specific design work has been undertaken therefore construction and maintenance costs are estimates for generic structures (e.g., seawall).
- No community or stakeholder consultation has been undertaken in strategy development therefore a selection of options has been provided rather than one recommended option.
- A number of economic assumptions have been made. For further details see Appendix F.
- For the purposes of this project no fieldwork has been undertaken and so analysis is based on existing technical information that has been provided by EW and TCDC as well as project team knowledge and experience.

2 Definition of Strategy Boundaries

The boundaries of the Buffalo Beach Erosion Management Strategy were defined by Environment Waikato (EW) and Thames Coromandel District Council (TCDC) as:

“The area from Tarapatiki Stream in the north through to the area adjacent to the wharf at the southern end of the beach (Figure 1), and excludes Ohuka Beach to the northwest.”

The strategy does not consider Ohuka Beach to the northeast of Tarapatiki Stream as this area is currently the subject of a beach nourishment study being conducted by Opus International Consultants¹.

As seen in Figure 1, the Buffalo Beach strategy area has differing levels of development along the foreshore and therefore differing levels of coastal erosion hazard. It was therefore considered necessary to divide the Buffalo Beach study area into sections depending on the existing level of development/infrastructure and the level of present and potential future coastal erosion hazard. The divisions are shown in Figures 2a, 2b and 2c and are described as:

- 1) southern section – starts at the end of the beach adjacent to the wharf and extends north to where Halligan Road meets State Highway 25 (Figure 2a);
- 2) mid section - where there is currently no development adjacent to the shore (Figure 2b);
- 3) northern section – where there is currently residential development adjacent to the shore and extending north until the Tarapatiki Stream (Figure 2c).

¹ Lesley McCormick, July 2004.

Figure 1: Buffalo Beach Coastal Erosion Management Strategy boundaries



Figure 2 (a): Buffalo Beach Southern Section



Figure 2(b): Buffalo Beach Mid Section



Figure 2 (c): Buffalo Beach Northern Section



3 Cause of Erosion

Understanding the cause of coastal erosion and whether, in fact, there is a coastal hazard at all is essential in determining the appropriate management response. For this reason, background research was undertaken based on existing studies, reports and other documents that investigate the coastal processes, the history of erosion at the site and hypothesise on the cause of the erosion (refer to Appendix K for a bibliography of all referenced material). The following parameters were researched in the assessment of the cause of the erosion:

- Coastal geomorphology;
- Sediment transport;
- Wind, wave and currents;
- Predicted changes in sea level (both short and long-term); and
- Vegetation cover

As well as data on natural parameters, information was collated on human modifications and/or activities (past and present) that may have altered processes and therefore contributed to, or exacerbated, a coastal hazard problem (for example - removal of natural buffers to a coastal hazard, such as vegetation or sand dunes).

Based on the review of existing information and utilising the knowledge and experience of the both the project team and Council staff, the likely cause of erosion and level of coastal hazard was determined. A detailed discussion on the cause of erosion for Buffalo Beach is provided in Appendix B.

4 Understanding the Environment and the Desired Environmental Outcomes

The next step in identifying an appropriate coastal hazard strategy for Buffalo Beach is to gain an understanding of the local and wider environment, and the desired environmental outcomes for that environment. Defining the existing environment sets constraints and opportunities for managing the erosion and formed the first step in the assessment of the actual or potential effects of the options for the management of hazards.

To facilitate the desired outcomes for Buffalo Beach, a draft strategy vision and objectives were developed. Consultation with the community and stakeholders is a key part of developing a vision and objectives for any strategic planning such as this, but consultation was not undertaken as part of this project. The draft vision and objectives have therefore been developed based on community consultation undertaken as part of both the EW and TCDC Long Term Council Community Plan (LTCCP) processes and also the experience gained from past strategic studies undertaken by the project team. EW and TCDC will be undertaking consultation on the Buffalo Beach CEMS prior to adopting the report and it is anticipated that the draft vision and objectives will be further refined in conjunction with the community and stakeholders. This consultation is a recommended action point of this strategy (see Action Plan Appendix J).

It is important to recognise also that the success of the CEMS will rely not only on council support but also on a strong sense of ownership and commitment from the community on the direction and philosophy of this document and the long-term vision for this coastal environment.

5 Screening Level Assessment of Options

The option(s) selected for the CEMS need to be capable of managing the risk from the identified cause of the coastal erosion, have acceptable environmental effects and have reasonable and practicable costs associated with it thus achieving triple bottom line outcomes. The following section details the process behind the initial screening level assessment of options to select the appropriate options that would then undergo a further environmental, economic and social impact assessment.

5.1 Workshop of Options

The first step in developing a management strategy is to identify the range of options that might be used to manage the identified cause of erosion. A workshop was held with relevant regional and district council staff, coastal engineering specialists, environmental economists, coastal scientists and coastal planning experts to initially brainstorm a wide range of available options and discuss any constraints or potential opportunities that should be included for further investigation.

5.2 Checklist of Possible Options

The background research and workshop produced a range of options available for managing coastal erosion at each section of Buffalo Beach, some of which are not technically or practically feasible. To refine the number of options that underwent a full triple-bottom line assessment a checklist of possible options and combination of options was completed for each section of Buffalo Beach. These options were then screened to determine whether they are technically or practically viable. Those options identified as viable were then carried through to the next stage to be assessed further for social, economic and environmental impacts.

Factors that resulted in some options being impractical included:

- 1) design issues (e.g. an incompatibility between the structure being considered and the site conditions);
- 2) options which will present unacceptable safety issues (such as adverse navigational effects); and/or
- 3) options that would have unrealistic costs making them unfeasible to implement.

Factors such as these are known as 'fatal flaws' and justified the removal of the option from the selection process. Fatal flaws of each option possible for management of coastal erosion at the different sections of Buffalo Beach were considered at this stage and justifications given as to why those options were discounted (Appendix D).

6 Social, Economic and Environmental Qualitative Assessment of Options

6.1 Assessment Process

Following the screening appropriate management options for each section of Buffalo Beach were assessed further using a matrix assessment process (multi-criteria analysis²). This matrix approach to options assessment creates a "visual image" of the results of the qualitative assessment process.

Part of development of the matrix included determining indicators against which each option, either singularly or in combination, would be assessed qualitatively. These were based on three broad areas – environmental, social and economic, to achieve a sustainable response^{3, 4}. EW have already undertaken work on indicator development based on the review of sustainability principles proposed in international works such as Earth Share of Washington's Environmental Policy, the Scottish Environment Protection Agency and the National Planning Policy Guideline No. 10, Planning and Waste Management (NPPG10).

² See Glossary in Appendix L for definition of multi-criteria analysis

³ Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

⁴ WCRP

International indicators that were appraised by EW include the 2000 Sustainability Environmental Indicators (UK Water) and 2001 Sustainability Indicators for the Construction Industry (CIRIA RP 609).

The list of indicators that EW had developed was used as a starting point for the assessment of potential options for coastal erosion management at Buffalo Beach. The indicators were further developed to better reflect the New Zealand situation by including matters of national importance as outlined in legislation (such as the RMA and the NZCPS), to reflect the long term assessment over a 50 year time frame and to achieve consistency with the CEMS vision. The 50-year timeframe is used to select options that will promote sustainable development of Buffalo Beach⁵. The full list of indicators used and their definitions is provided in Appendix G.

The grading process used (see below for more details) to assess potential options for the Buffalo Beach CEMS allowed the potential impacts of each option to be visually presented in a matrix format, also enabling the relatively easy comparison between options.

6.2 Grading

The impacts for each option assessed against the indicators were graded as to the level of negative and/or positive impact the option could have. A red or green bar was used depending on whether the option is expected to have a negative (red) and/or positive (green) effect in the long term. In addition to assessing whether there is a potential positive and/or negative impact caused by each option, the degree of impact was also assessed as being High, Medium or Low. The length of the bar in the matrix represents the level of impact (high impact is a longer bar, low impact a shorter bar). Some impact categories are considered to be not relevant to some options and where this occurs a 0 (zero) grading was applied to indicate the option has no impact (and no coloured bar appears in the matrix for that indicator).

The options were assessed against each indicator qualitatively using available data, current coastal science and engineering knowledge and literature. Justifications for the gradings are given in the assessment tables included in Appendix H. Each option has been assessed against the indicators based on whether or not it will have a positive or negative impact on the environment, society and the economy and the level at which it is likely to achieve the strategy vision over a 50-year time frame.

The matrix produces an 'image' of the most preferred option/s to achieve sustainable development and triple bottom line outcomes.

⁵ Environment Waikato Contract 921518 Coastal Erosion Management Strategies for Cooks and Buffalo Beaches, 2004.

7 Economic/Quantitative Assessment

The economic analysis provides a quantitative evaluation of each of the options for management of Buffalo Beach in terms of the overall impacts on society, including beachfront dwellers and the wider community. The economic analysis used in this strategy takes two approaches:

- It uses cost-benefit analysis (CBA) techniques to measure the overall well-being (or welfare) impacts of the different options for coastal management;
- It uses macro-economic techniques to measure impacts on the size of the local economy.

The details of the economic assessment are provided in Appendix F.

8 Action Plan

Once the preferred coastal erosion management options for each section of Buffalo Beach were identified using the economic evaluation and the qualitative matrix evaluation of options, an Action Plan was developed to identify the next key steps for the strategy development. A key part of the Action Plan for the CEMS is the consultation to be undertaken by EW and TCDC as part of the wider regional erosion management strategy. It is anticipated that consultation will enable the two authorities to build on the recommendations of this report and refine the direction and shared vision for Buffalo Beach with the community and other stakeholders.

9 Strategy Project Team

The Study Team for the Buffalo Beach Coastal Erosion Management Strategy included:

- Lamorna Cooper, CEMS Project Manager & Hazards Analyst, Environment Waikato
- Annabelle Giorgetti, Environmental Economist, Environment Waikato
- Peter Wishart, Forward Planning Manager, Thames Coromandel District Council
- Lucy Brake, CEMS Project Manager, Senior Planner – Coastal, Beca
- Cushla Loomb, Environmental Planner/Coastal Scientist, Beca
- Richard Frankland, Senior Civil Engineer, Beca
- Stephen Priestley, CEMS Project Director, Technical Director-Ports & Coastal, Beca
- Jim Dahm, Coastal Scientist, Eco Nomos Ltd
- Tim Denne, Environmental Economist, Covec Ltd
- Corrina Chai, Environmental Economist, Eco Nomos Ltd

We would also like to thank all those people who attended the Opportunities and Constraints workshop, and others that assisted in the preparation of this strategy document.

