This is the third part of a three part report. Continued from part 2

Appendix E

Definition of Options

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1 Introduction

A number of options were identified by the initial screening assessment as being technically or practically viable. These options were then carried through to the next stage to be assessed more thoroughly for social, economic and environmental impacts. The following describes each of these options in full.

Included in the definition of options is a statement on which tier of the hierarchy of responses the option would fall to be considered. National policy and best practice directs any assessment of options for managing coastal erosion to this hierarchy of responses, described as follows:

- 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 responses directs those assessing coastal management 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 Status Quo

2.1 Description

This option is essentially a continuation of the existing situation that has applied for the last 25-30 years, though with some changes

- Variety of ad hoc sea wall structures located on or beyond the seaward boundary of the erosion-affected properties – maintained or replaced by affected owners on an "as required" basis, usually after damage by coastal storms

These seawalls include gabion baskets, a variety of rock seawalls and various timber walls. Many properties also have extensive amounts of rock placed behind the seawalls.

The existing structures, constructed by affected owners, have not been designed or built to normal engineering standards for measures of this nature and there is considerable uncertainty in regard to their performance under conditions of severe erosion. For instance, in the severe storm of July 1978 several structures failed and erosion impacted several properties and partially undermined eight houses. Several structures have also had to be extensively renovated or replaced after lesser storms.

- To serve as a legally established option, resource consent would need to be obtained for existing structures and anticipated maintenance/replacement work. Landowner permission would be required for those structures on TCDC reserve.

At present, there is only one structure with a resource consent (short-term only) and none of the measures on Council-owned land have land owner permission. This situation could not continue if this was to be a viable long-term option.

- Maintenance of existing 30m-development setback and relocatability requirements

The existing 30m development setback and relocatability requirements would continue to apply for new dwellings or extensive renovations/additions – because of the uncertainties associated with the level of protection provided by this option. The 30m setback is designed to avoid the area potentially at risk from erosion with existing coastal processes – though the hazard lines recently developed by EW suggest this standard may not be adequate at this site in the absence of protection works. The requirement for the dwelling to be relocatable will enable the house to be moved further landward (or off site) if seriously threatened by erosion following failure of the walls (see Appendix B for discussion on setback lines).

The status quo option would be classed as tier 3 in the hierarchy of options promoted by the NZCPS and national climate change guidance documents as it consists of hard engineering structures.

2.2 Estimated Costs

The limitations of the existing structures inevitably means that a high level of maintenance will continue to be required – probably in the order of 5% of capital cost per annum.

Average annual costs, discounted at 5% over 50 years, are estimated at $75000.

3 Living with Coastal Erosion

3.1 Description

Involves living with coastal erosion, managing use and development of the property to minimise risk to dwellings. The option does not provide total protection to dwellings, as there is insufficient room on most properties for houses to be wholly located outside of the area potentially at risk from existing coastal processes (i.e. the Primary Development Setback).

Key elements of the option are as follows:

- Landward relocation or replacement of existing dwellings assessed to be at high risk from erosion.

Houses judged to be at very high risk from erosion in the absence of the existing works would be relocated or replaced further landward – probably about eight existing houses. There would still be residual risk to most dwellings. In the event of severe erosion up to 18 houses may need to be relocated further landward – with 14 of these potentially having to be temporarily relocated offsite until the shoreline recovered.

- Removal of existing seawalls and any rock buried landward of these structures – so that the shoreline responds naturally to erosion

Ideally, a natural frontal dune would also be re-established along the landward margin to encourage natural dune recovery between storm events.

- Development setback and relocatability requirements for all new dwellings and extensive renovations/additions

A realistic minimum setback would need to be established to minimise the risk from erosion to new dwellings. In view of the residual threat from erosion, all dwellings would need to be relocatable to enable landward movement if required. Appropriate triggers would also have to be established for relocation.

As the living with coastal erosion option involves the removing of hard engineering structures and letting nature take its course then it would be classed as a tier 1 option in the hierarchy of options promoted in the NZCPS and national climate change guidance documents.

3.2 Estimated Costs

The option requires landward relocation or replacement of at least eight existing dwellings – assessed at $400,000 (for relocation). Removal of existing walls and rock is assessed at $50,000 (assuming 10 cubic metres per metre length along the affected area and assuming discounted rate for excavation as rock removed could be reused).

In addition to these costs, there is the loss in capital value of the properties due to uncertainties in regard to future erosion and the potential costs of relocating up to 18 dwellings in the event of severe erosion.

In the longer-term, with erosion aggravated by projected sea level rise, there is potential for 25-30 properties to be rendered unusable by 2100 – these properties having a combined current capital valuation of $26-28 million.

4 Purchase of Beachfront Properties and Rezone as Open Space Policy Area

4.1 Description

This option involves:

- Purchase of affected properties and dwellings at current market value;
- Removal of existing dwellings – sale of houses that are relocatable, demolition and removal of those that are not;
- Removal of existing coastal structures and any buried rock behind these structures;
- Restoration of a natural foredune along the seaward margin of the area; and
- Designation of area as recreational or esplanade reserve.

As this option involves the removing of hard engineering structures and letting nature take its course then it would be classed as a tier 1 option in the hierarchy of options promoted in the NZCPS and national climate change guidance documents.

4.2 Estimated Costs

The purchase of the 25 worst affected beachfront properties (115-165 Captain Cook Road) is likely to cost at least $20.5 million. With upper end property prices, all-up costs could be in the range of $23-25 million when spread over the planning timeframe.

5 Frontal Seawall

5.1 Description

This option involves the protection of properties and dwellings by a properly engineered rock wall located seaward of property boundaries. Key elements of the option are:

- **A rock sea wall** located on Council-owned reserve along the seaward margin of the properties.

The sea wall would be approximately 500m long, 4-5m high, have a seaward slope of 1V:2H, a D50 rock size of approximately 0.9m, and an armour layer thickness of about 2.0m The structure would be underlain by an appropriate geotextile filter. Existing structures would only be removed to the extent required to construct the new wall.

The wall would be permanently exposed above prevailing beach levels and would reduce the width of the high tide beach, eliminating it for most of the time in some areas.

- **Existing development controls would be maintained** - to minimise complication of existing hazard should the wall need to be removed at some future date.

These controls include the 30m-development setback and relocatability requirements for new dwellings, additions and extensive renovations. Height limitations and site coverage requirements would also remain and further subdivision of the sections would not be permitted.

A rock seawall is a hard engineering structure and is therefore considered as a less favourable tier 3 option in the hierarchy mentioned in the NZCPS and national climate change guidance documents.

5.2 Estimated Costs

The capital cost of the wall is estimated at $1.6 million, with average annual maintenance costs estimated at $30,000 per year. These costs would be largely and probably entirely met by the benefiting properties as there is little benefit for the wider community.

6 Backstop Wall and Relocation and Land Swap

6.1 Description

This option involves the use of a properly engineered seawall to protect property and dwellings. However, the structure would be located sufficiently far landward so that it was buried on most occasions and only infrequently exposed - to avoid adverse effects on the beach and beach values. This option has been applied at various sites, including the Gold Coast.

The key elements of the option are:

- Relocation or replacement of up to five existing houses further landward (on the existing sections) to create room for wall.
- Removal of existing sea walls and associated rubble and construction of the backstop sea wall.

The wall will largely be located on private land, though tied into public reserve land at the eastern and western ends. The maximum landward extension of the wall into private property would involve a balance between minimising adverse effects on the beach and private property – but would probably be in the order of 10-12m in the worst affected areas and less in other areas.

The wall would be similar in design and dimensions to the frontal wall but would involve a lesser height because of the lesser depth of embedment required to avoid undermining. As with the frontal wall, the top elevation would be sufficiently high (probably about 1m above existing section elevations) to minimise wave overtopping, though not sufficiently high to impinge on views from adjacent properties and dwellings (although once the dune rebuilds it may affect some ground level views). In extreme storm events, green water could inundate properties. Re-contouring of the dune area may be necessary following such events.

The wall is unlikely to be exposed for more than a few weeks every 20-30 years with existing coastal processes. In the longer-term, aggravation of beach erosion by projected sea level rise may expose the wall and negate the benefits of the option – though this is very unlikely within the next 50-70 years given present best estimates of future sea level rise. Therefore, the option is likely to provide a viable long-term solution for at least 50-70 years.

- Ideally, the private land in front of the wall would be taken partly or wholly into public ownership to eliminate potential legal issues in respect of access when the beach lies within the front edge of existing boundaries.

This will inevitably require compensation of the affected landowners – probably involving land exchange (i.e. granting part of the road reserve along the landward margin to affected owners) and/or a significant contribution to the cost of the option from the wider community.

A vegetated natural dune would be maintained on the seaward side of the wall to assist in natural dune building and recovery, enhance natural character and to maintain a barrier between the public beach and adjacent private land.

Although a backstop wall is a hard engineering structure, it will only be exposed as a hard engineering structure for periods of severe storm attack. This option therefore has elements of a tier 3 option in the hierarchy but also consists of tier 1 elements such as relocation.

6.2 Estimated Costs

The cost of the wall is estimated at $1.2 million. Removal of the existing seawalls and landward relocation of up to ten existing houses would increase total cost to about $1.7 million (assuming approximate cost of relocation per house is $50,000).

Maintenance costs would be minimal with existing coastal processes, since the wall would only be very rarely exposed to wave action. However, to be conservative, maintenance costs of $380,000 have been assumed over the 50-year planning timeframe.

As there are significant benefits for both property owners (see Cost Benefit Analysis in Appendix F) and the wider community, costs would be shared between these parties.

7 Groyne(s) plus Nourishment

7.1 Description

This option involves the use of nourishment to widen the beach and dune sufficiently to protect properties from erosion. Nourishment would only be conducted adjacent to the affected properties and a groyne or groynes would be used to retain the placed sand in the affected area. As the groyne(s) at this site would be used to retain beach nourishment material then, in the true sense, the groyne(s) would be considered an artificial headland(s).

The key elements of the option would be:

- Construction of the retaining groyne(s)

This would probably involve a single groyne, possibly a hook groyne, located at the eastern end of the affected area. However, two shore-perpendicular groynes, one located at each end of the affected area, could also be considered.

Detailed design would be required to establish groyne details. However, it is probable that the groynes would need to extend to depths of 1-2m below low water, particularly with the shore perpendicular structures – requiring groynes of about 200m length. With a single groyne at the eastern end, the structure would need to extend across the wide intertidal ebb tide delta and would be a markedly visible feature at low tide, particularly from the eastern side (e.g. the entrance of the Purangi Estuary).

There is strong net longshore transport to the east along the foreshore adjacent to the ebb tide delta - associated with the pattern of net sediment recirculation over the ebb tide delta. Therefore, a groyne placed in this area will trap longshore moving sand and a beach will be formed on the western (i.e. updrift) side.

- Placement of beach nourishment

With retention of sands by the groyne(s), markedly lesser volumes of beach nourishment would be required than with the beach nourishment option used in isolation.

- Existing development controls would remain initially – though these might be able to be relaxed once it was established that the measures were effective.

Maintenance would probably be required as some sand could be lost around the end of the groyne(s) – especially during storm events.

The groyne is a hard engineering structure and is therefore a less favourable tier 3 option to coastal hazard management in the hierarchy of options given in the NZCPS and national climate change guidance documents. However, nourishment is a soft option promoted as a tier 1 option in the hierarchy.

7.2 Estimated Costs

The cost of the groynes will depend on the length required – but are likely to be in the order of $1-1.25 million. Nourishment costs are estimated to be at least $1.25 million, bringing total capital costs to about $2.5 million for the single groyne option.

Annual maintenance costs likely to average at least $30,000 per year.

8 Offshore Breakwater and Nourishment

8.1 Description

This option involves the placement of a breakwater offshore from the beach - built either to be invisible even at low tide, or higher, to provide a greater degree of wave protection. The offshore breakwater will create a seaward bulge in the shoreline along the front of the properties (i.e. a salient), provided some sand is added. (Otherwise it will simply redistribute what is there) - and this sand will help to protect properties from erosion. The option would also restore a high tide beach backed by a natural dune.

The key elements of the option are:

- Construction of an offshore breakwater in an appropriate location offshore from the affected area.

The breakwater is designed to refract waves and dissipate wave energy on the shoreline by wave breaking - creating a salient in the “wave shadow” of the breakwater. Design of an offshore breakwater would need to take into account the wave, current and sediment dynamics over the ebb tide delta in the vicinity of the Purangi Estuary, geotechnical conditions at the proposed site and navigation concerns as this is an important boating area. The required breakwater would probably need to be located in depths of 2-3m, about 100-150m offshore from low water level. Several breakwaters would probably be required over the target length of nearly 500m.

- Placement of sufficient beach nourishment to form the expected salient.

Ideally, beach nourishment is required so that formation of the salient does not draw sand from adjacent beach areas, thereby risking the creation of new erosion problems.

An offshore breakwater is a hard engineering structure and is therefore a less favourable tier 3 option to coastal hazard management in the hierarchy of options given in the NZCPS and national climate change guidance documents. However, nourishment is a soft option promoted as a tier 1 option in the hierarchy.

8.2 Estimated Costs

It is difficult to estimate the costs of the breakwater and nourishment without detailed design. However, preliminary estimates suggest total capital costs are likely to be in the order of at least $3 million for the breakwater and $1.25m for the nourishment, with maintenance costs averaging about 2% per annum for the breakwater and 1% for the sand.

Appendix F

Economic Analysis

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1 Economic Analysis

The economic analysis evaluates the options for management of the coast in terms of the overall impacts on society, including beachfront dwellers and the wider community.

2 Cost-Benefit Analysis Methodology

2.1 Objective of Analysis

Economics uses the term economic efficiency to define the optimal outcome for society. Options which are more efficient move society closer to an optimal outcome. The definition of optimality is based on the original definition posed by Italian economist Vilfredo Pareto as a point at which no other distribution of goods could be achieved that would make someone in society better off without making someone else worse off. But this pareto optimality criterion is difficult to achieve—changes usually make some people better off while making others worse off, e.g. protecting beach-front properties with a seawall reduces the naturalness of the beach as enjoyed by others. The criterion is modified by an additional test—can the winners compensate the losers? From the perspective of society as a whole, it does not matter if there are losers, so long as the benefits to the winners are, in aggregate, greater than the costs faced by the losers.

Under this definition[1], it does not matter if compensation is not actually paid to the losers. What is important is that it could have been paid. This then makes society as a whole better off and better able to tackle any distributional issues, such as occur when certain communities bear greater proportions of environmental damage. In contexts where these redistributions are never actually made, policy makers have sometimes concerned themselves with the distributional impacts of environmental policy.

In analysis here we are concerned with the aggregate position of the community; we use a national approach to the definition of costs and benefits. We will also comment on the distributional impacts of the effects.

2.2 Monetary Values and the Sustainable Development Framework

The analysis of impacts on economic efficiency is not an input to the economic section of a triple or quadruple bottom-line analysis. Economic analysis is measuring overall well-being impacts; it uses monetary values to rank people's preferences for different options. To understand differences in preferences, we use data available including:

- **revealed preferences** such as the time and effort that people spend in going to a beach, and the price premium on houses by the beach; and
- **stated preferences** in response to surveys.

Preferences for the outcomes of different management options will depend on environmental factors (naturalness of the setting), social factors (how good the recreational

[1] known as Kaldor-Hicks efficiency

experience is) and potentially cultural factors (their historical attachment to the beach). We do not separate these out; we seek only to measure how preferences change, regardless of the underlying reason.

2.3 Marginal Versus Average Effects

The primary interest in analysis is in the effects of changes—how will the different management options for the coast change the total well-being of the community. This is an analysis at the margin. However, measuring only marginal effects can lead to perverse results.

For example, the different management options will have different impacts on the attractiveness of the beaches to visitors and therefore on their enjoyment of the visit, and on the numbers of visitors or the duration of their stays. For many visitors, individual beaches are substitutable—if one beach is less attractive they can always go to another, possibly at a small additional cost or with a small reduction in quality of experience. When there are substitutes, the impact on visitor well-being of reducing the value of one individual beach, e.g. through construction of a seawall to protect properties, might be small. Despite the fact that people obtain considerable pleasure (well-being) from going to a beach, the value of an individual beach is limited by its substitutability. Figures 1a and 1b illustrate.

Figure 1a: Value of Beaches

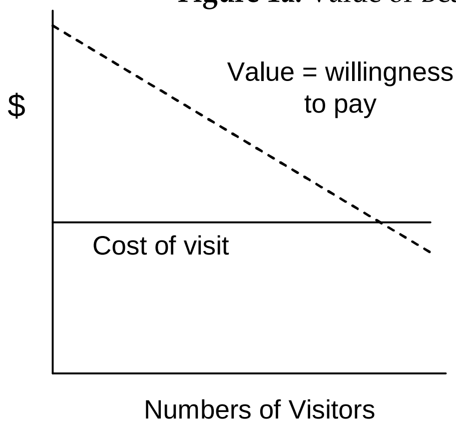

Figure 1b: Value of One Beach

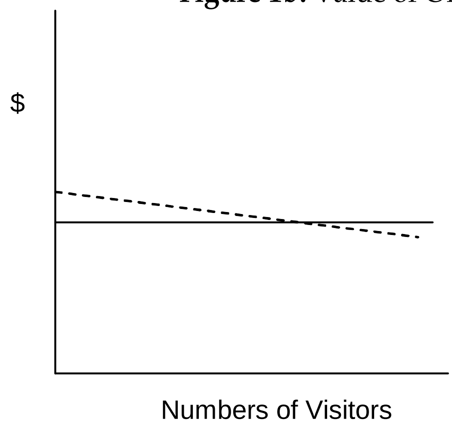

Figure 1a pictures the value that people obtain from beaches in general. It assumes that all visitors face the same costs to travel to a beach. To the left of the diagram the first visitors obtain a considerable benefit from the visit; they value beaches highly and gain a significant surplus from a visit—the difference between the costs of visiting and how much they would have been willing to pay to visit. As we move to the right, we find visitors for whom the value of the visit is close to the costs of getting there; they would be reasonably indifferent as to whether or not they went to the beach. Figure 1b shows the relationship when there are many substitutes. Here the willingness to pay to visit an individual beach is limited because any visitor can easily go to another beach and obtain a similar amount of pleasure.

The consequence for analysis of using this marginal approach is that an individual beach is measured as having a low value to visitors and there is little cost to beach damage via a reduction in its qualities. This can be appropriate if the policy choice will only ever relate to one beach.

If one beach is reduced in quality, the demand for other beaches increases; this is equivalent to an increase in value. Damage to the quality of the next beach will lead to further increases in demand and thus value of the remaining beaches, to a point where the costs of additional damage will be greater than the benefits. But such an approach leads to a distribution of damage that reflects the order in which the beaches are analysed, rather than it reflecting an optimal level of damage or beach value protection.

An analysis using average costs, using the demand curve for beaches in general (Figure 1a) is more appropriate for analysis of a policy type decision that will apply to numerous beaches. The analysis here has elements of both; it is intended to be an analysis of a single beach but using an approach that might be applied elsewhere. We have adopted the average approach to analysis.

2.4 Cost Definitions

The analysis measures the changes in real resource costs at the appropriate level. At the national level, taxes for example, are not costs but they are transfers between consumers and the government. These transfers are separated out in our assessment.

2.5 Counter-factual Assumptions

For analysis we evaluate all options against the status quo. This assumes that the current situation continues, i.e. there is some protection of existing houses via sea walls, but it is not reliable, whereby there is some discounting of current house values.

3 Well-being and Beaches

Beaches contribute to community well-being. We know this because:

- people choose to visit beaches at some cost, including those who choose to live at the beach at some price premium over alternative places to live; and
- surveys have recorded community interest in beach environments.

A recent survey for Environment Waikato reviewed available research, both from New Zealand and other countries, on beach use, beach values and perceptions of coastal erosion[2]. It identified a number of factors that contributed to beach value. Additional research used the specification of the values to derive a weighting of preferences for beach values[3]. These are illustrated in Figure 2.

