17.0 Natural Hazards

17.1 Introduction

The Wairau/Awatere is potentially subject to a wide range of naturally occurring hazards. Earthquakes, tsunamis, erosion, landslip, sea level rise, floods, sedimentation, wind, drought, fire, rain, hail and snowfalls can result in damage to private and community assets. In some cases human life will be at risk.

Of those hazards, flooding has historically been given the most attention even though the effects of other hazards can be equal to or more severe than flooding.

Natural hazards are commonly analysed in terms of magnitude-frequency concepts, whereby events of differing size (= magnitude) are assigned estimated average exceedence intervals (= frequency). As an example the 100 year flood level will be exceeded on average once in every 100 years. Because this is a statistical average only, more than one such event can occur in any 100 year interval. Note also that because the flood frequency relates to the so called 100 year flood being exceeded, such an event can be much larger and still be in accordance with statistical expectations. The 100 year frequency is often used in the assessment of risks when dealing with natural hazards. Below is a simplified hazard evaluation for the Wairau/Awatere.

Simplified Hazard Evaluation for the Wairau/Awatere Likely Exceedence Interval		
Hazard Category	Less Than 100 Years	Greater Than 100 Years
Meteorological	Climate change. Extreme storm event (rain or wind). Major drought in part of area. Snow.	Long-term climatic change.
Flooding	Severe flooding in any river system. Stopbank failure in many river systems. Local flooding due to intense rainfall in low-lying areas.	Breach in Wairau stopbanks (flooding in Blenheim, Spring Creek, Grovetown, Tua Marina). Stopbank failure in other river systems.
Coastal	Severe storm erosion of beaches. Continuing cliff and shoreline retreat. River-mouth/spit tip changes. Possible sea level rise due to "Greenhouse Effect".	Major tsunami damage along coast. Long-term sea level and storm pattern changes.
Landslide	Severe rainstorm-generated landslides in any catchment. Localised earthquake-generated slope failures and/or ground subsidence.	Large earthquake-generated rock avalanches. Earthquake-generated rockfalls upland and liquefaction in lower Wairau, Rarangi.

Simplified Hazard Evaluation for the Wairau/Awatere Likely Exceedence Interval		
Hazard Category	Less Than 100 Years	Greater Than 100 Years
Seismic	Ground shaking and local damage to small magnitude (M_L<6.0) event within District, or to large magnitude (M_L>6.0) event outside the District.	Ground rupture on Wairau Fault or Alpine Faults with accompanying large magnitude (M_L>6.9) earthquake effects in Blenheim. Subsidence or raising of land resulting in change to drainage pattern and potential flooding from rivers or sea.
Note: *Major forest fires in rural areas are excluded from classification, but can be expected to have a recurrence interval of less than 100 years.*		

17.2 Meteorological

17.2.1 Issue

Adverse effects arising from extreme meteorological events.

There are a number of meteorological events which have the potential to cause damage and destruction and for which little can be done. These hazard events which warrant consideration are damage by snowstorms, windstorms and drought.

Windstorms can result in damage to exotic forests and structures, stock losses (in conjunction with heavy precipitation) and loss of topsoil (losses of up to 5 tones/hectare have been calculated in extreme events). Dealing with the effects of windstorms requires appropriate responses in terms of structural standards for wind loading and emergency preparedness. Further research is required to assess actual damage that occurs in this part of the district due to extreme wind to determine the value of developing mitigation strategies.

Snowstorms can result in large stock losses, damage to horticulture and disruption of road, rail and other communication systems.

Drought may be defined in many different ways. Easiest of all is by applying the concept of "lack of rainfall". If agriculture is the primary concern then "soil moisture deficit" might be a more appropriate measure. In a hazards context, the way in which a population is able to adjust to drought potential is a factor of importance when considering the question of risk and need for a response. Nevertheless the impacts of severe droughts are generally widespread and the cost to the district often becomes difficult to separate from the cost to the Country. The greatest losses usually occur in agriculture and power generation.

