Natural Hazards

Key Information	Why is this Useful?	What is Happening?
The impact of major natural hazard events.	Large natural events have a considerable impact on the regional and national economy. They result in use of resources that would not normally have been consumed. Some impacts of natural hazards cannot easily be quantified by economic measures and need to be considered in ecological terms.	● The drought which affected Canterbury between 1997 and 1999 resulted in an estimated $600 million loss in regional income and a potential loss of 1,950 jobs.
Number of natural hazard events that have had minor local effects.	Small-scale hazard events result in minor damage or inconvenience. However, the cumulative effect of several small scale events in a short time frame may be quite significant.	● There has been eight minor events over the last three years.

Other Related Sections: Population Growth, Weather and Climate, Land Use, Surface Water, The Coastal Environment, Open Space and Natural Ecosystems, The Built Environment, Part 3: The City's Economy.

This section summarises the natural hazards that affect Christchurch City. Most of the information is from the Canterbury Regional Council report *Natural Hazards in Canterbury*. Natural hazards which affect Christchurch are divided into the following types: meteorological hazards, flood hazards, coastal hazards, slope hazards and seismic hazards (Table 2.3).

Types of Natural Hazards

Meteorological Hazards

Table 2.2 lists the types of severe storms and environmental risk associated with each meteorological hazard. The greatest economic effects result from events that have a regional impact eg heavy snow storms, drought and wind storms.

Christchurch does not experience the intensity of rainfall that occurs in other parts of New Zealand. Generally, 24-hour rainfall with return periods of five years[2] produce 50 -100 millimetres on the plains and 100 - 150 millimetres on the Port Hills. The effect of heavy rainfall is covered in the flood hazard and slope hazard sections.

Significant snowstorms have occurred in Christchurch in 1895, 1896, 1901, 1918 1945 and 1992. Snow storms cause damage to buildings and power lines, disruption to traffic and communications within urban areas and stock losses in rural districts. A secondary effect is snowmelt flooding.

Table 2.2 Severe Storms and Effects

Storm Type	Indirect Natural Effects
Heavy rainfall	Flooding, landslips
Snowstorms	
Wind	Erosion of top soil, dust storms
Hail	
Electrical	Forest fires

Source: Canterbury Regional Council, Natural Hazards in

The 1992 snow storm killed over one million stock in Canterbury and damaged buildings in Christchurch and surrounding areas. Its overall economic impact was estimated to be $50 million to $100 million. The 1992 snowstorm had a recurrence interval of 50 to 100 years.

The most severe winds in Christchurch are associated with north-westerly airflow over the South Island. Severe events occurred in 1945, 1964, 1975 and 1988. The peak wind in 1975 was 193km/hr, which exceeded the 100-year return period. Extreme winds cause personal injury and death, and extensive damage to buildings, vegetation and infrastructure.

Three significant tornado events have been recorded in the Christchurch area in the last 36 years - in 1962 (Christchurch), 1975 (Governors Bay) and 1983 (Halswell).

Electrical storms tend to occur between September and March but are relatively infrequent with, on average, thunder five days a year on the Canterbury Plains.

Canterbury normally has one significant hail storm a year, usually occurring between October and March.

On average, the region has one significant drought about every six years. Since 1970 severe droughts have occurred in 1977-78, 1985, 1988-89, 1992 and 1997-99. Drought is generally considered a rural problem but there are also significant effects on the urban environment, such as increased water consumption and the economic impact of reduced cash flow from the rural sector. The 1992 drought also significantly affected hydro-electric power generation, resulting in power shortages in Christchurch.

Flood Hazards

Flooding is the most common and most significant natural hazard in Canterbury. Both urban and rural areas are affected.

[2] Return period refers to the statistical likelihood of an event occurring eg an event with a five year return period will occur on average once every five years.

Table 2.3 Simplified Hazard Evaluation for Christchurch City

Hazard Category	Likely exceedence interval	
	Less than 100 years	Greater than 100 years
Meteorological	• Severe wind storm or intense rainfall • Major drought	• Extreme storm event (rain or wind) • Long-term climatic change
Flooding	• Severe flooding in any river system • Stopbank failure • Local flooding due to intense rainfall in low	• Breach in Waimakariri River stopbanks
Coastal	• Severe storm erosion of beaches • Continuing shoreline retreat • Rivermouth / spit 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 • Localised earthquake - generated slope failures and / or ground subsidence.	• Earthquake-generated rockfalls and liquefaction in metropolitan Christchurch
Seismic	• Ground shaking and local damage due to small magnitude event within region, or large magnitude event outside Canterbury.	• Ground rupture on Hope, Porters Pass or alpine faults with accompanying large magnitude effects earthquake in Canterbury.