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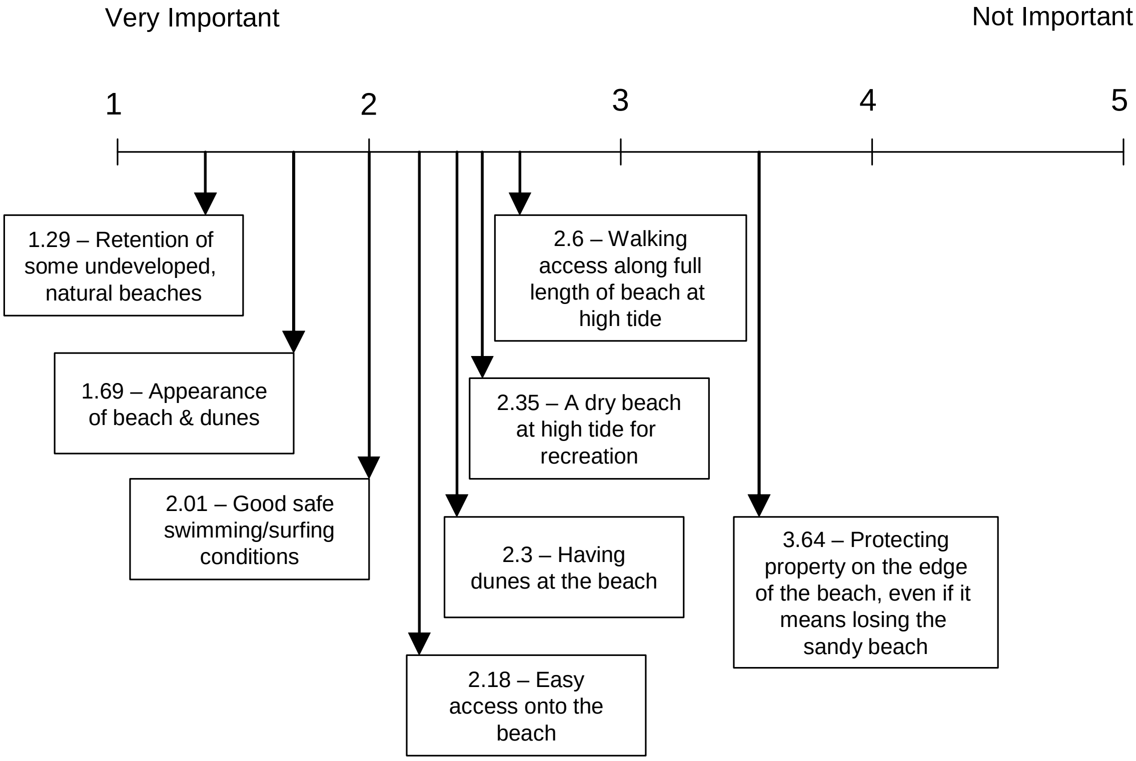
[2] Dahm C (2002). Beach User Values and Perceptions of Coastal Erosion. Final. Environment Waikato.

[3] Thompson J (2003) Coastal Values and Beach Use Report. Prepared by Jill Thomson Eclectic Energy for: Community, Economy and Environment Programme, Environment Waikato.

The main impacts of the management options we are assessing are on some of these valued parameters: the naturalness of the beach, its appearance and availability of beach at high tide for walking and recreation.

Figure 2: Average Rating of Beaches on 5-Point Scale



Source: Thompson J (2003) Coastal Values and Beach Use Report. Prepared by Jill Thomson Eclectic Energy for: Community, Economy and Environment Programme, Environment Waikato

These different elements make up the value of the beach from the perspective of those who live there and those who visit.

Below we analyse a number of individual impacts that result from the management options.

4 Impacts of Loss of Property

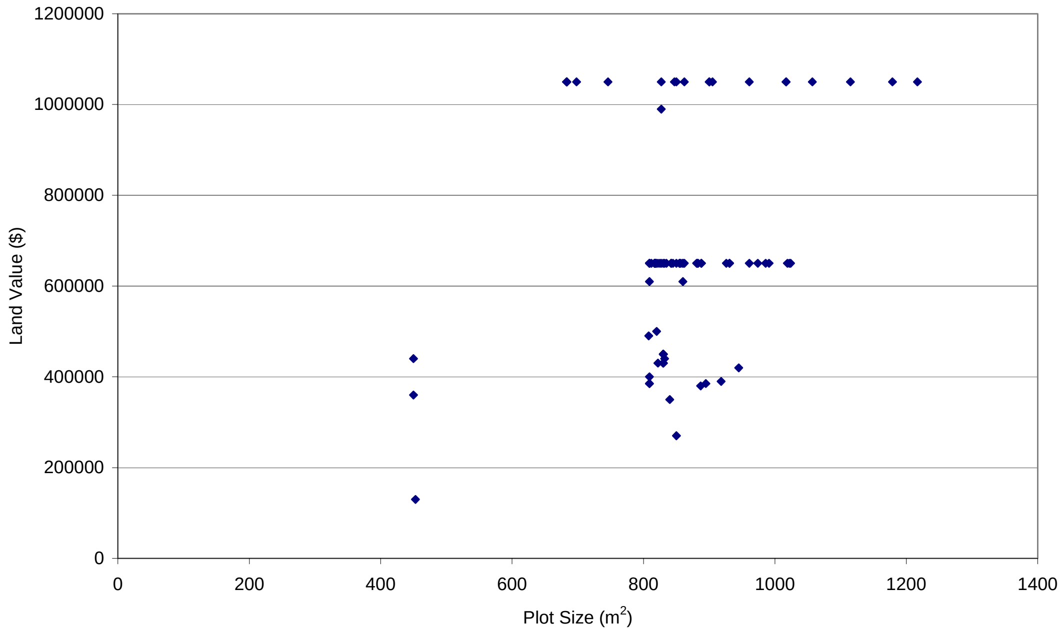
Property loss as a result of coastal erosion has two effects. There is a reduction in the land area of properties and, in extreme cases, loss of houses or the need to shift them. We examine both effects.

The analysis at Cooks Beach has concentrated on a strip incorporating numbers 117 to 165 Captain Cook Road. These properties are those at most risk from coastal erosion. Losses of land and houses are real resource costs. Their values represent the willingness of residents to pay to live at Cooks Beach. We use quoted values from Environment Waikato's property database as our basis for estimating the impacts of property values.

4.1 Loss of Land

To understand the cost of a reduction in property size, we examined the current relationship between land value and property size, using the Regional Council's property database. The results for Cooks Beach beachfront properties, excluding the properties that are the specific subject of our analysis, are shown in Figure3. The data suggests that there are many properties of very different sizes, with the same land value; this includes a cluster with a value of $1.05 million and a second cluster with a value of $650,000. At any plot size, there is potentially a very wide range of land values.

Figure 3: Relationship between Plot Size and Land Value—Cooks Beach



The results suggest that there is no meaningful relationship between plot size and land value; regression analysis of this data failed to produce any statistically significant relationship.

Our assumption is therefore that marginal reductions in plot size will have no measurable effect on land and thus property value. If losses of plot size became significant it is likely that the perceived risk of losing the house itself affects the property value, rather than the loss of land. This conclusion is confirmed from discussions with local real estate agents.

4.2 Loss of Houses

The loss of houses could have a significant cost. At some point the level of encroachment is such that the house is either moved or demolished. Alternatively, a management choice might be made to force houses to be moved or demolished. The costs of house removal are estimated as: the costs of land elsewhere to accommodate the people shifted, the reduction in consumer surplus (well-being) associated with a lesser quality plot of land plus either the costs of shifting the house and connecting it to networks, or the costs of demolishing the house plus the costs of building a new one.

The cost of a property elsewhere, plus the reduction in consumer surplus, is equivalent in value to the current land value of the properties. For the house related costs, we assume the loss of current improved value of the at-risk properties plus $10,000[4] for the costs of demolition; the assumption here is that the current occupiers purchase a property elsewhere and there is an additional cost of demolition and removal.

The total cost is therefore estimated as equal to the current capital value of the at-risk properties plus $10,000 per property. From the property database, the average capital value of the at-risk properties is $839,000 or $20.1 million in total for 24 properties. The cost of demolition would be an additional $240,000 in total.

4.3 Compensating Value Improvements

If beachfront property is lost, a new set of houses would become the beachfront properties and increase in value.

For this analysis we use land values to ensure that we are not taking account of differences in the value of the houses themselves. Currently, the average land value of the second row of houses behind the current at-risk beach-front houses is $365,000 compared with land value for the at-risk properties of $708,000, a difference of $343,000.

We assume that there is no change to the value on the basis of any removal of risk of erosion. It is assumed that this does not affect land values as discussed above.

A similar analysis for the rest of the beach, i.e. a comparison of the land value of the beach-front properties relative to the 2nd row, notes a similar difference in value of $377,000. For analysis we assume a compensating improvement of $350,000.

5 Value of Property Protection

Some risk of property loss is built into the current property value. Properties nearby to those at risk[5] have an average capital value of $1.12 million, ie a difference of approximately $285,000 per property. These nearby properties have smaller plot sizes; averaging 708m2 versus 777m2 for the at-risk properties.

For analysis, we assume that the protection of the at-risk properties would have a benefit, equal to the current difference in average value, i.e. $285,000 per property or a total of $6.8 million.

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[4] As advised by demolition company, Winston Jacob Ltd

[5] Numbers 83 to 115 Captain Cook Road

6 Impacts of Reductions in Visit Values

The management options differ in their impacts on beach user values, ie the overall value of a visit to the beach. The factors that determine the visit value include the naturalness of the setting, the beach aesthetics and the ability to walk along the beach or otherwise use it for recreational activities at both low and high tides.

A national coastal survey was used to estimate the public's willingness to pay for improvements in the natural character of beaches. Respondents resident at beaches were asked their willingness to pay, via their rates, for "new dune care and planting, including the replacement of current hard defences"[6].

Because of the small sample sizes for individual beaches, we have analysed a wider set of data for a number of North Island beaches[7]. The survey included results of those specifying a willingness to pay to improve natural character as a one-off payment and as an annual payment. The results are shown in Figure 4. As might be expected, the higher stated willingness to pay is for one-off payments.

The weighted average willingness to pay specified as a one-off payment is $1660 (at a 5% discount rate) or $913 at a 10% rate. As an annual payment the weighted averages are $91 and $92 at 5% and 10% discount rates respectively.

We use these figures in analysis[8].

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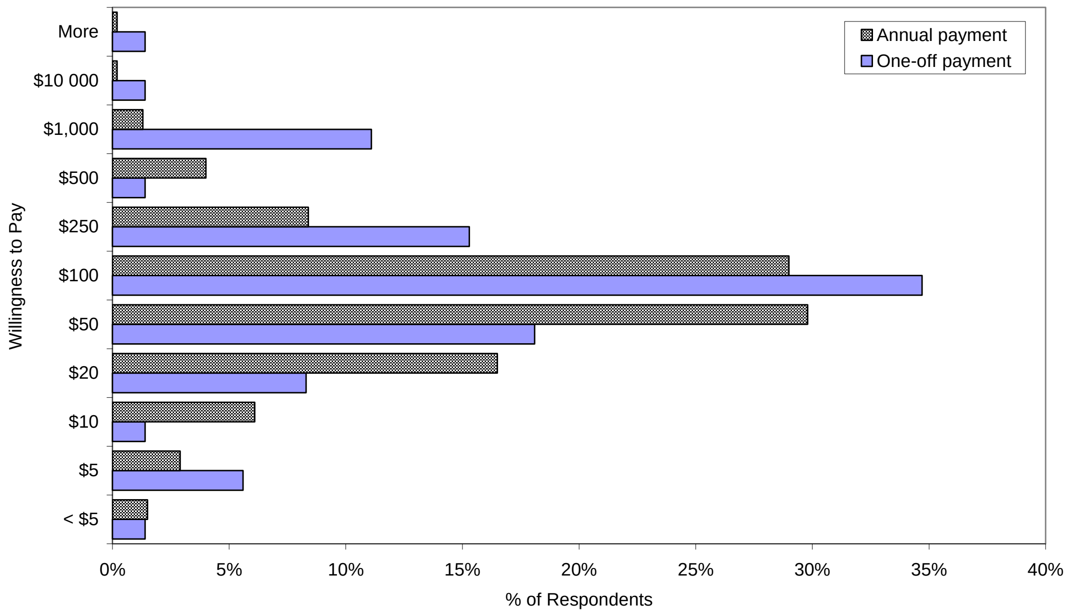
[6] Johnston D, Leonard G, Bell R, Stewart C, Hickman M, Thompson J, Kerr J and Glassey P (undated) 2003 National Coastal Survey. Institute of Geological & Nuclear Sciences Limited

[7] Coastlands, Cooks Beach, Langs Beach, Maketu, Mount Maunganui, Ohope, Omaha, Papamoa, Pukehina, Waihi Beach, Whangamata, Whitianga

[8] We use a one-off payment, although in practice it does not matter which approach is used.

Figure 4: Willingness to Pay of Residents for Improvements in Natural Character



Source: D Johnston, Institute of Geological and Nuclear Sciences Ltd, personal communication

Another study asked Waikato region residents their willingness to pay to protect beaches in their natural state. This was a more generalised survey to a wider cross section of people, not necessarily residents nor visitors to a beach, and the answers apply to all beaches not to an individual beach. The question asked was "how much would you donate to protect our beaches in a healthy, natural state?" The results are shown in Figure 5.

The weighted average value depends on what is assumed by a stated willingness to pay of more than $100[9]. If we assume $250 the weighted average willingness to pay is $35/person; at $500 the weighted average is $52. In contrast to the data above, when the same question was asked to people that owned beach property, the weighted average donation that owners were willing to give was $42 (assuming $250 for the over $100 category, or $65 assuming $500).

To compare with these values, Table 1 presents the results of a series of studies in New Zealand on the value of recreational visits to natural areas, taken from a database maintained by Geoff Kerr (Lincoln University). We have converted all figures to 2004 dollar values[10].

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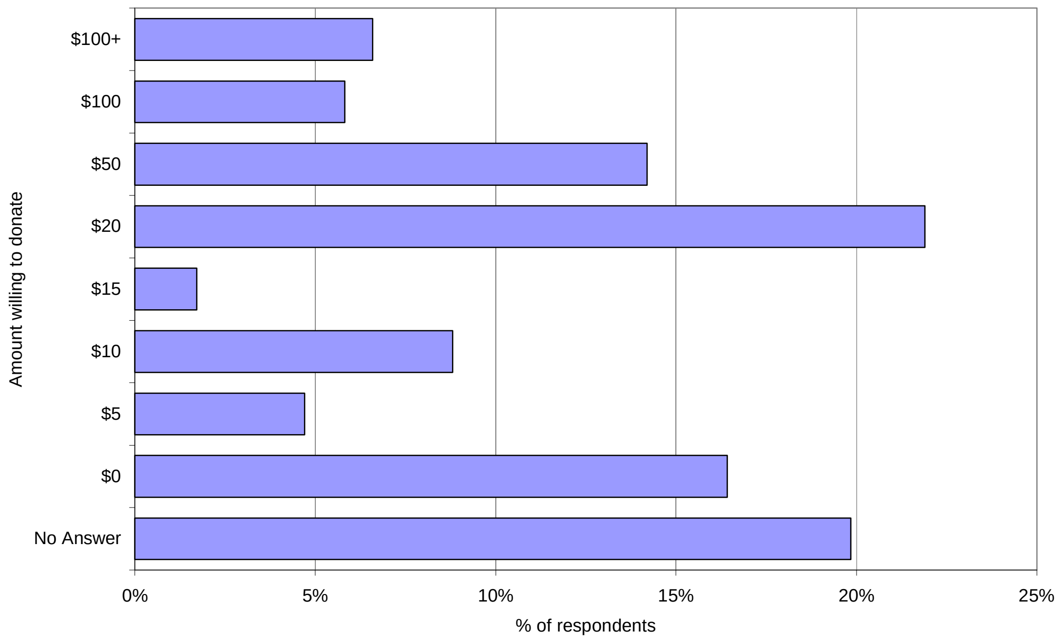
[9] Following the conclusions in the study, we assume that those stating no answer were unwilling to donate anything.

[10] Using the Reserve Bank of New Zealand's CPI Inflation calculator www.rbnz.govt.nz/statistics/0135595.html

Figure 5: Willingness to Pay to Protect All Beaches in their Natural State



It includes results from studies using two methods:

- Travel Cost (TC), which analyses how much people spent in travelling to a recreational site, used as a proxy for willingness to pay—it is a minimum willingness to pay; people must be willing to pay at least that amount as they already have;
- Contingent Valuation (CV) which uses surveys to ask people directly, how much they would be willing to pay. It results in higher values as it measures the additional surplus that visitors enjoy over and above their costs of visiting.

The contingent valuation studies provide potentially higher values because they incorporate people's willingness to pay, beyond what they might actually have to pay. Thus Bottle Lake Forest recreation has an average visitor value of $2/visit using travel costs but $36/visit using contingent valuation; the difference represents an estimate of the visitor surplus enjoyed.

The research suggests that recreational values for day visits range widely, from $2 to over $100, but that the highest value recreation visits are for specialist activities, eg canoeing ($81-$109/person/visit), skiing ($175/person) and fishing ($76/person/visit), or for visiting unique sites, such as Mt Cook ($83). More general recreation is valued at approximately $10/person/visit, with a maximum value of $56 for Hanmer Forest Park. This latter site has a high estimated travel cost and therefore a low surplus (contingent valuations are actually lower than the travel cost estimate but suggest that there is little additional value above the costs of getting there). This is similar to the results of assessments of the value of visits to Auckland regional parks (Table 2).

Table 1: Results from NZ Non-Market Valuation Studies

	Year		Methodology[1]
Hanmer Forest Park	1985	$56/person/visit	TC
Hanmer Forest Park	1986	$5.03 - $54.40/person/visit	CV
Wanganui River recreational canoeing	1986	$80.66-$109.41/person/visit	CV
Visitors to Mount Cook	1986	$83/person/visit	TC
National Park visitor centres	1988	$3.84/person/visit	CV
Camping, Tararua Forest Park	1988	$7.53/person/night	CV
Whangamarino wetland preservation	1988	$9.68-$18.64/household/year	CV
Whakapapa skifield recreation	1989	$93/person/year (summer) $175/person/year (winter)	TC
Wanganui River recreation	1989	$147/person/visit	TC
Reduction in flood risk Waimakariri river	1989	$65-$748/ratepayer/year	CV
Climbers at Mt Cook	1989	$226-$282	TC
Kaitoke Regional Park recreation	1990	$8.44/visit	TC
Recreational hunting	1990	$18/hunter/day	TC
Hollyford Valley walking track	1991	$121-$173/year	CV
Kauaeranga Valley recreation	1991	$5-$10/person/year	CV
Preservation of Aorangi Awarua forest block	1992	$10.92/household/year	CV
Bottle Lake Forest recreation	1992	$2.03/visit	TC
Bottle Lake Forest recreation	1992	$36/visit	CV
Ashburton river water instream values	1991/ 92	$63-$201/angler household/year $35-$119/non-angler household/year	CV
Improved water quality, Lower Waimakariri River	1993	$115-$165/household/year	CV
New recreational lake	1994	$45-$98/household/year	CV
Greenstone & Caples Valleys recreation	1996	$32/tramper/visit; $68/hunter/visit; $45/angler/visit	CV
Wellington Regional Council parks	1996	$12.08/person/visit	CV
Fishing Tongariro river	1997	$76/person/visit	CV
Orakei basin water quality	1997	$11.39-$12.30/household/year	CV
Rangitata River salmon angling	2001	$43-$110/angler/visit	TC

[1] TC = Travel Cost method; CV = Contingent Valuation

Source: New Zealand Non-Market Valuation Database (http://learn.lincoln.ac.nz/markval/)

Table 2: Values of Visits to Auckland Regional Parks

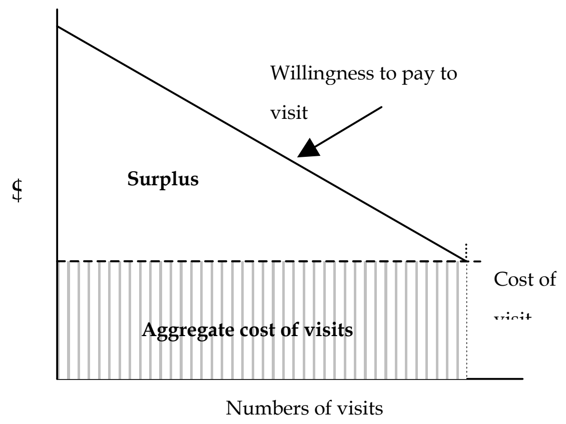
Activity	Unit Day Values ($)
General recreation	11.00
Specialised recreation	26.00
Camping	9.00
Education	11.00
Special Event	30.00

Source: Ball RJ, Saunders CM and Cullen R (1997) Auckland Regional Parks Network: Assessment of Benefits & Expenditure Recovery Options. Lincoln University, Canterbury, NZ

The highest values recorded in Table 1 are for reductions in threats to property—reduction in flood risk at the Waimakariri River.