Summary - Methodology

The preferred strategy for Buffalo Beach has been determined by considering the economic, social and environmental issues to achieve triple bottom line outcomes for the long-term sustainable development of this beach. The following approach has been used:

1. The entire study coastline (between the wharf and Tarapatiki Stream) has been categorised into sections, based on the existing level of development/infrastructure adjacent to the coast.
2. The background to the coastal erosion problem was researched, including investigations into whether there is a coastal hazard at Buffalo Beach, and a draft strategy 'vision' developed.
3. A list of potential options was produced for each section of Buffalo Beach based on available literature sources, the knowledge and experience of the project team and a constraints and opportunities workshop.
4. The potential options for each section of beach were screened for any 'fatal flaws' that made some options technically unfeasible. Justifications were given as to why these options were not considered viable options for further assessment.
5. The options that passed the screening were then qualitatively assessed (using multi criteria analysis) against carefully selected environmental, social and economic impact categories reflecting sustainable development principles and assigned an impact grade depending on their level of effects.
6. Each option was quantitatively assessed using cost-benefit analysis (CBA) techniques to measure the overall well-being (or welfare) impacts of the different options for coastal management and macro-economic techniques to measure impacts on the size of the local economy.
7. A number of preferred coastal erosion management options were identified for each section of beach using the matrix and the results of the economic analysis. These options are considered to be the most likely to achieve the strategy vision and progress the CEMS to the next stage.
8. A number of actions were identified to assist EW and TCDC to further refine the strategy vision and options and progress the CEMS to the next stage.



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Background Information on Buffalo Beach

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1 Environmental Characteristics

1.1 Description and Coastal Processes

Buffalo Beach is a fine-medium sand beach, approximately 3km long, located at the head of Mercury Bay (Figure 1).

Mercury Bay acts to shelter Buffalo Beach from most swell and sea waves - the beach being directly exposed to ocean wave action over only a relatively narrow segment from the east and northeast. Depths in Mercury Bay are also shallow, being less than 5m below Chart Datum for a distance of over 2km off the beach and the 10m isobath lying nearly 3.5-4 km offshore (compared to 500-1000m along most open coast beaches of the eastern Coromandel). Therefore, wave refraction, diffraction and shoaling significantly affect swell and sea waves entering the Bay and wave energy distribution can vary significantly according to wave direction and period (Smith, 1980). The northern end of the beach is generally subject to less severe wave action than the central and southern areas.

Tides in Mercury Bay are semi-diurnal with a spring tidal range of 1.62m and a neap tide range of 1.28m. Analyses of tide gauge records indicate seiching within Mercury Bay (Smith, 1980; Goring, 1999). The Bay is also subject to moderately significant storm surge effects, with water levels elevated about 0.8m above predicted astronomical tides during the major storm of July 1978. Waves commonly overtop back beach areas during coastal storms due to the combined effect of waves and storm surge.

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Whitianga Harbour, a large tidal estuary (tidal prism approximately 16 million cubic metres), discharges at the southern end of the beach (Figure 1). An ebb tide delta, formed by flows discharging from the harbour entrance, lies offshore from the beach but the feature is very low lying. The harbour results in complex tidal and sediment flow patterns within inner Mercury Bay

offshore from the beach and nearshore tidal velocities are relatively high in nearshore areas at the southern end of the beach. In general terms there is also an anticlockwise pattern of net sediment transport within the inner Mercury Bay - sediment discharged northwards offshore from the tidal entrance and recirculated landwards and southwards by the combined effect of waves and tidal currents. This sediment pattern results in a general trend for net southward littoral drift along Buffalo Beach.

The beach fronts a wide coastal dune plain (scientifically, a Holocene barrier system) that has prograded approximately 2800m seaward over the last 6500 years. Available information suggests that the long-term trend for seaward advance has now ceased, though the evidence is not unambiguous. Whitianga Township, dating from kauri milling days of the late 1800's, is situated on the coastal dune plain - together with the recent Whitianga Waterways canal and residential development.

Subdivision at the southern end of the beach dates from the late 1800's and the foreshore roads in this area were placed close to the sea. There is also beachfront subdivision and development on the seaward side of the state highway, at the northern end of the beach,

dating from the 1950's. In central areas of the beach, roads and private property are well setback from the sea with wide grassed public reserves in this area.

Figure 1: Buffalo Beach showing Whitianga Estuary entrance to the south. Note the ebb tidal delta.



1.2 Coastal Erosion

Photos dating from the 1950's indicate the foreshore roads at the southern end of the beach were separated from the sea by a narrow dune and a wide high tide beach. Photos suggest the beach in this area (located close to the town centre) was at that time a popular recreational area.

There is some evidence that the roads experienced periodic erosion problems prior to the 1960's, but particularly serious erosion appears to have commenced in the early 1960's, requiring the placement of rock armour to protect the state highway and parts of the Esplanade. The causes of the serious erosion problem are not clear, though they could

include offshore changes related to the severe tsunami event of May 1960, storm cycles and/or seaward widening of the road.

The southern end of the beach has also experienced frequent storm wave overtopping, with inundation of houses and properties on the landward side of the road. Ohuka Reserve and the adjacent state highway have also been frequently overtopped by storm waves.

The central and northern areas of the beach have experienced periodic storm cut erosion and recovery over time, but a period of very serious erosion and shoreline retreat commenced in this area in mid 1995.

At the northern end of the beach, fronting the development on the seaward side of the highway, the seaward toe of dune cut back by about 20-30m between the mid 1990's and a period of sustained easterly weather in mid 2000 - leading to initiation of the present seawall in this area. There is also some evidence that erosion cut back to a similar point in this area in the late 1950's.

Erosion of the Ohuka reserve also commenced about 1996, though the most serious retreat in this area has occurred since early 2000 - with total duneline retreat of about 20m between 1995 and 2003.

The available evidence suggests the erosion at Buffalo Beach is primarily related to dynamic shoreline fluctuations, rather than ongoing permanent shoreline retreat (Dahm and Munro, 2002).

The primary causes of the erosion appear to be periods of increased and decreased storminess (i.e. climate cycles associated with ENSO and IPO) and the influence of the adjacent ebb tide delta. The influence of climate cycles is suggested by the fact that the periods of beach and dune recovery and of erosion coincide with the general pattern observed along the eastern coast of the Coromandel and the

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Bay of Plenty. The influence of the ebb tide delta on the erosion is suggested by the pattern of shoreline change evident in offshore profile data and by anecdotal reports that the erosion has coincided with shallowing over parts of the ebb tide delta. If correct, the anecdotal evidence of offshore shallowing suggests that much of the sand eroded from the beach has been moved alongshore to the harbour entrance and recirculated seaward onto the ebb tide delta. The reports are consistent with the pattern of change available in the limited offshore survey data.

The joint influence of storms/storm cycles and the ebb tide delta on shoreline changes introduces a level of uncertainty in terms of the maximum potential fluctuations that might occur at this site over a period of several decades. The changes over the last 50-60 years are generally within the scale of shoreline changes noted at other eastern Coromandel beaches; with duneline fluctuations typically less than 30m except near stream and harbour entrances (Dahm and Munro, 2002). However, the potential for larger fluctuations cannot be conclusively ruled out - for instance, if an erosion cycle associated with ebb tide delta influences coincides with a period with a higher than normal incidence of coastal storms.

Moreover, while the present erosion appears to be primarily associated with decadal shoreline fluctuations, there is potential for permanent net erosion in the longer term – associated with projected sea level rise (and possibly other effects) likely to accompany predicted climate change.

These uncertainties will need to be given careful consideration in detailed design of any strategy.

1.3 Erosion Hazard – Is there an Issue?

It is clear from historic damage, both in the early 1960's and the period from 1995, that, in the absence of effective protection works, erosion poses a hazard to the former state highway at the southern end of the beach and to the properties (and probably some dwellings) on the seaward side of the road at the northern end of the beach.

The setback lines (Figure 2, 3 and 4) recently developed by Environment Waikato provide the best present estimates of the area vulnerable to erosion hazard, though these setbacks are probably precautionary. More detailed site-specific investigation and analysis would be required to refine these estimates.

The setbacks suggest that, at present, there are 68 properties and 43 dwellings that could potentially be impacted by erosion in the absence of shoreline protection works. These properties have a combined capital value of about \$43 million, though the present market value of the properties is probably closer to \$60 million.

In the longer-term future, erosion may be further aggravated by projected sea level rise, particularly in the period beyond 2050 AD. Present best estimates suggest potential for complete loss of many beachfront properties in the affected areas at both the northern and southern ends of the beach. At present, Environment Waikato estimates suggest there are 80 properties and 56 dwellings within the area potentially impacted. These properties have a combined capital valuation of \$56 million, though the present market value is probably closer to \$70 million.

Figure 2: Buffalo Beach North Hazard Lines



Figure 3: Buffalo Beach South (top) Hazard Lines



Figure 4: Buffalo Beach South (Bottom) Hazard Lines



In addition to the area potentially impacted by erosion, there are extensive backshore areas at both northern (Ohuka) and southern ends of the beach that are potentially vulnerable to coastal flooding. This flooding will also become more frequent and severe in the event of projected sea level rise.

Therefore, even though existing hazard setbacks are slightly precautionary (i.e. probably slightly overstate the risk), there are clearly coastal erosion and coastal flooding hazard problems at this site – at the southern end of the beach (basically from the wharf to about Halligan Street) and along the front of the properties on the seaward side of the state highway at the northern end of the beach.

1.4 Property Owner Response and Seawall Issues

To date, the primary response of the road managers and private property owners to coastal erosion has been the placement of various seawalls. Council has also placed limited lengths of armouring in these areas – to protect a toilet block on the foreshore towards the southern end of the beach; and to protect a reserve suffering end effects erosion from adjacent seawalls at the northern end of the beach.

The seawalls adjacent to the foreshore roads (Buffalo Beach Road and The Esplanade) at the southern end of the beach and to properties and coastal reserve at the northern end are moderately robust but have significant weaknesses and are unlikely to be

To date, the primary response of the road managers and private property owners to coastal erosion has been the placement of various seawalls.

certified as appropriate long-term protection by competent coastal engineers. They are best regarded as interim measures until a more appropriate long-term solution has been developed and implemented. For instance, a recent engineering assessment of the seawall protecting Buffalo Beach Road over the area north of Albert Street highlighted a number of

serious engineering deficiencies and concluded that significant work and cost would be required to provide a properly designed rock revetment wall (Tonkin and Taylor, 2003).

There are also significant adverse environmental effects associated with existing seawalls. For instance, the existing structures commonly reduce the width of high tide dry beach immediately adjacent to the roads at the southern end of the beach (especially the section of seawall north of Albert Street) and along the front of the properties at the northern end, adversely impacting on natural character, visual amenity, and recreational values. Access along the beach is also frequently precluded at higher stages of the tide, even though a high tide beach occasionally establishes in front of the rocks at the southern end of the beach and, far less frequently, against the structures at the northern end.



In terms of legal status, it is believed seawalls adjacent to the former state highway were originally legally established (most of this work having been conducted by central government agencies in the 1960's) and although present consent status is unknown the structures probably have existing use rights. However, even so, resource consents will need to be renewed once the regional Coastal Plan is fully operative and has been signed off

by the Minister of Conservation. The rock and concrete block wall fronting properties at the northern end of the beach currently has a short-term consent (subject to resolution of existing appeals). Parties responsible for most other existing seawall structures are generally in the process of preparing consent applications or taking professional advice in regard to the best future course of action. Therefore, none of the existing structures is presently consented as a long-term solution.

