Natural hazards

Objective

1. Any adverse effects of natural hazards on the environment of the Wellington region are reduced to an acceptable level.

Doing well

- Regional hazard investigations have been completed for earthquake, tsunami, wildfire and meteorological hazards.
- Floodplain management plans or river schemes are in place for all major rivers.
- Hazard information is now accessible on Greater Wellington's website.
- All district plans have rules for mitigating flooding and fault rupture hazards.
- The Wellington Region Civil Defence Emergency Management Group has been formed and the Civil Defence Emergency Management Group Plan launched.
- 69 per cent of Wellington region's residents have stored water for emergencies.

Must improve

- There is inadequate information available on who and what is at risk.
- Land use decisions do not always fully consider risk from natural hazards.
- 31 per cent of Wellington region's residents still don't have stored water for emergencies.

Reducing our risk

The Wellington region is vulnerable to natural hazards such as earthquakes, tsunami, flooding, landslides, coastal erosion, wind, wildfire, drought and even volcanic activity. The effects of such disasters will depend on just where and when they strike.

Greater Wellington aims to reduce their impacts to an acceptable level. Destructive natural events will occur – we can't completely avoid them – but we can lessen their effects.

Where we are now

Earthquakes

Our region rests on a geologically active zone near the junction of the Australian and Pacific tectonic plates. Wellington, Porirua and the Hutt Valley have the highest potential in the country for social and economic losses from earthquakes.

Figure 8.1:
Earthquakes larger than magnitude 2 recorded in central New Zealand between 1995 and 2005. There is a general pattern of shallow earthquakes (less than 40 km deep) through Hawke's Bay, Wairarapa, Wellington and Marlborough, and deeper earthquakes – linked to the subducting, or sinking, Pacific Plate – from Taranaki to Nelson.

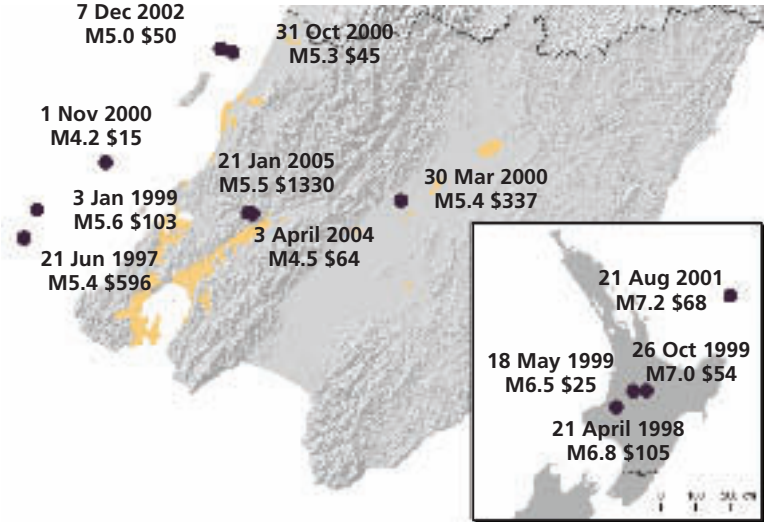

Figure 8.2:
Since 1997, 12 earthquakes have caused significant damage in the region. The date, earthquake magnitude and cost to EQC (in $1,000s) for the region are shown here. The most expensive happened on 21 January, 2005 – a magnitude 5.5 earthquake near Upper Hutt which cost EQC $1.33 million on some 1000 damage claims.

While there have been no reported injuries in the region from earthquakes over the last decade, earthquake damage to property came to more than $3 million. Ten years of data, however, don't reflect the real hazard we face. A number of active faults in and around the region could produce large, destructive quakes, resulting in hundreds of deaths, thousands of injuries and billions of dollars worth of damage.

Table 8.1: Characteristics of major active faults in and near the Wellington region.