Our interest in these analyses is in the surplus obtained per visit (see Figure 6). Thus higher surpluses can be obtainable for recreational sites closer to population centres.

Figure 6: Visitor Surpluses



This simple picture shows many visitors, all with the same cost of travel to the park. The aggregate cost of visits (visits x costs) is the area under the cost of visit line. This is the total private cost of recreational visits. Some people would have been willing to pay (WTP) a lot for their visit; they are at the left hand side of the graph—for them there is a large surplus. In theory, the last person to visit the park will be the one whose cost of visit is exactly equal to WTP. The total surplus is the difference between aggregate WTP and aggregate private costs.

Under a cost-benefit framework, the surplus represents the net benefits of the visits to the site.

If we use travel costs to analyse the willingness to pay to visit Cooks Beach, the suggested values are approximately $330/person (see Annex A). This is significantly above the values presented above, and reflects the fact that the Coromandel is a holiday destination rather than a day trip destination.

There is a possible additional surplus relating to the costs of travel. Private costs of travel include a tax element (duties and GST on petrol). This is a transfer payment to government and not a cost to society. However, there are external costs of transport that include pollution (air pollutants, greenhouse gases and road run-off) and road damage effects that are not explicitly priced. It is possible that, for rural travel, the level of these external costs is less than the amount of tax paid on petrol, therefore there is an additional social surplus when people make private choices to visit Coromandel beaches. The tax on petrol element of the total estimated travel cost is approximately 5% or $15 per person. However, we have no information on whether or how much of this is an additional social surplus. We have not included this in analysis.

Surpluses can be enhanced by the quality of the site. A survey in South Africa[11] estimated the current travel costs to visit selected beaches in the Cape Peninsula; the mean trip cost was R4.90 for residents and R4.20 for tourists. The researchers subsequently asked what people would be willing to pay to visit a clean beach. On the basis of a photograph, 43.5% of residents stated that they would be willing to travel 50km or more to visit a clean beach; this had an estimated minimum trip cost of R35.50. The difference between this willingness to pay and the current travel costs was the researchers' estimate of the surplus that would be received by visitors to the current beaches if made clean.

We use the New Zealand data above to identify two values for analysis:

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[11] Balance A, Turpie J and Ryan P (In draft) The recreational demand for clean beaches and economic impacts of pollution: a case study from the Cape Peninsula, South Africa. www.econ4env.co.za/wip/anna2%20-%20econ_beach.doc

- A value of beach naturalness to residents, valued at $1660 per property owner (or $913 at a 10% discount rate). This is a one-off cost. Spread across 754 residents, this value totals approximately $1.3 million (at a 5% discount rate).
- The value of a beach visit to visitors on the basis of the full set of beach attributes. We make an assumption of the size of the surplus, above the costs of visiting the beach, as $10/visit. This corresponds to a total of $1.5 million per annum for 150,000 visits. We use sensitivity analysis to test higher amounts.

In analysis we make assumptions regarding the extent to which each management option contributes towards increases or decreases in total beach value.

7 Analysis of Management Options

Analysis of all options is undertaken relative to the current state of the beach in terms of naturalness and the values that it offers to visitors and residents. Thus the status quo is our counterfactual for analysis. This is different from the approach taken in the multi-criteria analysis. However, whereas the stance taken for cost benefit analysis will change the absolute values of costs and benefits, it will not change the ranking of options.

7.1 Assumptions for Analysis

A number of assumptions are adopted for analysis. The general assumptions are summarised in Table 3.

In addition to these general assumptions, there are a number that are specific to the individual management options (Table 4). The naturalness change represents the improvement in the overall natural qualities of the total beach environment associated with the management options that affect a small part of the total beach area. We have assumed that these effects are small because they affect only a small part of the beach. Although we use the term naturalness, it effectively corresponds to a set of attributes that make up the attractiveness of the beach to people; this will include its natural character and the suitability of the beach for recreation. Under the options analysed, these characteristics move in the same direction. Large seawalls will make the beach less natural to look at; they will also lead to more beach scouring reducing the amount of beach available for recreational activities, particularly at high tide. The individual percentages are used with the values of visits and the value of naturalness to residents. For example, a 5% improvement would be valued at $0.50/visit to the beach or $75,000 in total for 150,000 annual visits.

Table 3: Assumptions for Economic Analysis

Factor	Assumption
Visitor numbers (per annum)	45,000
Visitor nights (per annum)	150,000
Total Properties	754
Increase in visitor numbers (per annum)	2.3%
Houses currently at risk of inundation	24
Average capital value of beach front property at risk of inundation	$839,000
Cost of house demolition	$10,000
Increase in beachfront property capital value from removal of erosion risk	$285,000
Further decrease in beachfront property capital value from removal of wall	$285,000
Increase in capital value of current 2nd row houses from becoming beachfront	350000
Number of 2nd row houses that could potentially gain	20
Costs of moving a house and reconnecting to networks	$50,000
Value of beach naturalness to residents per household	$1660
Surplus value of beach visit obtained by visitors (including naturalness value)/visit	$10

In terms of the descriptions of options, we have used the term "buy properties and rezone as Open Space" in the economic analysis as a summary description of "Council purchase of private land + relocation +rezoning to open space/reserve".

Table 4: Option-Specific Assumptions

	Status Quo	Live with Erosion	Buy properties and rezone as Open Space	Frontal Seawall	Backstop wall	Groyne + nourish-ment	Offshore break-water
Naturalness change	0%	5%	5%	0%	5%	2%	2%
Year of start		0	0	0	0	0	0
Year of start			5				
Capital Cost		50,000	50,000	1,600,000	1,250,000	2,500,000	4,500,000
Maintenance Cost	75,000			30,000	20,000	30,000	90,000[1]
Houses moved off site			24				
Houses with extra risk of inundation		14					
Houses moved back within site		4			10		

[1] Every 10 years

The evaluation of the different options is given below. We have used three discount rates for analysis – 2%, 5% and 10% (see Annex B for a justification of these rates).

7.2 Status Quo

There is an estimated $75,000 per annum cost for maintaining existing structures, but no additional capital costs. The current beach qualities are maintained. At a 5% discount rate the total net cost is $1.4 million.

	$ million (2% discount rate)	$ million (5% discount rate)	$ million (10% discount rate)
Costs			
Maintenance Costs	-2.4	-1.4	-0.8
Benefits	0	0	0
Net Present Value	-2.4	-1.4	-0.8

7.3 Living with Coastal Erosion

This option involves removal of existing structures and allowing the beach to return to natural cycles. It is assumed that there will be a need to move four existing beachfront houses back within their current sites. The benefits include a gain in the naturalness of a small section of the beach — we assume that the gain is equal to 5% of the total beach surplus value. This option has high net costs because of the property losses; these are up-front losses to the capital value that occur when the current structures are removed. The naturalness benefits are spread out over time; thus the net costs of this option are higher under higher discount rates.

	$ million (2% discount rate)	$ million (5% discount rate)	$ million (10% discount rate)
Costs			
Capital Cost	-0.05	-0.05	-0.05
Property Loss	-4.19	-4.19	-4.19
Total	-4.24	-4.24	-4.24
Benefits			
Naturalness gain	3.7	2.0	1.0
Net Present Value	-0.5	-2.2	-3.2

7.4 Buy Properties and Rezone as Open Space

This option is similar to "Living with Coastal Erosion", in that the existing structures are removed and there is no replacement with any structure to protect the current houses at risk. Under this option, the 24 front row houses are compulsorily removed from their current sites and have to move elsewhere; we assume this occurs after five years. There is a compensating gain in property value for second row houses which become beachfront properties. Because we assume there is a delay in the time of house removal—it will take some time to negotiate this policy — the property-related costs are delayed and are reduced further under higher discount rates.

	$ million (2% discount rate)	$ million (5% discount rate)	$ million (10% discount rate)
Costs			
Capital Cost	-0.05	-0.05	-0.05
Property Loss	-18.5	-16.0	-12.7
Total	-18.5	-16.0	-12.7
Benefits			
Naturalness gain	3.7	2.0	1.0
Property gain	6.3	5.5	4.3
Total	10.0	7.5	5.4
Net Present Value	-8.5	-8.5	-7.3

7.5 Front Seawall

The existing structures are replaced by a single, larger solid wall. We assume that, whereas it is a larger more dominating structure, it is less ugly than what is there at the moment. Thus there is no change to the current naturalness of the site. There is an upfront capital cost and ongoing maintenance costs. There is a gain in property values compared with the status quo because of the greater certainty of protection to the existing properties.

Most of the costs and benefits are up-front but there are ongoing maintenance costs that reduce in importance under higher discount rates.

	$ million (2% discount rate)	$ million (5% discount rate)	$ million (10% discount rate)
Costs			
Capital Cost	-1.6	-1.6	-1.6
Maintenance Cost	-0.9	-0.6	-0.3
Total	-2.6	-2.2	-1.9
Benefits			
Property gain	6.8	6.8	6.8
Net Present Value	4.3	4.7	4.9

7.6 Backstop Wall

The backstop wall has significant capital and maintenance costs, and there is an assumption that some (10) properties will need to be moved backwards on their current sites.

There are benefits in terms of improved beach naturalness (5% gain) and gains to the value of beachfront properties because of the removal of risk of inundation. It has greater net benefits than the frontal seawall because, at a 5% discount rate, there are lower costs (the capital costs and property moving costs are higher than the capital costs of a frontal seawall but the maintenance costs are lower), plus there are gains from a more natural site. At a higher 10% discount rate the future maintenance costs are more heavily discounted so that total costs of the backstop wall are greater than for a frontal seawall. However, the naturalness gains are still higher.

Note: the economic analysis of the backstop wall option has included an assumption that 10 houses need to be shifted at a cost of $50,000 each. This number of houses is higher than assumed elsewhere in the report (five houses identified as requiring relocation). This assumption provides a conservative assessment of costs. Sensitivity analysis of lower numbers does not change the ranking of the backstop wall in the cost benefit analysis.

	$ million (2% discount rate)	$ million (5% discount rate)	$ million (10% discount rate)
Costs			
Capital Cost	-1.3	-1.3	-1.3
Maintenance Cost	-0.6	-0.4	-0.2
Property Loss	-0.5	-0.5	-0.5
Total	2.4	2.1	2.0
Benefits			
Naturalness gain	3.7	2.0	1.0
Property gain	6.8	6.8	6.8
	10.5	8.9	7.9
Net Present Value	8.1	6.7	5.9

7.7 Groyne Plus Nourishment

There are significant capital and maintenance costs but a gain in improved naturalness (2% assumed) and gain to existing properties via protection of current value. Discount rates make no difference to the net value because, under the assumptions used, there are up-front costs and benefits (in year zero, which do not change with the discount rate), while the annual maintenance costs and naturalness benefits are equal in size.

	$ million (2% discount rate)	$ million (5% discount rate)	$ million (10% discount rate)
Costs			
Capital Cost	-2.5	-2.5	-2.5
Maintenance Cost	-1.0	-0.6	-0.3
Total	-3.5	-3.1	-2.8
Benefits			
Naturalness gain	1.5	0.8	0.4
Property gain	6.8	6.8	6.8
Total	8.3	7.6	7.3
Net Present Value	4.8	4.6	4.4

7.8 Offshore Breakwater

There are significant capital and maintenance costs but a gain in improved naturalness (2% assumed) and gain to existing properties via protection of current value.

	$ million (2% discount rate)	$ million (5% discount rate)	$ million (10% discount rate)
Costs			
Capital Cost	-4.5	-4.5	-4.5
Maintenance Cost	-0.2	-0.1	-0.1
Total	-4.7	-4.7	-4.6
Benefits			
Naturalness gain	1.5	0.8	0.4
Property gain	6.8	6.8	6.8
Total	8.3	7.6	7.3
Net Present Value	3.6	3.0	2.7

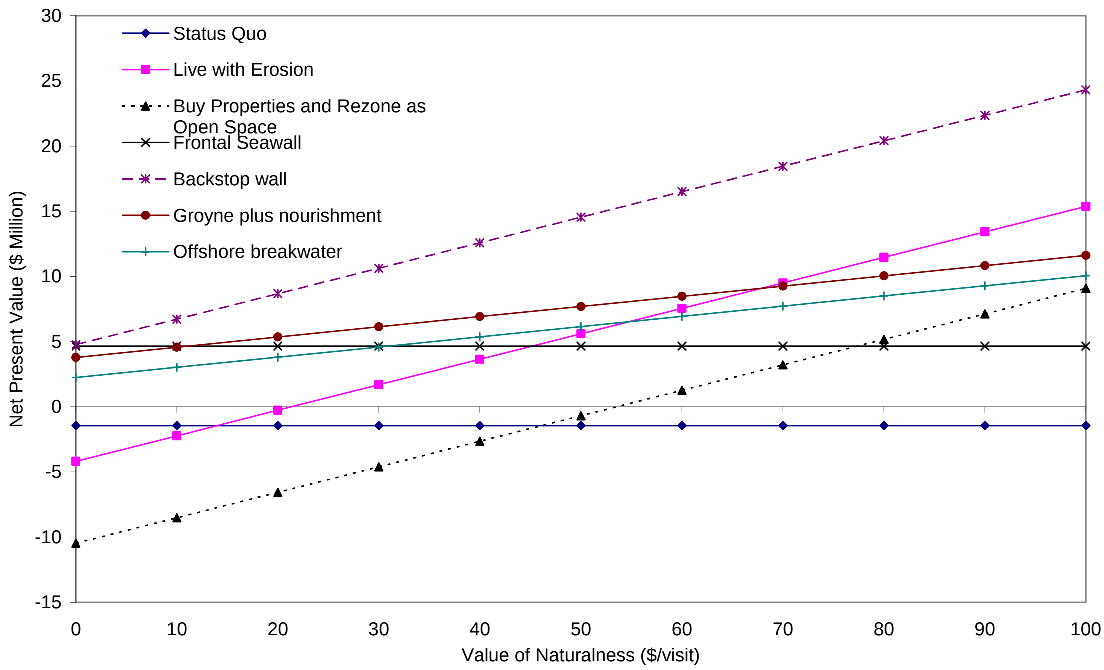
8 Ranking of Options

The ranking of the different options at a 5% discount rate is given in Figure 7; it shows the impacts of using different values of naturalness. A backstop wall has the greatest net benefits, even at a zero value, because it is the lower cost means of protecting the values of existing beachfront properties. Its costs include the capital costs of the wall, ongoing maintenance costs and the costs of moving an estimated ten houses. At an assumed zero value of naturalness improvements, it is very close to (but slightly higher than) the net benefit of the frontal seawall. Groyne plus nourishment becomes the second ranked option above a value of naturalness of $12/visit (and assuming that groyne plus nourishment has a 2% improvement in the overall value of the beach to visitors).

If we use the same analysis at different discount rate, the main impact is to shift the time at which "live with erosion" becomes the second ranked option—to a naturalness value of approximately $35/visit at a 2% discount rate, or to $138 at a 10% rate.

Table 5 summarises the ranking at different discount rates under the base assumption of a naturalness value of $10/visit. The preferred option is robust across a wide range of input assumptions. A frontal seawall is the preferred option only if there is no benefit assumed to result from improvements in the naturalness of the beach and the discount rate is greater than 9.5%.

Figure 7: Net Present Values of Management Options (5% Discount Rate) with different assumed naturalness values



After the backstop wall and frontal seawall, the next best options are "groynes plus nourishment" or an offshore breakwater; the former being valued more highly because of the substantially lower capital costs.

Table 5: Ranking and Net Present Value (NPV) of Management Options at 2%, 5% and 10% discount rates

2%		5%		10%	
Option	NPV ($ M)	Option	NPV ($ M)	Option	NPV ($ M)
Backstop wall	$8.14	Backstop wall	$6.72	Backstop wall	$5.91
Groyne plus nourishment	$4.85	Frontal Seawall	$4.66	Frontal Seawall	$4.91
Frontal Seawall	$4.27	Groyne plus nourishment	$4.57	Groyne plus nourishment	$4.43
Offshore breakwater	$3.60	Offshore breakwater	$3.02	Offshore breakwater	$2.70
Live with Erosion	-$0.54	Status Quo	-$1.44	Status Quo	-$0.82
Status Quo	-$2.43	Live with Erosion	-$2.22	Live with Erosion	-$3.21
Buy Properties and Rezone as Open Space	-$8.46	Buy Properties and Rezone as Open Space	-$8.51	Buy Properties and Rezone as Open Space	-$7.32

If very high values of naturalness are used, then the “live with erosion” and “buy properties and rezone as Open Space” options rise to second and third place respectively, but are never ranked above the backstop wall. “Live with erosion” is ranked in second place at a value of naturalness of $68/visit (at a 5% discount rate).

9 Distribution of Costs

The above analysis has assessed costs and benefits from the perspective of society as a whole. In this section we note the incidence of costs and benefits with respect to the beachfront property owners and the wider community. The impacts are summarised in Table 6.

Currently beachfront owners have favoured the frontal seawall; it has significant net benefits for them. However, the backstop wall could have significant benefits also, albeit that the costs are paid for by the public purse. For the wider community, “living with erosion” is the best option. However, this has very significant costs for beachfront property owners.

The analysis suggests that beachfront owners would still be better off with the backstop wall option if they were levied for up to $2.1 million of its total costs; at $2.1 million their net benefits (6.8 – 2.1 = 4.7) are equal to the benefits of the frontal seawall. This could then provide net benefits to the wider community of up to $2 million (2.1 – 0.1); this is equal to that obtained by the “living with erosion” option.

Table 6: Incidence of Costs and Benefits

Option	Impacts on Beachfront Property Owners	Impacts on the Wider Community
Status Quo	Costs of maintaining current structures $75,000 per annum **$1.4 M total**	Costs of continuing reduced beach naturalness **No net improvement**
Live with erosion	Costs of increased risk of inundation and thus reduced property prices ($285,000 for 14 houses) and costs of shifting 4 houses ($50,000 per house) **$4.2 M total cost**	Small cost of removing current structures ($50,000) Public benefits of increased naturalness **$2.0 M benefit**
Buy properties and rezone as Open Space	24 beachfront houses lost but compensation paid ($839,000 per property) **No net impact**	Small cost of removing current structures ($50,000). Costs of compensating beachfront property owners ($16 M) Public benefits of increased naturalness ($2.0 M) Benefit of increased value to 2nd row houses ($5.5M) **Net cost $8.5 M**
Frontal Seawall	Assume beachfront properties pay for wall ($1.6M) and maintenance Gain in property price from reduced risk ($285,000 per property; $6.8 M total) **Net $4.7 M gain**	Costs of continuing reduced beach naturalness (impact assumed to be same as status quo) **No net improvement**
Backstop wall	Assume public funding of wall. 10 houses shifted backwards on site (at public expense). Gain in property price from reduced risk ($285,000 per property; $6.8 M total) **$6.8 M gain**	Costs of wall ($1.25 M plus $0.4 M maintenance) Costs of moving houses ($0.5 M) Benefits of increased naturalness ($2.0 M) **Net $0.1 M cost**
Groyne plus nourishment	Gain in property price from reduced risk ($285,000 per property; $6.8 M total) **$6.8 M gain**	Costs of construction ($2.5M) plus maintenance Naturalness gain $0.8 M **Net $2.3 M cost**
Offshore breakwater	Gain in property price from reduced risk ($285,000 per property; $6.8 M total) **$6.8 M gain**	Costs of construction ($4.5M) plus maintenance Naturalness gain $0.6M **Net $3.8 M cost**

10 Conclusions of the Cost Benefit Analysis

The cost benefit analysis suggests the following options are ranked most highly:

Best Option:		
Backstop wall	Its ranking as the best option appears to be robust across a wide range of assumptions, including those in which we assign no value to improvements in the naturalness of the beach	
Second best Option:		
Frontal Seawall	**Groynes plus nourishment**	**Living with erosion**
Under the base assumptions, or those which assume that all options have relatively small effects on the value of visits to Cooks Beach	If improvements in the naturalness of the beach are highly valued	If improvements in naturalness are very highly valued, and/or if it is estimated that the introduction of groynes has a significant detrimental effect on the naturalness of the beach relative to options which let erosion takes its course

- Annex A

Travel Cost Analysis

There is no data on total visitor numbers to Cooks Beach. However, we can make an estimate of total visitors from peak data for Cooks Beach and total data for the Coromandel.

