

Weather-related hazards

Taranaki typically experiences moderate weather, but sitting out on the west coast of New Zealand, the region's exposed position means there can be some extremes.

Taranaki's west coast is exposed to weather systems moving east from the Tasman Sea and to powerful wave and wind conditions that cause erosion that has resulted in a coastline of cliffs. The mainly sunny, windy climate usually provides moderate temperatures and regular rainfall, but when the rainfall is heavy it can cause flooding and landslips. In periods of low rainfall, the region can experience droughts. In some parts of the region, and at certain times of the year, storms and tornadoes are a reasonably frequent occurrence.



Coastal erosion is the retreat of the shoreline caused by water currents, waves, and wind. It is a natural process that can be influenced by human activity. The Taranaki coastline is buffeted by high winds and waves from the west, and parts of the coastline are eroding significantly. However, the location, severity and rate of coastal erosion are influenced by factors such as the local geology and orientation of the location, the supply of sediment to and along the coast, and the influence of artificial structures such as breakwaters and sea walls.

The effects of climate change such as rising sea levels, wave patterns, storminess, and increased sediment from rivers also affect coastal erosion.

What's the story?

Since 2010, local authorities have been required to give effect to the *New Zealand Coastal Policy Statement* which, among other things, sets out mandatory policies for avoiding and mitigating the effects of natural hazards in the coastal environment.

There has been a shift away from managing beaches to managing human activities. The six policies that specifically relate to coastal hazard management focus on avoiding coastal hazards, avoiding the need for structural protection works, and promoting options such as dune restoration as opposed to structural

protection works for existing development. Set-backs from the coast are now generally accepted as the best way to reduce the risk from coastal inundation and erosion in undeveloped areas.

Under the *Resource Management Act 1991* (RMA), regional councils are required to prepare a regional coastal plan for their coastal marine areas. These plans address coastal issues, control the effects of activities and discharges, and identify conservation values. The *Regional Coastal Plan for Taranaki is* currently under review.

District councils, such as the New Plymouth and South Taranaki district councils, are required to manage land use to prevent coastal erosion within their respective districts and to mitigate adverse effects on people and property. The New Plymouth District Council has a *Coastal Strategy*, a *Coastal Strategy Implementation Plan*, and a *Coastal Erosion Strategy*, which together specify the course of action in respect of eight at-risk areas: Tongaporutu, Urenui, Onaero Beach, Onaero Township, Waitara Foreshore, Bell Block Beach, Fitzroy Beach and Oākura Beach. Attempts to prevent coastal inundation and erosion in these areas have included structural protection, beach stabilisation and re-nourishment, and land-use planning and relocation.

National comparison

It is estimated that approximately one-quarter of New Zealand's coastline is eroding. Coastal communities all over the country are struggling to manage the increase in erosion that is occurring as a result of normal weather patterns and climate change. At Haumoana on the east coast at Hawke's Bay, the shoreline is retreating by 0.3–0.7 metres each year. Protective structures have not been successful and managed retreat may prove to be the only viable option. This may also prove to be the case for at-risk areas on the northern Taranaki coast, such as the Onaero and Urenui beaches.



Coastal erosion affects the dunes in South Taranaki. A review of the South Taranaki District Plan currently underway will likely see new provisions for coastal erosion added.

Find out more

New Zealand Coastal Policy Statement 2010 tinyurl.com/TRC9s NPDC Coastal Strategy tinyurl.com/TRC9ad



Floods are New Zealand's most common and costly natural hazard and large floods have sometimes required central government support with response and recovery. Historically, lack of knowledge about the capacity of rivers to flood resulted in many communities being built on flood plains. Floods can be particularly hazardous for agriculture with flooding affecting the welfare of livestock. Economic and social impacts can be long-lasting.

Taranaki's flood plains are small in comparison with other regions. However, the region has numerous rivers and occasional extreme rainfall events. The Regional Council has primary responsibility for flood forecasting and public warnings, using information and data from their own rainfall and river level recorders, and from MetService and NIWA. Because catchments are often short and steep, flood warning times are relatively short. However, unlike earthquakes, floods often occur at the same location on a frequent basis.