Fault	Recurrence interval (yrs)	Time since last event (yrs)	Estimated magnitude *
Awatere (South Island)	<1000 – 1300	157	7.5 – 7.8
Wairau (South Island)	1000 – 2300	>800	7.2 – 7.7
Ohariu	1500 – >5000	1060 – 1140	7.6
North Ohariu	1000 – 4000	<4000	7.3 – 7.7
Gibbs	unknown	<10,000	~ 7.0
Shepherds Gully	2500 – 5000	>1000	7.6
Otaki Forks	4000 – 9000	unknown	7.3 – 7.6
Wellington	500 – 770	335 – 485	7.6
Wairarapa	1160 – 1880	150	8.0 – 8.3
Carterton	~1000	unknown	7.0
Masterton	~1000	unknown	6.7
Boo Boo (offshore)	500 – 2000?	unknown	7.2 – 7.6
Subduction interface	500 – 5000?	unknown	7.8 – 8.2

* Estimated earthquake magnitude able to be generated by that fault.

Earthquakes can be described in different ways. "Magnitude" measures the energy released in the earthquake or its "size". This is the number often reported on the news after an earthquake. "Intensity" is the amount of ground shaking and damage, and is usually measured with the Modified Mercalli (MM) Scale (see Table 8.2). Intensity at a given point depends on the magnitude of the earthquake, how far away and how deep it was, and the local ground conditions – such as whether the ground is sand or rock.

Even distant earthquakes can cause damage here. One of the quakes shown in Figure 8.2 was centred 180 km north of East Cape. The expected average return periods for ground shaking intensities on a bedrock site in downtown Wellington are given in Table 8.2. Return periods are likely to be shorter for areas of soft sediment, where ground shaking is often amplified.

Such areas include reclaimed land around central Wellington, Kilbirnie, Rongotai and Miramar, Petone, Lower Hutt, Wainuiomata, Mangaroa Valley, low lying areas around Porirua Harbour and Pauatahanui Inlet, and areas of the Wairarapa Basin around Masterton, Carterton and Lake Wairarapa. If ground shaking intensity exceeds MM VII, many of these areas could also suffer liquefaction. This is when some soils lose strength and behave more like a liquid than a solid.

Table 8.2:
Average ground shaking intensity return periods for a bedrock site in downtown Wellington according to the Modified Mercalli (MM) scale.

Ground shaking intensity (MM scale)		Return period (years)
V	Felt outside, sleepers wake, small objects and hanging pictures move.	2
VI	Felt by all, furniture moves, plaster cracks, some minor chimney damage.	9
VII	General alarm, difficult to stand, windows crack, some plaster/ bricks/tiles fall, small landslides and rockfalls, minor liquefaction.	42
VIII	General alarm approaching panic, unreinforced chimneys fall, stone and brick walls damaged/collapse, moderate landslides, ground cracks, liquefaction.	170
IX	Panic, masonry buildings and foundations damaged, some destroyed, some houses shift off their foundations, widespread landslides and liquefaction.	450

The impacts of earthquake hazards, such as ground shaking, fault rupture, liquefaction and landslides, will continue to increase with more development in the region, especially when development happens on or near active faults, on areas of soft soil or on steep or excavated slopes.

Ground shaking itself can't be avoided, but good engineering and planning can prevent or minimise building damage, liquefaction and landslides. Preparedness, response and recovery plans are also key to earthquake mitigation.

Tsunamis

No damaging tsunamis have struck the region's coastline over the last decade. The 2001 Peru and 2004 Asian tsunamis both reached Wellington, but measured less than 30 cm by the time they got here. However, the region has suffered damage in the last 200 years, and many coastal communities and assets remain at risk from both local and distant tsunamis.

Several undersea faults lie beyond our coast, including the major Hikurangi subduction margin to the east, the Boo Boo, Wairarapa, Wellington and Ohariu faults to the south and some smaller faults off Kapiti. Movement of these faults could trigger a tsunami, as could a submarine landslide. Recent research by NIWA shows many landslide scars in the canyon walls of Cook Strait.