Source: Canterbury Regional Council, Natural Hazards in Canterbury.

The most significant flooding threat to the Christchurch urban area is posed by the Waimakariri River, although this has been substantially mitigated by river control works. Breakouts of floodwaters from the Waimakariri River caused damage to urban Christchurch in December 1865, October 1866 and February 1868. The Waimakariri River still threatens more people and properties than any other New Zealand river.

The Halswell, Avon and Heathcote Rivers cause the most frequent flooding in Christchurch. Flooding from these rivers is usually the consequence of long-duration, moderate-intensity easterly storms.

Figure 2.5 shows the areas of the City which are prone to flooding. Areas of the Avon River most susceptible to flood damage are the lower Wairarapa Stream in the upper catchment and low-lying areas in New Brighton, Avondale, Horseshoe Lake, Hulverstone Drive and Bexley. Since 1883 over 30 different floods have caused damage due to ponding of stormwater and breakouts from tributary streams. Unusually high tides in July 1955, March 1957 and August 1992 also increased damage from flooding.

Flooding of property and roads occurs along much of the Heathcote River Channel between Woolston and Hoon Hay. Floodwaters have reached heights above house floor levels on four different occasions since the mid-1960s (1968, 1975, 1977 and 1980).

Coastal Hazards

The shoreline position of Pegasus Bay is generally stable or prograding[3]. However, sites such as South Brighton and Kairaki/Brooklands at the mouth of the Waimakariri River may be subject to rapid landform changes due to erosion or accretion.

Assessment of the tsunami hazard for Christchurch is subject to considerable uncertainty. A tsunami could be a serious hazard and damage a wide area, perhaps as much as 30 per cent of the urban area of the City. It is believed that during a tsunami all openings in the coastal dune system would become conduits and result in widespread inundation. There could also be large-scale flooding associated with extreme water levels entering the Avon-Heathcote Estuary.

The risk from coastal hazards is expected to increase in the future as the predicted sea level rise due to global warming will reduce the protective buffer from coastal processes.