Many existing seawalls are wholly or partially located on reserve. TCDC is presently considering adopting a policy that permission not be granted for such works on council owned foreshore. If this policy is adopted many existing structures will ultimately have to be removed or will necessitate some local variation to the policy.

Legal advice given to TCDC suggests there may also be potential liability issues for management agencies and/or property owners in regard to some seawall structures.

Past discussions with property owners at Buffalo Beach indicate that, as at Cooks Beach, the majority strongly favour management options that hold the shoreline seaward of their properties.

1.5 Response of Management Agencies

In response to the erosion problems at Cooks Beach and other sites, TCDC introduced 30m and 60m hazard setbacks at all developed beaches along the Coromandel east coast in the early 1980's (Figures 2, 3 and 4).

The 30m setback defines the area potentially at high risk from coastal erosion. New buildings are excluded in this area, including the replacement of existing dwellings unless a site-specific hazard assessment indicates that a lesser hazard zone is appropriate. The 30-60m setback identifies a lower risk area, unlikely to be impacted unless erosion is aggravated by sea level rise or other changes. New dwellings are usually consented within this area, conditional on relocatability and a damage waiver indemnifying Council. A Section 36 notice is also normally imposed.

The 30m setback has generally been firmly implemented for new houses at Buffalo Beach. However, the situation is more complicated at the southern end of the beach. This area was designated as a defended beach for a period in the 1980's and early 1990's in response to a proposal to protect the shoreline in this area using the hook groyne proposed by Simpson (1972), which proposal was further developed and modelled by Raudkivi (1981; 1986). The defended beach status was removed in the early 1990's but the existence of protected foreshore roads along the front of the properties appears to have blunted the influence of the hazard designations – perhaps tending to give rise to an assumption the area will always be protected. Consequently, subdivision and development within the hazard areas has intensified quite significantly over the last 20 years. More recently there has also been pressure for initiation of high-rise development in the area.

Following lifting of the defended beach designation, TCDC and Transit NZ commissioned a preliminary assessment of hazard management options – undertaken by Tonkin and Taylor (1998). The report examined a range of management options and recommended a strategy comprising status quo,

planning and managed retreat options with more focused monitoring – subject to further investigation and consultation. The monitoring recommendations were adopted and have provided data useful to this project. However, subsequent to the completion of the report, the beach experienced a period of severe erosion – leading to the present report that further extends the useful investigation of management options undertaken by Tonkin and Taylor.

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2 Social Aspects

This section outlines the social characteristics of the community, including population, visitor numbers and main attractions, as well as beach use and users.

2.1 Population and Ratepayers

Buffalo beach fronts Whitianga, the main settlement in Mercury Bay and the second largest township on the Eastern Coromandel.

The township has a total ratepayer roll of 2472 (Lesley McCormick, Area Manager, TCDC Whitianga, 2004). Statistics indicates that the community has a higher proportion in the 65+ age bracket (19.4%) than the NZ average (12.1%), a higher proportion of Europeans (93.8% against 80.1%), and a median income of \$14,500 (compared to \$18,500) (Statistics New Zealand, 2004).

The population increases significantly (about 7 fold) during peak seasons. For instance, the last (2001) census indicated that the town had a usual resident population of 3,078, while the population during the 2003/04 summer peaked at 21,888 people (TCDC, 2004).

Unlike other coastal settlements such as Whangamata, the peak experienced a more a gradual decline (as opposed to a significant exodus) after New Year's Eve (TCDC, 2004).



Absentee owners make up of 48% of the ratepayers' roll (Lesley McCormick, Area Manager, TCDC Whitianga, 2004). The majority of absentee ratepayers are likely to be originated from Auckland and the Waikato, following the breakdown of the Coromandel as a whole.

It has been projected that absentee dwellings are likely to increase. For instance, the 2001 Census recorded 19,848 absentee dwellings in the Thames Coromandel District. This is forecast to rise by 38% to 27,436 by 2020. This development will be faster in some areas than others. For example, Mercury Bay will see an annual increase of 3.5% per year compared with a 0.5% increase in Thames (Tourism Coromandel, 2004).

The permanent population in the Coromandel as a whole is also projected to increase by 20% between 2001 and 2021 (Tourism Coromandel, 2004) and Whitianga seems likely to follow this trend or be slightly higher.

2.2 Main Visitor Attractions

Whitianga is a popular coastal destination in the Coromandel – the local beaches ranking fifth among the top ten beaches visited by respondents in a recent survey conducted in the Waikato Region, (Environment Waikato, 2003).

It is also an attractive town with a wide variety of visitor activities in addition to the beach.

For instance, Whitianga has a deep-water harbour with several launching ramps and boating is very popular. It is the home of the Mercury Bay Boating Club, which challenged for the Americas Cut under Sir Michael Fay and a big-game fishing base for tuna, marlin, mako and thresher sharks. The Mercury Bay Big Game Fishing Club, formed in 1925, is very active and has a number of major events each year.

Many charter boats operate out of Whitianga harbour, providing scenic cruising, fishing, diving, whale watching and dolphin swimming. On land, various tours are available, including guided tramps, quad bike safaris and horse treks.

The town has a number of shops, including a wide variety of arts and crafts shops, cafés/restaurants, etc.

Whitianga also has a long history and the local museum is popular, as well as the heritage trails and the harbour crossing over to Ferry Landing where the oldest stone wharf in Australasia is located. A variety of walks and heritage trails are available in the general area, including Ferry Landing and Shakespeare Point (both readily accessible by the ferry crossing).

2.3 Beach and Beach Use

Buffalo Beach, named after a vessel wrecked on the beach in 1840, is the largest beach in the Mercury Bay area and the main beach for Whitianga Township.

The crescentic shape of the beach contributes to its high aesthetic values and walking along the beach is extremely popular, as is sitting and enjoying the view. (Mike Harper, Destination Mercury Bay, pers. comm., July 2004).

In recent years, various restaurants have opened along the beachfront at the southern end (i.e. near the town centre)

The 4-kilometre stretch of the sheltered sandy beach is very safe for swimming as it has no rips and is regarded as very much a family beach. It appears from historic photos that the southern end of the beach was very popular for swimming and sunbathing up until at least the 1950's. However, loss of high tide beach now limits these recreational opportunities in this area close to the town centre. In recent years, various restaurants have opened along the beachfront at the southern end (i.e. near the town centre) and the increasing use in this area suggest there may be benefits in restoration of high tide dry beach.

Fishing is also popular, particularly off the southern end of the beach near the harbour entrance.

There are roads along the back of the beach over the full length (though separated from the sea by private properties at the northern end), ready beach access, and extensive beachfront public reserves. There are also parking areas with beach views.

The local yacht club has premises on the reserve at the northern end of the beach and runs regular activities off the beach. A wide range of other water activities (including kayaking, sailboarding, boating, water skiing, etc) are also popular, particularly during summer.

The two beachfront camping grounds in Whitianga have recently closed, though there is a camping ground towards the landward side of town as well as several motels (including a number along the beach), a hotel and other accommodation.

2.4 Maori Values

Whitianga is rich in Maori history. The name Whitianga is short for Te Whitianga-a-Kupe (Kupe's Crossing Place) in memory of Kupe's arrival after crossing the ocean from Tahiti (Riddle, 1996). The presence of Kupe is commemorated by various place names around the area.

Just north of Buffalo Beach is Ngati Hei's turangawaewae - including the historic headland pa site, Wharetaewa, overlooking Wharekaho Bay. Archaeological investigation has revealed many centuries of continuous occupation here, making it one of the oldest inhabited sites in New Zealand (<http://www.ngatihei.iwi.nz/>).

The stream that flows out in the central regions of the beach has the name *Tapu Tapu Atea* - the name of Kupe's great temple at Opoa on the island of Raiiatea - the only place in New Zealand where this name occurs (<http://www.ngatihei.iwi.nz/>; Riddle, 1996).

Therefore, the beach has very considerable significance for Ngati Hei, the local tangata whenua.

3 Economic Aspects

This section highlights the economic importance of the beach, in particular, looking at its role as a tourist destination, its contribution to the local economy, and the high price people are willing to pay for beachfront properties and coastal protection.

3.1 Economic Importance of Coromandel Beaches

In the Coromandel, beaches are of significant economic importance in coastal areas, particularly to the tourism industry.

Unspoiled recreational beaches and a clean, spectacular coastline have been identified as one of the eight special experiences essential to the character and appeal of the Coromandel region to visitors

Unspoiled recreational beaches and a clean, spectacular coastline have been identified as one of the eight special experiences essential to the character and appeal of the

Coromandel region to visitors (Tourism Coromandel, 2004). The presence of numerous beaches is also noted as a key factor in attracting large numbers of domestic visitors, who make up 79% of total visitors numbers to the region (Tourism Coromandel, 2004).

Research by Tourism Coromandel found that the Coromandel attracted 1.1 million visitors in 2002, generating total visitor spending of \$244 million. It has also been projected that visitor numbers will increase by a further 16.9% by 2009 (Tourism Coromandel, 2004).

While there is no information on numbers of visitors to Whitianga over a total year, door counts from the Whitianga Information Centre indicate that about 100,000 people pass through the centre every year (Benson Lockart, Whitianga Information Centre, July, 2003).

In terms of a breakdown of visitor numbers and origin, 79% visitors to the Coromandel are of domestic origin, with the remaining 21% from overseas. Of the domestic visitors, Aucklanders account for 60.5% of domestic visitor nights to the Coromandel, followed by visitors from Waikato (21%) and the Bay of Plenty (Tourism Coromandel, 2004).

Figures for the Coromandel as a whole indicate that domestic visitors spend on average \$59/head/day while international visitors average \$109/head/day. It has been projected that domestic visitors will grow at an average of 1.4% per year and international visitors at 5.3% per year - with domestic visitor spending increasing to \$61/day and international visitor spending growing to \$138/day and by 2009 (Tourism Coromandel, 2004).

3.2 Property Values and Protection

Beachfront property values at Buffalo Beach are high, as with other eastern Coromandel beaches.



Average capital value of properties on the seaward side of the road at the northern end of the beach is presently about \$709,000. This is well below the capital value of similar beachfront properties elsewhere on the Coromandel and suggests that the values of the properties are being adversely impacted by uncertainties surrounding the existing erosion issue. This is further reinforced by recent

sales experience. At the time of writing (July 2004), the most recent sale (an estate) went for \$790,000. Other properties are currently on the market at around \$1-1.2 million, but to date none of these have sold.

The capital values of the worst affected properties at the southern end of the beach (1-18 Buffalo Beach Road – where the existing high risk hazard line incorporates most of the area of the beachfront sections) appear to be significantly less affected by the existing hazard risk. The average capital value in this area is about \$1,000,000. Similarly, the average capital value for the 14 properties along the Esplanade (13-27 The Esplanade – counting 21 The Esplanade as one property, though having two units) is also higher – presently \$909,000.

