2007 Coastal Hazard Risk Indicators Review

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Working with our communities for a better environment
E mahi ngātahi e pai ake ai te taiao
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Finally, we would also like to thank Rachael Musgrave for formatting this report.

This report was prepared by Lauren Schick (Planner) and Shane Iremonger (Environmental Scientist).

Cover photo: Ohope Beach as it was in 1947 (top) and as it is today.

Date: June 2009
Executive Summary

Environment Bay of Plenty’s Regional Coastal Environment Plan contains a chapter on managing coastal hazards and sets up a policy framework based on the objective of:

“No increase in the total physical risk from coastal hazards.”

Monitoring method s12.2.1 in the Regional Coastal Environment Plan requires Environment Bay of Plenty to measure:

“Change in the intensity of subdivision and structural development in known coastal hazard areas.”

A range of indicators were trialled for effectiveness and ease of use in 2005, and in 2006 seven of these indicators were chosen to measure the change in total physical risk from coastal hazards. The final set of seven coastal hazard risk indicators (CHRI) are:

- **CHRI–1** Have coastal hazard zones been identified and included on district planning maps?
- **CHRI–2** Are there district rules to support those hazard zones and are these aimed at not increasing physical risk of coastal hazards? (This may include no-subdivision rules and building setbacks).
- **CHRI–3** Are there administrative or district plan policies to ensure that any building within the coastal hazard zones is subject to controls to mitigate risk such as relocatability and relocation management plans?
- **CHRI–4** Average building set back for the most seaward residential dwellings on residential lots in coastal hazard zones from the year 2000 toe of foredune survey line datum.
- **CHRI–5** Number of residential dwellings in the coastal hazard zones at the date of the most recent aerial photography.
- **CHRI–6** Number of residential lots in coastal hazard zones from the DCDB at a date close to the most recent aerial photography.
- **CHRI–7** Percentage of new residential dwellings within coastal hazard zones subject to resource consent with building relocation conditions.

It is intended that on a three-yearly basis, these indicators will be used to assess whether or not there has been an increase of physical risk and therefore, if the Regional Coastal Environment Plan has been effective.

This review is the first time the final seven indicators have been investigated since they were created. The primary aim of this investigation is to establish a baseline for total physical risk.

Results from this study show all of the coastal territorial authorities have adopted or are in the process of adopting coastal hazard zones and subsequent rules and policies. Opotiki District Council has only set zones and policies for the Ohiwa Spit. In the 2005 Pilot Report, only two of the four councils in the region had identified hazard zones in their plans.
Excluding the East Coast area, Ohope had the highest average setback distance of 71 m and Papamoa had the lowest distance of 26 m. Waihi and Pukehina beaches shared the lowest minimum setback distance of 10 m.

In total there are 1401 residential dwellings within a coastal hazard zone in the Bay of Plenty region. Excluding the East Coast area which has no primary hazard zone, over 35% of all the dwellings in a coastal hazard zone in the Bay of Plenty are in a primary hazard zone, and 56% of those within the primary zone are within the Western Bay of Plenty district.

Ohope Beach is the only coastal community that has no residential dwellings within the primary coastal hazard zone. Waihi, the Mount and Papamoa all have dwellings within the primary hazard zone. Pukehina Beach is the only community that has more dwellings in the primary hazard zone than in the secondary hazard zone. The coastal community with the least amount of dwellings within a coastal hazard zone is Mount Maunganui the coastal community with most dwellings within a coastal hazard zone is Ohope.

Comparing risk across the region, Western Bay of Plenty District has the highest rate of risk from coastal hazards with the highest number of dwellings within the coastal hazard zone and the highest number dwellings within the primary coastal hazard zone. Tauranga City has the lowest rate of risk from coastal hazards with the least number of dwellings and residential lots within the coastal hazard zone.

All of the indicators were effective in analysing risk, with the exception of Coastal Hazard Risk Indicator 7. The information necessary to utilize this indicator to assess risk was not readily available. For Indicator 7 to be useful in the future, education on the aim and information requirements of the indicator should be given to the four territorial authorities and information sharing protocols established between the territorial authorities and Environment Bay of Plenty.
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Chapter 1: Introduction

1.1 Background

Chapter 11 of the Environment Bay of Plenty’s Regional Coastal Environment Plan (RCEP) is dedicated to managing coastal hazards and sets up a policy framework based on the objective:

“No increase in the total physical risk from coastal hazards.”

Monitoring (s12.2.1 of the RCEP) this objective requires Environment Bay of Plenty to measure:

Change in the intensity of subdivision and structural development in known coastal hazard areas.

Section 35 of the Resource Management Act requires the Regional Council to monitor the effectiveness of policies, rules and methods contained in regional plans and keep records of natural hazards to the extent appropriate for the effective discharge of its functions.

Therefore, in 2003 a project was initiated with the purpose of developing indicators to measure the coastal hazard risk and to provide information in order to meet Environment Bay of Plenty’s policy and legislative monitoring requirements.

Environment Bay of Plenty staff in association with planning consultants Hill Young Cooper Limited and technical coastal consultant Jim Dahm (Eco Nomos Limited), developed a set of proposed indicators (Hill Young Cooper, et al., 2003). After an initial consultation workshop with Bay of Plenty coastal territorial councils in 2003, a pilot trial of these proposed indicators was initiated in 2004 with the objective of testing if the proposed indicators were workable. The results of the trial were collated and reported in 2005 within the ‘Pilot Report of Proposed Coastal Hazard Indicators’ (Gordon and Fraser, 2005). The trialling of the indicators showed that there are some difficulties with collating the data required for the indicators and a number of the indicators were found to be unduly complex.

1.2 Refined indicators

As a result of the review process undertaken in the 2005 Pilot Report, a number of the initially proposed indicators have been amended or abandoned. A set of seven indicators were chosen and adopted as the final set. They were considered by the project team to be sufficiently robust to be practically implemented into Environment Bay of Plenty’s regional monitoring programme.
These final seven Coastal Hazard Risk Indicators (CHRI) as outlined in Gordon (2006) are:

- **CHRI-1** Have coastal hazard zones been identified and included on district planning maps?

- **CHRI-2** Are there district rules to support those hazard zones and are these aimed at not increasing physical risk of coastal hazards? (This may include no-subdivision rules and building setbacks).

- **CHRI-3** Are there administrative or district plan policies to ensure that any building within the coastal hazard zones is subject to controls to mitigate risk such as relocatability and relocation management plans?

- **CHRI-4** Average building set back for the most seaward residential dwellings on residential lots in coastal hazard zones from the year 2000 toe of foredune survey line datum.

- **CHRI-5** Number of residential dwellings in coastal hazard zones at the date of the most recent aerial photography.

- **CHRI-6** Number of residential lots in coastal hazard zones from the DCDB at a date close to the most recent aerial photography.

- **CHRI-7** Percentage of new residential dwellings within coastal hazard zones subject to resource consent with building relocation conditions.

The above indicators will provide the following monitoring information (Table 1):

<table>
<thead>
<tr>
<th>CHRI-1</th>
<th>Identifies if coastal erosion hazard zones for the four coastal territorial councils are in place.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHRI-2</td>
<td>Identifies if district rules are in place to support the hazard zones for the four coastal territorial councils.</td>
</tr>
<tr>
<td>CHRI-3</td>
<td>Identifies if policies are in place to ensure that buildings within the coastal hazard zones are subject to controls to mitigate risks for the four coastal territorial councils.</td>
</tr>
<tr>
<td>CHRI-4</td>
<td>Identification of the average setback (linear distance) for all dwellings in the coastal hazard zones from the specified survey line. The average setback can be compared to previous data to show an increase (desirable) or decrease.</td>
</tr>
<tr>
<td>CHRI-5</td>
<td>Calculating the total number of residential dwellings in coastal hazard zones. The total number can be compared to previous data to show an increase or decrease (desirable).</td>
</tr>
<tr>
<td>CHRI-6</td>
<td>Calculating the total number of residential lots in coastal hazard zones. The total number can be compared to previous data to show an increase or decrease (desirable).</td>
</tr>
<tr>
<td>CHRI-7</td>
<td>A number expressed as a percentage - showing the effectiveness of coastal territorial councils application of consent conditions for new dwellings in coastal hazard zones that mitigate the coastal erosion risk. 100% = desirable.</td>
</tr>
</tbody>
</table>
It is intended these indicators will become part of the NERMN programme and be used every three years to assess the change in physical risk. This cycle of reporting would align with the State of the Environment (SOE) monitoring.