Total visitor numbers to the Coromandel was estimated at 1.1 million in 2002, of which 857,000 were domestic and 220,000 international, spending a total of 3.6 million visitor nights on the Coromandel[12]. The peak population of the Coromandel was 142,375. The peak at Cooks Beach was 5,934, which is 4% of the Coromandel peak. Assuming that the relationship between peak population and total visitors at Cooks Beach is the same as for the Coromandel as a whole, suggests that total visitors to Cooks Beach were approximately 45,000, spending approximately 150,000 visitor nights there. Growth rates in visitor numbers are estimated at 2.3% per annum[13].

For domestic tourists, we do not have information on the origin of visitors. We do have information on the addresses of absentee landowners at Cooks Beach; of the total 52% are from the Auckland region, 35% from the Waikato and the remainder from elsewhere in the country and international. There is also data on the origin of visitors to the Waikato region as a whole for 2001[14] (Table A1). In addition, international visitors to the Waikato region were estimated to total 398,000 in 2001, equivalent to 4% of total domestic visitors.

Table A1: Origin of Day and Overnight Trips to the Waikato Region (Domestic Visitors), 2001

Origin Region	% of Day Trips	% of Overnight Trips
Waikato	44.4	19.7
Auckland	34.0	41.7
Bay of Plenty	16.4	15.6
Other	5.2	23.0

Source: Gravitas Research & Strategy Ltd (2002) New Zealand Domestic Travel Survey 2001

For analysis we weight the assumptions towards the overnight and landowner data and assume 50% of visitors are from Auckland, 30% Waikato, 10% Bay of Plenty, 6% other New Zealand and 4% international. The analysis of travel costs uses the assumptions listed in Table A2; the road categories are those used by Transfund New Zealand. Auckland, Hamilton, Tauranga and Wellington are used to represent the origin of visits from the Auckland, Waikato and Bay of Plenty regions plus other domestic.

Table A2: Assumptions in Travel Cost Analysis

		Road Category			
Origin	Distance	Urban arterial	Urban other	Rural strategic	Rural other
Auckland	202	25%	5%	20%	50%
Waikato (Hamilton)	194	5%	5%	40%	50%
Bay of Plenty (Tauranga)	194	5%	5%	40%	50%
Other (Wellington)	659	5%	5%	40%	50%

Source: Whitianga Information Centre; AA; Covec assumptions

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12 Barrett J (2004) Towards 2020: A Strategic Plan for Tourism in the Coromandel to the Year 2020. 3rd Edition—Revised April/May 2004.

13 Barrett J (op cit)

14 Gravitas Research & Strategy Ltd (2002) New Zealand Domestic Travel Survey 2001.

Travel times and costs are estimated from the assumptions in Table A3. Transfund estimates of car running costs are for inputs to cost benefit analyses and represent resource costs only, i.e. they do not include tax. Petrol tax costs[15] have been added to this as they are costs faced by visitors.

Table A3: Cost assumptions

	Urban arterial	Urban other	Rural strategic	Rural other
Average speed (km/h)(1)	80	40	75	65
Time cost ($/h)(2)	14.09	14.10	19.21	18.59
Running costs (c/km)(2)	17.8	17.7	22.7	23.3
Revised running costs (c/km)(1)	23.7	23.6	30.2	31.0

Source: (1) Covec assumptions; (2) Transfund New Zealand (2003) Project Evaluation Manual PFM2

These result in the following estimates of the costs of travel.

In addition, there are expenditure costs associated with the trip that include the costs of accommodation. These are estimated to be $68 per night for overnight trips[16]; some of these costs would have been incurred if people had stayed at home. We net off the estimated average household spend on food[17]; this is equal to $28.80 per week or $4.11 per day. In comparing the data, we assume 2.2 people per vehicle; this is the estimated weekend occupancy of vehicles in rural roads[18]. On the basis of these cost estimates the travel costs are estimated (Table A4).

Table A4: Estimated costs of travel to Cooks Beach ($/vehicle)

	Time Cost	Running Cost	Expenditure	Total cost
Auckland	103	116	476	695
Hamilton	105	116	476	698
Tauranga	105	116	476	698
Wellington	358	395	476	1229

Table A5 presents the estimated costs per person, assuming occupancy of 2.2 per vehicle. These data are then used to estimate the total costs for domestic visitors to travel to Cooks Beach. We assume that international visitors travel from Auckland and costs from Auckland are used as the estimate of willingness to pay.

15 http://www.med.govt.nz/ers/oil_pet/fuelduties.html

16 2001 data from Gravitas Research & Strategy Ltd (2002) New Zealand Domestic Travel Survey 2001

17 Statistics New Zealand, Household Expenditure Survey.

18 Transfund New Zealand (2003) Project Evaluation Manual PFM2

Table A5: Estimated costs of travel to Cooks Beach ($/person)

	Costs per person						
	Time Cost	Running Cost	Expendi-ture	Total	% of visitors from origin	Number of visitors	Total Cost
Auckland	47	53	216	316	54%	24,300	7,679,714
Hamilton	48	53	216	317	30%	13,500	4,282,411
Tauranga	48	53	216	317	10%	4,500	1,427,470
Wellington	163	179	216	559	6%	2,700	1,508,722
Total Costs							14,898,316
Costs per person							331

The travel costs for visiting Cooks Beach are estimated to average approximately $330 per person.

▪ Annex B

Discount Rates

Discounting as Opportunity Cost

In economic analysis, all costs are defined as opportunity costs: the cost of using resources for one activity (project or policy) is that the opportunity to use them for another activity is given up. Discounting is a form of opportunity cost adjustment.

Local government is interested in improving well-being[19]. In economic terms, well-being is the outcome of consumption of goods and services. These are as disparate as food, education, community belonging, safety, views, clean air and recreation. Individuals reveal what contributes to their well-being through their actions—how they spend their time and money. By consuming in one time period we can reduce the ability to consume in another, eg by going to the beach today we are less able to go tomorrow because of the impacts on our available income. The first approach to discounting for public policy purposes is as a measure of the opportunity cost of consumption. This is the **Social Rate of Time Preference (SRTP)**. If a (local) government project only had the effect of delaying current consumption, the SRTP would be an estimate of the cost of that delay.

In addition, to changing consumption patterns, local government expenditure may change levels of private sector investment. Investments that yield positive real returns allow greater future consumption. Therefore an opportunity cost of investment or capital is frequently used in analysis. An opportunity cost of capital is the rate of return that an investment could have achieved in some other activity—by investing in one project (eg beach erosion control) we give up the opportunity to invest in another that would be expected to achieve a rate of return (the marginal investment undertaken by the private sector). The rate of return of projects depends on the behaviour of actors across a range of markets for inputs and outputs. The **Social Opportunity Cost of Capital (SOC)** is the relevant approach to defining discount rates where government expenditure results in fewer private sector projects.

Under perfectly competitive market conditions, the discount rate measured using the opportunity cost of consumption should be the same as an opportunity cost of investment. However, because markets are not perfect, the two approaches do not result in the same estimate of discount rate[20].

Estimated Discount Rates

In New Zealand, there is no official guidance on discount rates, although a 10% discount rate has been used by government since the 1970s and is used by the Treasury where there is no other agreed rate[21].

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[19] The purpose of local government is "… to promote the social, economic, environmental and cultural well-being of communities, in the present and for the future" (Section 10). Section 77(1) requires local authorities to identify options and evaluate the costs and benefits of each in terms of the impacts on well-being.

[20] Market imperfections include the absence of perfect information about future rates of return, externalities and distortions such as tax.

[21] The Treasury (1999) Office Minute 1999/B41 Guidelines for Costing Policy Proposals 21 December. In: Young (2002) Determining the Discount Rate for Government Projects. New Zealand Treasury Working Paper 02/21

Social Rate of Time Preference

The social rate of time preference has two components:

- the rate at which individuals discount future consumption over present consumption, which is largely[22] made up **pure time preference,** ie the extent to which individuals prefer to consume now rather than later, independent of all other effects, it can equal the savings rate in the economy; and
- the **marginal utility of income**—the extent to which total levels of consumption are expected to increase over time (people will be richer), against which the value of any unit of consumption will be reduced.

The pure savings rate can be measured from the real, after-tax rate of return on savings using long-term low-risk investments, eg government bonds[23]. Yields for 5 and 10 year bonds are similar currently, at about 5.9%, or approximately 3.8% real[24]. Real rates have averaged approximately 4.9% over the period January 1985 to February 2004; but the trend has been downwards[25]; we use a rate of 4%. With a tax on savings at 25%, this suggests a real savings rate of 3% without the effects of tax. Some analysts suggest that this might still need to be adjusted downwards. Rates of savings via government bonds reflect some elements of individual risk, eg the risk of death, which reduce savings rates at a given rate of return. This is relevant, because the individual risk of death is higher than the risk of society's disappearance[26].

However, combining the 3% figure with an estimate of the marginal utility of income, equal to the per capita GDP growth rate (average of 2.1% over the last ten years), would suggest a New Zealand SRTP of 5.1%.

Social Opportunity Cost of Capital

In estimating the social opportunity cost of capital, we are interested in the rate of return on the marginal project avoided. The cost of capital is often estimated in the private sector using the capital asset pricing model (CAPM). It measures the discount rate as the pure cost of delay plus the price of risk times the amount of risk. Investments have two types of risk:

- risk of being in the market. This is systematic risk, which cannot be diversified away and for which investors therefore require compensation. It includes risks such as global recession; and

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[22] Some analysts also include a measure of catastrophe risk, ie the risk that a project will provide no benefits because of some natural unforeseen disaster

[23] Boscolo M, Vincent JR and Panayotou (1998) Discounting costs and benefits in carbon sequestration projects

[24] With inflation at approximately 2%, ie ((1 + 0.059)/(1 + 0.02)) - 1

[25] The average yield since January 1994 is 4.7% and since January 1999 is 4.2%.

[26] Boscolo M, Vincent JR and Panayotou (1998) Discounting costs and benefits in carbon sequestration projects. Environment Discussion Paper No 41. Harvard Institute for International Development. www.hiid.harvard.edu/pub/other/ieppub/edps/edp41.pdf

- unsystematic risk, specific to a company or investment. It can be eliminated through a diversified portfolio of assets or investments and would not therefore be compensated in a competitive market.

Estimates of the real cost of capital in New Zealand have suggested rates of approximately 10%. For example, Martin Lally in a study for the Business Roundtable used a number of techniques to produce results of 10.7%, 9.5% and 7.2%[27].

Sustainable Development and Future Generations

Discounting is a present generation concept. If we are equally concerned about the preferences of future generations then we would not use the time preference rate of current generations—we could assume that future generations would have the opposite preference, ie they would prefer consumption to occur in their generation rather than ours. However, the marginal utility of income is still a relevant consideration and would suggest a low but positive discount rate.

It is unlikely that current decision makers will ever truly be indifferent to impacts across generations. However, the indifferent position would suggest a rate of approximately 2%

Applications to Local Government Decisions

Analyses of weighted average costs of capital for local government include an estimate of 4.75%[28]; this was based on the average of a real pre-tax discount rate (4.5%) based on the current interest rate for council borrowings, and an estimate of the opportunity cost of capital to a rate-payer based on returns in a balanced portfolio (5%).

Chosen Rates for Analysis

There is no unambiguously correct rate to use for analysis. We have therefore used three rates in analysis to reflect this uncertainty. These are:

- 10%—because of its long history in government analysis in New Zealand and similarity to some estimates of the private opportunity cost of capital;
- 5%—close to our estimate of a social rate of time preference for New Zealand;
- 2%—to incorporate consideration of long term issues relating to future generations.

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[27] Martin Lally (2000) The Real Cost of Capital in New Zealand. Is it Too High? New Zealand Business Roundtable.

[28] Beattie Rickman (2003) Financial Analysis for Review of Otorohanga & Waitomo Districts. In: Capital Strategy Ltd (2003) Review of the Beattie Rickman Report on the Proposed Amalgamation of the Waitomo and Otorohanga Districts. Report to the Local Government Commission.

Appendix G

Definition of Indicators

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1 Introduction

The following section defines each impact category assessed in the matrix in terms of social, environmental and economic impacts. Each impact category was assessed qualitatively (expert opinion) to allow for a ranking of proposed coastal erosion management options. The assessments are based on a 50-year timeframe to provide for a long-term management approach to coastal erosion at Cooks Beach.

In general terms the gradings are given in terms of whether the option has a significant impact or only moderate impacts (either positive or negative) as follows:

High Positive Grading	=	significant positive effects.
Medium Positive Grading	=	moderate positive effects.
Low Positive Grading	=	minor positive effects.
High Negative Grading	=	significant negative impacts/effects.
Medium Negative Grading	=	moderate negative impacts/effects.
Low Negative Grading	=	minor negative impacts/effects.
0 Grading	=	no impact/not applicable.

2 Social Impacts

2.1 Policy / Statutory Compliance

The degree to which the management option complies with existing national, regional and district policies/provisions/guidance.

- High Positive Grading = option consistent with most/all policies.
- High Negative Grading = option not consistent with most/all policies.

2.2 Beach Amenity Values

Refers to the peoples ‘sense of place’, visual aesthetics of the option, public access and recreational impacts such as cycling, walking, running, surfing and boating. The question is asked, “will the option have a positive or negative impact on peoples desire to go to the beach”?

As defined in the RMA 1991: 'Those natural or physical qualities and characteristics of an area that contribute to peoples appreciation of its pleasantness, aesthetic coherence and cultural and recreational attributes'. The option will be assessed as having amenity impacts that either achieves the strategy vision or hinder reaching the vision.

- High Positive Grading = option helps achieve a beach with high amenity value.

- High Negative Grading = option significantly adversely impacts on beach amenity values.

2.3 Public Access

Public access is considered in terms of whether the option has a positive or negative impact on access both to the coast and along the coast. This is identified as a matter of 'national importance' in the RMA.

- High Positive Grading = option facilitates public access both to and along the coast.
- High Negative Grading = option significantly hinders public access both to and along the coast.

2.4 Construction Nuisance

Refers to disruptions, interference and noise levels impacting on visitors and the local community from any construction works (either temporary placement or on-going maintenance) required for the option. Assessments are either negative grading (as construction cannot have a positive nuisance impact) or 0 where no construction is required in association with an option.

- High Negative Grading = option has a high level of on-going maintenance or significant placement construction works associated with it that would cause significant adverse nuisance effects.
- 0 Grading = no construction required / not applicable.

2.5 Public Safety

Refers to the level of impact on public safety from the option such as navigation safety, accidents caused by construction activities associated with the option and injury / life risk to property owners.

- High Positive Grading = option significantly enhances public safety.
- High Negative Grading = option has a high level of potential adverse impact on public safety.

2.6 Impact on Council

The extent to which the management option relieves, maintains or increases pressure and / or Council liability to undertake coastal protection works to safeguard private property. Pressure may be compounded by increasing numbers of properties at risk, or relieved by options that reduce the number of properties at risk. Also refers to level of commitment required by EW / TCDC in the long term in terms of maintenance, resources provided, etc.

- High Positive Grading = option has no impact on EW/TCDC in terms of pressure from the community, on-going commitment of resources to maintain the option and no liability issues.
- High Negative Grading = option has a significant impact on EW/TCDC in terms of pressure from the community, on-going commitment of resources to maintain the option and liability issues.

2.7 Uncertainty

The level of certainty the option provides property owners on extent of protection afforded against future erosional events, i.e. loss or damage of property.

- High Positive Grading = option provides the public with a high level of certainty in the long term on erosion management.
- High Negative Grading = option has a high level of uncertainty in the management of coastal erosion.

2.8 Public Resistance

Refers to the expected resistance levels, public perceptions and disagreements within the community as a result of a proposed action. Assessments are either negative grading (as public resistance cannot have a positive impact) or 0 grading where there is expected to be no public resistance.

- High Positive Grading = option expected to receive little or no public resistance
- High Negative Grading = option expected to receive a large amount of public resistance and result in disagreements within the community.

2.9 Cultural Values

Includes a consideration of the impact of the option on values important to tangata whenua.

NOTE: this category is not assessed here as information on the level of impact of options on cultural values can only be obtained through extensive consultation with tangata whenua (see Action Plan). EW and TCDC have indicated that they will undertake this extensive consultation as part of the wider regional coastal erosion strategy work being undertaken.

2.10 Historic Heritage

Refers to the natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures. Includes a broad assessment of potential impacts on both recorded and unrecorded archaeological sites. The assessment on the degree of impact on present and potentially present archaeological sites is hypothetical as the degree of impact will be directly related to the nature of the site (in terms of its depth below ground, how intact the site is and what type of site it is). Further consultation with the NZHPT and possibly even site investigation by archaeologists will remove the uncertainty.

Historic heritage is defined in the RMA as a matter of 'national importance'.

- High Positive Grading = option protects historic heritage / archaeological sites.
- High Negative Grading = option hinders or adversely affects the preservation of historic heritage / archaeological sites.

2.11 Equity

Assessment of the balance of benefits to be gained between the wider community and private beachfront property owners etc.

- High Positive Grading = option creates equal benefits for the community as a whole.
- High Negative Grading = option benefits one group of individuals / part of community to a greater degree than others in the community.

3 Environmental Impacts

3.1 Biodiversity – Species and Habitats

Refers to the impact of the option on indigenous species and habitats including endangered and threatened species within the coastal environment.

- High Positive Grading = option enhances and promotes biodiversity.
- High Negative Grading = option adversely impacts on biodiversity.
- 0 Grading = no impact on biodiversity.

3.2 Natural Character

Refers to the extent of impact (either positive or negative) the option has on landforms, ecosystems and natural processes. Defined in the RMA as a matter of 'national importance'.

- High Positive Grading = option has a positive impact on the enhancement of natural character of the beach.
- High Negative Grading = option hinders achieving a high level of beach natural character.

3.3 Coastal Processes

Refers to level of impact the option has on natural coastal processes such as wave action, currents and resulting sediment movement.

- High Negative Grading = option is or possibly will have a significant adverse effect on natural coastal processes.
- 0 Grading = option has no effect on natural coastal processes.

3.4 Coastal Flooding

Refers to the effect of the option on coastal flooding risk. It includes wave overtopping, storm surge, wave run-up etc.

- High Positive Grading = option protects properties from the effects of coastal flooding.
- High Negative Grading = option significantly increases the risk of coastal flooding of properties.

3.5 Climate Change

Refers to how the option will face climate change and the effects of global warming, associated sea level rise and effects on coastal erosion.

- High Positive Grading = option effective in dealing with coastal erosion given the long-term effects of climate change.
- High Negative Grading = option not considered to be effective in dealing with coastal erosion given the long-term effects of climate change.

3.6 Environmental Footprint

Refers to the degree of impact the option has on environmental resources (such as the type of resource required to be used, amount needed for option etc). It refers to how we might quantify our use of nature and compares this with the carrying capacity of our ecosystems, so that we can assess environmental sustainability.

- High Positive Grading = option requires little or no resources and will promote the sustainable management of the environment.
- High Negative Grading = option requires the use of valuable non-renewable resources in large volumes and does not promote sustainable long-term management.

3.7 Reversibility of Option

Refers to the reversibility and easiness of restoring the affected area back to its original state prior to when the option was implemented.

- High Positive Grading = option is easily reversed in the future.

- High Negative Grading = option cannot be reversed without significant adverse environmental effects or cost.

4 Economic Impacts

4.1 Structure Construction, Works and Maintenance Costs

Refers to both initial capital costs associated with construction of engineered structures and maintenance/works associated with the option over a 50-year time frame.

NOTE: Maintenance costs have a 5% discounted rate included for calculations over the 50-year period.

- 0 Grading = no costs associated with option.
- High Negative Grading = total costs of initial construction and on-going maintenance between $3.5 and $5 million.
- Medium Negative Grading = total costs of initial construction and on-going maintenance between $1.5 and $3.5 million.
- Low Negative Grading = total costs of initial construction and on-going maintenance between $1 and $1.5 million.

4.2 Capital Costs

Refers to the cost of property relocation or purchase associated with some options.

- 0 Grading = no relocation or purchase of property required with option
- High Negative Grading = significant costs associated with relocation and/or purchase of property.
- Medium Negative Grading = moderate costs associated with relocation and/or purchase of property.
- Low Negative Grading = low or minor costs associated with relocation and/or purchase of property.