Because drought develops relatively slowly, is long lasting and often widely dispersed in extent, the range of immediate and appropriate options is limited. The most pressing need is for improved forecasting for both seasonal and several year time scales, and the use of this information. Such information should be built into strategic management strategies such as water storage and augmentation schemes and the encouragement of flexible agricultural regimes.

17.2.2 Objectives and Policies

Objective 1	To avoid, remedy or mitigate the adverse effects of extreme meteorological events.
Policy 1.1	Adopt measures which are cost/benefit efficient.
Policy 1.2	Adopt measures which are based on sound information.
Policy 1.3	Adopt measures which in themselves do not give rise to adverse environmental effects.
Policy 1.4	Adopt equitable measures when the solution relies on remedial steps to be taken, as is the case when water rationing is implemented.

Through increased knowledge of hazards, Emergency Response, engineering responses and the application of the Resource Management Act, the community is now better placed than it has ever been to respond to the effects of natural hazards. Nevertheless measures adopted need to be cost effective and equitable.

17.2.3 Methods of Implementation

Rules	Plan rules will be used to ration allocatable water during periods of drought. Plan provisions encourage the storage of water.
Research	The Council will conduct research into previous meteorological events and assess the costs to the district of severe events. The Council will conduct research into effective forecasting methods.
Liaison	The Council will liaise with government agencies to ensure observation networks are maintained so that the frequency of severe events may be better defined and the impact of significant events better determined.
Emergency Response	The Council will maintain emergency procedures in association with Emergency Response.
Education	The Council will develop and provide material on methods to avoid or mitigate the effects of severe meteorological hazards.

Appropriate responses vary for different types of meteorological hazards. Controlling the natural event is generally not possible except for hazards like snow avalanches and flooding which are indirect results of meteorological events, but even for these, this approach should not be totally relied upon. Only a few of the hazards discussed are amenable to the use of rules in Plans. Consequently for meteorological hazards, there is heavy reliance on forecasts and warnings, emergency preparedness and ultimately loss bearing responses such as subsidies, insurance and public relief.

17.3 Flooding

17.3.1 Issue

Effects from flooding and erosion are major hazards, especially on the main Wairau floodplain where extensive river channel modification and other river control works have been carried out.

Over the 100 years or so since river works were commenced on the Wairau floodplain, vast amounts of money have been spent to create the present river system for the prime purpose of flood control. Since the 1950's alone, over $80 million in present terms has been spent - mostly with a high degree if success and benefit in the prevention of catastrophic flooding. The Wairau is the most powerful river in New Zealand for which a comprehensive river control scheme has been carried out.

It is not possible to reverse these works and the Council and its ratepayers have a responsibility to at least maintain the current 'artificial' river pattern; or improve it to an appropriate standard.

In particular the location of rivers has been changed by construction of diversions, or by blocking off alternative outlet channels. These diversions and blockages have meant that every river channel or floodway on the Wairau floodplain below the Waihopai confluence (Rural 3 Zone) is carrying a different flow regime or in a different position (or both), and usually substantially different from what it did prior to European settlement. The major rivers of this Wairau floodplain have an integrated contiguous stopbank system.

The most significant of these works is the blockage of the Opawa distributary channel from the Wairau. This has increased flood flows down the mainstem Wairau by typically 50%. This has subsequently required substantial river control works on the mainstem Wairau - including the Wairau Diversion - to cope with these increased flood flows.

It has also allowed development of Blenheim to go ahead without the regular flooding from the Wairau. More recently it has also allowed much of the land of the Upper Opawa channel to be developed for viticulture within a narrowed floodway.

By 1991 the flood control standard achieved was capable of withstanding floods to a 1 in 30 year return period frequency over almost all of the floodplain.

For other Wairau tributaries outside the floodplain the river control works that have been carried out are to much lesser standards. The majority of the work has been channel clearing and bank edge protection to prevent erosion and generally do not include contiguous stopbank works.