The final seven indicators have not previously been used to assess the change in physical risk from coastal hazards. However, they were all trialled in 2005 for the Pilot Report using aerial photography from 2003. High resolution photography of the Bay of Plenty coast was collected in 2007 so in 2008/2009 this was used to ascertain coastal hazard risk in Bay of Plenty coastal communities by employing the final seven indicators for the first time.

1.3 Report scope

The purpose of this report is to ascertain a baseline of risk in coastal communities. The coastal communities surveyed in this study are: Ohope, Pukehina, Papamoa, Mount Maunganui and Waihi beaches. The coastline east of Ohiwa Spit (hereafter referred to as East Coast) was included in this study although a full assessment of the baseline risk could not be composed due to insufficient data.

This report does not show trends in risk. Even though the indicators have been employed previously (they were trialled in the 2005 Pilot Report), the data available is not sufficient to make comparisons of risk now versus risk based on the results obtained in 2005. Some changes in risk can be observed but the system and methods used in the pilot study are considerably different to those in this report, which produces difficulties in defining the change in risk for most coastal communities. However, when this report is repeated in three years time, the trend in risk will be obvious and will reflect the effectiveness of the relevant district coastal hazard policies and the RCEP in managing total physical risk from coastal hazards.

Data was obtained for this study during 2008 and 2009. Aerial photography used to obtain most of the necessary data was taken in 2007. Thus this report is referred to as the 2007 report. This report provides a snapshot of risk based on the 2007 aerial photography.
2.1 Introduction

A number of indicators simply required consultation with the relevant district/city councils but others required technical methods to be employed. A summary of the methods associated with these later indicators is given in this chapter.

2.2 Data used

In order to obtain a high accuracy when employing the indicators, this project relies on high quality aerial photography. Environment Bay of Plenty commissioned high resolution (0.25 m GSD\(^1\)) photography of the Bay of Plenty coast in 2007.

This photography was placed in an ArcMap\(^\circ\) project and subsequent data layers were added. For a full list and description of all layers see Appendix 1. Key layers used and referred to in this project are given below.

2.3 Datum layer

The Toe of the Foredune (2000) is point data that was collected by RTK GPS in 2000 (Iremonger and Stringfellow, 2000) and was used as the datum for measuring setback along the coast in this report. The point data was transformed into a line layer in order to provide a more accurate method for calculating setback. In instances where there was no Toe of the Foredune (2000) data available (e.g. East Coast), a new datum was created by digitising the vegetation line of the sandy coast. This datum line was called Toe of the Foredune (2007). Hereafter the acronym TOF refers to the combination of the Toe of the Foredune (2000) and Toe of the Foredune (2007) datasets.

There were numerous coastal settlements where small streams intersected the coast and thus produce a greater flooding hazard to houses and property nearby. The banks of streams that entered urban areas within the relevant coastal hazard zones were digitised to create a Riverbank Datum line so river setback could also be calculated.

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\(^1\) A 0.25 m GSD (ground sample distance) means that 0.25 metre on the ground is the equivalent to one pixel on the image.
2.4 Hazard zones

It has become obvious, in completing this project, that there are differences in how each of the four coastal territorial authorities display their hazard zones. The hazard zones for each different territorial authority were simplified in some cases to provide a more uniform analysis of coastal hazard risk. Assumptions and modifications are listed below.

2.4.1 Opotiki District Council (ODC) coastal hazard zones

ODC have two distinct hazard zones, Erosion Risk Zone (ERZ) and the Inundation Risk Zone (IRZ). These zones cover the majority of the Opotiki district coastline. The ERZ is described in detail in Eco Nomos (2007). The IRZ is described in detail in Blackwood (2008). At present the ERZ and IRZ have not been implemented by ODC. However the number of dwellings and the setback was still calculated for settlements within the ERZ and IRZ set out in Blackwood (2008) but only as an indication of risk in relation to these draft hazard lines.

Because there are so many small coastal settlements within the Opotiki district, for analysis purposes this area was broken up into two regions. East Coast 1 covers Ohiwa to Opape and East Coast 2 spans from Opape to Cape Runaway. Area 1 is characterised by sandy open coast beaches, whereas Area 2 generally is a mixture of sand/gravel beaches and rock platforms, punctuated with occasional pocket sandy beach.

Some areas had no TOF line so this was manually digitised off the 2007 aerial photography.

Along this coast, there were small settlements with unique situations where small streams exited along the coast and produced complex hydrology (Figure 2.1). Areas such as these were not included in the analysis.
2.4.2 Whakatane District Council (WDC) coastal hazard zones

WDC have divided coastal hazards into two separate zones. These are the Erosion Risk Zone (ERZ) and the Inundation Risk Zone (IRZ). The ERZ has then been further split into three zones, the Current Erosion Risk Zone (CERZ), the 2060 Erosion Risk Zone (2060ERZ) and the 2100 Erosion Risk Zone (2100ERZ). For the purposes of this study these three ERZ's were merged to create a primary and a secondary ERZ. It is generally accepted that the primary ERZ is the area between the landward boundary of the CERZ and Mean High Water Springs (MHWS). However at the time of this project, there was no accurate or appropriate regional MHWS layer available. So the primary ERZ was taken as the area between the CERZ and the TOF line.

The Secondary ERZ is given as the area between the CERZ and the landward boundary of the 2100 ERZ. Using the Merge tool from the ArcMap® toolbox, the primary and secondary ERZ’s were combined to create a new polygon layer called Total Erosion Zone in order to calculate the risk to houses across all erosion zones.

For background information on the generation of these hazard zones see Tonkin and Taylor (2008).
2.4.3 Western Bay of Plenty District Council (WBOPDC) coastal hazard zones

WBOPDC have combined both inundation and erosion into one coastal hazard layer which is then split into primary and secondary zones. For more information on these hazard zones see Healy (1993).

2.4.4 Tauranga City Council (TCC) coastal hazard zones

TCC have a series of hazard zones for erosion only because land elevation along this section of the coast prohibits any inundation. The area exposed to coastal erosion is referred to as the Coastal Hazard Erosion Policy Area (CHEPA). The zones within that area relevant to this study are the Current Erosion Risk Zone (CERZ), 50-year Erosion Risk Zone (50ERZ), and 100-year Erosion Risk Zone (100ERZ). As with the WDC ERZ lines, for this report the primary hazard zone was digitised as the area between the TOF line and the CERZ, and the secondary hazard zone was digitised as the area between the CERZ and the 100ERZ. For more information on these hazard zones see Gibb (1996). For the purposes of this report, Papamoa and Mount Maunganui were distinguished as shown in Figure 2.2.

![Figure 2.2](image)

The boundaries for Mount Maunganui and Papamoa used in this study.

2.5 Coastal hazard risk indicator methods

Below is a summary of the methods used for each indicator. For more detailed descriptions of these methods see Appendix 2.
2.5.1 **CHRI-1, 2 and 3**

The respective district or city council were asked to provide a response for these three indicators.

2.5.2 **CHRI-4**

In order to calculate the average setback, a line was drawn from the most seaward point of the roofline of the most seaward dwelling on each property, to just past the TOF line. The most seaward corner and most seaward dwelling were assessed using the authors’ judgement.

The setback line was to cross the TOF line at a right angle. A polygon was created by tracing the TOF line and extending the polygon well below all the digitised setbacks (Figure 2.3). This enabled each setback line to be clipped to the TOF polygon. The attribute table of the new clipped layer of digitised setbacks was copied into Excel® for analysis.

![Image of Coastal Hazard Zone at Ohope Beach](image)

**Figure 2.3** The Coastal Hazard Zone at Ohope Beach. The yellow lines represent the setback and the blue points represent dwellings within the hazard zone. See left of figure for key to other layers.

Waihi and Ohope beaches have a number of small streams intersecting their coastline. Dwellings built close to these streams may experience a greater inundation frequency and intensity and therefore be subject to a higher level of risk. For these reasons, each stream bank was digitised using the aerial photography and a separate setback distance from the river was also calculated. The setback was measured for every dwelling within a coastal hazard zone that shared a property boundary with a river or stream. Dwellings that were within the coastal
hazard zone and shared a property boundary with an empty residential lot which bordered the river or stream were also included (Figure 2.4).

This method was particularly open to the subjectivity of the analyst so it must be clarified that the setback measured provides a baseline only and cannot be used to compare risk between Ohope and Waihi.