The Council operates an extensive river level and flood warning and monitoring system, as well as wind and rainfall recorders, to track flood and weather conditions through its telemetered hydrometric network. The Council is required by law



Peak rainfall events for July 2012 and January 2011 compared with the average annual rainfall in Taranaki.

to minimise and prevent damage by floods and erosion. Flood protection works have been constructed in Taranaki where there is a significant flood threat to urban areas.



Flooding causes damage in the Waitōtara Valley.

What's the story?

Although there is currently little evidence of long-term change in rainfall patterns in Taranaki, NIWA notes that climate change could lead to more severe and more intense extreme rainfall events in the region with annual rainfall in the north increasing by 5-10% this century. Certain areas of the region are more prone to flooding from heavy rainfall than others, including the Waitara Township and the



Stopbanks along the Waiwhakaiho River protect the shopping centre.

Waiwhakaiho and Waitōtara valleys.

The Regional Council owns and operates, or provides maintenance on, flood control schemes for the Lower Waitara and Waiwhakaiho rivers, the Waitōtara River, and the Ōkato Scheme on the Stony (Hangatahua) River. Between 2011 and 2014, the Council allocated \$1.5 million to doubling flood protection in the lower Waiwhakaiho Valley, including raising the height of river stopbanks and the headwalls of culverts. In 2013, a significant upgrade of the Waitara Scheme began, taking into account the predicted effects of climate change, effectively future-proofing the Waitara township from future risk (see case study on page 259).

Under delegation from the Regional Council, the New Plymouth District Council owns and operates flood detention works on the Huatoki and Mangaotuku streams, providing flood protection in central New Plymouth. In South Taranaki, the Regional Council and South Taranaki District Council together manage the Waitōtara River Scheme programme of channel maintenance for flood management. Historically, the Stratford township has not been subject to major flooding events. However, a flood catchment management plan is scheduled for completion around 2016/2017 and there are number of small rural flood control and drainage schemes in the region.

The Taranaki CDEM Group is currently reviewing and merging its flood response plans and the final plan will also cover flooding that may occur as a result of a failure of the Pātea dam and other dams in the region.

Traditionally, flood risk-reduction measures have relied on building structures to keep water away from people. District councils are now moving more towards land-use planning to keep people and property away from flood-prone areas, and adopting building standards to keep people and property above flood levels.



Flood protection work undertaken in Waitara includes the extension of flood banks.

River bank erosion and landslides

High rainfall leading to flooding can also cause erosion and landslides, especially during major storms. Landslides are the natural hazard most frequently responsible for damage to property and infrastructure, including road closures.

What's the story?

Steep slopes with unstable geology that have been cleared of vegetation are more susceptible to landslides. For that reason, in Taranaki the eastern hill country, the slopes of Mount Taranaki, and the Pouakai and Kaitake ranges are more susceptible.



Heavy rain causes erosion and bank collapse in Mākāhu in the Stratford District.

Modification of the urban landscape can also increase the incidence of landslides that cause damage to roads and property, and sometimes to life. Although the region's largest urban area, the New Plymouth district, is assessed as having low landslide risk, an increase in rainfall as a result of climate change may increase the risk in the 21st century.

Sustainable management of soil and land is essential for the region's environmental and economic future, and protection of state highways from landslides is of national importance. The Council and district councils manage land use and control flooding to prevent (as far as practicable) damage and destruction by erosion on river banks and by landslides, as well as on the coast. 'New Zealand has a relatively high number of landslides compared with other countries.'

The Council's *Sustainable Land Management Programme* targets the eastern hill country promoting sustainable land management through comprehensive farm plans and other plans, and through advocacy and facilitation (see Chapter 2—Land). District councils also focus on control and development of erosion-prone slopes.

The Council's review of both the *Regional Soil Plan for Taranaki* and the *Regional Fresh Water Plan for Taranaki* will contain policies to manage and prevent soil erosion and minimise landslides throughout the region.

In the event of a large or significant landslide, GeoNet can provide rapid advice on how to manage public safety. GNS also collects information that will contribute to a better understanding of the causes and mechanisms of landslides.