The region's coast, especially in the east, is also exposed to tsunamis generated off the coast of South America.

Research shows that on average, a damaging tsunami is likely to strike some part of the region's coast every 85 years or so. Castlepoint, Riversdale and Palliser Bay communities – along with low lying communities in Wellington Harbour and the south coast – are most at risk.

The move to coastal living has put more people and property in areas where tsunamis are likely to hit, increasing the potential impact. Rising sea levels caused by climate change could worsen that impact because sea level will become closer to people's homes.

The best way to avoid tsunami damage is not to build in exposed coastal areas. At the very least we should be using building techniques to better withstand tsunamis in these areas. However, because tsunami strikes are so infrequent, we tend to rely on preparedness, rather than applying land use restrictions in tsunami prone areas.

Flooding

Flooding is the most commonly experienced natural hazard in the region. Steep river catchments tend to funnel rain directly onto floodplains and gravel fans, where much of our population works and lives.

The last decade saw a number of serious floods. The largest and most destructive came in October 1998, when two northwesterly storms in the same week flooded Kapiti, the Hutt Valley and Wairarapa. Homes were evacuated in Kapiti and two civil defence emergencies were declared. A number of roads were closed in the Wairarapa.

Sustained heavy rains returned to Kapiti, the Hutt Valley and Wairarapa in February 2004. In early January 2005, the Otaki, Waikanae, Akatarawa and Whakatikei rivers rose to over 60-year highs. The Waikanae River burst its banks and hundreds were evacuated from houses and a camping ground.

Later, in March 2005, a southeasterly storm hit the eastern Wairarapa and the Rimutaka Range, severely damaging the eastern Wairarapa hill country and Wainuiomata and sending huge debris flows down the Orongorongo Valley. Four hundred and forty four mm of rain fell in just 36 hours – the kind of deluge expected less than once in a hundred years.

Flooding at Hutt Park during February 2004. These floods prompted evacuations and closed roads, some for months, throughout Kapiti, the Hutt Valley and Wairarapa.

In the last ten years, floods in the region killed four people and wrought tens of millions of dollars in damage - more than $11 million to Greater Wellington's flood protection works alone. An average of five storms a year caused surface flooding with minor property and infrastructure damage.

Catchments on both sides of the Tararua Range, such as the Hutt, Otaki, Waikanae, and Ruamahanga, face the greatest danger from flooding. But areas away from major rivers can still suffer localised flooding if natural drainage and stormwater systems can't cope.

Meteorologists predict more La Niña events over the next 20-30 years, increasing the likelihood of ex-tropical cyclones striking from the east. Over the longer term, climate change is likely to bring more intense rain across the region.

We can't stop storms, but the effects of floods can be reduced by constructing stopbanks, maintaining river corridors and reforesting upper catchments. We can also build less in flood-prone areas, have minimum floor levels and have effective response and recovery plans.

Landslides

The region's steep, unstable hills – and the tectonic turmoil beneath – make it particularly prone to landslides. Earthquakes can unleash large slips of bedrock and soil; the 1855 Wairarapa earthquake triggered landslides over 20,000 square kilometres in the southern North Island. Most of our landslides, however, are small soil slides and flows set off by intense or prolonged rainfall.

The last decade saw at least 17 events that involved widespread slipping, property damage and/or evacuations. Most of these were set off by heavy rain and accompanied by major flooding. For example, in October 2003 an intense rainstorm dumped 100mm of rain in just 24 hours on Paekakariki and the hills behind it. The resulting debris flow enveloped a motel and covered road and rail lines with gravel. Houses and shops were inundated with muddy water.

A landslide triggered by heavy rain at Te Marua during the February 2004 floods. This landslide blocked the Hutt River, diverting it through Te Marua golf course. Photo: Graham Hancox.