The closer proximity of the properties at the southern end of the beach to the town centre and the more permissive development rules that operate in this area are undoubtedly contributing factors to the higher values in this area. The market values are also possibly much higher than existing capital values suggest.

The hazard risk to these properties does not seem to have as significant an impact as at the north end of the beach. It is possible the roads and (for The Esplanade) the heritage value phoenix palms seaward of the properties has given rise to an assumption that these areas will always be protected – even though there is not presently any long term commitment to this.

4 Historic Heritage

Buffalo Beach has been relatively well assessed by field archaeologists in southern part of the beach, adjacent to the Whitianga Estuary Entrance. There is therefore a good level of information available on historic heritage in that area. However, the other parts of Buffalo Beach are relatively undiscovered, and little information is available on historic heritage.

The frontal dunes of Buffalo Beach are not considered to have any archaeological sites of significance given their dynamic nature (Warren Gumbley, pers. comm. July 2004).

However, it is possible that there are a number of undiscovered archaeological sites near the mouths of Tarapatiki and Taputapuatea Streams (Warren Gumbley, pers. comm. July 2004). Archaeological information held by Environment Waikato does show a recorded midden and pa inland from the northern section of Buffalo Beach (circled in Figure 5), although this is sufficiently landward to not be affected by the CEMS.

The HMS BUFFALO was wrecked in a storm at Mercury Bay on 29 July 1840 and therefore is an important archaeological site offshore of Buffalo Beach (although its location is not clear). This wreck has protection under the Historic Places Act 1980.

Figure 5: Archaeological sites for Whitianga and Cooks Beach held in EW register.



5 Previous Work

Tonkin and Taylor prepared a report in 1998¹ that addressed the extent of the effects (both current and potential) of coastal erosion and sand migration at Whitianga and identified appropriate measures to manage those effects. The report stated erosion at Buffalo Beach appears to be caused by extreme events such as water level, storms and tsunami rather than annual climatic trends. The results of the Tonkin and Taylor investigation into the coastal processes at Buffalo Beach suggest that the beach is dynamically stable, however, the beach was identified as oscillating within a horizontal zone of 20-30 m.

The Tonkin and Taylor report considered a number of options to manage coastal erosion hazard at Buffalo Beach ranging from soft, non-engineered options such as “Managed Retreat” and “Planning Responses” through to hard structural options such as “Groynes”, “Seawalls” and “Offshore Breakwaters”.

The Tonkin and Taylor recommendations for coastal management at Buffalo Beach were for a phased implementation approach with a combination of “Status Quo”, “Planning” and “Managed Retreat” options combined with more focussed monitoring. “Beach Dewatering” was recommended if more structural works were desired.

¹ Tonkin & Taylor. 1998. Thames Coromandel District Council Buffalo Beach 5H/95: Coastal Management Study.

Unpublished report prepared for the Thames Coromandel District Council.



Appendix C

Policy/Planning Framework

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1 Introduction

As a strategic document, the Coastal Erosion Management Strategy (CEMS) for Buffalo Beach will provide overarching direction to both the district and regional council when managing the coastal erosion hazard at Buffalo Beach. The focus of the CEMS as a non-statutory document is to go beyond the Resource Management Act 1991 with a wider Local Government Act 2002 approach but that is intended to tie in with existing management documents (including the District Plan, Annual Plans and financial plans). It is therefore important to recognise the influence that national, regional and district strategic and policy documents provide to the CEMS.

The following sections outline the planning framework for the management of coastal erosion hazards in the Buffalo Beach area and the statutory framework currently used to administer coastal hazards. It also discusses non-statutory documents that have been prepared in association with coastal erosion hazards management of relevance to this site.

2 Statutory Framework

2.1 Resource Management Act 1991

The Resource Management Act 1991 (RMA) provides a framework for integrated and sustainable management of natural and physical resources. Avoidance or mitigation of coastal hazards must be undertaken in a manner that achieves the purpose and principles of the RMA, and must be consistent with the provisions of the relevant statutory documents which derive from it. Part II, IV, V, VI, X, XII, the fourth schedule and relevant case law derived from the RMA are discussed further below.

2.1.1 Part II - Purpose

Section 5 of the RMA states that its purpose is to promote the sustainable management of natural and physical resources. The term “*sustainable management*” is defined to mean:

“...managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while:

- (a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
- (b) Safeguarding the life-supporting capacity of air, water, soil and ecosystems; and*
- (c) Avoiding, remedying or mitigating any adverse effects of activities on the environment.”*

Sections 6, 7 and 8 sets out matters that must be considered in carrying out functions and duties under the RMA. Section 8 requires that the principles of the Treaty of Waitangi be taken into account.

2.1.2 Part IV

Part IV of the RMA , relates to functions, powers and duties of central and local government. It includes Section 30 which sets out the functions of regional councils including:

- “(c) *The control of the use of land for the purpose of-*
 - (iv) the avoidance or mitigation of natural hazards’*
- (d) *In respect of any coastal marine area in the region, the control (in conjunction with the Minister of Conservation) of -*
 - (v) Any actual or potential effects of the use, development, or protection of land, including the avoidance or mitigation of natural hazards.....”*

Section 31 sets out the functions of territorial authorities which includes:

- “(b) *The control of any actual or potential effects of the use, development, or protection of land, including for the purpose of the avoidance or mitigation of natural hazards....”*

Section 32 states that before a proposed plan, proposed policy statement, change, or variation is publicly notified an evaluation must be carried out by the local authority that must examine the extent to which each objective is the most appropriate way to achieve the purpose of the RMA and whether, having regard to their efficiency and effectiveness, the policies, rules, or other methods are the most appropriate for achieving the objectives (including an assessment of the benefits and costs of policies, rules or other methods). Therefore, this strategy document provides an assessment of coastal management options that is consistent with an analysis required by Section 32. Section 32 of the RMA will also be relevant if options which require a plan change, such as rezone beachfront land to open space, are pursued.

Section 35 of the Act requires every local authority to gather, monitor and keep *“records of natural hazards to the extent that the local authority considers appropriate for the effective discharge of its functions”*.

2.1.3 Part V

Part V of the RMA sets out the requirements for policy statement and plans. Under Sections 62, 65, 68, 75 and 76, regional policy statements, regional coastal plans and district plans shall include policies, methods and rules to manage the effects of natural hazards, and the effects of land use on natural hazards where this is considered a *“significant resource management issue”*.

2.1.4 Part VI

Section 106(1) within Part VI of the Act states that a consent authority may refuse to grant a subdivision consent if it considers that either-

- “(a) Any land in respect of which a consent is sought, or any structure on that land, is or is likely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; or
- (b) Any subsequent use that is likely to be made of the land is likely to accelerate, worsen, or result in material damage to that land, other land, or structure, by erosion, falling debris, subsidence, slippage, or inundation from any source, or
- (c) Sufficient provision has not been made for legal and physical access to each allotment to be created by the subdivision.”

Conditions under 106(1) must be for the purposes of avoiding, remedying, or mitigating the effects referred to in 106(1) and of a type that can be imposed under Section 108 of the RMA (conditions of resource consents).

2.1.5 Part X

Part X of the Act relates to Subdivision and Reclamations and includes Section 220 which provides for a condition of subdivision consent to be imposed to protect land against hazards.

2.1.6 Part XII

Part XII of the Act includes a provision relating to emergency works to take preventative or remedial action to avoid or mitigate any sudden event causing or likely to cause loss of life, injury or serious damage to property. The important tests for application of this section are the demonstration of both immediacy and urgency.

2.1.7 Fourth Schedule

The Fourth Schedule to the Act requires that Assessments of Environmental Effects to accompany resource consent applications should consider risks to the neighbourhood, wider community or the environment through natural hazards.

2.1.8 Common Law Property Rights

Recent case law (*Falkner vs. Gisborne District Council*) has established that common law property rights relating to the use of land, and the right to protect property from the sea, are subject to the purpose and principles of the RMA. The effect of this is that any coastal erosion management works must obtain all necessary statutory approvals as applicable, and must be consistent with the fundamental purpose of the RMA (to promote sustainable management of natural and physical resource), the principles of the RMA including matters of national importance, principles, objectives and policies in other plans.

Summary

Avoidance or mitigation of coastal hazards must be undertaken in a manner that achieves the purpose and principles of the RMA.

2.2 Hauraki Gulf Marine Park Act 2000

The eastern coast of the Coromandel Peninsula is included in the area defined as the Hauraki Gulf Marine Park and therefore the Hauraki Gulf Marine Park Act 2000 (HGMPA) is relevant to the site.

Section 7 of the HGMPA recognises the national significance of the Hauraki Gulf and the importance of sustaining the life supporting capacity of the environment of the Hauraki Gulf (including its islands and catchments).

Section 8 of the HGMPA outlines the objectives of the management of the Hauraki Gulf, its islands and catchments as follows:

- “(a) the protection and, where appropriate, the enhancement of the life-supporting capacity of the environment of the Hauraki Gulf, its islands, and catchments:*
- (b) the protection and, where appropriate, the enhancement of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments:*
- (c) the protection and, where appropriate, the enhancement of those natural, historic, and physical resources (including kaimoana) of the Hauraki Gulf, its islands, and catchments with which tangata whenua have an historic, traditional, cultural, and spiritual relationship:*
- (d) the protection of the cultural and historic associations of people and communities in and around the Hauraki Gulf with its natural, historic, and physical resources:*
- (e) the maintenance and, where appropriate, the enhancement of the contribution of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments to the social and economic well-being of the people and communities of the Hauraki Gulf and New Zealand:*
- (f) the maintenance and, where appropriate, the enhancement of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments, which contribute to the recreation and enjoyment of the Hauraki Gulf for the people and communities of the Hauraki Gulf and New Zealand.”*

Section 9 of the HGMPA states that Regional Councils and territorial authorities must ensure that any part of a regional policy statement, regional plan, or district plan that applies to the Hauraki Gulf, its islands, and catchments does not conflict with Sections 7 and 8 of the HGMPA, which are deemed by Section 1 of the HGMPA to constitute a New Zealand Coastal Policy Statement.

Summary

The Hauraki Gulf is nationally significant and therefore consideration must be given to the HGMPA in the management of Cooks Beach. Sections 7 and 8 of the HGMPA constitute a New Zealand Coastal Policy Statement.