National comparison

Along with the west coast of the South Island, the Tararua Ranges and the north-eastern North Island, Mount Taranaki has the highest 24-hour rainfalls in New Zealand. A combination of intense rainfall and small catchments with hilly topography means the region's rivers can rise very rapidly.

New Zealand has a relatively high number of

Find out more

- Other NPDC District Plan, Management Strategy, Natural Hazards tinyurl.com/TRC9ac
- Taranaki Regional Council, Flood Event Standard Operating Procedure; Flood Warning Procedures Manual; Severe Weather Event Procedures

landslides compared with other countries. Fortunately, the country's low population density and settlement patterns mean there are few landslide deaths and comparatively limited damage.



McLean Street, Waitara, in the 1965 floods.

Keeping the town safe and the river tamed

The ever-altering boundary between Waitara and its river is changing again, with work well under way on measures to keep the township safe in the face of heightened flooding risk revealed in new hydrological studies and expected to be aggravated by climate change.

Waitara sits on a floodplain and many townsfolk will remember the devastating floods of 1965 and 1971, and the damage that occurred to the stopbanks in 1990.

The current stopbanks were constructed in the early 1970s and after flood damage to parts of the river bank and stop banks in 1990, the Council undertook a significant amount of work to strengthen the channel banks and improve the channel alignment. The main channel alignment works were constructed downstream of SH3 to direct the river flow away from the stopbanks to the south of the town centre. The last of the strengthening work was completed in 2013.

Latest studies commissioned by the Council suggest that if the 1971 flood was repeated today, the river would spill over the stopbanks and result in significant flooding affecting many homes and businesses

At the moment, a flood this size can be expected every 30 years on average, so existing stopbanks provide a much lower standard of protection than the 'one-in-100-year' standard that is a minimum requirement for urban areas like Waitara. And it can only get worse. Climate change means that by 2065, a flood the size of 1971's would be expected every 15 years on average.

To future-proof the town, the flood defences are being raised by up to 1.8 metres, with a variety of methods being used in different locations.

Don't be fooled by the '100-year' label: The term "100-year flood" does not refer to an event that will occur only once a century. It means that there is a one in 100 (or 1%) chance of such a flood occurring in a given year. Two 100-year floods could occur a year apart or even a month apart, depending on rainfall. As this *State of the Environment Report* went to press, 90% of the Council's three-year, \$3.3 million upgrade was nearing completion, on time and within budget.

This work included:

- raising the earthen stopbanks upstream of the Town Bridge to Browne Street
- raising the stopbanks on the east side of the river between the Town Bridge and High Street East
- raising the height of the stop bank by about a metre on the town side alongside Queen Street from the NPDC pumping station to the northern end of Domett Street
- constructing a flood wall alongside the Anzco site.

The upgrade project includes pedestrian access along or beside all of the flood defences on the town side of the river, from the north end of Dommett Street to the south end of Browne Street. It has also involved relocation of piping infrastructure along the river bank in front of the Anzco site to allow for the removal of 23 trees along a 140 metre section so the riverbank can be recontoured. In conjunction with the New Plymouth District Council, a new walkway and amenity planting are also planned in this area.

The final stage of the upgrade will involve raising the stopbank through Marine Park and from Gold Street to Howard Street on the eastern bank of the river. This work is programmed for summer 2015/2016.

The work in Waitara follows the completion of an earlier three-year project to similarly improve the level of protection at the Council's Lower Waiwhakaiho Flood Protection Scheme. When the Waitara project is completed, all of the Council's major flood schemes will offer the highest practical level of protection—putting this region at the forefront of flood control nationally.



Earthen stopbanks being raised north of the Town Bridge.



High winds and tornadoes

Taranaki is exposed to high winds, tornadoes and cyclones as a result of weather systems coming over the Tasman Sea. The region is also exposed to wind effects related to Mount Taranaki (called orographic effects). The prevailing wind is westerly, but the strongest winds come from the south-east. However, wind speed on the ground varies according to local topography and location within the region.

Tornadoes occur as a result of thunderstorms when a rotating column of air extends below a cumulonimbus cloud. Tropical cyclones often track close to Taranaki and produce strong to gale force winds from all directions.

'On average, one damaging tornado will occur somewhere in the region every year.'

What's the story?