4.3 Local Economy

Refers to the contribution and spill over effects the option has on the local economy, i.e. the potential for increased local employment, spending and other economic activities in the local community.

- High Positive Grading = option has potential to increase local employment, spending and economic activity.
- High Negative Grading = option reduces potential for local employment, spending and economic activity.
- 0 Grading = no impact on local employment, spending and economic activity in the area.

4.4 Transaction Costs

Refers to the efforts and hence costs that go into choosing, organising, negotiating and entering into contracts and implementation of options (e.g. resource consents, litigation process, etc). Includes costs borne by the local and regional councils as well as private property owners. Assessment is either a negative grading (as you cannot have transaction costs that have a positive impact) or 0 grading (no transaction costs).

- High Negative Grading = significant transaction costs associated with option.
- 0 Grading = no transaction costs / not applicable.

4.5 Tourism

Refers to the contribution of the option towards local tourism in terms of visitor numbers, tourist spending, etc.

- High Positive Grading = option enhances numbers of tourists or tourist spending.
- High Negative Grading = option reduces numbers of tourists or tourist spending.

4.6 Private Capital

The extent to which an option affects private capital and equity gain such as an increase or decrease in property prices (includes both adjacent beachfront properties and the whole community).

- High Positive Grading = option significantly increases capital value.
- High Negative Grading = option significantly decreases capital value.

4.7 Protection of Public Infrastructure

Refers to how likely the mitigation option will provide protection for assets other than property such as infrastructure (e.g. public reserves, road and rail links), services (water, sewerage, electricity, gas) and impact on costs.

- High Positive Grading = option provides a significant level of protection to public infrastructure.
- High Negative Grading = public infrastructure likely to be significantly adversely affected due to option.
- 0 Grading = no public infrastructure at risk / not applicable.

Appendix H

Assessment Of Options

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1 Introduction

The level and type of impact of the chosen options were assessed against each indicator. The options were assessed against each indicator qualitatively using available data and current coastal science knowledge. The table below provides full details for each indicator of the expected impact, whether positive or negative with justifications for the gradings. 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 (H, M or L). For some indicators it was considered that there are potentially both positive (+ve) and negative (-ve) impacts from the option.

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 also the level at which it will achieve the strategy vision over a 50-year timeframe. The following assessment is based on a consensus view of the project team.

2 Cooks Beach Assessment of Options

2.1 Status Quo

Impact Category	Status Quo Assessment	+ve	-ve
Policy / Statutory Compliance	None of the existing structures along the foreshore currently have authorisation under either the RMA or the Harbours Act. Therefore the status quo option at Cooks Beach has negative impacts in regards to compliance with statutory legislation, as it would mean that existing structures would need to obtain resource consent, and therefore TCDCs permission as landowner, to remain in the CMA. The TCDC have a draft policy presently being considered by Council that advocates for hard structures such as the existing seawalls to not be permitted adjacent to TCDC owned land. It is therefore unlikely that resource consent for the existing structures could be obtained as landowners permission is unlikely to be forthcoming. Hard engineering structures also have adverse environmental effects that are contrary to the provisions of the NZCPS, WRPS, WRCP and TCDP which require soft options be considered in preference to hard structural options		**M**

Impact Category	Status Quo Assessment	+ve	-ve
	as sustainable solutions to coastal erosion.		
Beach Amenity Values	The existing structures are not engineered, not constructed using consistent materials (i.e. there are a number of different types of structures along the foreshore such as a vertical timber wall, gabion baskets, rock work etc), encroach onto the active beach and some structures are in a state of disrepair. Collectively, the existing protection structures therefore appear unsightly and adversely affect visual amenity. Loss of high tide beach also adversely impacts recreational values. If the small amounts of TCDC owned reserve areas that still exist adjacent to the foreshore are left unprotected there will be some loss of land, thus removing some amenity value.		**H**
Public Access	The existing structures restrict access along the shore during higher stages of the tide as they often eliminate high tide 'dry' beach, particularly near Iti Lane. These structures generally protect the land behind at the expense of the beach. There are currently signs at the top of the seawall prohibiting access along the top of the structure, even though they are constructed on reserve land. There is often no way to walk along the beach at high tide without getting your feet wet. These adverse effects become very severe during erosional periods and will be further aggravated by any erosion accompanying projected sea level rise. Seawalls generally steepen the interface between foreshore and beach, thus reducing ease of access from the foreshore to the beach (e.g. Iti Lane accessway).		**H**
Construction Nuisance	The only construction associated with the status quo option occurs during maintenance of existing structures. Construction nuisance (such as noise impacts) associated with maintenance works will be temporary and therefore have minor effects in the long term.		**L**
Public Safety	It is understood the existing seawalls were not properly engineered and therefore some pose potential hazards to		**L**

Impact Category	Status Quo Assessment	+ve	-ve
	people accessing the beach over them. Rocks dislodged onto the foreshore could also create a hazard for beach users. The existing structures are not designed for safe use of the beach and the risk of injury from a fall, especially for children and the elderly, is increased.		
Impact on Council	This option is likely to result in ongoing demands on both TCDC and EW time following severe storm damage to act to mitigate the effects of coastal hazards, demands for reduced setbacks on the basis of the structures, and (possibly) increased community concern in respect of the adverse effects of the structures on beach use. Consenting and granting landowner permission for the existing structures may also expose EW/TCDC to future liability.		**M**
Uncertainty	Existing structures were constructed without engineering design and it is not known how long they will provide adequate protection and how they will perform under conditions of severe erosion. Therefore, there is considerable uncertainty in regard to the level of protection provided to property and to those dwellings close to the foreshore. Also, there is uncertainty in regard to the level of maintenance/upgrade likely to be required if erosion worsens in the future. The end effects associated with some existing structures also creates uncertainty for neighbouring beachfront properties.		**M**
Public Resistance	The uncertainties associated with this option will necessitate maintenance of the existing 30m setback building restrictions and this may raise concerns for affected property owners. There may also be resistance from beach users and/or adjacent property owners because of adverse effects associated with the existing structures.		**M**

Impact Category	Status Quo Assessment	+ve	-ve
Cultural Values	Consultation to be undertaken by EW/TCDC with tangata whenua in regards to the benefits/impacts on cultural values of this option as part of wider consultation associated with regional strategy development.		
Historic Heritage	Unprotected areas of coast will be vulnerable to dynamic fluctuations of the shoreline that may damage archaeological sites. Existing coastal protection structures may provide minor benefits to archaeological sites by preventing further erosion of sites.	**L**	**L**
Equity	This option has some property erosion protection benefits for the relevant property owners but adversely impacts on beach use values (e.g. natural character, amenity values, public access) important to the wider community. There is also potential for adverse impacts from some existing structures on adjacent properties.		**H**
Biodiversity	The status quo option limits the width of the upper beach in places due to the existing protection structures and this may have some small local adverse effect on habitat. In addition, the status quo option prevents the development of a natural frontal dune along much of the affected area so there is only limited and temporary space for natural dune vegetation to establish. The rock wall may provide additional habitat for rock dwelling fauna and flora. However, rock walls are often associated with rats.		**M**
Natural Character	The back beach area is developed and therefore the natural character of the wider coastal environment is already modified. However, the existing seawalls further significantly reduce the natural character of the beach itself – the beach being backed by a human built structure rather than a natural dune and some of the structures encroaching well out over the beach (especially in the vicinity of Iti Lane). Areas of the beach with no hard engineering structures and areas to the immediate west where properties have		**M**

Impact Category	Status Quo Assessment	+ve	-ve
	been setback further from the shore (and the beach is backed by a natural dune) have higher natural character.		
Coastal Processes	The existing walls separate the dune sand reserves from the beach, preventing natural shoreline response to erosion events and potentially aggravating beach erosion in front of the walls during storm events. Some of the existing coastal protection structures also clearly cause exacerbated erosion of adjacent unprotected areas (known as “end effects” erosion). Areas with no structures have no effect on natural coastal processes.		**M**
Coastal Flooding	The lack of a natural dune buffer along the frontage of most properties increases the potential for coastal flooding, though some properties have elevated the area behind existing structures to compensate for this. However, to date, coastal flooding has been relatively infrequent – the last serious occasion being the storm of July 1978. The risk of coastal flooding usually increases as seawalls provide a sense of security for beachfront property owners, promoting development closer to the shore. However it is acknowledged that the current Building Act provisions prevent further development within the 30m hazard setback.		**M**
Climate Change	The existing structures are unlikely to provide adequate protection in the event that existing erosion is aggravated by current IPCC predictions for sea level rise. Also likely increases in storm wave run-up as sea level rises would result in increased overtopping of the seawalls and damage to the properties immediately behind the wall. Adverse effects on beach values (natural character, amenity, public access) would also be considerably worsened. Therefore, the status quo option is unlikely to be sustainable in the event of climate change effects.		**H**
Environmental Footprint	The beach resource will be lost as the existing structures protect physical resources (buildings) but at the cost of natural resources (beach). The status quo situation does not use many additional resources except for materials		**L**

Impact Category	Status Quo Assessment	+ve	-ve
	required for on-going maintenance of existing structures.		
Reversibility of Option	This option has a high level of reversibility, so long as all houses are moved landward of the 30m setback as they are replaced or extensively renovated (promoted by current Building Act provisions).	**H**	
Structure Construction, Works and Maintenance Costs	Existing structures are relatively inexpensive compared to more rigorously engineered seawalls but require a high level of maintenance after coastal storms. Maintenance costs to affected property owners will probably average at about 5% of the capital costs.		**L**
Capital Costs	Existing unprotected dwellings may have costs associated with relocation back from the shore in the future.		**L**
Local Economy	Very small (if any) reduction in numbers of total visitors to Coromandel because of adverse effects on beach values (natural character etc). However, reduction in beach amenity may divert a small number of beach visitors to other Coromandel sites. There may also be adverse effects on local property prices, particularly at the eastern end of the beach. Low capital spend/local labour requirement due to limited construction works required.		**L**
Transaction Costs	Could be high costs to TCDC in the event of any future litigation arising from the structures. Resource consent process could also be complex, depending on level of objection by wider community.		**M**
Tourism	Very small, if any, reduction in numbers of total visitors to Coromandel because of beach amenity impacts (reduced natural character etc). Any reduction in beach visitors will probably be to Cooks Beach itself – with some visitors possibly choosing other Coromandel beaches in preference because of the reduced beach values.		**L**

Impact Category	Status Quo Assessment	+ve	-ve
Private Capital	It is probable that the affected properties would continue to have significantly lower capital values than adjacent unaffected properties because of ongoing uncertainties and the adverse effects associated with this option. The values of other properties at the eastern end of the beach may also be reduced against comparable properties because of the adverse effects on beach values.		M
Protection of Public Infrastructure	The storm water outlet at Iti Lane would continue to enjoy the existing level of protection. The adequacy of this protection in the face of severe erosion is unknown though probably reasonable given the size and nature of the existing rock protection in this immediate area.	L	

2.2 Living with Coastal Erosion (removal of existing structures and let nature take its course)

Impact Category	Living with Coastal Erosion Assessment	+ve	-ve
Policy / Statutory Compliance	The removal of the structures would be in compliance with RMA legislation as the structures currently require resource consent authorisation to remain in the CMA but do not have this consent. Living with coastal erosion is not consistent with the natural hazards provisions of planning documents as it does not avoid the effects of natural hazards. It also does not promote the protection of existing physical resources. However, this option is consistent with provisions relating to natural character as it involves removing natural structures and allowing natural processes to take their course.	M	L

Impact Category	Living with Coastal Erosion Assessment	+ve	-ve
Beach Amenity Values	The removal of the existing structures would restore a high tide dry beach and a nature backshore, improving visual and recreational amenity.	**H**	
Public Access	The removal of any coastal protection structures will allow for improved physical public access to and along the foreshore. However, coastal erosion may result in the high tide beach becoming located on private land and legal access may then be lost.	**L**	**L**
Construction Nuisance	The removal of existing structures would require diggers on the site to remove seawall material. However the noise and disturbance caused by demolition works would only be temporary and there would be no on-going construction disturbance once structures are removed from the foreshore.		**L**
Public Safety	The removal of the existing coastal protection structures would put private property at risk, but not the property owners themselves as there is plenty of advance warning of storm events allowing people to remove themselves from the risk. Removal of the existing structures would also eliminate the risk of injury caused by accidents on these structures.	**L**	
Impact on Council	Outcome statements from both the EW and TCDC LTCCP processes indicate that the community expect both Councils to act to protect the community from natural hazards. The living with coastal erosion option does not meet this community expectation. Existing hazard lines suggest there is potential for severe property damage with this option and some properties may be rendered unusable. Therefore, it is almost certain property owners would not accept this option and that		**M**

Impact Category	Living with Coastal Erosion Assessment	+ve	-ve
	complex and expensive litigation would arise if the option were pursued. If implemented, parties adversely affected by coastal processes would probably hold TCDC and Environment Waikato responsible for those effects and complex and expensive litigation is very likely. Parties adversely affected by coastal processes due to TCDC's inaction may hold the TCDC responsible for those effects. TCDC has responsibilities under the Reserves Act and the RMA to protect a community and therefore the removal of structures and letting nature take its course means that TCDC may be held liable for any damage to property suffered. No on-going commitment of resources would be required by either TCDC or EW for this option.		
Uncertainty	The removal of existing levels of protection will increase uncertainty and emotional stress on beachfront property owners and the future of beachfront properties and dwellings would be very uncertain with this option.		**H**
Public Resistance	The beachfront owners are expected to be the source of greatest resistance to this option as they stand to lose the most by the removal of existing coastal protection structures. Consultation with the community in the past has indicated that they would resist the "living with nature" option as it is seen as TCDC and EW being inactive in managing a natural hazard. The wider community, although likely to be concerned about private property owners rights, are not expected to resist this option to such a degree as they would benefit from improved beach amenity values and public access.		**M**
Cultural Values	Consultation is to be undertaken by EW/TCDC with tangata whenua in regards to the benefits/impacts on cultural values of this option as part of wider consultation associated with regional strategy development.		
Historic Heritage	Although there are no recorded archaeological sites in the foredunes of the study area, dynamic fluctuations of the		**L**

Impact Category	Living with Coastal Erosion Assessment	+ve	-ve
	shoreline (if allowed to occur uninhibited) could potentially threaten any unrecorded archaeological sites.		
Equity	Wider community would benefit from improved beach values but private land owners may experience considerable costs/losses and very high levels of stress. Removal of structures will enhance amenity but at the cost of private land.		**M**
Biodiversity	A natural dune and associated vegetation would eventually re-establish naturally or could be assisted by human intervention.	**M**	
Natural Character	Natural character of the beach will be enhanced with the removal of human-made structures, however development adjacent to the beach remains reducing natural character.	**M**	
Coastal Processes	Once structures were removed there would be no effect on natural processes.	**0**	**0**
Coastal Flooding	Coastal flooding of beachfront properties may increase with removal of structures until a natural dune is re-established. Original development involved levelling of the dunes and removal of the dune buffer, leaving low lying beachfront land subject to flooding by high seas. However, some relocation of houses back on the property is likely to be required with this option and flood risk may therefore be reduced, but only slightly.		**M**
Climate Change	Sea level rise will continue unabated in the living with erosion option and assets will be left vulnerable to effects of climate change. Existing hazard lines suggest this could leave up to 25 properties unusable by 2100.		**M**

Impact Category	**Living with Coastal Erosion Assessment**	**+ve**	**-ve**
	The risk of serious coastal flooding would also increase considerably with sea level rise.		
Environmental Footprint	No resources needed for this option and no impact on natural environment as it lets nature take its course and there is no human modification of the system. There will be a small amount of resources used for the initial demolition and removal of existing structures required with this option but this will not affect the overall environmental footprint of the option.	**H**	
Reversibility of Option	Expensive intervention would be required to reverse the option and appropriately protect properties and dwellings. Serious losses may be incurred before such action is practical.		**M**
Structure Construction, Works and Maintenance Costs	The costs of excavating and removing the structures would be relatively low.		**L**
Capital Costs	There may be costs associated with relocation of dwellings threatened by coastal erosion in the future		**M**
Local Economy	Small increase in numbers of total visitors to Coromandel because of improvements in beach values (amenity values, natural character, public access) leading to improved tourism opportunities. Loss of rates from any sections that had to be abandoned. Low capital spend/local labour requirement apart from the initial removal cost.	**L**	
Transaction Costs	Likely to be high legal costs associated with refusal to allow existing beachfront properties to protect their land and dwellings. Compensation may also be required if the courts rule there were alternative practicable options that could have been pursued that would have avoided the cost to affected landowners.		**H**

Impact Category	Living with Coastal Erosion Assessment	+ve	-ve
Tourism	Small increase in numbers of total visitors to Coromandel because of improvements in beach amenity and natural character.	L	
Private Capital	Severe damage and even loss of some beach-front properties could arise, with a high negative impact on the affected landowners. Increases in value of other properties (particularly those properties adjacent to the seawall and those behind the beach front properties) because of beach amenity improvements.	L	H
Protection of Public Infrastructure	Public infrastructure such as the stormwater outfall at Iti Lane would be exposed to dynamic fluctuations of the shoreline from the living with erosion option.		M

2.3 TCDC Purchase of Private Land + Relocation + Rezoning to Open Space Policy Area

Impact Category	TCDC Purchase of Private Land and Relocate and Rezone to Open Space Assessment	+ve	-ve
Policy / Statutory Compliance	The TCDP states that setbacks are imposed under the Building Act and no buildings are to be located within the 30m setback line and only relocatable houses may be located within the 60m setback line. This option is therefore consistent with the Building Act, discouraging development located within the hazard area. By relocating existing development and rezoning to prevent further development along the foreshore, this option is consistent with objectives and policies of the WRCP and TCDP, which promote the avoidance of natural hazards and establishment of hard engineering structures. In particular the TCDP Policy (222.4) ensures development is located, built or carried out in such a way that the effects of natural hazards are avoided or the creation of a hazard is avoided. This option is also consistent with provisions in plans that promote the creation of reserve along the coast that	M	

Impact Category	TCDC Purchase of Private Land and Relocate and Rezone to Open Space Assessment	+ve	-ve
	provide access (Policy 212.4 TCDP). However, in terms of the Local Government Act, significant public benefits would have to be demonstrated to justify public expenditure of this magnitude. The site would also have to be established as a high priority relative to other benefits that could be obtained for this expenditure. It is doubtful that this option would meet these standards.		
Beach Amenity Values	Removing development and providing more open public space will improve recreational use and amenity in this area of Cooks Beach and enhance the adjacent popular reserve at the entrance to Purangi Estuary.	**H**	
Public Access	Public access to the foreshore will be significantly improved at the eastern end of Cooks Beach. Public access along the foreshore at high tides will also be significantly improved with land transferred into TCDC ownership (currently good along shore access during high tides is restricted to the wider public by private properties).	**H**	
Construction Nuisance	Temporary construction nuisance with the relocation of buildings will be minor in the long term. Similar construction nuisance from the removal of existing structures.		**L**
Public Safety	Small benefits for public safety once development and existing walls are removed as there will be no hard engineering structures on the foreshore.	**L**	
Impact on Council	Issues associated with existing structures and coastal hazards are eliminated. However, the major expenditure involved with this option could have major implications for district and regional council rates and considerable ratepayer resistance and associated increased pressure on both EW and TCDC will probably be encountered. As land would be taken out of private ownership with this option then TCDC's commitment to mitigate hazards with protection works is avoided. By reducing the number of properties at risk TCDC's commitment is also reduced. No on-going resources required by either EW or TCDC in the long term.	**H**	

Impact Category	TCDC Purchase of Private Land and Relocate and Rezone to Open Space Assessment	+ve	-ve
			M
Uncertainty	High level of long term certainty provided by this option as threatened development is removed and owners are compensated at market value.	**H**	
Public Resistance	Major resistance is likely from beachfront owners and the wider community. Owners will probably wish to retain this high amenity land and are likely to prefer options that enable continued occupation and use. District and regional ratepayers are likely to be very resistant to the costs of this option, given other funding priorities. However, the benefits to be gained from improved beach amenity values is likely to reduce the amount of resistance by the wider community.		**M**
Cultural Values	Consultation is to be undertaken by EW/TCDC with tangata whenua in regards to the benefits/impacts on cultural values of this option as part of wider consultation associated with regional strategy development.		
Historic Heritage	Very little impact on any archaeological sites from this option and rezoning will prevent further development disturbance of the land that may potentially have unrecorded sites. The land will be subject to dynamic fluctuations of the shoreline as erosion would be uninhibited. Although there are no recorded archaeological sites in the frontal dunes of Cooks Beach, there is the potential for negative impact on any unrecorded archaeological sites.	**L**	**L**
Equity	Provided owners are fairly compensated for their land, the option will have no difference in benefits between the wider community and beachfront property owners.	**M**	
Biodiversity	The option would enable the re-establishment of a native dune ecosystem along the margin – though human	**M**	

