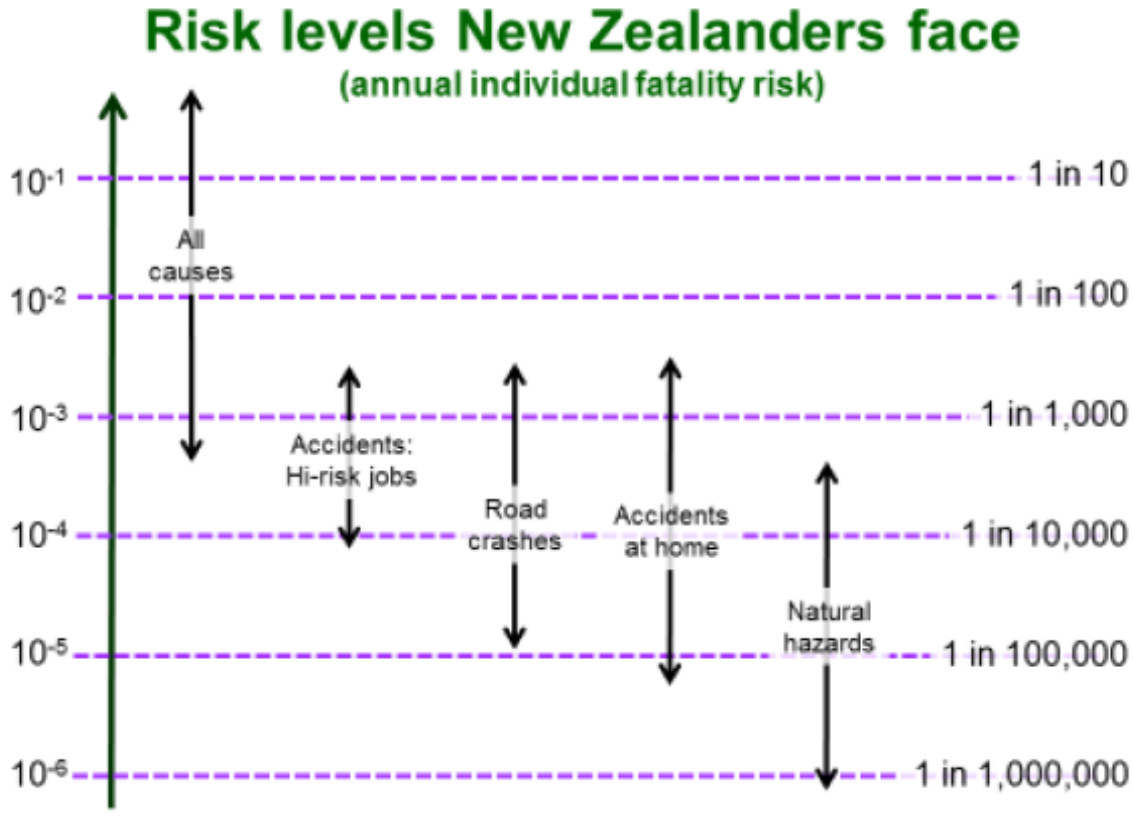
SOUTH NEW BRIGHTON AND SOUTHSHORE FACT SHEET

LIFE SAFETY RISK FROM STOPBANKS AND FLOODING

This Fact Sheet gives an explanation of life safety risk in relation to stopbanks and flooding. It is supporting information for the Southshore and South New Brighton Earthquake Legacy Issues Project.

Risk

In many aspects of our lives we are exposed to some risk. The level of risk can be calculated as a probability (or chance) or a range of probabilities. The graph below shows the probability of an individual dying in any one year for various activities. This is called the Annual Individual Fatality Risk.



Different ways of expressing probabilities and risk

The risk probability can be expressed in different ways. For example:

Probability … (per year)	… is the same as … (per year)	… is the same as … (per year)	… is the same as. (per lifetime)*
1 in 1000	10^{-3}	0.1%	8%
1 in 10,000	10^{-4}	0.01%	0.8%
1 in 100,000	10^{-5}	0.001%	0.08%
1 in 1,000,000	10^{-6}	0.0001%	0.008%

*Based on the average New Zealand life expectancy of about 82 years (from 2018 mortality data)

Stopbank safety

Stopbanks (and bunds) are one of the methods used by Christchurch City Council to provide a level of protection to people and assets from flood events. Stopbanks are designed to remain structurally stable and capable of controlling seepage for specified flood events and to withstand most earthquake events - except where there is liquefaction in the foundation soils.

The stopbanks are designed and maintained to meet an agreed level of service, so the risk level acceptably low.

Even with the stopbanks in place there is still some risk from flooding.

Assessing the risk

The stopbanks may overtop or fail in events such as an earthquake or when there are floods larger than the stopbank design. Stopbanks may also fail at below flood design levels if excessive erosion of the stopbank occurs.