New Plymouth city is a high wind-speed area in the Taranaki region. Low wind-speed areas are located in the area east and north of the mountain. Mount Taranaki does not influence the development of tornadoes in the region.

On average, one damaging tornado will occur somewhere in the region every year and a severe tornado occurs about once in every four years. Seventy per cent of tornadoes in the region occur in or near New Plymouth city and have caused extensive property damage. In August 2004, a tornado caused two deaths at Motunui. In 2007, north Taranaki was buffeted by a swarm of tornadoes which affected property, and in 2011, strong winds caused widespread damage in the region.

The MetService issues a severe weather warning when widespread gales are expected over a 1000 km² area with a minimum wind speed of 90 km/h, or frequent gusts exceeding 110 km/h are expected within 24 hours. A severe-weather watch is generated if these conditions are expected to occur in a 24–72 hour period. Around two to five wind warnings are issued for Taranaki each year.

With climate change, NIWA expects strong westerlies to increase in frequency in Taranaki in this century.

National comparison

Unlike those in the United States, tornadoes in New Zealand are mostly small and short-lived. Around 20–30 tornadoes are observed in New Zealand each year, most lasting less than 15 minutes. Damage paths are usually 10–20 metres wide and less than five kilometres long.

Compared with other regions in New Zealand, Taranaki is a high-risk area for tornadoes, accounting for 12% or more of the national total. Aside from Taranaki, tornadoes are most frequent in the west and north of the country, particularly the Waikato, Bay of Plenty, and Westland areas.

Find out more

Climate Hazards and Extremes - Taranaki Region (NIWA,2007) tinyurl.com/TRC9u National Hazardscape Report (DPMC, 2007) tinyurl.com/TRC9t



Droughts, or water shortage events, are a prolonged period of weather when rainfall is lower than normal. As a result, soil moisture levels are much lower for much longer than an area would normally experience and become insufficient for plant growth (such as pasture). Demand for water increases, particularly for irrigation. However, when demand increases in drought conditions, river levels are usually also lower, reducing the supply of water available for domestic use, for stock water, and for irrigation.

Droughts can have significant psychological and social impacts on our farming communities and create the need for difficult farm management decisions. Droughts are one of New Zealand's most common and costly natural hazards because they can affect large areas, with the effects lingering for several years. As they develop, monitoring of water resources intensifies, and it sometimes becomes necessary for the Regional Council to impose water use restrictions including apportioning, restricting, or suspending water abstraction. District councils can also impose conditions on how domestic water supply is used, in an attempt to reduce demand.

What's the story?

NIWA produces three-monthly climate outlooks based on rainfall, river flow and soil moisture data, and likely climate patterns. These outlooks help farmers and water users to make decisions and prepare early for possible droughts.

Droughts often occur over a relatively long period of time and, unlike flood events, it is possible to anticipate their onset. However, it is more difficult to predict how long a drought will last and how extensive it will be. Taranaki's most recent drought was declared in March 2013 and lasted until September that year. Fortunately, good weather conditions prior to the drought enabled many farmers to be less affected than they would normally be.

Local authorities monitor water levels, which assists in identifying at-risk water resources



The Waiwhakaiho River has periods of low flow during summer months.

and allocation limits for sustainable water management, including management during water shortage events or droughts. This management role increases as a drought intensifies.

The Regional Council's *Water Shortage Event Standard Operating Procedure* outlines the way in which the Council will fairly and equitably fulfil its statutory requirements during droughts to produce the desired outcome. Based on water monitoring, the Council can provide early warning to water users and the general public of possible water restrictions. The Council can liaise with, and advise, other stakeholders of impending water use restrictions and when normal use of water resources can resume.

Restrictions can be imposed through resource consent conditions or, if the Council considers it necessary, by the issue of a water shortage direction under Section 329 of the RMA. The Council also monitors compliance with any restrictions that may be in place.

Federated Farmers, Fonterra and the Rural Support Trust provide assistance to farmers during drought conditions. Taranaki farmers can also follow the NIWA climate outlooks and information provided by district and regional councils.

National comparison

Drought in New Zealand is related to topography. Although any part of the country can be affected by drought, the most susceptible areas are those in the lee of ranges subject to dry winds—Hawke's Bay, Wairarapa, Marlborough, Canterbury and Central Otago. These areas are also likely to have soils with low moisture-storage potential and little or no available irrigation water.