2.3 New Zealand Coastal Policy Statement

The purpose of the New Zealand Coastal Policy Statement 1994 (NZCPS) is set out in Section 56 of the Resource Management Act which states: “*the purpose of a New Zealand Coastal policy statement is to state policies in order to achieve the purpose of this Act in relation to the coastal environment of New Zealand.*”

The NZCPS includes the following principles of particular relevance to the management of coastal hazards:

- ‘7. The coastal environment is particularly susceptible to the effects of natural hazards.’*
- ‘12. The ability to manage activities in the coastal environment sustainably is hindered by the lack of understanding about coastal processes and the effects of activities. Therefore, an approach which is precautionary but responsive to increased knowledge is required for coastal management.’*

Relevant policies include:

- 1.1.2 It is a national priority for the preservation of the natural character of the coastal environment to protect areas of significant indigenous vegetation and significant habitats of indigenous fauna in that environment by:
 - (c) protecting ecosystems which are unique to the coastal environment and vulnerable to modification including estuaries, coastal wetlands, mangroves and dunes and their margins...**
- 1.1.5 It is a national priority to restore and rehabilitate the natural character of the coastal environment where appropriate.*
- 3.2.1 Policy statements and plans should define what form of subdivision, use and development would be appropriate in the coastal environment, and where it would be appropriate.*
- 3.2.2. Adverse effects of subdivision, use or development in the coastal environment should as far as practicable be avoided. Where complete avoidance is not practicable, the adverse effects should be mitigated and provision made for remedying those effects, to the extent practicable.*
- 3.3.1 Because there is a relative lack of understanding about coastal processes and the effects of activities on coastal processes, a precautionary principle should be adopted towards proposed activities, particularly those whose effects are as yet unknown or little understood...*
- 3.4.1 Local authority policy statements and plans should identify areas in the coastal environment where natural hazards exist.*
- 3.4.2 Policy statements and plans should recognise the possibility of a rise in sea level, and should identify areas which would, as a consequence be subject to erosion and/or inundation. Natural systems which are a natural defence to erosion and/or inundation should be identified and their integrity protected.*

- 3.4.3 *The ability of natural features such as beaches, sand dunes, mangroves, wetlands and barrier islands, to protect subdivisions, use or development should be recognised and maintained, and where appropriate, steps should be required to enhance that ability.*
- 3.4.4 *In relation to future subdivision, use and development, policy statements and plans should recognise that some natural features may migrate inland as a result of dynamic coastal processes (including sea level rise).*
- 3.4.5 *New subdivision, use and development should be so located and designed that the need for hazard protection works is avoided.*
- 3.4.6 *Where existing subdivision, use or development is threatened by a coastal hazard, coastal protection works should be permitted only where they are the best practicable option for the future. The abandonment or relocation of existing structures should be considered among the options. Where coastal protection works are the best practicable option, they should be located and designed so as to avoid adverse environmental effects to the extent practicable.*
- 3.5.3 *In order to recognise and provide for the enhancement of public access to and along the coastal marine areas as matter of national importance, policy statements and plans should make provision for the creation of esplanade reserves, esplanade strips or access strips where they do not already exist, except where there is a specific reason making public access undesirable."*

Summary

The NZCPS emphasises the use of the best practicable option for coastal hazard management where there is existing subdivision use or development. Overall the NZCPS emphasises the use of natural protection measures and the adoption of the precautionary principle as means to avoid coastal hazards.

2.4 Waikato Regional Policy Statement

The operative Waikato Regional Policy Statement (October 2000) (WRPS) sets out the significant resource management issues along with providing policies and methods to achieve integrated management of the Region's natural and physical resources.

This integrated and co-ordinated approach to resource management gives regional policy statements a central role in ensuring that integrated management takes place and that the purpose of the RMA is achieved. The WRPS will provide policy guidance/ direction to territorial authorities.

Regional policy statements must not be inconsistent with any national policy statement, a New Zealand coastal policy statement or any water conservation order². Regional plans and district plans must not be inconsistent with the regional policy statement or other regional plans or any national policy statement, New Zealand coastal policy statement or water conservation order.

Section 3.5 of the WRPS outlines the significant resource management issues associated with the coast. The following is a summary of significant resource management issues that have been identified from the overview section on coastal management:

- Inappropriate subdivision, use and development within the coastal environment results in loss of natural character.
- Any decline in coastal water quality can reduce its life supporting capacity, and/or result in decreased cultural, recreational and commercial value.
- Failure to consider the interconnected nature of coastal processes and interagency responsibilities may result in unforeseen adverse effects.
- Conflict between the demand for public access to and along the coastal marine area, and the need to restrict access for conservation, safety, security or defence purposes.
- The emission of excessive noise from within the coastal environment can adversely affect amenity and conservation values.

Relevant policies include:

“Policy Two - Recognition of Natural Processes: Ensure that the subdivision, use and/or development of the coastal environment are undertaken in a way, or at a rate which recognises and provides for the unique processes operating in this environment.

Policy Three – Precautionary Approach: Adopt a precautionary approach when managing the coastal environment which recognises the likely occurrence of events in the coastal environment of high potential impact and low probability.

Policy Four – Coastal Hazards: Promote the use of ‘soft-engineering’ or non-engineering solutions to avoid or mitigate the adverse effects of natural hazards in the coastal environment.”

The environmental results anticipated in regard to natural character are 1) significant coastal areas, features and processes protected, 2) no further inappropriate subdivision, use or development and 3) reduced use of hard engineering solutions to coastal erosion and hazards.

Section 3.5.7 outlines the importance of public access in the coastal environment and states an objective is *“Public access to and along the coastal marine area, and to public coastal lands maintained or enhanced except in defined circumstances.”*

The principle reason for adopting this objective is given as *“People’s enjoyment of the coast depends on access, both to and along the coast. Appropriate subdivision design and layout and the provision of access roads/walkways would increase the opportunity for public use of coastal areas. In some cases private property rights extend down to the high tide line, making public access unavailable. Access in such cases would need to be negotiated with landowners.”*

Integrated management in relation to public access will be necessary as access to the coast generally occurs on the landward side of mean high water spring. That is, there will be both territorial authority and regional council input into the provision of public access. For example, Environment Waikato (EW) will advocate to territorial authorities for the

provision of esplanade reserves and walkways in heavily used areas of the coast. These can both provide access to the coast and to public coastal lands, and assist in channelling pedestrian traffic away from more sensitive areas.

Section 3.8 of the RPS is the most important section to the coastal erosion strategies as it outlines Regional issues around Natural Hazards.

The following is a summary of significant resource management issues that have been identified from the overview section on natural hazards:

1. The roles and responsibilities of local authorities and other agencies for the management of natural hazards in the Waikato Region have not been agreed or clearly identified. Until this is done, inefficiencies and/or a duplication of functions may occur.
2. A lack of public awareness of the causes and potential effects of natural hazard events increases the likelihood of adverse effects when these events occur.

The WRPS defines the regional and territorial authority roles when dealing with natural hazards as follows:

“The Waikato Regional Council (Environment Waikato) will:

- *develop specific objectives, policies, rules and/or other methods in regional plans for the avoidance or mitigation of natural hazards in the coastal marine area and in the beds of rivers and lakes*
- *take a lead role in the collection, analysis, storage and communication of natural hazard information to territorial authorities*
- *prioritise risks from natural hazards across the Region for further investigation, in consultation with territorial authorities and the Region’s community*
- *develop, in conjunction with territorial authorities and the wider community, hazard specific mitigation plans for managing the risks associated with natural hazards*
- *implement those aspects of mitigation plans that are relevant to Environment Waikato’s functions*
- *co-ordinate responses to regionally significant natural hazard events with those of territorial authorities, network utility operators, government departments and other relevant agencies*
- *support the development and implementation of environmental education programmes related to specific natural hazards.*

Territorial authorities will:

- *develop specific objectives, policies, rules and/or other methods in district plans that control the use of land (except for in the beds of lakes and rivers and the coastal marine area) for the avoidance or mitigation of natural hazards;*
- *deliver environmental education programmes on local natural hazards to their communities*
- *implement relevant hazard specific mitigation plans through building consents and other regulatory and non-regulatory methods;*

- *provide information on the presence of natural hazards at specific sites through land information memoranda and project information memoranda where such information is known by the territorial authority;*
- *work in partnership with the Waikato Regional Council (Environment Waikato) and their communities to ensure efficient and effective response and recovery to natural hazard events including planning for emergencies."*

The methods indicate that EW will usually be in an integrating role involving aspects such as the provision of expert advice, support and co-ordination. Implementation Method 1 identifies that, only in circumstances where Environment Waikato has specific functions for managing hazards under legislation, Environment Waikato take a more leading role. In contrast, Implementation Method 2 identifies that territorial authorities and the local community will be responsible for implementing many of the strategies and plans for managing natural hazards through methods such as rules and environmental education. This differentiation is appropriate because territorial authorities are best placed to determine the most efficient and effective methods for managing natural hazards in their districts as part of their district plan, strategic plan and annual plan development processes and through methods such as setting floor levels in building consents.

Section 3.8.4 outlines the adverse effects of natural hazards and has the following relevant policies.

"Policy One - Ensure the occurrence of natural hazard events are prevented or the associated adverse effects are avoided or mitigated.

Policy Two - Ensure new subdivisions and developments are built in a manner designed to avoid or mitigate the adverse effects of natural hazards.

Policy Three - Raise public awareness of the causes and effects of natural hazard events (and the means by which their effects can be avoided or mitigated) and ensure that the community are prepared for civil defence emergencies."

Summary

The WRPS does not preclude development in the regions coastal areas but rather recognises the need to retain the unique natural values that characterise coastal areas. The WRPS outlines the separate functions of both the territorial and regional authority in the management of the coastal environment but advocates an integrated approach.

2.5 Waikato Proposed Regional Coastal Plan

The Proposed Regional Coastal Plan for Waikato (WRCP) was notified in December 1994 and decisions on submissions were released in September 1998. The Environment Court in August 2003 determined the last remaining reference to the WRCP (notwithstanding those that relate to the marine farming variation), however, the Minister of Conservation has yet to approve the plan so is therefore not deemed to be fully operative. The plan seeks to

promote the sustainable management of resources in the coastal marine area of the Waikato region.

The Natural Character section of this plan states the natural character of the coastal environment of the Region is a fragile and finite resource that is vulnerable to irreversible alteration and damage. The section also states that protection of the CMA from inappropriate subdivision, use and development includes restoration and/or enhancement of any natural character values that may have been adversely affected, to avoid adverse cumulative effects.

Structures in the coastal marine area are given discretionary activity status in the WRCP so long as they are not located in an area identified as waahi tapu and the Hydrographic Office of the Royal New Zealand Navy, and the Maritime Safety Authority are given written notice of the details of the structure before it is erected (Rule 16.4.24). The assessment criteria for structures in the CMA are as follows:

- i. the extent to which the activity will adversely affect any conservation value within the ASCV areas as marked on maps in Appendix III and described in Appendix IV of this Plan; and*
- ii. the Decision-Making Criteria and Considerations which are set out in Appendix II of this Plan, and which are relevant to this activity; and*
- iii. the extent to which the structure has a functional need for location in the CMA; and*
- iv. the extent to which the structures will be designed, constructed and maintained to a standard to withstand coastal processes and relative changes in sea level; and*
- v. the extent to which the structure results in cumulative effects; and*
- vi. the extent to which the structure provides for public use and access.*

This Rule recognises that there are a variety of structures which are appropriately located in the CMA. However, it is also recognised that cumulative effects, amenity values and natural character need to be considered on a site by site basis. It is therefore important that the effects of such structures are managed."