Few river control works have been carried out for rivers outside the Wairau catchment.

17.3.2 Objectives and Policies

Objective 1	**To minimise potential for loss of life and damage to property in the main Wairau floodplain (Rural 3 Zone) downstream of the Waihopai confluence.**
Policy 1.1	To maintain and upgrade to a uniform high standard the existing highly modified floodway systems as the primary mechanism of mitigating against the flood hazard.
Policy 1.2	To attain a floodway capacity and standard of protection for flood sizes up to a 1 in 100 year return period for the major rivers on the floodplain.
Policy 1.3	To provide and maintain a network of constructed channels and structures to remove local stormwater (and drainage water) and dispose of it into the major river floodways.
Policy 1.4	Not locate houses and structures where damage could occur because of the effects of flooding where the flood standard in Policy 1.2 cannot practically be achieved.
Policy 1.5	Define areas on suitable maps where a significant flood hazard exists and flood paths of extraordinary floods.
Policy 1.6	Avoid locating urban or industrial development on flood path areas of extraordinary floods.
Policy 1.7	Provide heavy rainfall and flood warnings and emergency flood response procedures.

Objective 2	**Management of areas outside the main Wairau floodplain that are susceptible to flood hazards so as to mitigate damage to property and infrastructures and to avoid loss of life.**
Policy 2.1	Locate houses and structures to avoid damage from the effect of the flood hazard.
Policy 2.2	Maintain river channel efficiency and protection works where the benefits outweigh the costs.
Policy 2.3	Define areas at risk from significant flood hazard as information becomes available.
Policy 2.4	Provide heavy rainfall and flood warnings and emergency flood response procedures.
Policy 2.5	To minimise bedloads of floodways by encouraging retirement of badly eroding areas of the mountain lands.

The river works and floodways that have been imposed in the past on the Wairau floodplain rivers have completely altered them from their 'natural' state. The rivers are impossible to return to their former state. The Council, as river authority, now has the responsibility of at least maintaining the current river pattern to enable them to pass

flood flows safely. There is no 'do nothing' option, and the economics of undertaking river control works on the main Wairau floodplain are a secondary issue.

On the Wairau floodplain, works need to be built to control at least to a standard of a 1 in 50 year return period event to achieve the specified standard of the Building Act. Most urban areas of New Zealand have higher standards, a 100 year return period event being a common standard. Furthermore, some of the works, cannot sensibly be designed to a lower standard than a 1 in 100 year period event.

The inter-related nature of the floodways and the floodplain areas at risk means that it is appropriate to have the same standard for all main floodplain rivers, except for some isolated pockets of identifiable flood prone land.

Most of the Wairau floodplain is protected from floods in the major rivers up to 1 in a 100 year return period event. Exceptions to this are:

- *Within the stopbanked floodways of the rivers;*
- *Riparian margins of non-stopbanked tributaries;*
- *Areas where river control works do not yet protect land to the intended standard; and*
- *Areas of ponded/gently flowing floodwaters where it is not economically feasible to construct flood protection works.*

These areas on the Wairau floodplain are depicted by a flood hazard overlay. The degree of hazard within this hazard overlay is site specific and varies from location to location.

A flood hazard overlay is not drawn for areas outside the Wairau floodplain because of a lack of information on the flood hazard.

Urban and industrial areas can have particularly high flood losses and any further expansion of such areas should be planned so as to avoid the flood breakout paths of extraordinary floods.

Flood losses can also be reduced by timely warnings and emergency actions.

Local stormwater also causes significant nuisance on the lower plains, which has been worsened by high stopbanks on the major rivers inhibiting drainage.

Outside the main Wairau floodplain the benefit of carrying out structural protective works is lower and the costs of full protection often outweigh the benefits.