Some regional councils (the Greater Wellington Regional Council, for example), have developed regional drought-prediction models that can assist in drought management planning.

Find out more

🖑 Drought definition, recognition and assistance measures (MPI, formerly MAF, 2009) tinyurl.com/TRC9v



New Zealand's climate varies from year to year but is strongly influenced by natural climate cycles operating on scales of years to decades. Climate change is a phenomenon by which the global climate system responds to increasing concentrations of greenhouse gases in the atmosphere.

Climate change is already starting to influence the weather and climate in New Zealand and causing rising sea levels. Current research predicts that the sea-level rise around New Zealand may be higher than the global average. However, natural climate variations may offset some of the predicted impacts of climate change for New Zealand in the short term.

What's the story?

Changes in rainfall patterns are predicted for all regions, and in Taranaki, predictions are that summers will get drier and winters wetter. Current best-evidence projections predict steadily increasing higher annual average rainfall in Taranaki overall. Seasonal changes may mean that by 2080 Taranaki is up to 25% wetter in winter and up to 5–20% drier in summer. This might not mean much change on an annual basis but it does mean more frequent extreme events such as longer droughts and more intense rainfall. These changes will increase adverse weather and erosion hazards, especially along the region's coastline and rivers.

Rising sea levels (predicted at between 0.5 and 0.8 metres by the end of the century) will continue beyond 2100, even if global warming can be limited. Rising sea levels may cause escalated risks to natural and built environments, and to the people who live in coastal and river mouth areas in the region.



The Council's flood control works are now constructed to take climate change into account for AEP (annual exceedance probability) levels. Climate change has also been factored into tsunami inundation modelling in the region, and into coastal erosion management strategies, as a result of the *New Zealand Coastal Policy Statement 2010*.

The impacts on, and responses of New Zealand's trading partners to international climate change, may be significant for trade-intensive sectors such as agriculture and tourism. On a positive note, the growing season for Taranaki pasture production could lengthen. However, insurance to cover potential weather extremes and uncertainties may become more expensive, or even unaffordable.

National comparison

Depending on whether the world can rapidly reduce its greenhouse gas emissions or continues to emit at the same rate, New Zealand's temperature is expected to rise by between 0.8°C to 3.5°C above the average temperatures recorded between 1986 and 2005.

Other long-term climate trends for New Zealand point to a rise in hot extremes with fewer cold extremes, increased westerly flows in spring and winter, and decreased flows in summer and autumn. There is also evidence of rising extreme rainfalls and shifting regional rainfall patterns.

In addition, rising sea levels, together with increased rainfall, will increase flooding and erosion on the coast and at river mouths. The East Cape area is predicted to change in the opposite direction to Taranaki: it will get wetter by 5–20% in summer and drier by up to 25% in winter. Taranaki's climate is expected to experience less change than other regions around New Zealand.

Find out more

Climate change effects and impacts assessment: A guidance manual for local government in New Zealand (MfE, 2008) tinyurl.com/TRC9w

Climate change urban impacts toolbox (NIWA, 2012) tinyurl.com/TRC9y

Climate Trends, Hazards and Extremes—Taranaki Synthesis Report (NIWA, 2008) tinyurl.com/TRC9x

'All Councils in the region continuously review current hazard management information ...'



Our responses

National legislation

Natural hazard management in New Zealand is governed by various Acts of Parliament, regulations, and other central and local government guidance documents. Regional and district councils must undertake hazard management and risk reduction and readiness under these Acts, regulations, plans and guidelines:

- The Local Government Act 2002 requires territorial authorities to ensure avoidance or mitigation of natural hazards and infrastructure investment to reduce vulnerability and improve resilience.
- > The Resource Management Act 1991 (land use control).
- ▷ The *Soil Conservation and Rivers Control Act 1941* (soil conservation and the minimisation of floods and erosion).
- The Building Act 2004 and the associated Building Code has provisions that ensure wind loading is taken into account during design and construction. Bracing requirements for structures consider wind zones, local topography, site exposure, ground roughness, and wind region. The code also considers earthquake risk.