Temporary structures for hazard management are given controlled activity status as follows:

"The erection or placement of any structure in the CMA, for a period of time less than three months, for the sole purpose of managing hazard risk is a controlled activity provided it complies with the standards and terms stated in this Rule:

Standards and Terms

- It shall be demonstrated that there is a functional need for the structure to be located in the CMA.*
- The structure shall not restrict public access to the CMA.*
- The structure shall be totally removed from the CMA within three months of the issue of a Resource Consent under this Rule.*

The matters over which the Regional Council reserves control are:

- *location of the structure,*
- *material used,*
- *method of placement,*
- *method of removal"*

Policy 3.1.5 promotes the restoration of natural character in areas where it has been degraded recognising that one mechanism for enhancing areas is to undertake planting.

Section 3.4 of the WRCP recognises the need to take into account the effects of coastal processes and the dynamic nature of the coast when considering use or development in the CMA and adopting a precautionary approach when effects of activities are unknown (as outlined in the NZCPS).

Chapter 5 of the WRCP discusses structures and identifies that structures in the CMA can adversely affect natural character, public access and amenity values, impact on natural processes, and conflict with other uses. Policy 5.1.1 states that existing structures that were not lawfully established will need to be assessed against the objectives of the plan and either authorised or removed.

The Natural Hazards section of this plan is the most relevant to these coastal strategies. It has policies relating to the avoidance or mitigation of coastal hazard risk to people and property and acknowledges that effective management requires an integrated approach to the avoidance or mitigation of hazard risk as most effects are felt above the line of mean high water springs (and therefore in territorial authority managed areas).

Policy 8.1.1 directly refers to the production of site specific management strategies such as the ones for Cooks and Buffalo Beaches and states that these strategies may be guided by the plan but may also result in subsequent changes being made to the Plan. Policy 8.1.3 promotes the protection of natural features that provide a buffer against natural hazards (such as dunes).

Policy 8.1.4 specifically applies to coastal protection structures and aims to ensure that any use of structures to control coastal erosion is necessary and avoids or remedies any adverse effects on other coastal processes and on natural character. This is in recognition of the fact that some structures can aggravate the hazard problems and degrade natural character values.

The environmental results anticipated by the natural hazards section in the WRCP is

1. increased public awareness of coastal hazards and associated risks,
2. adverse effects on people and property avoided or mitigated,
3. dune and wetland habitats protected,
4. amenity and natural character values protected, and
5. reduction in 'hazard protection' structures.

Section 9 of the WRCP emphasises that public access within the CMA (i.e. along the foreshore and across the water) should not be unduly restricted. Policy 9.1.2 says that the Regional Council should identify areas in the coastal environment where public access

should be enhanced, and support the development of landward reserves and walkways in those areas.

Methods for implementing the WRCP are given below:

17.7.4 Appropriate Management Options

In managing hazard risks, Environment Waikato will emphasise:

- proactive management of hazard risk by the avoidance of hazard risks,
- the use of district planning controls to restrict new or further development in areas of potential hazard risk,
- the use of measures which will protect and/or enhance natural buffers between coastal development and the sea,
- the avoidance of hazard management options which adversely affect public access and coastal values, in particular shore-line armouring works.

Principal Reasons for Adopting: Community consultation is critical in the management of hazard risk. Managing the interface between the coast and land also requires an integrated management approach with territorial authorities. The above options will most effectively avoid or mitigate hazard risk while protecting public access and coastal values. Soft engineering options such as beach nourishment or set back zones recognise that structures can not only interfere with wave patterns and sand transport, resulting in additional or transferred problems of erosion or accretion, but can also have adverse effects on natural character.

17.7.9 Protection of Natural Features

Environment Waikato will consult with the Department of Conservation and territorial authorities to ensure natural features that provide a buffer against natural hazards are protected and restored. Provision must be made for possible landward migration of features e.g. dunes and wetlands.

Principal Reasons for Adopting: Such 'buffering' features occur above and/or below Mean High Water Springs, therefore requiring co-ordination between organisations. It is important to leave undeveloped areas between land development and the sea to accommodate possible landward migration of dune and wetland systems, should a rise in sea level occur.

17.8.2 Consultation with Territorial Authorities

EW will consult with territorial authorities to ensure that any near shore subdivision, use or development does not restrict public access, unless such a restriction is necessary, and that public access is provided to as much of the foreshore of the coast as possible.

Principal Reasons for Adopting: Because territorial authorities control subdivision and development above Mean High Water Springs, it is through them that EW must advocate the retention of public access. Any restrictions on access to these areas implemented by EW would apply only to the CMA. Situations where restrictions on public access may be necessary are set out in Policy 3.5.1 of the NZCPS.

Summary

The WRCP has a natural character section that promotes the restoration of degraded areas and the enhancement of natural character.

The Natural Hazards section of this plan is the most relevant to these coastal strategies. It has policies relating to the avoidance or mitigation of coastal hazard risk to people and property and acknowledges that effective management requires an integrated approach to the avoidance or mitigation of hazard risk as most effects are felt above the line of mean high water springs (and therefore in territorial authority managed areas).

2.6 Thames Coromandel Proposed District Plan

The Thames Coromandel Proposed District Plan (TCDP) was publicly notified in March 1997 and attracted a large number of submissions, and further submissions. The Proposed Plan was publicly notified in December 1999.

The TCDP recognises that the District's landscape contains substantial areas of significant landscape including the coastal environment, which is of national significance and has been determined to be of outstanding value. In particular, Dunelands and spits are described as outstanding landscape features that are particularly sensitive to development, due both to their dynamic character and lack of visual backdrop.

In accordance with Section 6(a) of the Act the TCDP also recognises that natural character is a matter of national importance and that the coast is highly valued for scenic, ecological and cultural reasons (Principle reason 212.6.1 and 213.6.2).

The natural hazards section of the TCDP states four objectives (222.3):

1. *To avoid the effects of natural hazards as far as practicable.*
2. *To avoid the creation of natural hazards as far as practicable.*
3. *To promote the protection of existing physical resources where practicable and sustainable.*
4. *To avoid the establishment of hard engineering structures as far as practicable, especially within the coastal environment."*

These objectives have supporting policies in the section.

Rule 452.5 of the TCDP states that coastal defence structures are a non-complying activity with a note that this rule applies to both public and private property.

The TCDP has noted that coastal erosion areas setback standards are applied and enforced under the Building Act 1991 as follows:

- No Buildings: Structures shall not be located within 30m inland from the toe of the natural shoreline or seaward vegetated toe of the foredune on the East Coast.
- Relocated Buildings: May be situated between the 30m and 60m hazard lines, East Coast (as measured above), provided that Council may require a greater setback or building to be relocatable in other circumstances if required because of the severity of the erosion risk.

2.7 Draft Thames Coromandel District Council Landowners Policy

The Thames Coromandel District Council (TCDC) is currently considering a draft policy paper that recommends soft engineering options be used for Council foreshore property at risk from coastal erosion.

The policy paper investigated options ranging from do nothing through to permitting works that incorporate a range of coastal hazard mitigation measures encompassing both soft and hard responses. As part of the policy report each option was summarized in terms of its advantages and disadvantages, including the legal implications of options. The report recommended that TCDC permit works that work with natural processes. If adopted, this policy would mean that Council, as landowner, would allow only soft engineering structures as an option to protect coastal reserves and the private land behind.

2.8 Local Government Act 2002

The Local Government Act (LGA) requires stopped roads along the margins of the coast (along Mean High Water Springs) to be vested in Council as esplanade reserves. The Local Government Act 2002 also establishes the means by which Council may collect financial contributions for funding the acquisition, maintenance and development of reserves.

2.8.1 Long Term Council Community Plan (LTCCP)

Section 93 of the Local Government Act 2002 states that a local authority must have, at all times, a long-term council community plan. Section 93 (6) states that the purpose of a long-term council community plan is to –

- “(a) describe the activities of the local authority; and
- (b) describe the community outcomes of the local authority's district or region; and
- (c) provide integrated decision-making and co-ordination of the resources of the local authority; and
- (d) provide a long-term focus for the decisions and activities of the local authority; and
- (e) provide a basis for accountability of the local authority to the community; and

- (f) *provide an opportunity for participation by the public in decision-making processes on activities to be undertaken by the local authority."*

Schedule 10 of the LGA includes things that must be included by a local authority in a LTCCP.

Both EW and TCDC have operative LTCCP's with a number of outcomes stated in relation to the coastal environment.

In particular a community outcome stated in the TCDC LTCCP is "*Social: a healthy, safe and secure community*". Among the actions required to achieve this is the statement "*protect our communities from natural hazards*".

The EW LTCCP states a desired community outcome of "*The community is actively managing the coast in an integrated way that allows for dynamic natural processes, preserves natural values and provides timely planned solutions to accommodate a variety of coastal uses.*" It is from this desired community outcome that the strategy vision was developed.

2.9 Civil Defence Emergency Management Act 2002

The Civil Defence Emergency Management Act, 2002 (CDEMA) also gives central government, regional and territorial authorities responsibility for civil defence planning, response and recovery. The civil defence responsibilities for these authorities are outlined in national, regional and local civil defence plans, known as Civil Defence Emergency Management Plans (CDEM Plans). CDEM Plans must state and provide for:

1. local authorities that have united to establish the CDEM group,
2. the hazards and risks to be managed by the Group,
3. the civil defence emergency management necessary to manage the hazards and risk,
4. the objectives of the plan and the relationship of each objective to the National Civil Defence Management Strategy,
5. the apportionment between local authorities of liability for the provision of financial and other resources for the activities of the Group, and the basis for that apportionment,
6. the arrangements for declaring a state of emergency in the area of the Group, and
7. the arrangements for co-operation and co-ordination with other groups.

Central government agencies and local authorities are not the only agencies with legal responsibilities for the management of natural hazards; network utility providers, businesses and individuals have the ability to reduce their exposure to risk from natural hazards.

2.10 Building Act 1991

Under Section 36(1) of the Building Act 1991 (BA), territorial authorities are required to refuse to grant building consent for a new building or major alteration unless they are satisfied that adequate provision has or will be made to protect the land or building from natural hazards.

If the building work will not accelerate or worsen the situation affecting the land then Council can grant building consent as long as the title is notated to state that the land is subject to a hazard.

2.11 Soil Conservation and Rivers Control Act 1941

The Soil Conservation and Rivers Control Act 1941 (SCRCA) regulates soil management and river works associated with hazard management. Soil conservation relates to land management practices to reduce erosion and flooding hazards and to maintain the soil resource. EW has responsibilities for administration of the SCRCA in the Waikato.

2.12 Reserves Act 1977

The Reserves Act 1977 (RA) enables the formation of esplanade reserves and esplanade strips (in accordance with the purposes outlined in the RMA) where land adjoins the coast. The key difference between these two provisions being that esplanade strips are not fixed in position but maintain their position relative to the coast (or other body of water), even if the coast moves.