Between 1997 and 2005, the Earthquake Commission received at least 1200 claims, totalling more than $5 million, for landslide damage to houses and contents in the Wellington region. Over half came from Wellington City.

The areas most susceptible to landslides are steep, unsupported cuts along the Hutt motorway, Ngauranga Gorge, and Haywards and Rimutaka Hill roads. Similar cuts in metropolitan hill suburbs are also sensitive, as are areas of steep coastal slopes, fault scarps, steep river terraces and quarry slopes.

Much of the eastern and coastal Wairarapa hill country is prone to slumps and shallow soil slips. Every four to 12 years the area suffers a storm severe enough to cause widespread landslides, with smaller slips every one to three years.

More landslides are likely in future as a result of the heavy rain expected to come with climate change. Development, modification and deforestation of hillsides – especially in steep areas – makes them more unstable. For example, more than two thirds of the 74 landslides reported during the February 2004 storms happened on slopes already weakened by earthworks.

Shallow soil slides at Castlepoint Station in the eastern Wairarapa hill country, triggered by intense rainfall in March 2005. Photo: Masterton District Council.

To reduce landslide risk, future development should avoid terrain that needs excessive modification to accommodate it.

Coastal erosion

Coastal erosion is part of a natural cycle of sediment movement, and only becomes a hazard when buildings, roads and other assets are built too close to erosion-prone sites.

Much of our coast is hard bedrock, but softer sediments, such as the dunes at Castlepoint, Riversdale and the Kapiti coast, soft mudstone on the Palliser Bay coast and small areas within Wellington and Porirua harbours, are prone to erosion.

Erosion may worsen with climate change, which will increase sea level and alter other erosion drivers such as wave action, storminess and sediment movement. The potential for erosion damage is also climbing with the demand for coastal living. Human activities can easily make things worse – building a seawall in one area might increase erosion further along the coast – so careful management is a must. The most sensible option is to avoid developing erosion-prone areas in the first place.

Te Kopi, Palliser Bay, 2002. Coastal erosion is a continuing problem for settlements and the road along this stretch of coast.

Severe wind

Climate and topography make the Wellington region especially windy. Westerly winds, turned south by the Tararua Range, race through the gap of Cook Strait to produce strong north or northwesterly winds. The Tararua Range creates turbulent downwind waves in such conditions, delivering very high winds to the Wairarapa.

Southerlies flow parallel to the main Wellington ranges, so they don't gust as strongly as northerlies, but overall, southerly wind speeds are higher.

Damaging winds blow on average about once a month, disrupting transport (particularly ferry crossings), felling trees, power and telecommunication lines, and even lifting roofs.