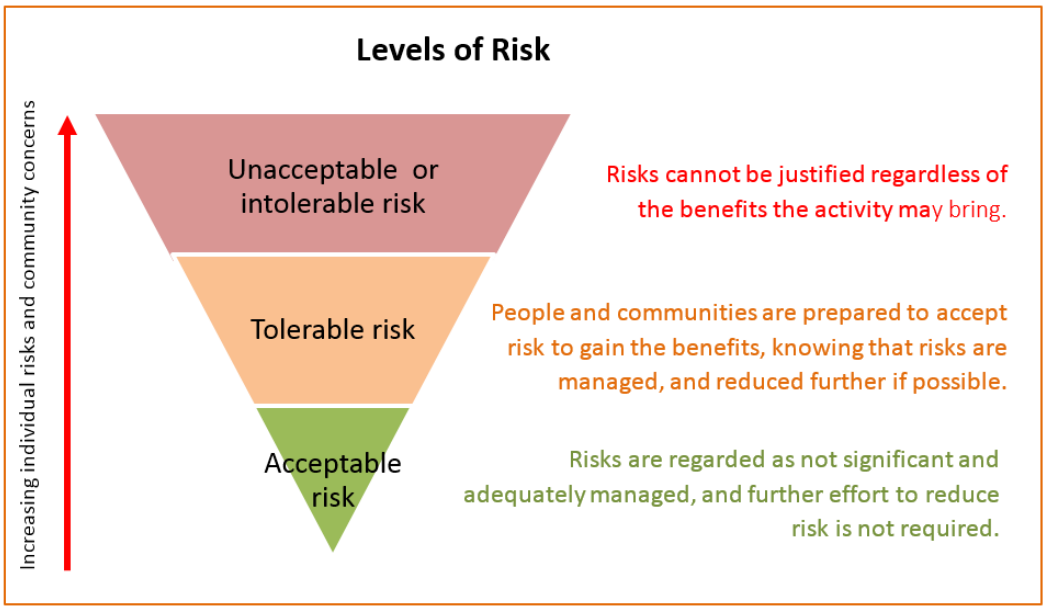
The level of risk of flooding from stopbank failure can be estimated. It takes into account the impact of any resulting flooding which depends on:

- the depth and velocity of the flood waters - an indication of flood conditions in which people are likely to be swept away in a flood with the possibility of drowning;
- the characteristics of the floodplain that would affect the affect the depth and velocity of the flood waters, including the 'roughness' of the ground; the location, type and density of structures; and the type and density of vegetation; and
- the vulnerability, exposure and coping capacity of the community.

The resulting 'Annual Individual Fatality Risk' is the assessed annual probability of an individual losing their life due to flooding.

The outcome of a risk assessment is compared with risks that are tolerable or acceptable, taking into account the community's social, cultural, environmental and economic situation.

These levels of risk are explained in the diagram below:



The purpose of a risk assessment is to make decisions about which risks need managing and where the priorities are in managing the risks.

What risk is considered tolerable? A comparison with rock fall risk in the Port Hills.

Following the 2010 and 2011 earthquakes to determine which dwellings in the Port Hills faced an unacceptable risk to life safety, a tolerable threshold for annual individual fatality risk of 1 in 10,000 was adopted.

What risk is considered tolerable for stopbanks?

Based on various risk guidelines for dams and stopbanks a tolerable limit for stopbanks is also 1 in 10,000.

2016 results for the Ōtākaro/Avon River stopbanks

In 2016 GHD was engaged by the Council to investigate the risks, benefits and costs associated with the ongoing reliance on the Ōtākaro/ Avon River temporary stopbanks for flood protection.

The GHD report showed that, aside from some sections of the stopbanks upstream of Anzac Drive that were constructed with sandbags, the temporary stopbanks along the Ōtākaro/ Avon River had annual individual fatality risk levels better than 1 in 10,000. The left bank stopbanks downstream of Pages Road had individual risk level of better than 1 in 1,000,000 lives per annum.

The GHD investigation informed the Council decision in May 2016 to improve the stopbanks and potentially extend their lifespan to up to 20 years. This included replacing sandbags with more robust materials and raising the stopbank height to at least RL 11.2m.

An option to update the risk assessment

One of the options in the Southshore and South New Brighton earthquake legacy project is to reassess the risk to life for the stopbanks north of Bridge Street and downstream of Pages Road. This would take into account that the stopbanks have been raised and repaired, and that the high tide statistics were updated in 2018. The purpose of this reassessment would be to ensure there is still an acceptable or tolerable annual individual fatality risk.

Other Southshore and South New Brighton Fact Sheets

The Southshore and South New Brighton Fact Sheet series cover a range of issues:

Fact Sheet title	What it covers
Flooding	Why the Canterbury earthquakes have led to increased flooding risk in Southshore and South New Brighton.
Groundwater	What groundwater is and why it causes issues in Southshore and South New Brighton.
Stormwater	What stormwater is and why it causes issues in Southshore and South New Brighton.
Planning and approvals	How the planning and approvals process can impact the timing, cost and requirements for options in this area.
Christchurch drainage datum and levels	What the Christchurch drainage datum is, and how we use it and other levels in our planning.
2018 new high tide statistics	Information on the record high tides experienced in Christchurch coastal areas and the 2018 review and update of tidal statistics which has occurred following these events.
Stopbanks, bunds and other structures	Explanations of some of the different structures that can be used for flood and erosion mitigation.
What is a 1 in 100 year flood?	How we describe the probability of flooding.