While the RA is based on public use and access, often reserve areas are used to provide buffers of coastal land through managed retreat, or adaptation responses where coastal hazards have been identified. Without explicit reference to buffer functions in a reserve management plan, it is questionable whether reserve areas can be treated in this way by Territorial Authorities because their buffering function may impact upon their specified use for reserve or open space recreation reserve¹.

2.12.1 Whitianga and Wharekaho Reserves Management Plan

Under Section 41 of the RA, a reserve administering body shall, within five years after the date of its appointment or within five years after the commencement of the RA, whichever is the later, prepare and submit to the Minister for his approval a management plan for the reserve under its control, management, or administration.

The Whitianga and Wharekaho Reserves Management Plan (WWRMP) was advertised in draft form in August 1991. The WWRMP has general objectives and policies relating to the management of reserves for the benefit, use and enjoyment of the public, provide amenities and conserve open space.

¹ Coastal Hazards and Climate Change: a Guidance Note for Local Government in New Zealand, March 2004. Ministry for the Environment, Wellington.

3 Non Statutory Documents

3.1 Coastal Erosion Risk Mitigation Strategy for the Waikato Region

The Coastal Erosion Risk Mitigation Strategy for the Waikato Region (CERMS) outlines the way risk mitigation will be approached in the Waikato with regard to coastal erosion. The purpose of the CERMS is to promote integrated and sustainable management of coastal erosion hazard.

The strategy has four major elements:

1. Central focus - relevant to the management of coastal erosion hazard at all sites in the Region;
2. Site Specific Hazard Management Strategies - relevant to difficult problem sites (e.g., Buffalo and Cooks Beaches).
3. Guidelines for the Use of Coastal Structures - recognising that these devices will continue to be relevant in the management of coastal erosion at some sites in the immediate future; and
4. Ongoing Monitoring and Investigations - to develop and refine the strategy over time.

Summary - Policy/Planning Framework

The focus of the Buffalo Beach CEMS as a non-statutory document is to go beyond the RMA with a wider LGA approach but that is intended to tie in with existing management documents (including the TCDP, Annual Plans and financial plans). It is therefore important to recognise the influence that national, regional and district strategic and policy documents provide to the CEMS. The following summarises the statutory environment that needs to be considered in strategy development.

- Avoidance or mitigation of coastal hazards must be undertaken in a manner that achieves the purpose and principles of the RMA. The theme through RMA case law appears to be that although district councils can exercise some judgement about whether to allow a subdivision or development, councils cannot ignore responsibilities for avoiding or mitigating effects of natural hazards in favour of reliance of controls under the BA.
- The NZCPS emphasises the use of the best practicable option for coastal hazard management where there is existing subdivision use or development. Overall the NZCPS emphasises the use of natural protection measures and the adoption of the precautionary principle where the effects of activities in the coastal marine area are unknown.
- The WRPS does not preclude development in the regions coastal areas but rather recognises the need to retain the unique natural values that characterise coastal areas. The WRPS outlines the separate functions of both the territorial and regional authority in the management of the coastal environment but advocates an integrated approach.
- The Natural Hazards section of the WRCP has policies relating to the avoidance or mitigation of coastal hazard risk to people and property and acknowledges that effective management requires an integrated approach to the avoidance or mitigation of hazard risk as most effects are felt above the line of mean high water springs.
- The TCDP has identified coastal erosion areas setback standards that are applied and enforced under the BA.
- TCDC is currently considering a draft policy paper that recommends soft engineering options be used for Council foreshore property at risk from coastal erosion. If adopted, this policy would mean that Council would allow only soft engineering structures as an option to protect coastal reserves and the private land behind.
- Both EW and TCDC have operative LTCCP's with a number of outcomes stated in relation to the coastal environment.
- The CBRMP states that (with one exception) there are no "defended" beaches on the Coromandel.
- The CERMS provides guidelines for the use of coastal structures as well as ongoing monitoring and investigations.



Appendix D

Screening of Options

1 Initial Screening Assessment

1.1 Introduction

The option(s) selected for the CEMS needs to be capable of managing the risk from the identified cause of the coastal erosion, have acceptable environmental effects and have reasonable and practicable costs associated with it thus achieving triple bottom line outcomes. The background research and workshop produced a range of options available for managing coastal erosion at Buffalo Beach, some of which are not technically or practically feasible in some sections of the beach. To refine the number of options that were to undergo a full triple-bottom line assessment the following checklist of possible options and combination of options was completed for each section of Buffalo Beach. These options were then assessed at an initial screening level to determine whether they are technically or practically viable. Those options identified as viable were then carried through to the next stage to be assessed more thoroughly for social, economic and environmental impacts.

Factors that resulted in some options being impractical included:

- design issues (e.g. an incompatibility between the structure being considered and the site conditions);
- structures which will present unacceptable safety issues (such as adverse navigational effects); and/or
- options that would have unrealistic costs making them unfeasible to implement.

Factors such as these are known as 'fatal flaws' and justified the removal of the option from the selection process. Fatal flaws of each option possible for management of coastal erosion at each section of Buffalo Beach were considered at this stage and justifications given in the table below as to why those options were discounted.

National policy and best practice directs any assessment of options for managing coastal erosion to a clear hierarchy of responses. This hierarchy of responses is considered to be an options feasibility assessment based on the following:

- Tier 1: Non-Structural Options, e.g. do nothing, management (protection) of natural systems and natural defences.
- Tier 2: Soft Structural Options, e.g. beach dewatering.
- Tier 3: Hard Structural Options, e.g.: seawalls, groynes and offshore breakwaters.

This hierarchy of response options directs those assessing options to Tier 1 as the most preferred option and Tier 3 as the least preferred option. (This hierarchy is also defined in the Glossary, Appendix J).

2 Buffalo Beach Southern Section Checklist

Tier	Option	Viable	Reason/Justification option not considered viable - 'Fatal Flaw'
1	Status quo	√	
1	Living with coastal erosion (removal of any existing structures and let nature take its course)	X	This option would result in severe damage and probably closure of existing foreshore roads and also loss or severe damage to the phoenix palms in the area of The Esplanade, these trees having a high heritage value. Loss of the higher areas seaward to erosion would also result in adjacent private properties experiencing very serious coastal flooding problems. There is also potential for erosion damage of the adjacent properties. This is not judged to be a viable option.
1	Commercial rezoning of beach front land	X	Commercial zoning of the beachfront properties without a structure to protect the road and properties is not a viable option. With this option the properties would be developed to a commercial level and the road would continue to erode placing pressure in the future on the commercial properties. This option would carry too much cost both to the private individual/company and councils to be considered for further assessment.
1	TCDC purchase of private land adjacent to beach + rezoning to open space/esplanade reserve	√	
1	Transferable development rights	X	Transferable development rights are where the development rights for land in private ownership are transferred/compensated for with another site. This is unlikely to be useful/practicable at Buffalo Beach south. The value of beachfront properties is too high to be compensated by development rights elsewhere. This option would be primarily used to protect undeveloped land in private ownership, which is not the situation at this site.
1	Beach and dune replenishment	X	Beach replenishment alone is not viable in this area as there are very high nearshore tidal velocities and, without some form of retaining structure, the sand would simply be moved rapidly into the harbour. As well as being expensive, this option has the potential to seriously aggravate sedimentation problems at the adjacent commercial wharf. Therefore, this option in isolation is not judged to be worthy of further consideration.
1	Removal of existing structures + nourishment	X	This option would be totally dependent on beach nourishment alone for protection of the road and adjacent properties. As discussed above, beach nourishment without some form of retaining structure is not judged to be a practical option in this area.

Tier	Option	Viable	Reason/Justification option not considered viable – ‘Fatal Flaw’
1	Dune restoration	X	This option involves the restoration of the existing dune through rebuilding the dune with imported sand and replanting with native vegetation, which will hopefully trap more sand and build up the dune over time. There is insufficient space in front of the road and existing walls to build a sustainable dune. Past experience has been that a temporary feature can develop in places but is removed during severe erosion events. The hazard at Buffalo Beach is related to short-term storm cycles rather than long-term erosion. An option of this type is more suitable to beaches undergoing the type of dynamic fluctuations at Buffalo Beach where there is a reasonable area in front of properties to build up a dune buffer.
2	Beach dewatering	X	Beach dewatering is an erosion management option where a series of pipes are laid beneath the beach and dune to lower the water table by extracting the water in the sand and pumping it to a pumping station. The system is based on the idea that, when the water table under the beach is lower than under the ocean, sand accretion is enhanced. As each wave rushes up the beach, water from the wave easily drains through the dry beach, leaving part of its suspended sand load on the beach. Less water drains back into the ocean taking less sand with it ¹² . This option is most appropriate for beaches where there is excess water in the sand over long periods of time, essentially the beach is ‘water logged’ and thus more susceptible to erosion by the backwash of waves. The aim is to remove the water and stabilise the beach, the excess water can then be redistributed further inland. Not yet a widely accepted and well-tested approach with no test site yet in New Zealand. A number of test sites have been set up in Europe that have shown that lowering of the water table in beaches can have some beneficial effects, mainly enhanced accretion in fair weather rather than erosion protection during storms ¹³ . This option is therefore unlikely to be practical at Buffalo Beach due to the large dynamic shoreline fluctuations experienced (i.e. up to 30m of erosion). There is a high risk that the pipework would be exposed by erosion and damaged. The fine sands with poor permeability at Buffalo Beach would also require a relatively high density for the pipework underlying the beach.
3	Frontal Seawall	√	
3	Seawall + nourishment without beach perpendicular retaining structure (such as a groyne)	X	This option involves building a new seawall and placing sand (from either a local or non-local source) on the beach and dune without a structure perpendicular to the beach. The nourishment would require very large volumes of sand at Buffalo Beach. This option has proved to be successful at Mission Bay in Auckland only due to the structure (groyne) placed at the eastern end of the beach. The required volumes of suitable sand would be difficult and expensive to obtain for this site – probably having to be dredged from 8-15m depth along the inner continental shelf, several kilometres from Buffalo Beach (if available at all) due to the large

¹² www.unesco.org/csi/pub/source/ero11.htm

¹³ Turner, I L & S P Leatherman (1997): Beach dewatering as a soft engineering solution to coastal erosion: A history and critical review. J Coastal Res, Vol 13, No 4, pp 1050-1063.