Impact Category	TCDC Purchase of Private Land and Relocate and Rezone to Open Space Assessment	+ve	-ve
	intervention will be required to facilitate this.		
Natural Character	Very significant improvement of natural character due to removal of human built elements (existing houses and structures) and restoration of natural dune environment along margin.	**H**	
Coastal Processes	No effect on natural processes from this option.	**0**	**0**
Coastal Flooding	Relocation of development away from the shore and dune restoration will largely eliminate coastal flooding hazard.	**H**	
Climate Change	This option enables natural shoreline adjustment to climate change effects. However, existing hazard lines suggest there may be some threat to Captain Cook Road by 2100 if erosion is aggravated by sea level rise.	**M**	
Environmental Footprint	The option involves some resource loss (e.g. associated with demolition of non-relocatable dwellings) but restores natural beach and dune system in this area. Overall, effects on the environment are reduced and the environmental footprint decreased.	**H**	
Reversibility of Option	It may be difficult to reverse this option and return to the state of the beach prior to implementation of the option as it involves relocating houses which is a high cost and rezoning which is a public and, sometimes, lengthy process.		**H**
Structure Construction, Works and Maintenance Costs	Capital cost should be small as there are no structures required. However, there will be an initial minor cost involved in removing existing structures.		**L**
Capital Costs	There will be a large cost involved in purchasing beachfront properties and relocating the buildings off the site.		**H**

Impact Category	TCDC Purchase of Private Land and Relocate and Rezone to Open Space Assessment	+ve	-ve
Local Economy	Small increased incentive for economic activity with the improved natural character and amenity values leading to improved tourism opportunities. This in turn would lead to increased opportunities for the local economy – such as cafés and gift shops. Also there may be the opportunity for appropriate commercial recreational activities within the reserve area focused on beach themes.	L	
Transaction Costs	Likely to be high costs (legal and otherwise) associated with negotiation and implementation of this option, although these will be once off and therefore only moderate in the longer term.		M
Tourism	Small increase in numbers of total visitors to Coromandel because of beach amenity improvements.	L	
Private Capital	Values of properties immediately landward of open space zoned beachfront land will be significantly increased due to enhanced sea views and the improvements in access, beach amenity and natural character associated with removal of existing houses and seawalls. Enhanced beach values should also improve values of other properties at eastern end of beach.	M	
	Affected land owners should receive fair return for their property, assuming market price is paid. However, they lose potential opportunities for future capital gain – generally high for beachfront properties		H
Protection of Public Infrastructure	The stormwater outlet at Iti Lane will need to be relocated landward to compensate for any erosion. In the absence of the existing rock protection works, complications will also arise in this area related to scour. Additional public assets will also be at risk as a new beach reserve will be provided and will be exposed to the dynamic fluctuations of the shoreline with no protection.		M

2.4 Frontal Seawall

Impact Category	Frontal Seawall Assessment	+ve	-ve
Policy / Statutory Compliance	Coastal defence structures above the line of mean high water springs (MHWS) are a non complying activity in the TCDP. Coastal defence structures below the line of MHWS are a discretionary activity in the WRCP. There is therefore a difference in the activity status depending on the location of the structure. A seawall is likely to be placed within and above the CMA and therefore require resource consent from both the Regional Council and TCDC, as well as permission from TCDC for placement on Council-owned reserve. Depending on the length of seawall required it may be classed as a restricted coastal activity and require Minister of Conservation approval. Seawalls are generally contrary to the policy provisions of the WRPS, WRCP, TCDP and the NZCPS unless they are considered the most appropriate option for erosion control over and above soft engineering solutions. Seawalls are not consistent with the draft policy paper currently being considered by TCDC that advocates for soft engineering approaches to coastal erosion management on TCDC owned land.		**M**
Beach Amenity Values	A seawall located on Council-owned reserve seaward of the front property boundaries will generally be exposed on most occasions and therefore reduce visual amenity. The width of high tide beach will also be reduced and, in some places eliminated – particularly during erosional periods. Therefore, public amenity in respect of the beach and use of it will generally be reduced by this option.		**H**
Public Access	Public access along the coast will be adversely impacted at higher stages of the tide due to elimination of the high tide dry beach along some areas of the wall (arising from encroachment of the wall onto the beach) and during erosional periods (due to passive erosion effects) The seawall will also steepen the interface between the beach and adjacent land therefore making access to the		**H**

Impact Category	Frontal Seawall Assessment	+ve	-ve
	beach more difficult and probably necessitating access structures to avoid clambering over rocks.		
Construction Nuisance	Temporary construction effects will be generated by the construction of a seawall. Over time nuisances will have only moderate effects associated with maintenance work.		**M**
Public Safety	Rock structures represent a hazard that is not present in a natural foreshore/dune situation. Seawall structures can be dangerous for people traversing them to get to the beach.		**L**
Impact on Council	There is the possibility of EW being held liable should the consented structure fail. Maintenance will be required and therefore on-going commitment from TCDC is expected. There is likely to be reduced pressure on TCDC from private property owners as a seawall is seen to protect properties and TCDC will be viewed as assisting in mitigating the risk of hazard. However, there may be an increase in pressure on TCDC in the future from the wider community due to adverse effects of the structure on amenity of the beach and public access.		**H**
Uncertainty	There are some uncertainties associated with the seawall option such as longer-term impacts on the structure associated with climate change (particularly sea level rise and associated erosion which may increase wave damage). Therefore, the structure may not be a sustainable solution in the long term with changing coastal processes. However, in the short to medium term this option eliminates uncertainty for affected private property owners.		**L**
Public Resistance	There is little resistance in general to hard engineering structures such as seawalls (as shown in the recent Buffalo Beach consent application for a seawall that attracted only one submission in opposition after a public notification process). This lack of resistance is due to the perceived ability of these structures to protect assets from coastal	**M**	

Impact Category	Frontal Seawall Assessment	+ve	-ve
	erosion. However, there may be some resistance from the wider community in the future due to the loss of beach amenity, natural character and public access that is associated with such structures. Therefore, even if consented, this option may not gain a long-term consent.		**M**
Cultural Values	Consultation is to be undertaken by EW/TCDC with tangata whenua in regards to the benefits/impacts on cultural values of this option as part of wider consultation associated with regional strategy development.		
Historic Heritage	Minor negative impacts on fringe of seawall construction works. The seawall may also lead to an increase in development of beachfront land that may adversely impact on any archaeological sites. However, the frontal dunes and area immediately landward is not expected to have many archaeological sites due to the dynamic nature of the front beach area.		**L**
	In long-term positive impacts on the protection of any archaeological sites.	**H**	
Equity	Seawalls protect beachfront land at the expense of the beach in front. Therefore, with this option, private property owners gain protection of their assets at the expense of the values and interests of the wider community.		**H**
Biodiversity	Depending on the design of the seawall it may provide an additional habitat for some fauna. However, the structure is most likely to be rock and these types of seawalls tend to be associated with rats. The seawall is also located too far seaward on the beach to allow a frontal dune to establish in front of the structure, preventing re-establishment of dune vegetation and a natural coastal ecosystem.		**L**
Natural Character	This seawall option will result in a highly visible engineered structure along the back of the beach and will substantially reduce the natural character of the beach relative to adjacent unprotected areas.		**H**

Impact Category	Frontal Seawall Assessment	+ve	-ve
Coastal Processes	Seawalls may interfere with wave patterns (reflecting waves off their face) and cause a lowering of the beach in front because they lock up sediment that would otherwise be available in the system. Unprotected areas adjacent to the structure may also suffer from accelerated erosion due to end effects erosion. This option therefore significantly impacts on natural coastal processes.		**H**
Coastal Flooding	The seawall option being considered would have a higher crest elevation than the existing structures and would probably decrease the potential for coastal flooding. If a rock structure is used this will also tend to dissipate wave energy and reduce overtopping. Nonetheless, some wave overtopping of the structure may occur.	**L**	
Climate Change	Changes accompanying climate change, including sea level rise would significantly aggravate erosion of the beach in front of the structure and lead to serious degradation of beach values – including public access, beach amenity and natural character. Increased wave attack on the wall arising from elevated sea levels and erosion may lead to more frequent and severe damage to the wall. However, the wall is likely to be designed to provide for climate change effects such as increased wave run-up and sea level rise.		**L**
Environmental Footprint	A seawall requires resources for the construction of the structure and potentially resources for the maintenance of the structure in the long term. This will include rock and other construction materials as well as fuel for the construction and maintenance equipment.		**L**
Reversibility of Option	A seawall is relatively easily removed from the foreshore but will involve disturbance associated with construction works, cost of removal of the structure and rehabilitation of the beach. If development on adjacent land had intensified, the value of assets at risk (land and development) will have significantly increased and reversal of the option could be very expensive.		**M**

Impact Category	**Frontal Seawall Assessment**	**+ve**	**-ve**
Structure Construction, Works and Maintenance Costs	Over the long term, a well engineered and built sea wall will have a moderate capital cost and a low maintenance cost. The final design of the seawall can also impact upon the capital and maintenance costs. Capital costs for a rock wall at Cooks Beach based on previous work by Tonkin & Taylor is likely to be $2,000 per metre. Maintenance costs for such a wall will be between 2% and 5 % of the capital cost, per annum, or up to $40 to $100 per metre.		**M**
Capital Costs	There is no relocation or property purchase required with this option and therefore no capital costs.	**0**	**0**
Local Economy	Very small reduction in numbers of total visitors to Coromandel because of adverse impacts on beach values (including amenity, natural character and public access). There would be some capital spend on construction with some local labour requirements as well as ongoing maintenance requirements.		**L**
Transaction Costs	High transaction costs could be expected from this option given the requirement for a notified resource consent , the status of the activity in the District Plan, and the associated potential adverse environmental effects. In the longer-term, the adverse effects of the structure on community values (and possibly on properties further landward) may also lead to increased community concern and even to litigation.		**H**
Tourism	There may be a very small reduction in numbers of total visitors to Coromandel because of beach amenity impacts – but this is unlikely. However, it is possible there will be a small reduction in the number of visitors to Cooks Beach relative to what would otherwise have occurred due to the adverse impacts on public access to and along the beach and reduced amenity values and natural character. This has the potential to reduce the number of visitors/tourists to Cooks Beach as a whole, relative to what would otherwise have occurred, as they choose to visit a more 'natural' beach elsewhere in the Coromandel.		**L**

Impact Category	Frontal Seawall Assessment	+ve	-ve
Private Capital	Protection of beach-front property will reduce present uncertainty and help offset the difference between the value of these properties and adjacent beachfront land. However, the properties will probably continue to have a lower value because of the reduced beach values associated with the wall. Overseas work also suggests potential for reduction in the values of other property in this immediate area (relative to what otherwise would have occurred) because of adverse impacts on beach amenity and natural character[1].		**L**
Protection of Public Infrastructure	The Iti Lane stormwater outlet will be protected from erosion as a result of the seawall. However, public reserves adjacent to either end of the wall may experience some aggravated erosion associated with end effects.	**M**	

2.5 Backstop Wall + Relocation + Land Swap

Impact Category	Backstop Wall + Relocation + Land Swap Assessment	+ve	-ve
Policy / Statutory Compliance	A backstop wall is considered a coastal protection structure and will therefore require resource consent from TCDC as a non-complying activity. No resource consents will be required from EW as the works occur above the line of MHWS. As the wall will largely be located on private land (except perhaps towards both ends) there will probably also be less difficulty with landowner permission from TCDC – especially as those portions on public reserve will largely be buried and only very infrequently exposed. As a backstop wall will only have minor effects on the natural character of the area, coastal processes and temporary effects caused by construction work, the chances of obtaining resource consent are high. The relocation aspect of this option is consistent with natural hazards, natural character and public access policies of local, regional and national planning documents as the effects of the hazard are mitigated and by relocating		**L**

[1] Kriesel, W and Friedman, R: 2003: Coping with coastal erosion; Evidence for community wide impacts. Shore and Beach, Volume 71 (3) July 2003.

Impact Category	Backstop Wall + Relocation + Land Swap Assessment	+ve	-ve
	development back from the foreshore then natural character is enhanced. Acquisition of the land by TCDC will improve public access along the shore in the long term and is therefore consistent with Policy 3.5.3 of the NZCPS which states that public access should be recognised and provided for by the creation of esplanade reserves, strips or access strips where they do not already exist.	**H**	
Beach Amenity Values	A backstop wall will remain hidden for most of the time and only be exposed during severe storm events. Because of their location landward they will have no impact on recreational use of the shore and maintain public access along and to the shore. The acquisition of a strip of beachfront land through a land swap will enhance public access along the foreshore. However this strip of public land will be vulnerable to dynamic shoreline fluctuations in the long term. The relocation of houses back from the shore will maintain the wider community's 'sense of place' while at the beach. The location of a backstop wall may allow the establishment of a dune in front over time.	**H**	
Public Access	Public access along the beach will be improved with this option as, for most of the time, there will be no coastal protection structures on the foreshore. Acquisition of a strip of beachfront land will also enhance public access along the beach, although this will be vulnerable to dynamic fluctuations of the shoreline and may result in the high tide beach becoming located on private land. Legal access may then be lost along the shore at high tides.	**M**	
Construction Nuisance	Temporary construction effects will be generated by the construction of the backstop wall. Over time nuisances will have only minor effects associated with infrequent backstop wall maintenance work.		**L**
Public Safety	As the structure is buried then public safety is unaffected by this option as chances of an accident caused by the engineered structure is minimised. During serve storm events, when the structure is exposed, there is a small chance of an accident due to the structures slope etc.	**L**	**L**

Impact Category	Backstop Wall + Relocation + Land Swap Assessment	+ve	-ve
Impact on Council	Pressure on TCDC from beachfront property owners is likely to decrease in the long term as the backstop wall will provide a “security blanket” for property owners. However, TCDC may receive pressure from beachfront property owners to relax current building restrictions within the hazard zones because of the presence of the structure. TCDC will still retain some liability as they will be providing consent for an erosion protection structure that may fail (although this is unlikely). TCDC will be responsible for maintaining the structure and obtaining resource consent to construct it.	**M**	**M**
Uncertainty	High level of certainty provided by backstop wall in the event of severe storms. However, it is uncertain how the backstop wall would cope in the event of several severe storm events.	**M**	
Public Resistance	Beachfront owners will probably wish to retain high amenity beachfront land and are likely to prefer options that enable continued occupation and use. District and regional ratepayers are likely to be very resistant to the initial costs of this option.		**M**
Cultural Values	Consultation is to be undertaken by EW/TCDC with tangata whenua in regards to the benefits/impacts on cultural values of this option as part of wider consultation associated with regional strategy development.		
Historic Heritage	Disturbance of any archaeological sites possible with the placement of backstop wall but will be minor and limited to the short term. However, any archaeological sites behind the backstop wall will be provided from protection from erosion caused by severe storm events over the long term.	**H**	**L**
Equity	A backstop wall would benefit both future private beachfront property owners (providing effective protection to	**H**	

Impact Category	Backstop Wall + Relocation + Land Swap Assessment	+ve	-ve
	property and dwellings behind the wall) and the wider community (due to significant improvements in natural character, amenity values and beach access).		
Biodiversity	As a backstop wall is buried and a strip of beachfront land acquired by TCDC through a land swap then there is the chance for dune revegetation and a natural dune ecosystem to develop, which will enhance biodiversity.	**M**	
Natural Character	Natural character values for the beach would be significantly improved, for the majority of time, as there would be no hard engineering structures visible on the beach. While the structure will be exposed for short periods during and after sever storms, these periods will be very infrequent and of relatively short duration. This is therefore not considered to be a significant effect. If revegetation of dunes above the structure provided for then natural character would be considerably enhanced. As some houses would be relocated back from the shore (necessary for construction of the backstop wall) then natural character would also be enhanced.	**H**	
Coastal Processes	For the majority of the time a backstop wall will remain buried at the back of the beach profile and would therefore have no effect on coastal processes. Coastal erosion of the beach profile would only be impacted during large storm events with the structure preventing any wave attack of beachfront properties. This effect would be minor and short-lived with existing coastal processes.		**L**
Coastal Flooding	The relocation of houses back from the shore will decrease the effects of storm surge, wave run up etc on beachfront properties. A backstop wall is elevated to reduce wave overtopping and together with dune restoration in front of the wall will markedly reduce the potential for wave flooding of the beachfront properties and dwellings.	**M**	
Climate Change	The relocation of infrastructure will reduce the risk from climate change on those properties. The backstop wall will	**H**	

Impact Category	Backstop Wall + Relocation + Land Swap Assessment	+ve	-ve
	provide additional protection from the effects of climate change (sea level rise and storm events) while still accommodating for any increase in supply of sediment as a result of climate change (the natural dune buffer will be able to trap any additional sand). However, with a projected rise in sea level of 0.5m, there is potential for erosion to be aggravated sufficiently for the wall to become permanently exposed by 2100 – with similar or worse adverse effects to a frontal wall on the current shoreline. Therefore, this option, while providing an effective solution for the next 50-70 years, may not be sustainable in the longer-term (i.e. 70-100 years). Therefore, while building setbacks could be relaxed (subject to relocatability to allow for longer-term uncertainties), it would not be wise to allow further subdivision of these sections.		
Environmental Footprint	The backstop wall will use a lim ited amount of resources at the time of construction (e.g. rock and fuel) and may require maintenance following large storm events. Otherwise it is not expected to have an impact on the environment or resources in the long term.		**L**
Reversibility of Option	The option is not considered to be easily reversible. Removing the structure would be expensive and would raise the need for an alternative protection option. If the structure has to be removed in 50-70 years time due to aggravated erosion accompanying projected sea level rise, an alternative soft option would be required or else some properties may become unusable.		**M**
Structure Construction, Works and Maintenance Costs	Capital costs will be similar to those for a sea wall, however maintenance costs should be less because the wall is not exposed to wave action (i.e., structure is buried).		**M**

Impact Category	Backstop Wall + Relocation + Land Swap Assessment	+ve	-ve
Capital Costs	There are five houses that would need to be relocated further landward to provide space for the backstop wall at a high cost– though the owners of two of these properties have already indicated they would be willing to replace their existing houses further landward if this option proceeded.		**M**
Local Economy	Small increases for local economy with the improved natural character leading to improved tourism opportunities. This in turn would lead to increased opportunities for the local economy – such as cafés and gift shops.	**L**	
Transaction Costs	Likely to be high legal costs associated with relocation of existing beachfront properties. There will also be costs involved with a resource consent application for backstop wall (given it is a non complying activity).		**H**
Tourism	Small increase in numbers of total visitors to Coromandel because of beach amenity improvements. The improved natural character as a result of a more natural beach and additional opens space is likely to attract more visitors from outside the local area.	**L**	
Private Capital	Relocation of some beachfront properties is likely to have negative impacts on private capital in the short-term, although with improved protection from coastal hazards this is only likely to be temporary. Increases in value of other properties in the near vicinity because of beach amenity improvements.	**M**	**L**
Protection of Public Infrastructure	Additional public infrastructure may be gained with this option if Council obtains beachfront land through land swap. However this beach front asset (reserve) will have little protection from a backstop wall as its location seaward of the wall will make it vulnerable to dynamic fluctuations of the shoreline.		**L**

2.6 Groyne + Nourishment

Impact Category	Groyne + Nourishment Assessment	+ve	-ve
Policy / Statutory Compliance	A groyne structure and deposition of sand material would need resource consent as a discretionary activity for works in the CMA from EW and resource consent from TCDC for those areas above MHWS (i.e. the landward end). Landowner permission would also be required from TCDC for those parts of the structure on Council-owned reserve. Groyne structures are not consistent with the draft policy paper presently being considered by TCDC for soft engineering options as erosion management for TCDC owned beachfront land. Depending on the length of groyne required it may be classed as a restricted coastal activity and require Minister of Conservation approval. Groynes are generally contrary to the policy provisions of the WRPS, WRCP and TCDP unless they are considered the most appropriate option for erosion control over and above soft engineering solutions. Beach nourishment is generally consistent with local, regional and national policy as this is a 'soft' engineered approach that is considered to be more appropriate than 'hard' engineered approaches (such as groynes). However, in this case beach nourishment is being used in conjunction with a hard engineering structure and so the benefits from using a soft engineering approach are not as significant.	L	M
Beach Amenity Values	The beach formed on the western side of the groyne would enhance the width of high tide beach along the front of the existing structures and associated beach amenity. However, the groyne would be located on intertidal areas of the ebb tide delta and be highly visible during lower stages of the tide – probably having quite a significant adverse effect on visual amenity on such occasions – especially from the harbour entrance side where no beach would be	L	L

[2] Kriesel, W and Friedman, R: 2003: Coping with coastal erosion; Evidence for community wide impacts. Shore and Beach, Volume 71 (3) July 2003.