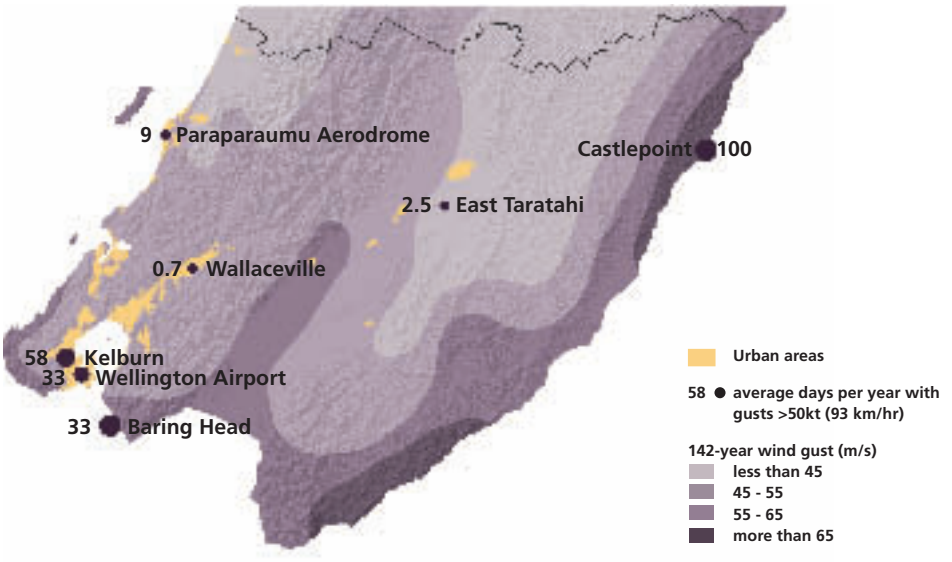

Figure 8.3:
Wind hazard varies widely across the region. The calculated 142-year return period wind gust is shown here, along with the average number of days per year with wind gusts over 50 knots (93 km/h) at selected locations. (The return interval values don't consider local topographic effects caused by features like hills, gorges and vegetation.)

The windiest areas are generally the eastern Wairarapa coast – particularly Castlepoint and the area around Tora – followed by the southern Wairarapa and Wellington coasts. Featherston, Mt Bruce and parts of the Rimutaka Road suffer localised wind effects.

Westerlies are expected to occur more often with climate change, but it's not yet known what that might mean for wind hazard in our region.

Wind-resistant building design and accurate weather forecasting remain the best defence against wind damage.

Wildfire

A wildfire is any unplanned blaze in an open space. They can ignite naturally – by lightning strike for instance – but are more commonly started by people. A wildfire's spread depends on the weather, slope angle, and how much fuel and oxygen are available to it. Wildfires are most common during the warmer, drier months between November and March.

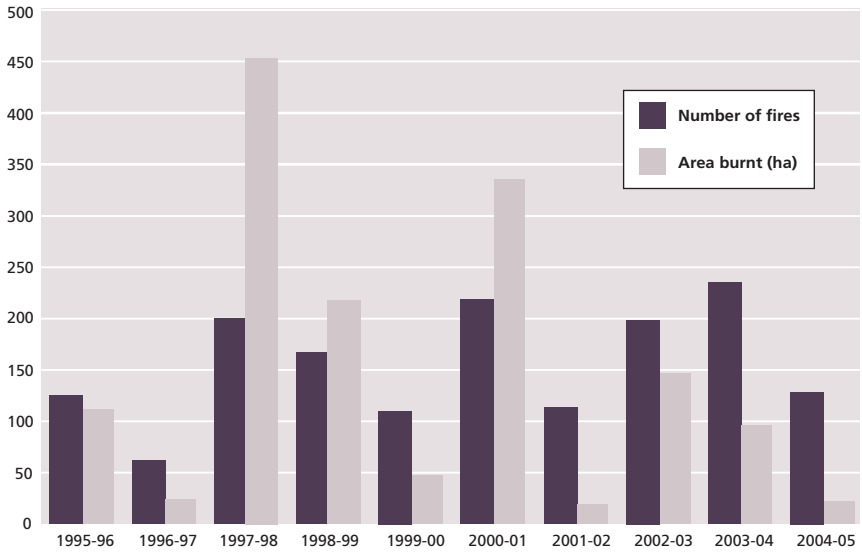

Figure 8.4:
Between July 1995 and June 2005, 1,544 wildfires burnt a total of 1,460 hectares in the Wellington region. There were many fires during the particularly hot and dry summers of 1997-98, 2000-01 and 2002-03.

Around 165,500 hectares, or 20 per cent, of land in the Wellington region is at high or extreme risk from wildfire, based on the prevalence of gorse and scrub, steep slopes, low rainfall and the proximity of people. The most at-risk areas are the southern and western edges of Wellington city, the eastern Hutt hills and areas around Eastbourne and Wainuiomata. In the Wairarapa, the eastern foothills of the Rimutaka and Tararua ranges, the Cape Palliser coast and parts of the coastal eastern hills are most vulnerable.