Civil Defence and Emergency Management (CDEM)

Representatives of the New Plymouth, Stratford and South Taranaki district councils and the Taranaki Regional Council make up the Civil Defence Emergency Management (CDEM) Group. Under the *Civil Defence and Emergency Management Act 2002*, the Taranaki CDEM Group is responsible for planning and delivering the civil defence role across the region. The Taranaki CDEM Group is administered by the Taranaki Regional Council. Functions include:

- identifying and managing hazards and risks to reduce the region's vulnerability, in conjunction with the regional community
- promoting, educating, and raising awareness of the community's role in implementing CDEM reduction, readiness, response and recovery.

Policies and plans

The Council's *Regional Policy Statement for Taranaki (RPS)* includes policies on climate change (RPS Chapter 7) and natural hazards (RPS Chapter 11). All regional and district plans, and the *Taranaki Civil Defence Emergency Management Group Plan*, must align with these policies. All councils in the region keep abreast of current hazard management information, undertaking new research into hazards and reviewing their hazard management plans.

- Under the RMA, the district councils are responsible for the use of land to avoid or mitigate natural hazards, except where the control relates to the regional council's functions regarding the coastal marine area and the beds of rivers, lakes, and other waterbodies.
- District councils also control proposed subdivision and/or development in hazardous areas and ensure any approved development will not exacerbate natural hazards. They ensure that known hazard information relating to specific sites is appended to Project Information Memoranda (PIM) and Land Information Memoranda (LIM).

Monitoring

The Council monitors river and stream levels for both extreme lows and flood risk. Live data and risk information is published on the Taranaki Regional Council website.

GNS undertakes earthquake monitoring through the GeoNet seismographic network. GNS also undertakes volcanic monitoring through the GeoNet network to detect any earthquakes or movement of magma that would indicate the beginning of an eruption.

The Ministry of Civil Defence and Emergency Management and Taranaki Civil Defence websites provide advice to the public on how to prepare for earthquakes in their homes and businesses, and what to do in the event a major earthquake occurs. Other information is provided on the Government's 'Get Ready, Get Thru' website.

Along with MetService, the Council monitors wind speeds to alert agencies and individuals of impending high and dangerous wind. As previously mentioned tsunami information for New Zealand comes from the Pacific Tsunami Warning Centre. The Ministry of Civil Defence and Emergency Management uses the National Warning System (NWS) to issue advice and warnings to the local civil defence duty officer. Taranaki Civil Defence takes action based on this information.

Contingency and preparation

The Taranaki Civil Defence and Emergency Management Group periodically runs exercises to test the region's ability to respond to a major event like a volcanic eruption. The Group also prepares contingency plans to use during different hazard events. Information and advice on how business and individuals can prepare for, and deal with, an eruption from Mount Taranaki is available in various forms and websites. Exercise Pahū, held in November 2013, was the most recent volcanic event exercise (see case study on *page 249*).



The Taranaki CDEM Group regularly undertakes exercises to test responses to major events.

Education, information and advice

CDEM has a five-year public education plan to increase community awareness, understanding and participation in CDEM in the Taranaki region. In particular, the plan concentrates on:

- increasing preparedness for and understanding of the significant hazards in Taranaki
- outlining what individuals need to do and where they can find guidance before, during and after an emergency
- explaining the role of the CDEM Group and its key partnership agencies
- encouraging the public to participate in rebuilding and restoring communities after the emergency event has passed.

In the 2013/2014 year the CDEM Group carried out a number of activities with children, including promoting the 'What's the Plan, Stan?' teaching resource to schools throughout Taranaki.

In addition, the Council's Education Officer led several marae-based lessons and conducted tours of the Emergency Operation Centre during this period.



Stan from 'What's the Plan, Stan?' at a Taranaki CDEM public awareness presentation.



Find out more

National Hazardscape Report (DPMC, 2007) tinyurl.com/TRC9t

Taranaki Civil Defence Emergency Management Group Plan for Taranaki, 2012 to 2017 tinyurl.com/TRC9ab

Taranaki Civil Defence Emergency Management website tinyurl.com/TRC9aa

What's the Plan, Stan? tinyurl.com/TRC9z