Figure 2.4  The river setback (peach) and riverbank datum (pink) at 3 Mile Creek, Waihi Beach.

2.5.3  CHRI-5

Every dwelling that was within the coastal hazard zone was assigned a “dwelling” point. At the completion of digitising this layer, a query was carried out to ascertain how many dwellings were in each zone (primary, secondary, total etc). This required the hazard zones to be in polygon form in order to identify all dwellings within the boundaries of the coastal hazard zone. This was effectively achieved by using the trace tool in ArcMap®.

2.5.4  CHRI-6

The relevant planning zone layers were collected from each council. Using the ArcMap® tool ‘union’, the information in this layer was merged with that of the property parcel layer. This resulted in all the individual property parcels in a community being assigned a zone, i.e. residential, rural etc (Figure 2.5). The attribute data of this layer was then modified so only those property parcels in residential zones were visible since this CHRI deals with residential lots only. Following this step, a location query was then initiated to select all the residential lots in a particular coastal community that intersected each coastal hazard zone (i.e.
primary and secondary zones). This method could introduce error into the analysis as many of the lots intersected both the primary and secondary hazard zones. For Waihi and Pukehina beaches this was not an issue as the hazard zones are aligned to property boundaries and thus the number of lots in each zone is obvious. The total number of lots at the other coastal communities surveyed was calculated by undertaking a location query to select all lots within the secondary zone, and then adding to the selection any lots within the primary hazard zone. This method ensured lots were not counted twice and therefore the total number of lots is more accurate.

![Image showing residential lots at Ohope Beach](image)

Figure 2.5 Residential lots at Ohope Beach (shaded blue). Any of those shaded lots that were intersected with a Hazard zone line were classed as been within the hazard zone.

2.5.5 CHRI - 7

The Environment Bay of Plenty internal District Consents Database was used to ascertain how many resource consents had been granted within each of the councils’ respective coastal hazard zones. These consents were then appraised to see how many were subject to relocation conditions.

Unfortunately resource consents of this nature were not always received by Environment Bay of Plenty and so the quality of the data for this indicator is questionable.

2.6 Limitations of project

A number of limitations associated with using the indicators have become apparent through the completion of this study.
Firstly, there will be errors associated with the rectification and accuracy of the aerial photography. This may induce discrepancies when comparing photography from different years. For instance the hazard zones will not change spatially but the placement of the aerial photography could and therefore, houses that were previously within the coastal hazard zone, may not be and vice versa. The cadastre property boundary layer will also introduce a degree of error as there can often be a difference between the real, surveyed property boundary and the electronic property boundary which is what was used in this study. In urban areas such as those studied in this report, the accuracy of the electronic cadastre layer is higher but can still be ±2m.

Secondly, each district council has used the method outlined in the RCEP to calculate their respective coastal hazard zones, but, each council has interpreted these in various ways and hence employed slightly different techniques which have lead to variances between districts. For instance, WDC hazard lines are split into two zones, the inundation hazard zone and the erosion hazard zone. This erosion hazard zone is then split into primary and secondary risk zones. In comparison TCC and WBOPDC have combined inundation and erosion risk into one hazard zone and have primary and secondary risk zones for the combined hazards. Therefore when comparing risk to dwellings in the primary hazard zone across the region, it is difficult to compare risk at Ohope, where the primary risk zone relates to erosion only, to Waihi Beach for example, where the primary hazard zone includes erosion and inundation.

Furthermore some of the councils have opted to align the hazard zones with property boundaries for ease of consenting etc. This also creates discrepancies when comparing the risk. For example, at Ohope Beach the hazard lines are placed based on scientific research, whereas at Pukehina the hazard lines have been manipulated to fit around a property boundary and therefore do not represent the true risk.

The 2005 Pilot Report also concluded that the wide variation in coastal hazard zone methodologies used by coastal territorial councils in the region caused some difficulty when undertaking a comparative regional analysis of trends.

Thirdly, three of the seven CHRI require the digitising of information from aerial photographs using ArcMap® software. This too can introduce discrepancies as even if strict methods are followed, the accuracy of the study is still dependant, to a certain degree, on the subjectivity of the person digitising. This person will be forced to make certain judgement calls, such as ‘is that part of the house or is it a deck?’ or ‘is that one dwelling or two?’ Although only small, these differences can add up and will become particularly obvious when the study is replicated in three years time by a different person.

Lastly, there is an obvious lag effect between the adoption of coastal hazard policy and the effects of that policy being evident. This effect will be prevalent until all the districts have had coastal hazard policies and zones in place for at least five years. After the five year period there should be no outstanding resource consents for dwellings or subdivision that pre-date the policy as land use consents must be given effect to within five years or they are cancelled. This lag will still be obvious when the study is repeated in three years time but will not be as prevalent as three of the four districts will have had policy in place for a longer period of time.

As long as these factors are all taken into consideration then the results from this study can be used to provide a baseline assessment of coastal hazard risk in the Bay of Plenty region as of 2007.
Chapter 3: Indicator results

3.1 Policy and planning indicators

3.1.1 CHRI-1 Have coastal hazard zones been identified and included on district planning maps?

The TCC coastal hazard zones (CHEPA) were adopted in 2003 for the Mount Maunganui and Omanu parts of the open coast. The Papamoa area was subject to an Environment Court appeal which was resolved in 2003. Following this, TCC undertook a refinement process on the objectives, policies and rules in line with the Environment Court decision. This process was completed in March 2006 with all Coastal Hazard provisions now operative.

WBOPDC have also already adopted coastal hazard zones. It is noted that the Western Bay of Plenty District Plan is currently being reviewed. This reviewed District Plan was formally notified on 9 February 2008. Submissions to the Proposed District Plan are now being collated prior to the remaining processes as outlined in Schedule 1 of the RMA being undertaken.

WDC are currently in the process of formally adopting hazard zones and associated objectives, policies and rules.

ODC are currently in the process of formally adopting a hazard zone and associated objectives, policies and rules for the seaward properties on the western end of the Ohiwa Spit only. The rest of the coastal Opotiki district relies on the ASCH as set out in the Regional Coastal Environment Plan.

3.1.2 CHRI-2 Are there district rules to support those hazard zones and are these aimed at not increasing physical risk of coastal hazards? (This may include no-subdivision rules and building setbacks)

*Western Bay of Plenty District Council*

The Western Bay of Plenty District Plan contains objectives and policies for coastal hazards that are included as a subset of natural hazards. The District Plan requires land-use consent for new buildings and external additions to buildings in the coastal protection areas. In the Secondary Coastal Hazard Zone or Secondary Risk Area, as it is referred to in the Western Bay of Plenty District Plan, building activity is a restricted Discretionary Activity and within the Primary Risk Area, building is a Discretionary Activity.
Within the primary risk area it is a non-complying activity to have more than one dwelling per lot, accommodation, and/or educational facilities. Within the secondary risk area subdivision is a non-complying activity. Subdivision is prohibited within the primary risk area.

For new buildings and external additions to buildings in the primary risk area, WBOPDC states in their performance standards (section 12.3.5 of the District Plan) that new buildings or significant redevelopment of existing buildings within the coastal hazard zone should be situated as far back from the sea as is practicable to provide the greatest distance between the hazard and the building and additions or alterations to any building should be landward of the existing building.

For new buildings and external additions to buildings in the secondary risk area, WBOPDC states in their performance standards (section 12.3.5 of the District Plan) that they will have particular regard to the proposed avoidance, remedial or mitigation measures relating to the identified hazard including the provision of an access yard and the relocatability of the building.

**Tauranga City Council**

The Tauranga City District Plan contains Objectives and Policies specific to coastal hazards:

**Objective 6.1.4** To avoid coastal erosion and inundation resulting from the subdivision, use and development of coastal land, and to avoid, remedy or mitigate damage to land, structures and the environment arising from coastal erosion and inundation.

Policy 6.1.4.4 prohibits significant development, such as building new dwellings, within the current erosion risk zone.

Within the 2050 and 2100 erosion risk zones, subdivision and building is a Discretionary Activity and must meet the following performance standards:

- An alternative practicable building platform can be provided adjacent to and clear of the Coastal Hazard Erosion Policy Area.
- The requirements of s106 of the Resource Management Act 1991 are satisfied.