Increasingly, people have moved to the rural/urban fringe, and forests and open spaces have become their playgrounds, raising the likelihood – and potential impact - of wildfires. Climate change, predicted to bring a drier climate to eastern parts of the region, will further increase the threat of wildfire.

The number of wildfires has fallen nationally in the last ten years. This has been put down to more public education, more and better-equipped volunteer firefighters, and better cooperation between the National Rural Fire Authority and the New Zealand Fire Service.

Fire prevention is still our best defence, but rapid response and "safety zones" around homes and schools are important safeguards too.

Drought

Drought can lead to water shortages or restrictions, crop damage or failure, lack of stock feed and higher fire risk. Most summers, Kapiti and the Wairarapa can expect a water shortage to some degree, but it takes a major drought to affect the Wellington metropolitan area.

Nevertheless, the last decade saw three serious droughts in the region. El Niño conditions in the 1997-98 summer, with predominant westerlies, parched the Wairarapa, where just 30 per cent of normal summer rain fell on some of the eastern hills – the worst drought for almost 100 years. Water was rationed and farmers were forced to sell stock.

The summer/autumn drought of 2000-01 – this time linked to La Niña conditions – struck the Wellington, Hutt and Kapiti areas and to a lesser degree, southeast Wairarapa. The summer was the driest in Wellington city in nearly a century. In Kapiti, water supplies were restricted and swimming pools were closed. Farmers, faced with feed shortages, sold stock and fires were banned over the entire Wellington region.

In 2002-03, the Kapiti coast suffered again – as did the Tararua and Akatarawa ranges and the Wairarapa – when rainfall dipped well below normal. With between 20 and 40 per cent of average rainfall in Kapiti and Porirua, water restrictions returned.

Like flooding, droughts result from naturally- and human-induced climate variations. In general, La Niña periods bring easterly and northeasterly winds – with drier summers – to the Kapiti coast, western and southern Tararua Ranges and the Rimutaka Ranges.

In contrast, El Niño periods – with their prevailing westerlies – can bring drought to the Wairarapa.

Climatologists expect more La Niña events over the next 20 to 30 years, which could bring more droughts to Kapiti and central Wellington catchments. Longer term, climate change could mean more westerlies, driving up temperatures and reducing rainfall in the Wairarapa.

We can't control the weather, but we can ease the impact of drought by providing timely, accurate information so that water users can plan ahead.

Volcanic eruption

There are no active volcanoes in the Wellington area – the nearest are Mt Taranaki, Mt Ngauruhoe and Mt Ruapehu – but we could still feel their wrath. In 1995, and again the following year, westerly and southerly winds kept ash from the Mt Ruapehu eruptions from reaching us, falling instead over East Cape, Hawke's Bay and the Bay of Plenty. A northerly would have brought a different story, in which a millimetre of ash could have covered the region.

This doesn't sound like much, but even small amounts of ash can irritate lungs and eyes, contaminate water supplies, damage vehicles and houses, and close airports.

Ash layers preserved in the geological record tell us that falls have reached here in the past, but it's difficult to estimate when it could happen again – it would depend on the source and size of the eruption, and the direction of prevailing winds.

Return periods for the Wairarapa are estimated at 1300-1600 years for a 1-5 mm ash-fall from Mt Taranaki and more than 2000 years for a 0-2 mm ash fall from the central North Island volcanoes.

The likelihood of the Wellington region being directly affected by a volcanic eruption is low, but we should still be prepared, knowing what to do if ash comes our way.

What's being done

The nature of – hence our response to – each natural hazard is different. We might reduce risk by avoiding hazard prone areas, by adopting better building design or by constructing stopbanks. And we can reduce the impact of an event by being prepared. Greater Wellington plays a leading role in managing natural hazards in the Wellington region along with several other organisations.

Investigations and monitoring

Over the last 15 years, Greater Wellington has carried out many regional scale natural hazard investigations. In 1996, after a series of studies, we published earthquake hazard maps for the Wellington metropolitan area. Since then, earthquake hazard studies have mostly focused on mapping the region's many active faults.