Impact Category	Groyne + Nourishment Assessment	+ve	-ve
	present. The structure will extend some distance offshore and may restrict some recreational activities (such as sailing and kayaking) at higher stages of the tide. They are highly visible engineered structures and therefore may affect people's 'sense of place' when visiting the beach. However, a U.K. beach use survey[2] found that groynes can enhance beach amenity. For instance, they are used for sitting, lying down, children to play on, etc.		
Public Access	The beach retained by the groyne will improve public access to and along the coast. Access along the shore may be restricted by the structure, depending on its design. Some groynes also provide improved public access to the CMA as they can be used for fishing off, etc.	**L**	**L**
Construction Nuisance	Temporary construction effects will be generated by the construction of a groyne. Over time these will have minor effects. Minor nuisance could be expected with ongoing maintenance to both the groyne and associated sand replenishment but these effects will be temporary and of relatively limited duration. Also any works required are likely to be conducted outside of peak holiday periods.		**M**
Public Safety	May be a minor effect on public safety if they have to traverse the groyne. There also may be some navigational effects associated with the groyne depending on required length, distance offshore and location.		**L**
Impact on Council	TCDC (assuming they will hold the resource consent and take responsibility for the structure) will have a large on-going commitment to maintaining the structure and renourishing the beach to maintain protection of beachfront properties.		**M**
Uncertainty	There are many uncertainties associated with the effects of this option and physical modelling would be required to		**H**

Impact Category	Groyne + Nourishment Assessment	+ve	-ve
	design the option and assess effects with any confidence. It is also uncertain as to how long nourishment material would stay in the upper beach profile and what effects there would be on beach areas east of the wall if starved of longshore sediment supply by the groyne. Properties behind the nourished beach will be provided with a level of certainty but properties downdrift of the groyne will not have any certainty of erosion protection.		
Public Resistance	There may be some resistance from beachfront property owners to groyne structures due to the costs and uncertainties associated with the protection provided by this option. Resistance from the wider community may also be marked due to the significant visual effects associated with this structure in the popular and very natural entrance area.		**M**
Cultural Values	Consultation is to be undertaken by EW/TCDC with tangata whenua in regards to the benefits/impacts on cultural values of this option as part of wider consultation associated with regional strategy development.		
Historic Heritage	Archaeological sites protected behind area of nourished beach from dynamic shoreline fluctuations in the long term. However, sites landward of the area of shore downdrift of the structure will be left unprotected and vulnerable to shoreline fluctuations.	**M**	**L**
Equity	Benefits to be gained by the wider community from the creation of a high tide beach and also to those property owners directly behind groyne and created beach. However, benefits to the wider community will be offset by adverse impacts on visual amenity, natural character and by possible erosion of reserve land on the eastern side of the groyne. Overall, property owners are likely to be the main beneficiaries with this option and would probably have to fund the larger portion of capital and maintenance costs.		**M**

Impact Category	Groyne + Nourishment Assessment	+ve	-ve
Biodiversity	Creation of wider high tide beach may provide additional habitat for beach dwelling species and the opportunity for a natural foredune to develop.	L	
Natural Character	The groyne structure reduces the natural character of the beach, as the hard engineering structure will be highly visible. However, the creation of the beach (and possibly a dune) along the face of the properties will enhance natural character in this immediate area.	L	M
Coastal Processes	A groyne structure works by capturing any longshore movement of sediment and holding it in place. In conjunction with nourishment it will cause the creation of wider high tide beach. However, the beach profile on the downdrift side of the structure may suffer from more erosion as it will be starved of an upstream supply of sediment.		H
Coastal Flooding	The wider high tide beach formed along the seaward face of the properties will enhance protection from coastal flooding associated with wave run up and storm surge.	L	
Climate Change	A groyne and nourishment option is likely to face climate change reasonably well as it will reduce the erosion risk from sea level rise and provides a mechanism to trap any increase in sediment supply into the system from climate change effects. However, the groyne may need to be upgraded and raised to deal with more frequent and severe wave action associated with projected sea level rise.	M	
Environmental Footprint	The construction of the groyne and the nourishment with sandy beach material will use resources both during the initial construction stage and also with periodic renourishment expected to be required to maintain a wide high tide beach. Over the long term a large amount of resources (including sand and fuel) will be used in obtaining the nourishment material and possible beach grooming required to keep it in place on the beach profile.		H

Impact Category	Groyne + Nourishment Assessment	+ve	-ve
Reversibility of Option	Once the groyne is constructed and nourishment material placed then it will be difficult and expensive to remove the option. An alternative solution would also be required.		**M**
Structure Construction, Works and Maintenance Costs	The groyne will be initially expensive to construct but if well designed the maintenance costs are likely to be low. The sand for nourishment will be expensive as it will probably need to be brought in from outside of the local beach system (rather than redistribution of existing sands).		**M**
Capital Costs	There is no relocation of buildings or property purchase required with this option and therefore there are no capital costs.	**0**	**0**
Local Economy	Imperceptible change in numbers of total visitors to Coromandel. Capital spend not necessarily local. An improved beach environment through nourishment has the potential to provide incentives for additional eco or tourism related businesses to set up (such as motels and café's).	**L**	
Transaction Costs	Moderately high transaction costs are expected from this option as resource consent and design costs are likely to be high both for the groyne (including engineering designs) and for ongoing nourishment of the beach.		**M**
Tourism	Imperceptible changes in numbers of total visitors to Coromandel because of beach amenity improvements. The improved natural character as a result of a more natural beach is likely to attract more visitors from outside of the local area, though this may be offset by the loss in natural character associated with the groyne and the significant change in beach plan shape at the eastern end.	**L**	
Private Capital	Value of beachfront properties protected. Increases in value of other properties because of beach amenity	**M**	

Impact Category	Groyne + Nourishment Assessment	+ve	-ve
	improvements.		
Protection of Public Infrastructure	Assets directly behind nourished beach (updrift side of groyne) protected from erosion – though scour protection may be required around the Iti Lane stormwater outlet.	**M**	**L**

2.7 Offshore Breakwater + Nourishment

Impact Category	Offshore Breakwater + Nourishment Assessment	+ve	-ve
Policy / Statutory Compliance	An offshore breakwater is a major structure within the CMA and is likely to require a publicly notified discretionary activity resource consent from the Regional Council. Depending on the length of the breakwater, consent may be required as a restricted coastal activity and Minister of Conservation approval. Placement of nourishment material on the beach will also require resource consent from EW. Breakwaters are hard engineering structures and are therefore generally contrary to the policy provisions of the WRPS, WRCP, TCDP and national policy unless they are considered the most appropriate option for erosion control over and above do nothing or soft engineering solutions.		**M**
Beach Amenity Values	A breakwater that was exposed for all or part of the tidal cycle would have significant adverse effects on visual amenity. A submerged structure would have less adverse effects, though breaking waves would occur in areas where they were not previously noted. Whether visible or not, a breakwater will reduce the amenity of the waterspace by creating a restriction that was not there before. However, if effective, a breakwater in combination with beach nourishment would improve beach amenity by helping to create a wider beach and a more sheltered nearshore environment. The wider beach arises from the shoreline bulge (known as a salient) that forms behind the structure due to wave refraction. Beach nourishment will		**M**

Impact Category	Offshore Breakwater + Nourishment Assessment	+ve	-ve
	assist in salient formation and will reduce erosion of adjacent beach areas.	M	
Public Access	If the breakwater structure and nourishment were successful in creating a wider high tide beach along the front of the properties then public access to and along the shore would be improved.	M	
Construction Nuisance	There will be some construction nuisance associated with the construction of the breakwater, but this would not affect many people as it would be offshore and temporary. Some ongoing maintenance of the breakwater would probably be required but again this would be offshore and likely to have low negative impacts on the beach users. Beach nourishment will have some minor construction nuisance associated with the placement of the beach material.		M
Public Safety	Some issues of public safety may arise from the breakwater, particularly in relation to navigation. The area offshore is a very significant boating area used by recreational and commercial activities operating out of Whitianga Harbour and for recreational boating off Cooks Beach and out of Purangi Estuary. Depending on location, the breakwater may be a significant navigational hazard.		M
Impact on Council	To date, breakwaters have not always been as effective as intended due to various design and construction difficulties. This is also an exceptionally difficult area to design such an option. If the structure was unsuccessful, there could be significant repercussions for TCDC given the expenditure required. Similarly, if the structure was only partially successful and some properties were not protected, or if formation of the salient led to erosion of adjacent beach areas and new erosion problems, TCDC could be placed under additional pressure. If navigation problems or accidents occurred, there could also be significant liability issues. There will be an on-going maintenance commitment required by TCDC (assuming they would be the resource		M

Impact Category	Offshore Breakwater + Nourishment Assessment	+ve	-ve
	consent holder and therefore responsible for compliance with consent conditions) to ensure the structure stays in good condition and possibly in terms of beach renourishment that may be required in the longer term.		
Uncertainty	There are significant design and construction uncertainties with breakwaters, especially in complex near-entrance locations such as this. For instance, it is uncertain how much of a ‘shadow zone’ the breakwater structure will create, the amount of dry beach expected to be built up and the volumes of nourishment required to avoid aggravating erosion in adjacent beach areas. Similarly, with the performance of the structure under various different storm wave conditions (i.e. variations in height, period and direction) that may arise and onshore effects under these wide variety of potential conditions. These are compounded by existing difficulties with building these structures to the design profile – small variations in depth can make significant differences to performance. In the long term the structure is likely to build up a wide high tide beach but it is uncertain how stable this would be during severe storm events. Properties behind the structure are provided with a level of certainty but properties not within the ’shadow zone‘ of the structure are not provided with any certainty on level of protection of their properties in the long term.		**H**
Public Resistance	To date, there has generally been good wider community support for breakwaters. However, the uncertainties associated with design and construction of the breakwater structure may mean that beachfront property owners would be reluctant to risk investing large sums in this option.	**L**	**L**
Cultural Values	Consultation is to be undertaken by EW/TCDC with tangata whenua in regards to the benefits/impacts on cultural values of this option as part of wider consultation associated with regional strategy development.		
Historic Heritage	There may be an impact on offshore wrecks if present, however the regional field archaeologist does not think wrecks are likely off Cooks Beach (Warren Gumbley, pers. comm.).		**L**

Impact Category	Offshore Breakwater + Nourishment Assessment	+ve	-ve
	Beach nourishment associated with the breakwater may provide land based archaeological sites with protection from dynamic shoreline fluctuations	**M**	
Equity	Beachfront property owners directly behind offshore breakwater and the wider community will benefit from the wider nourished beach. However, properties that are not directly behind the formed beach have no protection in the long term from coastal erosion effects. The potential for adverse effects on navigation could also result in these benefits being obtained at the expense of boating safety.		**L**
Biodiversity	Rock breakwaters are considered to provide a new habitat for marine fauna and flora. Whilst there would be some damage to the local ecosystem during construction of the breakwater and placement of beach sediment, the impact on biodiversity of this option is generally viewed as positive in the longer term.	**L**	
Natural Character	The breakwater structure is likely to have a negative effect on natural character whether submerging or emerging as there will be periods of the tide when the structure is visible. The nourished beach will improve natural character of the beach.	**L**	**L**
Coastal Processes	Properties on the downdrift side of any salient formed by the breakwater may be starved of sediment that usually moves along the shore but is trapped in the shadow zone of the breakwater. However, beach nourishment will provide additional sediment into the beach system and therefore effects on the downdrift beach profile are not likely to be significant. An offshore breakwater will cause waves to break further out and will therefore reduce the amount of wave attack on the beach profile.		**H**

Impact Category	Offshore Breakwater + Nourishment Assessment	+ve	-ve
Coastal Flooding	A wider high tide beach will provide additional protection of beachfront properties against storm surge and wave run up. A breakwater will also help dissipate large waves during storm events and has the potential to mitigate wave run-up effects.	**L**	
Climate Change	An offshore breakwater has the potential to reduce the risk from climate change effects (such as increased storm activity and wave run-up) by providing a 'first line' of defence. However, the breakwater may need to be modified in response to sea level rise.	**M**	
Environmental Footprint	Initial resources for the construction of the breakwater will be required (such as rock and fuel) and also beach nourishment material. In the long term, minor resources for any maintenance of the breakwater will be required.		**H**
Reversibility of Option	It will be difficult and involve large costs and disturbance of the CMA to remove an offshore breakwater once installed (depending on material used in original construction). Beach material placed as nourishment could be left to naturally redistribute itself while the beach returned to equilibrium.		**M**
Structure Construction, Works and Maintenance Costs	Large capital cost for construction and maintenance of the breakwater over the longer term. The sand for nourishment will be expensive as it will probably need to be brought in from outside of the local beach system (rather than redistribution of existing sands).		**H**
Capital Costs	There is no relocation of buildings or property purchase required with this option and therefore there are no capital costs.	**0**	**0**
Local Economy	Imperceptible change in numbers of total visitors to Coromandel. These visitors are potentially recreational users	**L**	

Impact Category	Offshore Breakwater + Nourishment Assessment	+ve	-ve
	such as divers and surfers. An improved beach environment through nourishment has the potential to provide incentives for additional eco or tourism related businesses to set up (such as motels and café's).		
Transaction Costs	There will be moderately high transaction costs associated with the resource consent applications and design of the breakwater and any on-going nourishment required.		**M**
Tourism	Imperceptible change in numbers of total visitors to Coromandel. Depending upon the design of the breakwater (if it includes a surf break) there would be opportunities for increased tourism associated with surfing. Additional tourism opportunities will arise from the new marine habitat provided. This could result in improved opportunities for dive tour operators in the area using the breakwater as an 'attraction'. This would lead to other associated incentives such as dive shops and café's.	**L**	
Private Capital	Value of beach-front properties protected. Increases in value of other properties because of beach amenity improvements.	**M**	
Protection of Public Infrastructure	Public assets (such as reserves and infrastructure) behind structure protected from erosion by wider beach and more sheltered wave environment.	**M**	

Appendix I

Results of Assessments

1 Introduction

Following the assessment of each option against the indicators, the grades were transferred into a matrix and cost benefit analysis. The qualitative matrix provides an ‘image’ of the potential impacts and the ability to compare the options. The quantitative cost-benefit analysis paints a ‘picture’ of the economic impact of each option. The comparison of the two assessments then provided the opportunity to prioritise the options in the context of sustainable development.

2 Qualitative Assessment Matrix

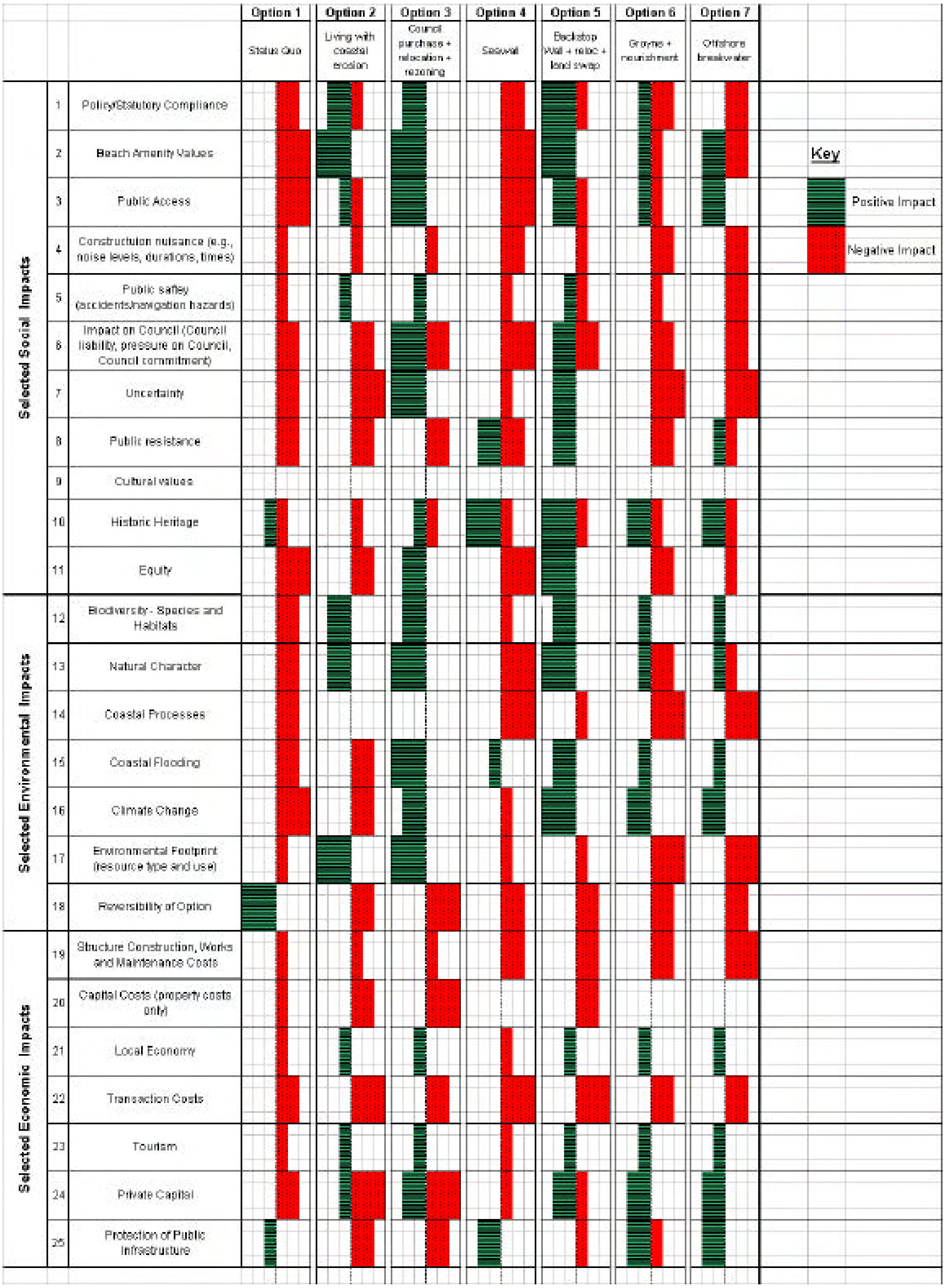
The impacts for each option assessed against the indicators were graded as to the level of negative and/or positive impact the option could have. A red or green bar was used depending on whether the option is expected to have a negative (red) and/or positive (green) effect in the long term. In addition 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 matrix produces an ‘image’ of the most preferred option and/or combination of options to achieve sustainable development and triple-bottom line outcomes.

3 Cost Benefit Analysis

The cost-benefit analysis is used to measure the overall well-being (or welfare) impacts of the different options for managing coastal erosion at Cooks Beach. The following cost-benefit analysis table provides a ‘picture’ of these economic impacts, including capital costs, property loss, naturalness gains, and property gain and the net economic benefit/costs of each option.

The following table then provides the opportunity to compare and rank the options to identify a preferred option.