New buildings or structures in the 2050 or 2100 erosion risk zones must be designed to be:

- Lightweight in construction.
- Conventionally relocatable.
- Appropriately designed to be located to the alternative building platform adjacent to and clear of the Coastal Hazard Erosion Policy Area.
- Floor levels of new structures must be established above coastal inundation levels.
Like WBOPDC, TCC is reviewing its District Plan. As part of this process the intent of the Plan will remain, however further refinement may occur to clarify the permissibility of certain activities that do not increase risk. TCC is also reviewing, as required by the current District Plan, the Coastal Hazard Erosion Policy Area (CHEPA) zones. This work is currently underway and the outcome will be considered for inclusion in the Proposed City Plan (at this stage the Proposed City Plan will be notified at the end of August 2009).

**Whakatane District Council**

WDC has developed policies in a new Coastal Hazard chapter of the District Plan. Policy has been split into two areas, the Coastal Hazard Erosion Policy Area (CHEPA) and the Coastal Hazard Flood Policy Area (CHFPA). Within the CHEPA there is the Current Erosion Risk Zone (CERZ) and the 2060 and 2100 Erosion Risk Zones (2060 ERZ and 2100 ERZ).

Within the CHEPA, subdivision of land is a restricted discretionary activity if each property lot contains an alternative building site.

Alterations, additions or replacements to any existing and lawfully established buildings or structures is a Permitted Activity in the CHEPA and CHFPA (or restricted discretionary in the CHEPA CERZ) provided that the applicant:

- Proposes an additional floor area at ground level not exceeding 20 m² in area; or
- Proposes an additional floor area of 50 m² including any upper floor areas and decks but not exceeding 20 m² at ground level.

At any upper floor level no addition shall project further seaward than the existing building or structure unless cantilevered from the existing structure.

Two or more dwellings per lot within the CHEPA is a non-complying activity and within the CERZ it is a prohibited activity.

Construction or a new dwelling in the CERZ is prohibited and within the 2060ERZ and 2100 ERZ it is a restricted Discretionary Activity. Applications for new buildings and structures or extensions within the CHEPA, must include confirmation from a suitably Chartered Professional Engineer and a house removal company that the building is relocatable to an alternative building site. That building site must be vacant land, situated outside the CHEPA, and held in the same certificate of title.

Within the CHEPA, council can also review the conditions of a building consent particularly when the crest of the Foredune or top of the dune scarp has receded to a point within 20 metres or less from the nearest part of the building. Under these circumstances the council can require relocation of the building and/or further monitoring.

Within the CHFPA, subdivision of land, where no buildings structures or earthworks are proposed within overland flow paths or natural ponding areas, is a restricted Discretionary Activity. Two or more dwellings per lot and the construction of new dwellings or other structures are restricted Discretionary Activities within the CHFPA.
Opotiki District Council

ODC have notified a Plan change which was going through an appeals process at the time of writing. This Plan change incorporates hazard policy and zoning for the Ohiwa Spit. The new policy states: ‘With the exception of one relocatable earth toned building of no more than 10 m² floor area, not exceeding 3 metres height and with no dimensions exceeding 3.2 m, any new building requiring building consent under the Building Act within the Ohiwa Spit Coastal Hazard Overlay is a non complying activity’.

The Opotiki District Plan states that activities located within the Area Sensitive to Coastal Hazards (ASCH) as identified in the Regional Coastal Environment Plan are controlled activities where a report from a qualified person is provided ‘detailing the impact of the perceived hazard on the proposed activity and vice versa and where the outcomes of the report indicate there will be no significant adverse effects from the activity or from the hazards’.

For new dwellings or structures within the ASCH, the Opotiki District Plan requires a detailed site assessment which is to take into account the following:

- **Erosion impacts of sea level rise**: the Intergovernmental Panel on Climate Change best estimate should be used (currently IPCC 1995 IS92a) which uses a scenario of 0.49 metres by the year 2100.
- **Shoreline response to erosion and flooding**: scientifically appropriate models should be used.
- **A 100-year planning horizon**.
- **Historical long term trends in the erosion or accretion of the shoreline**.
- **Short-term fluctuations in the shoreline**.
- **A factor of safety**.

3.1.3 CHRI-3 Are there administrative or district plan policies to ensure that any building within the coastal hazard zones is subject to controls to mitigate risk such as relocatability and relocation management plans?

Each council now has provision for relocation and these are stated in 3.1.2. These provisions are only evident within the Ohiwa Coastal Hazard Overlay within the Opotiki District.
Table 3.1 Summary table of results for Coastal Hazard Risk Indicators 1-3 for this study (2007), and in 2005 when the pilot study was conducted.

<table>
<thead>
<tr>
<th>Council</th>
<th>CHRI 1 Hazard zones been identified?</th>
<th>CHRI 2 Rules and policies to support zones?</th>
<th>CHRI 3 Policies to mitigate risk such as relocation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Bay of Plenty District Council</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Tauranga City Council</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Whakatane District Council</td>
<td>Yes</td>
<td>No</td>
<td>Yes (awaiting formal adoption)</td>
</tr>
<tr>
<td>Opotiki District Council</td>
<td>For Ohiwa Coastal Hazard Overlay only</td>
<td>No</td>
<td>Within ASCH and the Ohiwa Coastal Hazard Overlay (awaiting formal adoption)</td>
</tr>
</tbody>
</table>

3.1.4 CHRI-7 Percentage of new residential dwellings within coastal hazard zones subject to resource consent with building relocation conditions

This indicator was very difficult to assess as the information needed was not easily accessible. It appears Environment Bay of Plenty has not received all district consent applications for activities within the Coastal Hazard Zone. This lack of information makes it difficult to determine internally how many new dwellings there have been since the Pilot Study in 2005 that are located within the coastal hazard zone of each district. Furthermore, Environment Bay of Plenty has not received copies of all the decisions that the territorial authorities send out to applicants. Therefore it is difficult to assess how many of the new dwellings within a coastal hazard zone have relocation conditions. This information was not readily available to the territorial authorities either so this indicator could not be assessed properly. However, using the Environment Bay of Plenty District Consents Database, the following results were obtained (Table 3.2). WBOPDC had the highest number of new dwellings within a coastal hazard zone whereas Tauranga City Council had the least.

Table 3.2 The number of district consent applications Environment Bay of Plenty has received for comment from each district council for activities within the Coastal Hazard Zone from July 2005 to July 2007.

<table>
<thead>
<tr>
<th>Consent applications within the Coastal Hazard Zone from July 2005 to July 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>ODC</td>
</tr>
<tr>
<td>WDC</td>
</tr>
<tr>
<td>TCC</td>
</tr>
<tr>
<td>WBOPDC</td>
</tr>
</tbody>
</table>
Tauranga City Council provided a list of all the consents applied for within the coastal hazard zone from July 2005 to July 2007. These results were compared with those extracted from the Environment Bay of Plenty database to highlight the information sharing gap.

Table 3.3 The number of consent applications that TCC has received for activities within the Coastal Hazard Zone and the number of district consent applications Environment Bay of Plenty has received for comment from TCC, for activities within the Coastal Hazard Zone for the time period July 2005 to July 2007.

<table>
<thead>
<tr>
<th>Consent applications within the TCC Coastal Hazard Zone from July 2005 to July 2007</th>
<th>New dwellings</th>
<th>Replaced dwellings</th>
<th>New buildings</th>
<th>Additions or alterations</th>
<th>Subdivision</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCC database</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>EBOP database</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Similar consent information was not available from the other three district councils so Table 3.2 displays the only data available to aid in the assessment of coastal hazard risk in the Bay of Plenty region for CHRI-7.

3.2 Baseline indicators

3.2.1 CHRI 4 Average building set back for the most seaward residential dwellings on residential lots in coastal hazard zones from the year 2000 toe of foredune survey line datum

The setback from the TOF to the most seaward point of a dwelling within a coastal hazard zone was measured for all coastal communities. Further, Waihi and Ohope beaches have rivers and streams that intersect the coastline and thus increase flooding risk. Therefore the setback from the riverbank to the point of the dwelling closest to the river was also measured.

The results of setback in the Bay of Plenty are given in Table 3.4. The coastal settlement with the lowest average setback (26 m) was Papamoa Beach while East Coast 1 had the greatest average setback (99 m). East Coast 1 had both the highest maximum setback (241 m) and the lowest minimum setback (8 m).

Table 3.4 Building setback results for residential dwellings in the coastal hazard zone in the Bay of Plenty (rounded to nearest metre)
In comparing the average setback between districts (Figure 3.1), the district council with the highest average setback was the WDC, followed by WBOPDC and then TCC with the lowest average setback.