17.3.3 Methods of Implementation

Council Activities	Maintain and improve river control works on the major rivers as detailed in a suitable comprehensive integrated engineering plan.
	Maintain and improve a network of constructed channels and structures to deal with local stormwater (and drainage) as detailed in a suitable comprehensive engineering plan.
	Encourage retirement of eroding mountain lands.
	Prepare a flood response manual regarding emergency procedures during flood occurrences in association with Emergency Response.

Zoning	Zone land within the floodways and identify land on which significant flooding is known to occur as a flood hazard area with appropriate rules.
Designations	Floodway land will also be designated as required for river control works so as to control activities such as tree planting which might impair the functioning of the floodway.
Rules	For defined flood hazard areas rules will be used to ensure damage from the flood hazard is avoided by sensible location of structures outside the identified area or, to minimum floor levels.
Monitoring	Monitor the performance of the floodway system by measuring size of floods, recording flood levels along banks, inspecting banks for erosion damage and survey of flood events, especially following major floods. Regularly re-survey river channel bed levels and re-analyse the effects of changed channel conditions on waterway capacity. Use monitoring information to review expected flood size from time to time.
Information	Develop an information database relating to the location and extent of the flooding hazard.
Education	Promote community understanding of the severity of the flood hazard on the Wairau floodplain, of Wairau tributaries and other flood prone rivers.

The historical modification for flood control purposes of the inter-related watercourses of the Wairau floodplain (below Waihopai confluence) is irreversible. The maintenance and upgrading of the river control floodways has to remain the primary method to reduce the flood hazard here. This is a public work that has to be done by the Council to a comprehensive and integrated plan.

Even so there will be identifiable areas on the floodplain where the costs of flood control works exceed benefits and flood hazard avoidance measures are preferable.

The efficient and effective operation of the floodways, many of which are on private land, may be compromised by activities of other parties. Defining acceptable activities within defined floodway zones will help maintain floodways to an effective standard.

Outside the main Wairau floodplain the costs of structural flood hazard avoidance measures usually exceed the benefits. Here the location of houses and structures where they will not be damaged will be a more effective method of reducing loss and sustaining development.

An information base on the frequency, location and extent of the flood hazard is required in the design of the Council flood control works; in the delineation of flood hazard areas and in rules for flood hazard areas and other zones.

17.4 Coastal Hazards

17.4.1 Issue

Natural hazards can compromise human wellbeing and safety and cause damage to habitat, amenity values, property and infrastructure.

Hazards can be aggravated by inappropriate land use management practices and activities.

Climatic Change

During the last decade there has been increasing evidence that a concentration of "greenhouse" gases in the earth's atmosphere may be changing the world's climate. In the coastal marine area most of the focus has been on the effect of sea-level rise, however for East Marlborough Coast the greatest impact may be due to an increased frequency or size of storm events.

Historically sea-level rise has been minimal around New Zealand. Along the East Marlborough Coast the continual sediment movement and seismic activity has countered any sea-level rise with many of the gravel sections continuing to grow seawards. This is expected to occur if sea-level rise continues at approximately the same rate. This may not be the case though for the Wairau Lagoons.

The stopbanks constructed around the Lagoons will limit the natural migration of the wetlands and inundation of the drier areas of the lagoon may occur. Provision could be made to allow for the natural migration of the estuaries and wetlands in the event of sea-level rise but this may be inappropriate for the Wairau Lagoons because of the developed nature of the area behind the stopbanks and the importance of the stopbanks for flood protection.

Changes in the frequency and size of storm events may alter sediment movement and result in areas of increased erosion and/or marine inundation. The possibility of this occurring has not been studied for the Marlborough area but, as many of the gravel beaches along the coast have the ability to rapidly replenish themselves after storm events, moderate storm events are not perceived to be a major issue. Catastrophic events could, though, result in the penetration and/or destruction of the banks fronting the Wairau Lagoons and Lake Grassmere. This could result in the formation of large shallow embayments.

Seismic Activity and Tectonic Movement

The East Marlborough region, especially the Wairau Valley, is a very active seismic area and contains the Wairau, Awatere and Ward faults. Seismic activity can result in a number of different natural hazards including inundation by the sea, salt water intrusion into freshwater aquifers, and tsunamis.