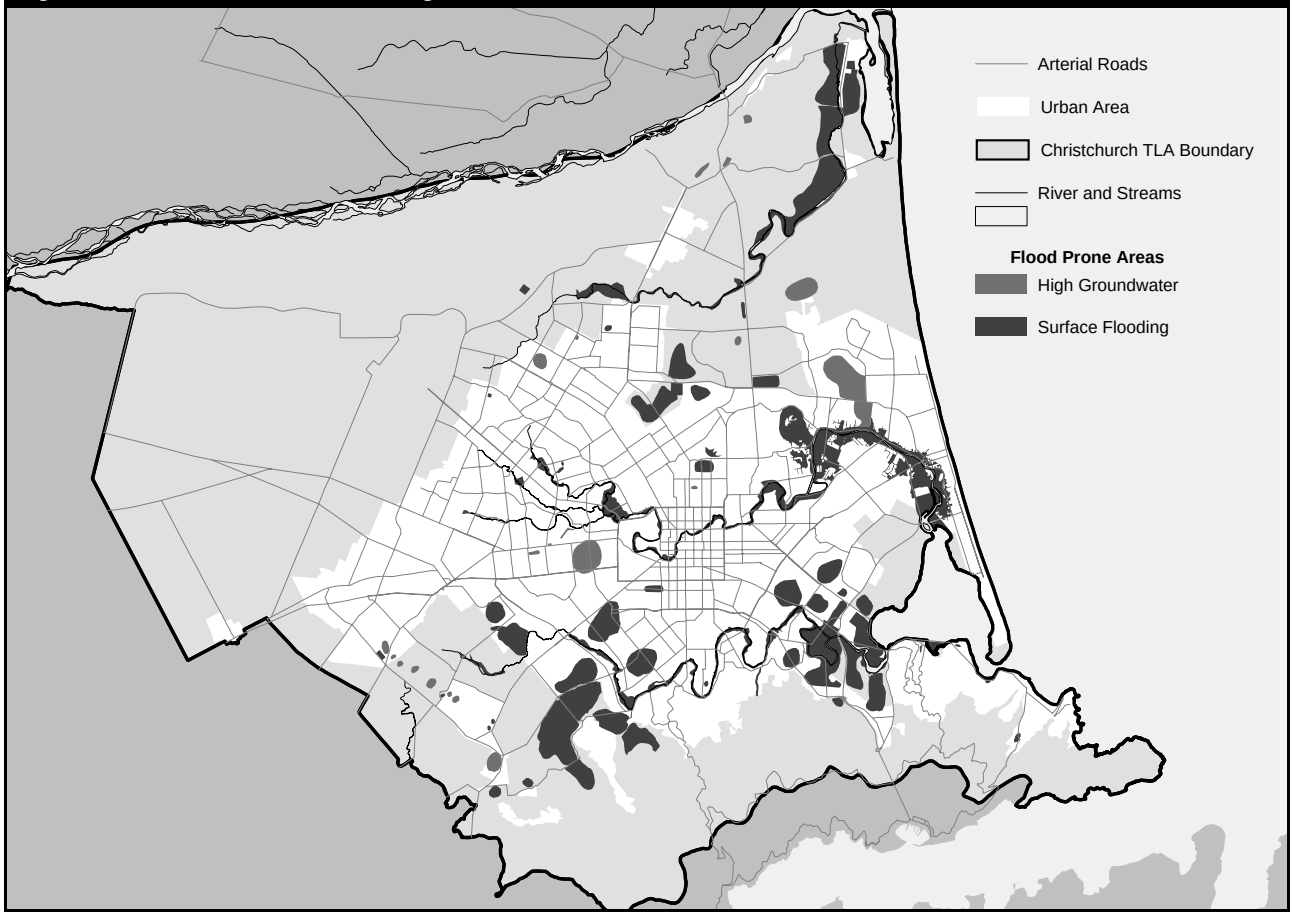
Slope Hazards

The Port Hills are at significant risk of landslides and rockfalls caused by earthquakes or severe rainstorms. Earthquakes can produce a rockfall hazard on the Port Hills or facilitate slope failure if they occur during mid-winter to early spring when soil moisture levels are high enough to reduce the cohesive strength of loess soils.

Rainstorm-induced landslides tend to be associated with prolonged wet periods, for example two or more consecutive wet winters, or after a major snowstorm when soil moisture levels are close to saturation. These conditions only require a minimal increase from

[3] A prograding coastline is one that is accumulating additional sediment and often growing seaward.

Fig 2.5 Land Area Prone to Flooding



Source: Christchurch City Council.

moderate frequency storms to initiate movement. There appears to be a frequency of 10-20 years between significant events.

Seismic Hazards

Since 1850 Christchurch has experienced three earthquakes that have generated effects such as difficulty in standing, furniture broken, weak chimneys broken at roof lines and the falling of plaster, loose bricks, stones and tiles. It is expected that a similar earthquake will occur again within the next 50 years.

The greatest impact from a major earthquake to the Christchurch area is widespread liquefaction, especially in the fine-grained loose sediments around the Avon-Heathcote Estuary. Liquefaction results from ground shaking which does not permit pore fluids to escape. As a consequence, loose saturated silts and sands lose strength and tend to become fluid, resulting in failure to support structures, soil movements, and the floating of buried structures such as pipelines.

Recent Impacts of Natural Hazards

Table 2.4 lists natural events that have caused damage in Christchurch City during the 1998 and 1999 June years. Eight events caused minor localised damage or inconvenience in Christchurch. Four minor earthquakes were felt in the City during this period but no damage was reported from them.

A prolonged drought affected most of Canterbury and Marlborough for both the summers of 1997/98 and 1998/99. This period of lower than normal rainfall and higher than normal temperatures had a major economic effect, both regionally and nationally. The Canterbury Development Corporation estimated that the impact of the drought during this period will lead to a decline in farm output over three years of $169 million, plus further losses in downstream processing (especially meat) of $426 million[4]. At present it is difficult to know what long-term effects the drought has had on the natural environment. However, mature trees died and groundwater levels and stream flows were reduced.

[4] Canterbury Development Corportation: The Leading Edge Newspaper, Issue 2, May 1999.

Table 2.4 Damage Caused by Natural Hazards Between July 1997 and June 1999

Event	Date	Location	Reported Damage to Assets
Wind and rain	6 May 1999	Christchurch	Minor wind damage and surface flooding.
Hail	11 Dec 1998	Halswell	Damage to fruit crops and orchards.
Hail, heavy rain and lightning	8 Dec 1998	Christchurch	Small fires, power disrupted, hail damaged orchards in Halswell. Surface flooding.
Wind	19 Oct 1998	Christchurch	Two light aeroplanes badly damaged at airport, trees blown over.
Wind	5 Oct 1998	Christchurch	Minor wind damage.
Lightning	21 Nov 1997	Christchurch	Power cuts - computers and security alarms damaged.
Wind	11 Nov 1997	Christchurch	Trees blown over, boats damaged.
Snow	22 Aug 1997	Christchurch and Banks Peninsula	Power cuts, difficult road conditions on the hills.
Drought	1997-1999	Canterbury	Sixteen consecutive months of drier than average weather up to June 1999. Extensive impact on regional and national economy.

Source: The Christchurch Press.