This plot also presents a pattern for the average setback which is high at Waihi Beach then dips lower gradually at the Mount and Papamoa before rising again gradually at Pukehina, Ohope and East Coast 1.
The frequency distribution graph (Figure 3.2) shows the range of values for each coastal community. The distribution of setback distances at Ohope Beach range from 30-100+ m. Papamoa Beach setback distances are concentrated around 10-60 m. The setback distribution at Mount Maunganui is more concentrated around the 20-50 m distance. Waihi and Pukehina are represented in every setback brackets from 10-100+ m. The setback distance at Pukehina is more concentrated around 10-40 m whereas Waihi setback distances are fairly evenly distributed. East Coast 1 is concentrated predominantly in the 100+ m bracket but shows setback distances across each category, even the 0-10 m bracket, the only one to do so. In comparison, East Coast 2 is fairly evenly distributed across the categories.

The results for setback are best summarised and displayed in Figure 3.3 where the average median, minimum and maximum setback can all be seen and compared between coastal communities. This further shows the large range of setback distances exhibited at Waihi, and East Coast 1, and the relatively small range at Mount Maunganui and Papamoa. Also obvious from the plot is that East Coast 1 exhibits both the highest maximum and lowest minimum setback distances.
Comparison with 2005 pilot study results

Unfortunately the methods used to establish coastal hazard risk in the 2005 Pilot Report varied greatly from the methods used in this study, predominantly due to the data available and technological advances. In 2005, the pilot study used aerial photography from 2003 which only had a resolution of 0.75 m GSD. This study uses high resolution photography (0.25 m GSD) which allows for higher accuracy, especially when ascertaining whether or not a dwelling is within the coastal hazard zone or not.

In the 2005 Pilot Report study, dwellings within the coastal hazard zone and their subsequent setback distances were not digitised so no layers exist from this study.

Originally it was intended that the results from this 2009 study could be compared to those obtained and published in the 2005 Pilot Report. However as such different methods were used for the two projects it became apparent that the results could not be compared to formulate trends in risk. So, using the methods of the current CHRI study, the setback and number of dwellings within the coastal hazard zone were digitised in ArcMap® off the 1999 high resolution aerial photography that was available for Ohope Beach only. For the rest of the Bay of Plenty coast, only the 2003 Regional Digital Aerial Mosaic (RDAM) was available and the resolution of this was too low to accurately ascertain setback distances etc (Figure 3.4).
Figure 3.4  Comparison of photographic images available for this study (high resolution aerial photography collected in 2007) and for the 2005 pilot study (RDAM images collected in 2003).

Ohope Beach results for average setback and the number of dwellings and lots within the coastal hazard zone obtained using the 2007 aerial photography (this report) were compared to those given in the 2005 Pilot Report using the 1999 high resolution aerial photography that was only available for Ohope Beach (Table 3.5). Unfortunately this photography was not complete and therefore comparison between the two sets was difficult. Any areas where photography was missing for the 1999 collection were left out of the analysis (Figure 3.5) such as the Waterways Subdivision at Ohope. The same set of coastal hazard zones was used for both years.

Table 3.5  Comparison of setback and number of dwelling within the coastal hazard zone at Ohope Beach using the 1999 and 2007 high resolution photography.

<table>
<thead>
<tr>
<th>Ohope</th>
<th>Setback (m)</th>
<th>Number of dwellings in CHZ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>average</td>
<td>minimum</td>
</tr>
<tr>
<td>1999</td>
<td>72</td>
<td>31.3</td>
</tr>
<tr>
<td>2007</td>
<td>72</td>
<td>31.3</td>
</tr>
</tbody>
</table>
Figure 3.5  An example of the incomplete coverage of the 1999 high resolution photography of Ohope Beach. The yellow points represent dwellings within the hazard zone as digitised from the 2007 photography.
Comparison of the two years reveals that the average setback and the minimum and maximum have remained the same over the 8 year period between aerial surveys. The number of dwellings has increased by 54 in that period and most of these new dwellings can be attributed to the new Beach Point apartment block (Figure 3.7) and the Waterford Estate subdivision (Figure 3.6). The creation of the Waterford Estate subdivision had occurred in 1999 but there was only one dwelling within the Estate at that time. The Beachpoint Apartment complex had not been built when the 1999 photography was collected. These two developments resulted in 43 new dwellings within the coastal hazard zone in Ohope Beach between 1999 and 2007. The remaining 11 new dwellings are spread out along Ohope Beach.
Figure 3.7  The setback at the site of the future Beachpoint Apartments, Ohope Beach as digitised using the 1999 aerial photography (red lines) and the 2007 aerial photography (yellow lines). The blue points represent dwellings as digitised from the 2007 photography and the yellow points represent dwellings as digitised from the 1999 photography. The light blue undulating line represents the WDC inundation hazard zone and the blue lines represent the WDC erosion hazard zone. The background image is the 1999 high resolution Ohope Beach photography.

**River setback**

Only two of the coastal communities, Ohope and Waihi, have streams or rivers that intersect the coastline. The setback for riverfront dwellings at these communities was digitised separately and the results are shown in Table 3.6 below. The results do not relate directly to risk as the size of the stream/river, and the frequency and intensity of flooding for each stream or river were not taken into account. This exercise was merely carried out to provide a baseline so when repeated in three years time, the change in risk can be calculated.

**Table 3.6**  The number of dwellings that share a boundary with a river and the measured setback distances from the riverbank to the point of the dwelling closest to the river.

<table>
<thead>
<tr>
<th>Coastal Community</th>
<th>Number of houses adjacent to river or stream</th>
<th>River Setback (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Average Minimum Maximum</td>
</tr>
<tr>
<td>Waihi</td>
<td>28</td>
<td>23  9  71</td>
</tr>
<tr>
<td>Ohope</td>
<td>22</td>
<td>25  5  59</td>
</tr>
</tbody>
</table>
3.2.2 **CHRI-5 Number of residential dwellings in coastal hazard zones at the date of the most recent aerial photography**

The number of dwellings within a coastal hazard zone (Table 3.7, Figure 3.8) was difficult to calculate at Ohope Beach because the primary and secondary hazard zones relate to erosion hazard only. Therefore for the purposes of this study, dwellings within the primary erosion zone were counted as being in the primary zone, and then all dwellings within the secondary erosion hazard zone were added to all dwellings within the inundation zone and counted as being in the secondary zone. To be sure these were not doubled up the location query tool was used. Additionally there are a number of dwellings around Ohiwa Harbour that are within the inundation and erosion hazard zones but as this project looks at coastal hazards, these were excluded from the following analysis.

A total of 235 dwellings are within the inundation and erosion hazard zones around Ohiwa Harbour, including five dwellings on Ohakana Island. These dwellings can all be viewed in the ArcMap® layer Dwellings_Ohope_Harbour_2007. Further there are three dwellings within the Whakatane district that were not included in the analysis either as they could not be lumped with Ohope Beach results. Two of these dwellings were at Murphy’s Campground at Matata and a further dwelling was located within the coastal hazard zone at the Whakatane Heads. These can be viewed in the ArcMap® layer Dwellings_WDC.

**Table 3.7 Residential dwellings in a coastal hazard zone in the Bay of Plenty.**

The East Coast beaches have no distinction between primary and secondary zones and the Ohope secondary zone is the sum of all dwellings within the secondary coastal erosion hazard zone and the coastal inundation zone.

<table>
<thead>
<tr>
<th>District</th>
<th>Number of Dwellings</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primary Zone</td>
<td>Secondary zone</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Waihi</td>
<td>122</td>
<td>212</td>
<td>334</td>
<td></td>
</tr>
<tr>
<td>Mount</td>
<td>17</td>
<td>30</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Papamoa</td>
<td>46</td>
<td>80</td>
<td>122</td>
<td></td>
</tr>
<tr>
<td>Pukehina</td>
<td>253</td>
<td>86</td>
<td>339</td>
<td></td>
</tr>
<tr>
<td>Ohope</td>
<td>0</td>
<td>374</td>
<td>374</td>
<td></td>
</tr>
<tr>
<td>East Coast 1</td>
<td>N/A</td>
<td>69</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>East Coast 2</td>
<td>N/A</td>
<td>88</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>438</strong></td>
<td><strong>939</strong></td>
<td><strong>1401</strong></td>
<td></td>
</tr>
</tbody>
</table>

Ohope Beach is the only coastal community that has no residential dwellings within the primary coastal hazard zone. Waihi, the Mount and Papamoa all have dwellings within the primary hazard zone. Pukehina Beach is the only community that has more dwellings in the primary hazard zone than in the secondary hazard zone. Mount Maunganui has the least amount of dwellings in a coastal hazard zone (75) whereas Ohope has the most (374).