The 1848 earthquake was a particularly large earthquake resulting in subsidence of the sediment in the Wairau Lagoons by up to 1.5m, thus enlarging them considerably.

South of White Bluffs the tectonic movement has been historically upwards with more rapid uplift south of Cape Campbell. This trend is expected to continue. However, sudden subsidence could result in marine inundation of Lake Grassmere.

Tsunami

Tsunamis are large waves triggered by earthquakes, landslides, underwater slumping or underwater volcanism. Tsunamis can result in marine flooding of large areas of land with its associated impacts.

Tsunamis in this area may result in marine inundation of the Rarangi settlement, low-lying farm lands, Lake Grassmere and the Wairau Lagoons. The frequency or size of tsunamis and the extent of inland flooding has not been estimated and would be very difficult to quantify.

17.4.2 Objectives and Policies

Objective 1	**Management of areas prone to coastal hazards to avoid loss of life, and avoid or mitigate damage to property, infrastructure and the environment as a result of the occurrence of natural hazards.**
Policy 1.1	To assess the likely need for coastal protection works when determining appropriate subdivision, use or development in the coastal environment and where practicable avoid those for which protection works are likely to be required.
Policy 1.2	The ability of natural features and systems to provide a natural defence to coastal hazards, including erosion, inundation and sea level rise, should be recognised and the integrity of such features or systems be protected where appropriate.
Policy 1.3	To avoid developments or other activities that are likely to interfere with natural coastal processes including erosion, inundation, except as provided for in Policy 1.5.
Policy 1.4	To monitor and research coastal processes and the extent to which they constitute a hazard.
Policy 1.5	To allow the establishment of coastal protection works only where: • The works are justified by a community need; • There are substantial capital works or infrastructure at risk; • Alternative responses to the hazard (including abandonment or relocation of structures) are impractical, impose a high community cost, or have greater adverse effects on the environment; • It is an inefficient use of resources to allow natural processes to take their course; and • Protection works will not generate further adverse effects on the environment or transfer effects to another location.
Policy 1.6	Provide warnings and emergency response procedures for areas at risk from or affected by predictable coastal hazards.

As previously noted no natural hazards directly affecting human activities presently occur along the coastline. The Council is in a position to maintain this and avoid any activities which may give rise to natural hazards or be affected by potential future hazards. To accurately establish the potential impacts of hazards and develop detailed policy, further research is required.

17.4.3 Methods of Implementation

Rules	Plan rules will be used to ensure that the effects of coastal hazards are a factor taken into account in the consideration of applications for coastal permits.
Research	The Council will conduct research into the potential effects of sea level rise and tsunami and record the hazard on the Council's Hazards Register.
Liaison	The Council will liaise with agencies conducting research into the effects of coastal hazards and will maintain emergency procedures in association with Emergency Response.
Education	The Council will develop and provide material and advice on mitigation of coastal hazards.
Monitoring	The Council will maintain an information base relating to the frequency and nature of coastal hazards.

Due to the undeveloped nature of the coastline the risk from natural hazards arising on the coast are relatively minor. Consideration should however, always be given to avoiding risk. Information describing the frequency and extent of potential natural hazards is an essential precursor to the community taking appropriate measures to minimise the threat of damage or danger.

The Natural Hazards Register will provide an information base detailing the risk of natural hazard occurrence.

A co-ordinated emergency response process will ensure that the community is warned about and is prepared for any known hazard occurrence.

17.5 Landslide/Soil Erosion

17.5.1 Issue

Danger to life and property from the effects of slope failure.

Slope instability involves ground failure by falling, sliding and/or flowage of material downslope, and may occur within bedrock or in the mantling soil. It is of concern in some parts because of the potential effects of earth movements to affect residential sites (Wither Hills, for example), rural areas/sites and, rivers and transportation routes.