A 2001 regional tsunami study led to an options report on managing tsunami risk, and a meteorological hazard study was completed in 2002. All major rivers – and some smaller streams – have had their own flood hazard assessments and in 1997, after a wildfire study, Greater Wellington produced wildfire hazard maps of the region.

Greater Wellington also keeps a watching brief on the effects of climate variations, both natural and human-made and has developed models to help predict drought likelihood.

City and district councils also investigate natural hazards, independently and in partnership with Greater Wellington. Wellington and Porirua cities, and Kapiti Coast, Masterton and South Wairarapa districts have all commissioned coastal erosion reports and Greater Wellington has helped several city and district councils with fault mapping projects.

A trench across the Ohariu Fault in the Ohariu Valley - the land on the right hand side has been pushed over the land on the left hand side. Scientists date organic material in buried soil layers to determine when and how often the fault has moved. The Ohariu Fault last moved about 1100 years ago in an estimated magnitude 7.6 earthquake. Photo: GNS.

Funding from the Earthquake Commission, the Foundation for Research, Science and Technology and others goes into natural hazard research by the Institute of Geological and Nuclear Sciences, the National Institute of Water and Atmospheric Research, Scion (formerly Forest Research) and private companies. Universities, particularly Victoria University, also make a valuable contribution to hazard research in the region.

Regional plans

The Regional Freshwater Plan, operative since 1999, sets out low flow levels for the region's main rivers. These direct people when to stop taking water from rivers so that fish and other stream life are not threatened. The Regional Soil Plan, operative since 2000, controls roading and tracking, land disturbances and vegetation removal on erosion prone land.

The Regional Coastal Plan, also made operative in 2000, promotes the use of soft engineering options – like beach nourishment – to manage coastal erosion. It encourages too, the consideration of natural hazards when assessing consent applications for coastal activities.

District plans

The Regional Policy Statement provides direction for land use planning in district plans. All city and district councils in the region recognise natural hazards as a resource management issue and their district plans reflect this with various levels of land use control.

For instance, they all carry provisions restricting or managing development around active faults and in flood-prone areas. Some (Upper Hutt, Kapiti Coast, Porirua, Wellington) have controls on earthworks and the removal of vegetation on erosion-prone land (Hutt City).

The Kapiti Coast District Council's upcoming coastal strategy will address coastal erosion management, and review their coastal setback limits – the distances people may build from the foreshore. The Wairarapa Coastal Strategy – a joint project between the three Wairarapa district councils and Greater Wellington – also sets out policies dealing with coastal hazards, particularly erosion. Provisions from the Strategy may be built into the combined Wairarapa District Plan. Currently in draft, the Plan contains controls on the construction of buildings within a foreshore protection area – generally 50 metres from mean high water springs.

No city or district council has land use restrictions in tsunami-prone areas. Instead, they rely on preparedness and proper response in such an event. Some planning provisions which are in place, such as setback limits, go some way to mitigating tsunami hazard.

Under the Building Act 2004, city and district councils must develop policies for dealing with earthquake-prone buildings to reduce the level of risk to the public over time. Measures to address ground shaking, liquefaction, landslides and strong winds are generally dealt with during the building consent process.

Providing information

In the last five years, Greater Wellington has improved access to natural hazard information through the internet and GIS technology. In 2003-04, we published 18 fact sheets on a range of hazards in the region and their mitigation. Greater Wellington's website hazard pages are updated regularly, and the Hazards Online database lists over 500 resources (reports, articles, etc) from a range of agencies. Greater Wellington staff also give presentations on natural hazards and emergency management to schools and other groups, and answer public enquires.

Greater Wellington shares hazard information with city and district councils, who pass it on to the public through district plans, Land Information Memorandums and Project Information Memorandums. Masterton and South Wairarapa district councils have also erected signs along their coastlines alerting people to the tsunami risk.