In total there are 1,401 residential dwellings within a coastal hazard zone. That is to say over 1,400 houses are at risk to coastal erosion and flooding in the Bay of Plenty. The majority of these houses (48%) are within the western Bay of Plenty district (Figure 3.9). Tauranga and Opotiki districts all have a similar number of houses at risk whereas Whakatane district equates to over a quarter of the total number of dwellings at risk (27%). Excluding the East Coast which has no primary hazard zone, over 35% of all the dwellings in a coastal hazard zone are in a primary hazard zone, and 56% of those within the primary zone are within the western Bay of Plenty district.
Figure 3.8  The number of dwellings within a coastal hazard zone in the Bay of Plenty. East Coast 1 and 2 have no shading because the Opotiki District Council hazard lines do not distinguish primary and secondary zones therefore the column merely represents the total number of dwellings in a CHZ. The Ohope secondary zone is the sum of all dwellings within the secondary erosion hazard zone and the inundation zone.
Census data from 2006 was collected in order to show the percentage of dwellings within each district that are currently at risk of coastal erosion and inundation hazards. The results (Table 3.8) show that Opotiki and western Bay of Plenty districts have the highest percentage of dwellings at risk but all districts currently have less than 5% of their dwellings at risk of coastal inundation and erosion hazards.

Table 3.8  The Population and number of dwellings for each district (as given in the 2006 Census results) and the number and percentage of dwellings at risk from coastal hazards for each district.

<table>
<thead>
<tr>
<th>District</th>
<th>Population</th>
<th>Number of dwellings</th>
<th>Dwellings at risk of Coastal Hazards</th>
<th>Percentage of Dwellings at risk of coastal hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opotiki</td>
<td>8973</td>
<td>4089</td>
<td>157</td>
<td>3.8</td>
</tr>
<tr>
<td>Whakatane</td>
<td>33300</td>
<td>13359</td>
<td>374</td>
<td>2.8</td>
</tr>
<tr>
<td>Tauranga</td>
<td>103632</td>
<td>45369</td>
<td>197</td>
<td>0.4</td>
</tr>
<tr>
<td>Western Bay of Plenty</td>
<td>42075</td>
<td>18510</td>
<td>673</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Some general comparisons can be made between the results of this study and the results in the 2005 Pilot Report. For instance Pukehina Beach still has the highest number of dwellings within the Primary hazard zone and the western Bay of Plenty district still has the highest percentage of dwellings within the primary hazard zone (56%) and within the coastal hazard zone overall (48%). In the 2005 Pilot Report, Pukehina had the highest number of dwellings within the total hazard zone, whereas Ohope Beach now has the most dwellings at risk. This is probably related to the Beachpoint Apartments and Waterford Estate subdivision as described earlier in this report. This is an example however of how comparison with past studies, will show how risk has changed.
3.2.3 CHRI-6 Number of residential lots in coastal hazard zones from the DCDB at a date close to the most recent aerial photography

The number of residential lots within a coastal hazard zone (Table 3.9, Figure 3.9) varies across the region as with indicator 5. All of the coastal communities have lots in the primary and secondary zones but again Pukehina Beach is the only community that has more residential lots in the primary hazard zone than in the secondary hazard zone. Just as with indicator 5, Mount Maunganui has the least amount of residential lots in a coastal hazard zone (66) but Ohope has the most this time (445).

The residential lots within each hazard zone were difficult to calculate at Ohope Beach because the primary zone is for erosion hazard only. Therefore for the purposes of this study, residential lots within the primary erosion zone were counted as being in the primary zone, and then all residential lots within the secondary erosion hazard zone were added to all residential lots within the inundation zone. To be sure these were not doubled up the location query was used. Additionally there are a number of residential lots at eastern Ohope Beach that are within the inundation and erosion hazard zones but only because of their close proximity to the Harbour. Therefore, as this project looks at coastal hazards, these were excluded from the following analysis. A total of 430 residential lots were within the inundation hazard zone around at the Harbour at Ohope.

Table 3.9 Residential lots in a coastal hazard zone in the Bay of Plenty

<table>
<thead>
<tr>
<th>District</th>
<th>Number of Residential lots</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primary Zone</td>
<td>Secondary zone</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Waihi</td>
<td>128</td>
<td>220</td>
<td>348</td>
<td></td>
</tr>
<tr>
<td>Mount</td>
<td>49</td>
<td>66</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>Papamoa</td>
<td>90</td>
<td>130</td>
<td>130</td>
<td></td>
</tr>
<tr>
<td>Pukehina</td>
<td>268</td>
<td>88</td>
<td>357</td>
<td></td>
</tr>
<tr>
<td>Ohope</td>
<td>63</td>
<td>445</td>
<td>445</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>598</td>
<td>949</td>
<td>1346</td>
<td></td>
</tr>
</tbody>
</table>
Figure 3.10  The number of residential lots within a coastal hazard zone in the Bay of Plenty.

In total there are 1,346 residential properties that are at risk of erosion and flooding in the Bay of Plenty (excluding those in the Opotiki District). The majority of these lots are within the Whakatane and Western Bay of Plenty districts (Figure 3.11).
Figure 3.11  Percentage of residential lots within a coastal hazard zone for each district.

Residential lot data from earlier years was not obtained for this study, therefore no comparisons with earlier years or the 2005 Pilot Report can be made. Likewise, residential zoning layers were not available for the Opotiki District and therefore no calculation of residential lots at risk to coastal hazards was made.
Chapter 4: Conclusions

This is the first time the coastal hazard risk indicators have been used for their intended purpose since they were developed in 2003. This study utilises the indicators to successfully undertake a baseline assessment of coastal hazard risk in the Bay of Plenty region.

4.1 Indicator results for 2007

4.1.1 District overview

**Western Bay of Plenty district**

WBOPDC has adopted hazard zones and subsequent rules and polices in place to manage coastal hazards and reduce risk.

Setback distances at Waihi Beach were evenly distributed between 10 and 100+ m and Waihi Beach had the lowest minimum setback (tied with Pukehina). Over 50% of all the residential lots and dwellings within the coastal hazard zone at Waihi Beach were in the Primary Hazard Zone. Based on the results of this study, Waihi Beach has 28 houses adjacent to a river or stream within a coastal hazard zone and an average setback distance of 23 m.

Setback distances at Pukehina Beach were also evenly distributed between 10 and 100+ m and Pukehina had the lowest minimum setback (tied with Waihi). The majority of dwellings and residential lots within the coastal hazard zone were in the primary hazard zone.

Western Bay of Plenty district had the highest number of residential dwellings at risk to coastal hazards in the Bay of Plenty region with over 55% of these located within the Primary Hazard Zone. The Western Bay of Plenty District has the second highest population of the four districts in this study.

Based on the results from this study, this district exhibits the highest level of coastal hazard risk of all four coastal districts in the Bay of Plenty region. When this study is repeated in the future, this baseline data can be compared with new data to determine if the operative coastal hazard rules and policies are sufficient to ensure total physical risk is not increasing.

**Tauranga City district**

TCC has adopted hazard zones and subsequent rules and polices are in place to manage coastal hazards and reduce risk. These policies include relocation conditions.
The setback distances at Mount Maunganui were concentrated around 20-50 m. Mount Maunganui had the least number of dwellings and lots at risk to coastal hazards.

In comparison, Papamoa Beach had the lowest average setback distance and setback distances concentrated around 10-60 m. Over 50% of all the dwellings and residential lots at risk to coastal hazards at Papamoa were within the primary hazard zone.

Overall, the Tauranga City district had the lowest number of dwellings (197) and residential lots (196) at risk to coastal hazards of all the districts in the Bay of Plenty region. Considering Mount Maunganui and Papamoa beaches are heavily populated, the number of dwellings at risk was very low when compared to other districts.

Based on the results from this study, the Tauranga City district has the lowest physical risk to coastal hazards of all four coastal districts in the Bay of Plenty region.

**Whakatane district**

WDC is currently in the process of adopting hazard zones and subsequent policies which include relocation conditions.