Option 1
Status Quo
Option 2
Living with coastal erosion
Option 3
Council purchase + relocation + rezoning
Option 4
Seawall
Option 5
Backstop Wall + reloc + land swap
Option 6
Groyne + nourishment
Option 7
Offshore breakwater
Selected Social Impacts
1 Policy/Statutory Compliance
2 Beach Amenity Values
3 Public Access
4 Construction nuisance (e.g., noise levels, durations, times)
5 Public saftey (accidents/navigation hazards)
6 Impact on Council (Council liability, pressure on Council, Council commitment)
7 Uncertainty
8 Public resistance
9 Cultural values
10 Historic Heritage
11 Equity
Selected Environmental Impacts
12 Biodiversity - Species and Habitats
13 Natural Character
14 Coastal Processes
15 Coastal Flooding
16 Climate Change
17 Environmental Footprint (resource type and use)
18 Reversibility of Option
Selected Economic Impacts
19 Structure Construction, Works and Maintenance Costs
20 Capital Costs (property costs only)
21 Local Economy
22 Transaction Costs
23 Tourism
24 Private Capital
25 Protection of Public Infrastructure
Key
Positive Impact
Negative Impact

Option Specific Assumptions	Status Quo	Live with Erosion	Buy Properties and Rezone as Open Space	Frontal Seawall	Backstop wall	Groyne plus nourishment	Offshore breakwater
Naturalness change	0%	5%	5%	0%	5%	2%	2%
Year of start		0	0	0	0	0	0
Year of start			5				
Capital Cost		50,000	50,000	1,600,000	1,250,000	2,500,000	4,500,000
Maintenance Cost	75,000			30,000	20,000	30,000	90,000
Houses moved off site			24				
Houses risk of inundation		14					
Houses moved back within site		4			10		

Results	Status Quo	Live with Erosion	Buy Properties and Rezone as Open Space	Frontal Seawall	Backstop wall	Groyne plus nourishment	Offshore breakwater
Costs							
Capital Cost	$0.00	-$50,000	-$50,000	-$1,600,000	-$1,250,000	-$2,500,000	-$4,500,000
Maintenance Cost	-$1,444,194			-$577,678	-$385,119	-$577,678	-$122,780
Property Loss		-$4,190,000	-$15,965,129		-$500,000		
Naturalness Loss	$0			$0			
Total	-$1.444.194	-$4.240.000	-$16.015.129	-$2.177.678	-$2.135.119	-$3.077.678	-$4.622.780
Benefits							
Naturalness Gain		$2,018,305	$2,018,305		$2,018,305	$807,322	$807,322
Property gain		$0	$5,484,683	$6,840,000	$6,840,000	$6,840,000	$6,840,000
Total		$2,018,305	$7,502,988	$6,840,000	$8,858,305	$7,647,322	$7,647,322
Net Benefit	-$1,444,194	-$2,221,695	-$8,512,141	$4,662,322	$6,723,187	$4,569,644	$3,024,542
Rank	5	6	7	2	1	3	4

Discount Rate	5%

Assumptions	
Visitor numbers	45000
Visitor nights	150000
Total Properties	754
Property loss per house	839000
Demolition cost	10000
Houses at risk	24
Property loss	20376000
Beachfront propertygain/house	285000
beachfront property gain	6840000
Cost of extra risk without wall	285000
2nd row house gain	350000
2nd row houses	20
2nd row Property gain	7000000
Costs of moving a house	50000
Value of naturalness/resident	1677
Total resident value of naturalness	1.264.327
Value of naturalness/visit	10
Total visitor value of naturalness	1,500,000
Annual increase in visitor numbers	2.3%

Order		
1	Backstop wall	$6.72
2	Frontal Seawall	$4.66
3	Groyne plus nou	$4.57
4	Offshore breakw	$3.02
5	Status Quo	-$1.44
6	Live with Erosioi	-$2.22
7	Buy Properties a	-$8.51

Appendix J

Action Plan and Lessons Learned

1 Introduction

The Cooks Beach CEMS has identified a number of suitable options for managing coastal erosion, following qualitative and quantitative assessments of viable options. As no community consultation has been undertaken as part of this strategy, this selection of options should be taken to the community for further development. The strategy vision and objectives will also need to be further refined with community and stakeholder input.

The following section provides guidance on general actions that EW, TCDC, the community and stakeholders could undertake to further refine the CEMS for Cooks Beach. Following consultation the Cooks Beach CEMS will need to be updated to better reflect the chosen option(s) and the actions required to implement this.

Whilst the CEMS will provide guidance over a 50-year time horizon, the following general actions should be implemented in the short term (within the next 5 years) to develop the CEMS to the next stage (preferred option(s) with community support).

2 Action Plan

2.1 General

Pre-feasibility and Design Work (pre- consultation).

This study identified the need for further investigative or pre-feasibility work into selected options such as sensitivity analysis and detailed design for engineered options to confirm costs and impacts, etc.

Feasibility Study (post-consultation).

Following identification of the most preferred option or combination of options (once community consultation has been completed) the option(s) will require further feasibility assessments (including field investigations and specific design) to make sure the option or combination of options is viable and practical to implement

Funding Policies

The allocation for funding and the recognition of where the costs will fall for the selected options will need to be identified. It is recommended that this is undertaken in accordance with existing council funding policies and discussion undertaken with the local community, in particular the beachfront property owners. The impact category “equity” in the matrix produced for this strategy can also be used for guidance on where costs should fall.

Implementation Plan

Following consultation with tangata whenua, the community and stakeholders, and once a preferred option(s) is determined for Cooks Beach, it is recommended that EW and TCDC develop an implementation plan for the preferred option(s) and include a timeframe of actions.

Structure Plan

Community and stakeholder consultation may result in many differing values and wants for different parts of the Cooks Beach strategy area. If this is encountered then it is recommended that a local structure plan be developed that can address site-specific combinations of options at each section of the study area at a more detailed level.

Resource Consents

It is recommended that TCDC/EW proceed with appropriate resource consent applications for the preferred option(s) identified from consultation as soon as possible to initiate implementation of the Cooks Beach CEMS.

2.2 Consultation

The first step to further develop the CEMS for Cooks Beach is to take the selection of options presented in this report to the community for comment and discussion. In particular tangata whenua should be consulted to allow an assessment of the impact of the various options on cultural values.

Consultation, or outreach, is also useful to increase awareness and understanding, at a local and regional level of the CEMS. The following table identifies outreach mechanisms that can be used by EW/TCDC for consultation on the Cooks Beach CEMS. This list is not exhaustive and should be considered in addition to any existing consultation plan for the region-wide joint Coastal Erosion project.

Outreach Mechanism	Stakeholders	Purpose	Stage*
Council Workshops	- Internal council staff - Councillors	For internal council staff and/or councillors to provide an opportunity to present on the information and to work through the findings of the CEMS.	1 and 2
Hui	- Tangata Whenua	For tangata whenua consultation on selected options at local marae. Provides for consultation with tangata whenua at a location where they feel comfortable and are able to accord appropriate protocol to the occasion.	1 and 2
One-on-one Meetings	- Beachfront property owners	With individual beachfront property owners at an appropriate location to provide the opportunity to discuss the likely impacts of the CEMS (selected options) on each property owner.	1 and 2
Cottage Meetings	- Adjacent property owners	With adjacent property owners and directly affected parties. The location will typically be a local resident's house. Provides an informal means of discussion.	1 and 2
Issues and Options Paper	- All Cooks Beach ratepayers	This paper will summarise the CEMS and opportunities for consultation involvement in its development.	1
Public Newsletters/ Flyers	- Local community - General public	To inform the community of upcoming consultation sessions (including open days). Feedback of information gathered to date.	1 and 2
Press Releases	- Local community - Local businesses - General public - Environmental groups	These should be following the approval of the CEMS for public consultation, following the adoption of the CEMS by both EW and TCDC and at appropriate stages of the implementation of the CEMS.	1 and 2

Outreach Mechanism	**Stakeholders**	**Purpose**	**Stage***
Letters	- Government officials - Key community representatives	These letters should detail the purpose and need for CEMS and outcomes of community consultation.	1 and 2
Website	- Local community - Local businesses - General public - Environmental groups	Website page on both EW and TCDC websites and regular updates following initial consultation and implementation.	1 and 2
Open Day	- Local community - General public - Environmental groups - Local businesses	For the general public. This could also include a site visit to the area of the CEMS to provide a practical opportunity for people to present their views on the issues at hand.	2
Public Displays	- Local community - General public	To present the CEMS information to the wider community at a central location (such as local libraries and community centres).	2
Conference Presentations	- Professional organisations - Territorial authorities	Presentation of findings. Potential opportunities are the NZ Coastal Society Annual Conference and the NZ Planning Institute Annual Conference.	2

*Stage 1 **= Following the approval of the CEMS for public consultation by both EW and TCDC.**

*Stage 2 **= Following the adoption of the CEMS by both EW and TCDC**

2.3 Monitoring

The Local Government Climate Change Guidance notes prepared by MFE state that with the onset of climate change, effects on coastal hazards are likely to accelerate with time. For this reason, any strategy to manage coastal erosion needs to be a working document. Also, as time passes, communities change as does development, priorities and perceptions of the coast. As the strategy is focussed around a shared community vision, this should also be reviewed and changed as necessary to reflect the community's values.

As coastal hazards may change with time, it is essential that on-going monitoring is undertaken, interspersed with regular reviews or audits of the methods used, and adjustments made where necessary. For this reason, it is recommended that a formal Monitoring Plan be developed by both Councils that addresses, at the very least, the items in the table below. This list is not exhaustive and should be considered in addition to any existing monitoring plan for the region-wide joint Coastal Erosion project.

Monitoring type	Who should monitor?	Purpose	Timeframe (Stage*)
Review of CEMS	- Coastal Erosion Steering Group It is considered that the best approach to ensuring effective implementation of the strategy is to create a sub committee of the steering group made up of the sponsoring authorities that will manage the Cooks Beach CEMS.	To monitor the effectiveness of the CEMS and changing community values. To incorporate the implementation of the preferred option(s) from community consultation including re-evaluation of the matrix.	1
Physical Shoreline Monitoring	- EW coastal specialist - TCDC	To monitor beach width and volume, scour depths around existing protection structures, sand size and colour, sediment supply, wave climate, etc. Beach profiling should be undertaken at least yearly and following storm events. Beach profiling should be undertaken in the area of worst erosion hazard (between 105 and 165 Captain Cook Road) and the site marked so that consistent measurements can be taken.	1 and 2
Community Survey	- EW consultation specialist - TCDC consultation specialist	Surveys should be undertaken to reassess community and stakeholders values of the coast and to review the effectiveness of the strategy in achieving the shared vision. Community values and the shared vision should be reviewed every five years and the matrix re-evaluated at the same time. Monitoring of changing community values / perceptions could be by way of workshops, surveys, one-on-one meetings, etc.	2

***Stage 1 =** Following the approval of the CEMS for public consultation by both EW and TCDC.

***Stage 2 =** Following the adoption of the CEMS by both EW and TCDC

3 Lessons Learned

A number of challenges were encountered while developing this strategy. As a result the following are lessons learned and recommendations for other site specific CEMS's:

- **Weighting of the matrix**. As there was no consultation as part of this strategy development, recognising that consultation would be undertaken with the community as part of EW/TCDC wider strategy development, it was not possible to accurately assign a weighting to each impact category assessed in the matrix. In future site specific strategies it is recommended that community and stakeholder consultation be undertaken prior to strategy development to determine an appropriate weighting to give to each impact category. This could be achieved by way of a community/stakeholder survey requesting that impact categories are ranked in terms of that individual's opinion of their importance. This type of weighting can be re-assessed over the timeframe of the strategy through further surveys to update people's opinion on level of importance of certain assessment categories.
- **Other options?** To build on the above community/stakeholder survey, the survey could also ask people to list options they wish EW/TCDC to investigate further at the screening level stage. This could therefore be addressed in strategy development.
- **Design details.** Due to the timeframe and budget constraints of the present CEMS project, it was not possible to produce design details for each potential option. If there was design details for each preferred option (such as the various types of seawalls, rock, timber, gabion basket, recycled tyres etc) then assessment of preferred options could be on a specific rather than a generic level.
- **Two assessments and possible discrepancies.** As there are two assessments involved in the methodology of CEMS development, it is recognised that there is potential for discrepancies between ranked results from the two types of assessment, qualitative and quantitative. Although both assessments in this study resulted in the same option as a preferred approach to coastal management of Cooks Beach (backstop wall), it is likely that this will not always be the case. It is suggested that in those situations where there are discrepancies in preferred options from the two assessments weight be given to those options in the lower tiers of the hierarchy of response options promoted by the NZCPS and national guidance documents on climate change (see discussion in Appendix E).

Summary – Action Plan

It is recommended that EW and TCDC undertake consultation, monitoring of the strategy and its effectiveness, funding policy reviews, pre-feasibility and detailed design work. In particular the consultation with the community and other stakeholders will enable EW/TCDC to further refine the shared vision for Cooks Beach and to discuss the outcomes of this study in the selection of a preferred strategy for Cooks Beach.

Lessons Learned

In future site specific strategies it is recommended that community and stakeholder consultation be undertaken prior to strategy development to determine an appropriate weighting to give to each impact category. A suggested way of achieving this is to conduct a survey of the community and stakeholders.

Also, site-specific strategies such as this will benefit in the future from a detailed design analysis of preferred options as part of the analysis. Design details would allow a direct comparison between different types of options within each option (e.g. rock vs. timber vs. gabion basket vs. recycled tyre seawall etc).

The hierarchy of response options should be used in future assessments where there is a discrepancy in the results for the preferred option from the quantitative and qualitative analyses.

Appendix K

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Appendix L

Glossary

Glossary

Accretion	Accumulation of sediment that builds up land. May be the result of either natural (e.g. by the action of Aeolian transport) or artificial (by the action of humans) activity.
Backshore	That part of the beach / coast landward of mean high water mark. The backshore area is generally only subject to wave activity during significant storm events, especially when they coincide with periods of high water.
Beach	Beaches are accumulations of unconsolidated sediment (usually sand) that extend from the mean low tide line to the inland limit of the littoral zone (i.e. usually beyond the high water mark where there is a marked change in relief and / or to the line of permanent vegetation).
Beach Material/Sediments	Granular sediments (usually sand, shell or gravel), which are transported by coastal processes.
Beach Profile	The outline or shape of the beach, usually surveyed from a fixed position landward of the zone that can be disturbed by storm events, such as behind the frontal dune, extending seawards to or near the line of Mean Low Water.
Climate Change	Any significant change or trend in climate over time, either in the average state of the climate and / or in its variability. It includes 'natural' change and that attributable to human activities.
Coastal Marine Area (CMA)	The area below Mean High Water Springs, including the wet part of the beach, the foreshore and seabed. The seaward boundary of the CMA is the outer limits of the territorial sea.
Coastal Processes	Collective term covering the action of natural processes on the coastline and seabed.
Coastal Protection Works	Any structure or works erected, placed or carried out on or adjacent to the foreshore to alter natural coastal processes, in order to protect land above MHWS against erosion or encroachment of the sea.
Coastal Zone	The 'coastal zone' is a component of the Proposed Thames Coromandel District Plan that provides the statutory basis under the Resource Management Act 1991. The Coastal Zone is defined in the TCDP as "*generally the land between the coast and the first ridgeline inland and other land where the coast is a significant part, even though it might not be visible from the coast or a public road*'. Within the coastal zone are policy areas, such as the Open Space policy area.
Cost Benefit Analysis	A term used to describe analysis which examines options and assesses their relative merits by quantifying in monetary terms as many costs and benefits as possible, including items for which the market does not provide a satisfactory measure of value. The basis of the monetary quantification is usually willingness to accept or pay compensation for gains or losses.
Downdrift	In the direction in which a current or sediment is moving

Dunes	Mounds of loose sand formed by wind, considered part of a soft coast.
Dynamic Shoreline Fluctuations	A state of the shoreline where the beach profile undergoes periods of erosion and accretion, usually associated with climatic events.
ENSO	El Nino Southern Oscillation. ENSO is a disruption of the ocean-atmosphere system in the tropical Pacific having important consequences for weather around the globe.
Erosion	A general term for the removal of material from exposed surfaces by the action of natural processes.
Esplanade Reserve	Means any land set apart for any public purpose
Esplanade Strips	These retain private ownership of land but provide for a public accessway of fixed width from the coast, regardless of whether the land is lost as a result of erosion or added to through accretion.
EW	Environment Waikato
Foredune/Frontal Dune	The dune lying between the foreshore and the backdune. This is often the most seaward dune.
Foreshore	The 'wet' area of land and beach between the high-tide and low-tide marks.
Hazard	The interaction of coastal processes with human use, property or infrastructure, the action of which adversely affects or may adversely affect human life, property or assets.
Hierarchy of Options	Refers to assessment options to manage risk from coastal hazards (Tier 1=most preferred, Tier 3=least preferred as stated in New Zealand Coastal Policy Statement)): 1. Activities and land use practices to protect natural barriers such as sand dunes, gravel ridges, cliffs, salt marshes, other vegetation and other non-structural methods (e.g. beach nourishment). 2. Soft structural works including beach dewatering. 3. Hard structural works such as seawalls, rock armouring or groynes. This is a method to address the appropriateness of each option in a 'hierarchy', with the most preferred first. The optimal management approach may involve a selection of options.
Infrastructure	The means for delivering physical services to communities, including roads, septic tanks, power lines and stormwater pipes.
IPO	Interdecadal Pacific Oscillation. The IPO is an 'ENSO-like' feature of the climate system that operates on time scales of several decades.
Littoral Drift/Longshore Drift	The movement of beach material in the nearshore zone by waves and currents.
Long Term Council Community Plan (LTCCP)	A document required to be produced by the local authority under the Local Government Act 2002. The purpose of the LTCCP is to outline desired community outcomes and identify how councils will contribute towards achieving these outcomes in the future.

Mean High Water Springs (MHWS)	The average of the heights of each pair of successive high waters during that period of about 24 hours each semi-lunation, when the range of the tide is greatest.
Multi-Criteria Analysis	An assessment approach to determine overall preferences among alternative options. It is used in this strategy to describe the qualitative assessment of options that do not rely predominantly on monetary valuations.
Natural Character	The degree of naturalness of an area. Natural character depends on the extent of modification of landforms, ecosystems and natural process and the presence of structures and buildings. A landform having a low level of human modification is considered as having a proportionally higher natural character.
NZCPS	New Zealand Coastal Policy Statement
Relocation	When a community, infrastructure or property is at risk from a coastal hazard relocation involves moving away from the area of risk, as opposed to other hazard management options including promoting natural buffers, constructing structural defences or designing buildings to minimise the likelihood of damage.
Risk	Refers to coastal hazards and considers the probability that a hazard event (e.g. storm surge) will occur and the potential cost or consequence of this event on communities, infrastructure, land and / or property.
Scour	Removal of material by hydrological forces, especially at the base or toe of a structure.
Seawall	A structure separating land and the sea, primarily designed to prevent erosion of the land due to wave action.
Shadowzone	Refers to the area immediately landward of an offshore breakwater that is sheltered by the breakwater from wave energy.
Stakeholders	Those persons or parties who have an interest in Cooks Beach greater than the public in general and includes, Beachfront property owners, adjacent property owners, local residents, tangata whenua, resident and ratepayers groups, Department of Conservation, boating clubs, community board, New Zealand Historic Places Trust, recreational groups, local businesses, local tourism operators and environmental groups (e.g. The Royal Forest & Bird Protection Society).
Statutory	Key statutory resource management instruments are the Local Government Act 2002, the Resource Management Act 1991, the Historic Places Trust Act 1993, the Conservation Act 1987 and the Treaty of Waitangi / Te Tiriti o Waitangi 1840. These define the roles and responsibilities of the Thames Coromandel District Council, Waikato Regional Council, Department of Conservation, NZ Historic Places Trust and Transit NZ as well as other stakeholders in the Cooks Beach Coastal Erosion Management Strategy.
Stewardship	The ethic of guardianship or caring for the Cooks Beach coastal environment. It includes the concept of *kaitiakitanga.*

Storm Surge	The combined effects of atmospheric pressure set up and wind set up, causing a localised increase in water elevation.
Sustainable Management	Refer to Section 5 of the Resource Management Act 1991. In the Act, "*sustainable management*" means 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 whilst sustaining the potential of natural and physical resources for future generations, safeguarding the life-supporting capacity of air, water, soil and ecosystems and avoiding, remedying or mitigating any adverse effects of activities on the environment.
TCDC	Thames Coromandel District Council
TCDP	Proposed Thames Coromandel District Plan
Triple Bottom Line Outcomes	Options that have the least negative impact and most positive impact when assessed against economic, environmental and social indicators.
Wave Runup	The vertical distance above mean water level reached by the uprush of water from waves across a beach or up a structure.
Wave Setup	The increase in water level within the surf zone above mean still water level caused by the breaking action of waves.
WRCP	Proposed Waikato Regional Coastal Plan
WRPS	Operative Waikato Regional Policy Statement