Tier	Option	Viable	Reason/Justification option not considered viable – ‘Fatal Flaw’
			amounts required. Therefore, even if suitable sand could be found, the option would be very expensive – probably in excess of \$12 million for the nourishment alone.
3	Frontal Seawall + rezoning beachfront properties to town centre (commercial)	√	
3	Realign existing frontal seawall landwards + one laning of road	√	
3	Backstop seawall	X	A backstop wall is where a wall is buried into the dune at a distance set back from MHWS and the infrastructure built landward of this. At this location would not be viable due to the existing road being in front of the properties and the need for the road to facilitate transit of vehicles. The road needs to be protected from erosion as key infrastructure.
3	Groyne	X	A groyne is a structure that is normally perpendicular to the beach and is designed to trap sediment that is moving along the shore to build up a beach (typically the beach should exhibit significant littoral movement). Often the beach to the downstream side of the groyne will end up being starved of sand and will suffer increased erosion as a result of the structure. Groynes are generally made from large rock boulders. A groyne at Buffalo Beach south without beach nourishment is not judged to be a practicable option. It is now standard coastal management practice to fill nourish the beach on both sides of the groynes on sites like this (where there is a reasonable amount of sediment movement along the beach). Otherwise, there is potential for severe erosion problems on the downdrift side of structure.
3	Groyne + nourishment	√	
3	Offshore breakwater	X	Whitianga is an important harbour for the Coromandel, particularly given the next closest is Tauranga on the east coast. Therefore the navigational safety issues associated with an offshore breakwater are considered to be too great when balanced with the intensive use of the waterways off Buffalo Beach south to be viable.

3 Buffalo Beach Mid Section Checklist

Tier	Option	Viable	Reason/Justification option not considered viable - 'Fatal Flaw'
1	Status quo	√	
1	Commercial rezoning of beach front land	X	The land in this location is currently undeveloped, the zoning is Open Space and so there is no infrastructure or assets at risk. This zoning provides appropriate protection in the longer-term for the land and therefore this option is not considered to be viable.
1	Dune restoration	√	
1	Transferable development rights	X	Transferable development rights are where the development rights for land in private ownership are transferred/compensated for with another site. This is unlikely to be useful/practicable at Buffalo Beach Mid section. This option would be primarily used to protect undeveloped land in private ownership, which is not the situation at this site.
1	Beach replenishment	X	Beach replenishment would involve nourishing the beach with introduced sand. The central section of Buffalo Beach has a very wide natural buffer zone and no existing or potential erosion problems and therefore this option is considered to be redundant at this site.
1	Beach and dune replenishment + revegetation	X	This option would involved the nourishment of the beach with introduced sediment and revegetation with native sand dune species that will hopefully trap more sand and build up the dune over time. There is a very wide natural buffer zone at this location and no existing or potential erosion problems so this option is considered to be superfluous to the current and future expected situation.
2	Beach dewatering	X	Beach dewatering is an erosion management option where a series of pipes are laid beneath the beach and dune to lower the water table by extracting the water in the sand and pumping it to a pumping station. The system is based on the idea that, when the water table under the beach is lower than under the ocean, sand accretion is enhanced. As each wave rushes up the beach, water from the wave easily drains through the dry beach, leaving part of its suspended sand load on the beach. Less water drains back into the ocean taking less sand with it ¹⁴ . This option is most appropriate for beaches where there is excess water in the sand over long periods of time, essentially the beach is 'water logged' and thus more susceptible to erosion by the backwash of waves. The aim is to remove the water and stabilise the beach, the excess water can then be redistributed further inland. Not yet a widely accepted and well-tested approach with no test site yet in New Zealand. A number of test sites

¹⁴ www.unesco.org/csi/pub/source/ero11.htm

Tier	Option	Viable	Reason/Justification option not considered viable – ‘Fatal Flaw’
			have been set up in Europe that have shown that lowering of the water table in beaches can have some beneficial effects, mainly enhanced accretion in fair weather rather than erosion protection during storms ¹⁵ . This option is therefore unlikely to be practical at Buffalo Beach due to the large dynamic shoreline fluctuations experienced (i.e. up to 30m of erosion). There is a high risk that the pipework would be exposed by erosion and damaged. The fine sands with poor permeability at Buffalo Beach would also require a relatively high density for the pipework underlying the beach.
3	Frontal Seawall	X	This option involves building a new seawall in front of the land. There is no existing or potential erosion problem at Buffalo Beach central section as the land is undeveloped and there is no infrastructure or assets at risk, therefore the seawall option is essentially redundant
3	Frontal seawall + nourishment	X	This option involves building a new seawall in front of the land and placing sand (from either a local or non-local source) on the beach and dune. There is no existing or potential erosion problem at Buffalo Beach central section and therefore this option is unnecessary given the existing conditions and environment.
3	Backstop wall + relocation	X	A backstop wall is where a wall is buried into the dune at a distance set back from MHWS and for this option the infrastructure/assets would be relocated behind the backstop wall. Again there is no existing or potential erosion problem at Buffalo Beach central section and therefore this option is considered to be redundant.
3	Groyne	X	A groyne is a structure that is normally perpendicular to the beach and is designed to trap sediment that is moving along the shore to build up a beach. Often the beach to the downstream side of the groyne will end up being starved of sand and will suffer increased erosion as a result of the structure. There is no existing or potential erosion problem at Buffalo Beach central section and this option would not add any value.
3	Groyne + nourishment	X	As the beach to the downstream side of the groyne will often end up being starved of sand and will suffer increased erosion as a result of the structure, it is now standard coastal management practice to fill nourish the beach on both sides of the groyne on sites like Buffalo Beach (where there is a reasonable amount of sediment movement along the beach). Otherwise, there is potential for severe erosion problems on the downdrift side of structure. At Buffalo Beach central section there is no existing or potential erosion problem as the land is undeveloped so there is no infrastructure or assets at risk. Therefore there is no requirement for this type of for any engineering approach.
3	Offshore Breakwater (either submerged or emerging)	X	An offshore breakwater would provide protection to the beach from wave impact and thus help to reduce the erosion at a site. At Buffalo Beach central section there is no existing or potential erosion problem therefore this option is not judged to be appropriate for this site.

¹⁵ Turner, I L & S P Leatherman (1997): Beach dewatering as a soft engineering solution to coastal erosion: A history and critical review. J Coastal Res, Vol 13, No 4, pp 1050-1063.

4 Buffalo Beach Northern Section Checklist

Tier	Option	Viability	Reason/Justification option not considered viable – ‘Fatal Flaw’
1	Status quo	√	
1	Living with coastal erosion (removal of any existing structures and let nature take its course)	√	
1	Commercial rezoning of beach front land	X	Commercial zoning of the beach front properties in this location is not considered to be consistent with the residential character of the area and the infrastructure is not in place to support commercial operations here therefore this is not a viable option. This would also negatively impact upon the concept of nodes of commercial activity around the CBD.
1	TCDC purchase of private land + relocation + open space/reserve rezoning	√	
1	Transferable development rights	X	Transferable development rights are where the development rights for land in private ownership are transferred/compensated for with another site. This is unlikely to be useful/practicable at Buffalo Beach north. The – value of beachfront properties are too high to be compensated by development rights elsewhere. This option would be primarily used to protect undeveloped land in private ownership which is not the situation at this site
1	Beach and dune replenishment	X	For beach nourishment to be a long-term option in isolation, would need to nourish entire beach sufficiently to move dynamic envelope seaward of properties. This would require very large volumes of sand (probably in excess of 600,000 cubic metres) that are not available locally in the long term. Significant volumes of replenishment would also be required. Option is judged not to be practicable and even if a suitable source of sand could be found some distance away would be prohibitively expensive.
1	Removal of existing structures + nourishment	X	This option would be totally dependent on nourishment for protection and to be a long-term option in isolation, would need to nourish the entire beach sufficiently to move the dynamic envelope seaward of properties. This would require very large volumes of sand (probably in excess of 600,000 cubic metres) that are not available locally. The option is judged to be not viable for Buffalo Beach northern section.

Tier	Option	Viable	Reason/Justification option not considered viable – ‘Fatal Flaw’
1	Dune restoration	X	This option involves the restoration of the existing dune through rebuilding the dune with imported sand and replanting with native vegetation, which will hopefully trap more sand and build up the dune over time. The existing structures encroach onto the active beach and it would not be practicable to maintain a viable dune unless accompanied by large volumes of beach nourishment. Past experience has been that a temporary feature can develop in places but is removed during severe erosion events. The hazard at Buffalo Beach is related to short-term storm cycles rather than long-term erosion. Dune restoration in isolation is therefore not considered to be a viable option for Buffalo Beach northern section.
2	Beach dewatering	X	Beach dewatering is an erosion management option where a series of pipes are laid beneath the beach and dune to lower the water table by extracting the water in the sand and pumping it to a pumping station. The system is based on the idea that, when the water table under the beach is lower than under the ocean, sand accretion is enhanced. As each wave rushes up the beach, water from the wave easily drains through the dry beach, leaving part of its suspended sand load on the beach. Less water drains back into the ocean taking less sand with it ¹⁶ . This option is most appropriate for beaches where there is excess water in the sand over long periods of time, essentially the beach is ‘water logged’ and thus more susceptible to erosion by the backwash of waves. The aim is to remove the water and stabilise the beach, the excess water can then be redistributed further inland. Not yet a widely accepted and well-tested approach with no test site yet in New Zealand. A number of test sites have been set up in Europe that have shown that lowering of the water table in beaches can have some beneficial effects, mainly enhanced accretion in fair weather rather than erosion protection during storms ¹⁷ . This option is therefore unlikely to be practical at Buffalo Beach due to the large dynamic shoreline fluctuations experienced (i.e. up to 30m of erosion). There is a high risk that the pipework would be exposed by erosion and damaged. The fine sands with poor permeability at Buffalo Beach would also require a relatively high density for the pipework underlying the beach.
3	Frontal Seawall	√	
3	Frontal seawall and rezoning to Town Centre (commercial)	X	Commercial zoning of the beach front properties in this location is not considered to be consistent with the residential character of the area and the infrastructure is not in place to support commercial operations here therefore this is not a viable option. Even with an additional protection factor in place in the form of a frontal seawall the commercial zoning would negatively impact upon the residential character of this area.

¹⁶ www.unesco.org/csi/pub/source/ero11.htm

¹⁷ Turner, I L & S P Leatherman (1997): Beach dewatering as a soft engineering solution to coastal erosion: A history and critical review. J Coastal Res, Vol 13, No 4, pp 1050-1063.

Tier	Option	Viable	Reason/Justification option not considered viable – ‘Fatal Flaw’
3	Backstop wall + relocation	X	There is not enough land available on existing beachfront properties for the houses to relocate landwards on their properties. The road immediately behind the properties also restricts how far back properties can be relocated to provide the required space for a backstop wall.
3	Relocate dwellings and redevelop with backstop wall	√	
3	Groyne	X	A groyne is a structure that is normally perpendicular to the beach and is designed to trap sediment that is moving along the shore to build up a beach. Often the beach to the downstream side of the groyne will end up being starved of sand and will suffer increased erosion as a result of the structure. Groynes are generally made from large rock boulders. Utilising a groyne in isolation at Buffalo Beach northern section would risk aggravating erosion on the downdrift (i.e. southern) side of the groyne – since the groyne would trap longshore moving sediment and starve the beach areas immediately downdrift. This effect is well documented and it is now standard coastal management practice to place sufficient nourishment updrift of the groyne to avoid such effects.
3	Groyne + nourishment	√	
3	Offshore breakwater +nourishment	√	