Ohope Beach was the only coastal community included in this study that was within the Whakatane district. Ohope Beach had the highest average setback and setback distances ranged from 30-100+ m. Ohope Beach had the highest number of dwellings at risk to coastal hazards of all the coastal communities. Ohope Beach was the only coastal community with no dwellings within the primary hazard zone. Based on the results of this study, Ohope Beach has 22 houses adjacent to a stream within the coastal hazard zone and an average setback from the streambank of 25 m.

**Opotiki district**

ODC are currently in the in the process of adopting hazard zones and subsequent policies which include relocation conditions for the Ohiwa Spit only.

The two areas surveyed in this study, East Coast 1 and Coast 2 have high average setback distances. The setback distances range between 10-100+ m although for East Coast 1 the majority of setback distances are over 100 m. These areas have low numbers of dwellings within the coastal hazard zone.

Based on the results from this study and those obtained in the 2006 Census, over 3.5% of all dwellings within the Opotiki District are at risk to coastal hazards but no legal coastal hazard zones or policies are established for the majority of its coastline. Instead the Opotiki District Council have based assessments on the ASCH set out in the 2003 Bay of Plenty Operative Regional Coastal Environment Plan and site specific analyses (where necessary), for restricting activities within areas at risk to coastal hazards and reducing risk. Eco Nomos (2007) were contracted by ODC and Environment Bay of Plenty to define coastal hazard zones in the Opotiki district. This work provided an in-depth study of coastal hazards and vulnerability of beaches and settlements in the Opotiki district.
A comparison of the ASCH with the suggested inundation and erosion hazard zones defined by Eco Nomos (2007) and Blackwood (2008), show multiple instances where the ASCH has under predicted a particular area’s sensitivity to coastal hazards and thus under predicted the risk to coastal hazards. A full set of these instances can be seen in Appendix 3 but an example is shown in Figure 4.1. Almost ten dwellings are just outside the ASCH but are within the defined inundation lines. Given that there are multiple occurrences such as this in the Opotiki District, there are high numbers of houses and properties currently at risk to coastal hazards in the Opotiki District that are not covered by the ASCH policy. New activities in some of these areas may be required to supply site specific coastal hazard assessments, but a more uniform alternative may be to adopt hazard zones for the district.

![Figure 4.1](image.png)

An example of the discrepancies between the ASCH and the drawn hazard lines as given in Eco Nomos (2007) and Blackwood (2008). Yellow lines define the extent of the ASCH.

### 4.1.2 Comparison with 2005 Pilot Report results

In the 2005 Pilot Report, only two of the four councils in the region had identified hazard zones in their plans which resulted in coastal hazard risk only been addressed in four of the 12 areas of concern across the Bay of Plenty (Waihi, Pukehina, Mount Maunganui, and Papamoa). The 12 areas of concern highlighted in the 2005 Pilot Report were:

- Waihi, Mount Maunganui, Papamoa, Pukehina, Matata, Piripai, Ohope, Ohiwa Spit, Waiotahi, Hikuwai, Tirohanga, and Opape.
The 2009 study has shown that coastal hazard risk has been addressed at the first eight of the 12 areas which is a significant improvement. The remaining four areas are all within the Opotiki district.

The comparison of setback results between the 2005 Pilot Report and this study at Ohope Beach, show that the average setback distance remained the same but the number of dwellings at risk to coastal hazards has increased. A conclusion could be drawn, based on these results that the total physical risk at Ohope Beach has increased. However the photography used in the Pilot Report and in this report as a historic comparison, was taken in 1999 and the RCEP (with its coastal hazard policies and methods) did not become operative until 2003. Hence although there are more dwellings at risk now, this does not reflect on the effectiveness of the RCEP to ensure there is ‘no increase in total physical risk from coastal hazards’.

4.2 Effectiveness of indicators

The policy indicators (CHRI-1, CHR-2 and CHR-3) are easy to use and the information needed for them is readily available. However, they will be redundant once all four territorial authorities have adopted hazard zones and policies. When this happens these three indicators may need to be reviewed but in the meantime they are sufficient as they are.

It should be noted that the variation in methodologies used by the city and district councils for defining coastal hazard zones makes it difficult to undertake a comparative analysis for indicators 4, 5 and 6. This may be remedied in the near future with the current development (through the Envirolink tools programme) of the Coastal Hazard Assessment Guidance Manual, which will develop a uniform approach for defining hazard zones for regional councils and the territorial authorities.

Indicator 4 is effective at providing data on the setback distances and, in the next report, it will be easy to assess whether or not setback distances have increased or if dwellings have been extended seaward.

Indicator 5 is a very effective and valuable indicator. It can be digitised quickly and results are obtained easily using the location queries. However, extra time is required in some instances when determining whether a structure is a dwelling or not. When this study is repeated in the future this indicator will allow for a quick and simple assessment of risk in relation to coastal hazard policy.

Indicator 6, the number of residential lots within a coastal hazard zone, is not entirely effective as most residential lots are included in both the primary and secondary zones. But this data will still be useful in the future to assess whether or not the number of lots and thus the risk from coastal hazards has increased.

Indicator 7 was a trend indicator in the 2005 Pilot Report. Trial results of all the trend indicators suggested that they required collating of consenting information and adopting information sharing protocols. The 2005 Pilot Report stated that no recommendations could be given for the trend indicators.

As highlighted in section 3.1.4, the Environment Bay of Plenty District Consents Database lacked the necessary information to ensure CHRI-7 could be employed as it was supposed to be. As this is an Environment Bay of Plenty project, the onus should not be on the territorial authorities to individually supply the necessary information for this indicator every three years.
However, Indicator 7 can still be a functional and useful indicator. Further informing the territorial authorities on the aims, purpose and information requirements of the indicator and setting up information sharing protocols between the four territorial authorities and Environment Bay of Plenty will alleviate the majority of issues for this particular indicator.

If procedures are put in place to collect this information over the three years between surveys then the correct data should be available for collation every time this study is repeated. The number of consents for residential houses within the CHZ and their consent conditions should be relatively easy to extract from the Environment Bay of Plenty database if district consent applications and their decisions are received and entered into the database. This task will be managed by the District Applications Officer.

4.3 Summary of conclusions

- Excluding the East Coast, Ohope had the highest average setback distance of 72 m and Papamoa had the lowest distance of 26 m. Waihi and Pukehina beaches shared the lowest minimum setback distance of 11 m.

- In total there are 1,401 residential dwellings within a coastal hazard zone in the Bay of Plenty region. Excluding the East Coast over 35% of these dwellings are in a primary hazard zone.

- Ohope Beach is the only coastal community that has no residential dwellings within the primary coastal hazard zone. Pukehina Beach is the only community that has more dwellings in the primary hazard zone than in the secondary hazard zone.

- The coastal community with the least amount of dwellings within a coastal hazard zone is Mount Maunganui the coastal community with most dwellings within a coastal hazard zone is Ohope.

- Western Bay of Plenty district has the highest level of risk associated with coastal hazards whereas Tauranga City Council has the lowest level of risk from coastal hazards.

- All of the indicators have proven effective in analysing risk except for CHRI-7. The information and methodologies for all other indicators is readily available and straightforward to collect. For CHRI-7 to be useful, education and information sharing protocols need to be established between all the territorial authorities and Environment Bay of Plenty.
References


Hill Young Cooper Ltd & Eco Nomos Ltd., 2003: Coastal Hazard Risk Indicators. Report to Environment Bay of Plenty. 77 p.

Iremonger, S. & Stringfellow, M, 2000: Summary of the ‘TOF’ project to measure the position of the toe of the foredune along the Bay of Plenty coastline. Environment Bay of Plenty Internal Publication 2000/06.


Appendices

Appendix 1.................................................................Rules for digitising indicators 4, 5 and 6
Appendix 2.................................................................Description of ArcMap® layers used
Appendix 3.....................................................Areas within the Opotiki district where the ASCH has under predicted coastal hazard susceptibility
Appendix 1 – Rules for digitising the coastal hazard risk indicators 4, 5 and 6

1 Defining dwellings

A blue ‘dwelling’ point was placed on any building deemed to be a dwelling (whether that be permanent or a holiday home) that was within the respective district council’s coastal hazard zone, including both inundation and erosion zones, or any dwelling that’s roofline intersected the hazard line at a zoom scale of 1:300. The dwelling point was placed typically on the centre of the footprint of the dwelling. However, where the respective hazard line intersected the roofline of the dwelling the point was placed seaward of the line so the dwelling was included (Figure 1).

Figure 1 The placement of a dwelling point when the CHZ intersects the footprint of the building.