Civil defence emergency management

Greater Wellington and the region's eight city and district councils make up the Wellington Region Civil Defence Emergency Management (CDEM) Group. Released in May 2005, the CDEM Group Plan provides the context and direction for the region's civil defence emergency management. The Plan sets out a five-year work programme addressing areas such as public information and media management, communications systems, public education and debris disposal.

In an emergency, city and district councils are guided by their own standard operating procedures. Should a major disaster strike, the CDEM Group's job is to assess damage and needs, co-ordinate a response, and manage information through its Emergency Operations Centre.

Hazard warnings for severe weather, volcanic and distant-source tsunami arrive at the CDEM Group Office, where they are evaluated, then forwarded to other agencies, emergency services and the public.

Flood protection and warning

Greater Wellington has developed floodplain management plans or river schemes for the larger rivers in the region. These include hazard assessments, stopbank construction and annual programmes of groyne maintenance, planting, channel alignment and gravel extraction.

Floodplain management plans for the Hutt, Waikanae and Otaki rivers provide a 40-year programme to reduce flood risk. The Wainuiomata River and the Waitohu, Mangaone and Waiwhetu streams have all been assessed for their flood potential, and work on the Mangaroa River is underway.

In the Wairarapa river schemes are in place on the Waiohine, Waingawa, Waipoua and Ruamahanga rivers.

Construction of a rockline to form a new river channel edge on the Hutt River opposite Strand Park in 2004. The gravel bund in the river helps reduce sediment input into the river during construction.

Newsletters and consultation keep local communities informed, and care groups in Otaki and Waikanae monitor flood protection activities and help with care of the riverbank environment.

Greater Wellington gathers data electronically from a network of telemetered rainfall and river-level monitoring stations. City and district councils are alerted when water levels reach preset trigger points.

Erosion control

Greater Wellington works with landowners to control soil erosion – particularly in the eastern Wairarapa – by developing individual farm management plans with them.

We also monitor erosion, offer advice on soil management and stock rotation and subsidise the revegetation of eroded land. Further information is given in the Soil chapter.

Coast care groups – usually local residents – operate throughout the region, particularly on the Kapiti coast. They get funding from Greater Wellington, and sometimes their city or district council, to restore the coastal environment, often planting dunes with native sand binding plants to help curb coastal erosion.

Rural fire authorities

The Department of Conservation, and all city and district councils, act as rural fire authorities and are responsible for fire control within their areas. They train rural fire brigades, run education campaigns, maintain fire breaks, declare fire seasons and issue fire permits.

Lifelines groups

The Wellington Lifelines Group (WeLG) and the Wairarapa Engineering Lifelines Association (WELA) are voluntary associations of utility owners including power and telecommunications companies, water and sewerage providers, and transport infrastructure owners.

These two lifelines groups carry out hazard analyses and mitigation work to reduce vulnerability to natural hazards and to boost resilience during and after a disaster. WELA published the results of a major study of natural hazards, and the risk to lifelines in the Wairarapa, in 2003.

Where to from here?

In the years ahead, Greater Wellington will work closely with city and district councils on local hazard investigations, and continue to advocate for appropriate land use through district plans.

We need to investigate further not only the when and where of natural hazards, but also their consequences. We need to monitor just where, who and what is at risk – particularly from earthquake, flooding, tsunami, and coastal erosion. Without this information, it's difficult to know how well we are achieving our objective - reducing the adverse effects of natural hazards.

A July 2005 survey showed that 80 per cent of residents in the Wellington region consider themselves very or quite well informed about hazards – up from 69 per cent the previous year. However, only 69 per cent have emergency water stored, 65 per cent have emergency food supplies, and just 26 per cent have a household emergency plan.

Greater Wellington and the new CDEM Group need to continue their hazard awareness and preparedness education.

More information

Grant, Helen, 2005. *Natural hazards – background report.* Greater Wellington.