In general, rainstorm, tectonic or other naturally generated slope failures are unlikely to require emergency services response unless accompanied by extensive flooding and/or pose a threat to a population centre. The fact that transportation corridors are obviously vulnerable to such events means that agencies have an important

obligation to carry out regular maintenance to minimise storm damage costs and closure times.

Although much is known about the different types of land failures which affect different parts of the Wairau/Awatere further research is required in order to develop a more comprehensive picture of the risks associated with different kinds of slope failures.

In particular research is required to establish:

- **Historical Data Base**

  Collation of records of past rainstorm-generated slope failures, with a view to gaining a better understanding of frequencies and triggering rainfalls.

- **Rainfall Records**

  The extreme variability in magnitude/frequency/duration for different parts of the Region requires assessment.

- **Threshold Moisture Levels**

  Determination of threshold soil moisture levels for the loessial soils of the Wairau Catchment is needed, with a view to providing emergency services warnings when widespread slope failures can be anticipated.

- **Landslide Hazard Zoning**

  The zoning of areas according to risk of slope failure is also required, with priority being given to the Wither Hills area because of the greater urban population involved.

- **Landslide Monitoring**

  Existing landslides which move in response to increases in soil moisture should be monitored on a regular basis to provide an improved data base, and to facilitate remedial measures.

- **Vulnerable Localities**

  Areas at risk from slope movement and extensive soil erosion hazards, specifically transportation routes and population centres, should be identified in consultation between Transit New Zealand, Tranz Rail and the Council.

17.5.2 Objectives and Policies

Objective 1	**Avoid loss of life, and avoid, remedy or mitigate damage to property and infrastructure as a result of slope instability.**
Policy 1.1	Locate works and structures to avoid their damage from the effects of slope instability.
Policy 1.2	Establish and maintain protection works designed to avoid, or mitigate the effects of natural hazards, where the benefits outweigh the costs.
Policy 1.3	Define areas at risk from slope instability, including sea level rise, within a Natural Hazards Register to assist future sustainable management of resources.

Policy 1.4	Provide warnings and emergency response procedures for areas at risk from or affected by slope instability.
Policy 1.5	Maintain a program for soil stability and vegetation in the Wither Hills area.

Objective 2	**Avoidance of activities which could increase the frequency, severity or potential occurrence of slope instability.**
Policy 2.1	Locate works and structures to avoid effects which increase the adverse effects of slope instability.
Policy 2.2	Avoid, remedy or mitigate activities, including earthworks and vegetation clearance, increasing the risk or occurrence, or potential to cause damage, of slope instability.

One of the major concerns with landslip hazards relates to damage or destruction of property and infrastructure, loss of amenity values, restriction of public access, and interruption to land and water ecosystems.

Sustainable management of resources requires consideration of the avoidance of the adverse effects of natural hazards. Where effects cannot be avoided then they should be remedied or mitigated to provide for community health, safety and wellbeing.

17.5.3 Methods of Implementation

Rules	Provide for continued soil conservation works on Wither Hills. Identifying slope instability hazards for inclusion in the Hazards Register.
Research and Monitoring	Develop historical data base. Compile rainfall records for different parts of region. Determine threshold soil moisture levels for loessial soils. Develop zoning of slope hazard risks. Monitor existing landslip hazards.
Information	Maintain a Hazards Register.
Education	Promote community understanding of slope instability hazards and ways to avoid, remedy or mitigate the effects.
Council Activities	Maintain protection works and structures. Maintain emergency procedures in association with Emergency Response.

17.6 Seismic

17.6.1 Issue

The potential for loss of life, damage to property and disruption to infrastructure arising from seismic activity.

The Wairau/Awatere region lies within the highest zone of earthquake risk in New Zealand. The principle elements of the Marlborough fault system are the Wairau,

Awatere, Clarence and Hope faults while the New Zealand Alpine fault which originates in Milford Sound meets the Wairau fault at Blenheim.