To define a dwelling, size, shape and location were all assessed. If it was questionable whether a building was in fact a dwelling, then the building was assigned a query point. The property details for the queried lot were then researched using the Valuation New Zealand (VNZ) and Quotable Value (QV) databases to see how many, if any, dwellings were registered for a particular property. If this provided no clarity then the dwelling/property was marked for ground-truthing and checked via a field trip.
Generally dwellings were easy to identify but sometimes it was unclear whether a building was a dwelling or in fact a garage, shop or a shop with a dwelling above. Garages were not included as dwellings and were typically distinguished by looking at access, cars parked outside, overgrown trees, and size etc. Ground-truthing was also used to identify garages.

Dwellings that appeared to be in construction were included as dwellings if the footprint of the building was obvious.

Any dwelling that possessed marked or multiple car spaces on the adjacent road or within the property was also assigned a query point to check whether this was a shop or other type of building such as a surf club. Any shops or commercial buildings typically showed up when cross referencing the VNZ and QV databases but when ground-truthing the author checked these also.

Similarly multiple carparks, entrances or multiple building footprints such as those seen in Figure 2, were often indicative of a hotel, townhouse or apartment type complex. These were also checked with VNZ and QV databases and if need be, checked by ground-truthing or by ringing the complex, if commercial, to check the number of privately owned units. Any hotel units or apartments that were not privately owned were not included as dwellings.

![Figure 2](image_url)

**Figure 2** The red outlined parcel shows examples of buildings that have multiple car parking spaces and more than one privately owned dwelling within each building footprint.
Where the respective hazard lines intersected a multi-complex building, the building footprint was used to ascertain how many dwellings were in the CHZ’s. Typically the VNZ database was checked first to establish how many private dwellings there were in each building footprint. If the VNZ database could not clarify this then the property was investigated via ground-truthing. The number of mailboxes and numbering of the apartments/units etc was used to ascertain how many dwellings were on each property and thus how many were in each hazard zone.

There was one exception to this; the Beachpoint Apartment complex at Ohope. The coastal erosion hazard line cut right through the building and it was difficult to tell how many of the total 42 apartments within the complex were seaward of this line. The building plans from the original consent file for this building were thus scanned and rectified in ArcMap® and the number of apartments in the coastal erosion hazard zone obtained this way, as shown in Figure 3. This was the only instance where this method was used region wide as no other coastal community, to the author’s knowledge, had hazard lines cutting through large apartment complexes.

![Figure 3](image)

**Figure 3** The building plans for Beachpoint Apartments Ohope overlain on the map project. This allowed the number of apartments within the CHZ (blue line) to be calculated.

After this a series of location queries were carried out to ascertain how many dwellings were within each coastal hazard zone at each coastal settlement. For this indicator it worked best to search for dwelling points that ‘have their centroid in’ the respective hazard zone.
Calculating setback

Setback was measured as the distance in a straight line from the most seaward corner of the most seaward dwelling within the coastal hazard zone within each property parcel, to the TOF. The most seaward point of the dwelling is defined as the most seaward point of the roofline and not the decking, where it was possible to differentiate. The drawn setback line intersected the TOF and was always drawn perpendicular to this line. Where possible the line was kept parallel with the adjacent property boundary line (Figure 4).

![Figure 4](Image)  Depicting the method in which coastal setback was calculated.

Further, the line was taken from the most seaward point of the main dwelling, so any small buildings such as sheds or sleep-outs, or obvious garages seaward of the main dwelling were excluded. Where there were obviously two dwellings on one property parcel, the most seaward dwelling was chosen to measure setback.

There were some instances of gaps in the TOF and multiple instances of unrealistic or erroneous data. Where there was a gap in the TOF point data, the TOF datum was assumed to continue in a straight line between two known points. When the TOF line presented unrealistic or questionable data points, such as those seen in Figure 5, these erroneous points were removed and the line was smoothed and again, assumed to continue in a straight line between two realistic points.
Figure 5  An example of where TOF points (orange) and line (orange) display erroneous data and thus the Toe of the Foredune line is smoothed (black dotted line).

After the setback distances were digitised for each coastal community, the setback lines were then clipped to the TOF so they were accurate. First of all the TOF was traced and made into a polygon layer, extending landward of the TOF. This allowed all the setback lines that extended over the TOF to be shortened precisely to that line, giving a more accurate setback distance (Figure 6).
3 Streams/rivers

Property lots that are adjacent to streams are influenced by the hydrodynamic interaction of the stream and the coastal environment. The result of this interaction is the migration of the stream bed. Therefore, properties located adjacent to such an environment need to be noted.

The setback was measured for every dwelling within a coastal hazard zone that shared a property boundary with the river or for dwellings that were within the coastal hazard zone and shared a property boundary with an empty residential lot which bordered the river or stream (Figure 7).

The setback lines were drawn from the corner of the dwelling closest to the riverbank and the setback line intersected the riverbank datum line at a right angle and was drawn to the closest section of the river.
4 Establishing the number of ‘residential lots’ in the CHZ’s

The relevant council zoning layer was obtained and merged with the property parcel layer then all parcels that were assigned a zoning other than residential were deleted.

After this it was simply a case of running a series of location queries to ascertain how many lots were within each coastal hazard zone. For this indicator it worked best to search for lots that ‘have their centroid in’ the respective hazard zone. There are too many properties that ‘intersect’ (Figure 7).
Figure 8  The residential properties at Waihi Beach (Shaded light blue). The residential properties that have their centroid in the Secondary Coastal Hazard Zone have been highlighted (aqua).
Appendix 2 – Description of layers used

**Toe_of_Foredune_2000_Bay**

There is both a line and a point feature class with this name. These layers were interpolated from the previous point data set and represents the TOF.

**Toe_of_Foredune_2000_[name]**

This is a polygon feature class and represents the TOF in a particular coastal community. A polygon was necessary in order to provide an accurate area to clip setback lines within. There should be a layer like this for Waihi, Papamoa and Mount Maunganui, Pukehina, Ohope and East Coast 1 and 2.

**Setback_[name]**

This is a line feature class and represents the digitised setback distances from the most seaward corner of a dwelling, to a point seaward of the TOF. The name will be the coastal community which the layer relates to.

**Setback_Clipped_[name]_[year]**

This is the same as the previous layer but the seaward extent of the setback has been clipped to the TOF to give a more accurate setback distance. The name will be the coastal community which the layer relates to and the year represents the photography in which the layer was digitised off.

**Riverbank_Datum_[year]_[name]**

This is a line feature class and represents the riverbank digitised off the 2007 high resolution aerial photography. The name will be the coastal community which the layer relates to and the year represents the photography in which the layer was digitised off. This datum is only applicable to Waihi and Ohope beaches.

**River_Setback_[year]_[name]**

This is a line feature class and represents the digitised setback distances from the most river-ward corner of a dwelling, to the Riverbank_Datum_2007 Line. The name will be the coastal community which the layer relates to and the year represents the photography in which the layer was digitised off.

**Dwellings_[name]_[year]**

This is a point feature class and represents every dwelling that is within a coastal hazard zone in the Bay of Plenty. The name will be the coastal community which the layer relates to and the year represents the photography in which the layer was digitised off.

**[name] Planning Zones**

This is the district planning zones as obtained from each council. The name relates to the relevant district the zones are for.
**Residential_Lots_[name]_[year]**

This is a polygon feature class that was created by forming a union of the relevant council’s planning zones and the property parcel layer. The name will be the coastal community which the layer relates to and the year represents the photography in which the layer was digitised off.

**Clip_Property_Line**

This is a line feature class that shows the location of the property parcel boundaries and has been clipped to the coastal Bay of Plenty area to save loading time in Arc Map.

**Queries**

This is a point feature class and represents any dwellings that were hard to classify or needed further investigating.

**HiResCoastWDC1**

This is the high resolution photography that was taken in 2007 and formed the basis of this study.

**Beachpoint Level [number]**

This is the floor plans for the Beachpoint Apartments at Ohope Beach that were scanned in to assess how many of their units were within the Coastal Hazard Zone.
Appendix 3 - Areas within the Opotiki District where the ASCH has under-predicted coastal hazard susceptibility as given in Eco Nomos (2007) and Blackwood (2008).

For all figures the yellow line marks the seaward and landward extents of the ASCH. The dark blue line marks the landward extent of the Eco Nomos erosion zone. The light blue line marks the extent of the Blackwood inundation zone(s).