Damage from a major earthquake (i.e. greater than 6.5 magnitude Richter Scale) will include rock falls and landslides in the mountains. Large landslide deposits occur in a number of places throughout the mountains on both sides of the Wairau river, including one which dammed the Goulter River to form Lake Chalice, and are probably the result of major prehistoric earthquakes.

An earthquake could cause lowering or raising of the lower Wairau Valley floor, with implications for drainage and flood control. Lowering could occur due to compaction following liquefaction of water saturated, unconsolidated sediments as well as, in the case of the Alpine Fault, vertical fault movement. The effects are likely to be greatest from Grovetown to the coast. Damage to buildings, rail, roads and other man made structures would be widespread. In addition, the intensity of an earthquake can vary considerably depending on subsurface materials. In general, damage is higher for structures built on unconsolidated, water-logged sediments, such as on the valley floors, than on basement rocks. Other forms of earthquake damage could include collapse of aquifers, or their offsetting by fault movement, leading to failure of groundwater supplies.

The DSIR (1989) calculated the mean return periods for earthquakes in the Lower Wairau area as follows:

Intensity (modified Mercalli)	Likely effects	Approx. magnitude (Richter Scale)	Return Period (yrs)
MM VI	Felt by everyone - heavy objects move and plaster cracks.	4.9 to 5.4	5 - 10
MM VII	Very strong - cracking of buildings, plaster falls from ceilings, but well designed buildings little affected.	5.5 to 6.1	20
MM VIII	Destructive - damage considerable in all but well constructed buildings.	6.2 to 6.8	100
MM IX	Ruinous - some damage to well designed buildings and dwellings may be thrown out of plumb, ground fissures conspicuous.	6.9	500
MM X	Destructive - many buildings destroyed.	7.0 to 7.3	
MM XI	Very destructive - few buildings standing.	7.4 to 8.1	
MM XII	Catastrophic - damage total.	8.1 to 8.9	

17.6.2 Objectives and Policies

Objective 1	**To avoid, remedy or mitigate the adverse effects of seismic hazard.**
Policy 1.1	Recognise that Marlborough is in the highest zone of earthquake risk in New Zealand.
Policy 1.2	Establish an emergency recovery project for Marlborough.
Policy 1.3	Maintain emergency procedures in association with Emergency Response.

A large earthquake in the region has the potential to affect more damage in the region than any other natural hazard. However, the potential damage and danger to life posed by seismic hazard is difficult to quantify because it involves many factors, including earthquake magnitude, focal depth, distance from population centres or engineered structures, the response of soils and slopes to shaking and the variable condition on quality of design among many classes of building and public utility networks.

The extent of earthquake awareness and preparedness within the wider community, and especially amongst those tasked with emergency response, is a critical factor in mitigating the effects of earthquakes in Marlborough. These studies provide the basis of strategies for the rapid re-establishment of essential service following a disaster.

17.6.3 Methods of Implementation

Rules	Rules will be used to maintain a relatively low density of development in earthquake risk areas. Rules will discourage development in areas proven to be a liquefaction risk.
Council Activities	The Council will initiate a study to ensure the community can recover quickly from the aftermath of a major event.
Information	The Council will in conjunction with Emergency Response provide information on all aspects relating to earthquake survival through to strategies for coping with the aftermath.
Emergency Response	Maintain an active response programme in association with Emergency Response.

As expressed previously, the scale of an emergency response to an earthquake affecting all or part of the Wairau/Awatere will depend on the size and location of the event and the nature of site response in populated areas.

The extent of earthquake awareness and preparedness within the wider community is a critical factor in mitigating the effects of earthquakes.

17.7 Anticipated Environmental Results

Implementation of the policies and methods for management relating to natural hazards will result in:

- Future use and development of the resources of the Wairau/Awatere that occurs in sympathy with the natural processes operating in the area and risk from natural hazards being minimised;
- Provision of information defining the risk to all sites from known natural hazards; and
- Implementation of emergency response procedures which avoid loss of life and mitigate damage to property and infrastructures prior to events.