Appendix 5: Explanation of Annual Individual Fatality Risk

1. *Canterbury Earthquakes Port Hills Slope Stability: Principles and Criteria for the Assessment of Risk from Slope Instability in the Port Hills, Christchurch*, gives a framework for assessing the risk posed by slope instability in the Port Hills. This report was based on a number of internationally recognised precedents for quantifying and assessing risk.

2. The report suggests that an Annual Individual Fatality Risk (AIFR) of 10^{-6} is the acceptable level of risk for sensitive developments such as schools, which is equivalent to 1,000,000 years. The AIFR converts risk of fatality due to a hazard into a numerical value in the form '10 to the power of minus X per year', as detailed in Table 6 below.

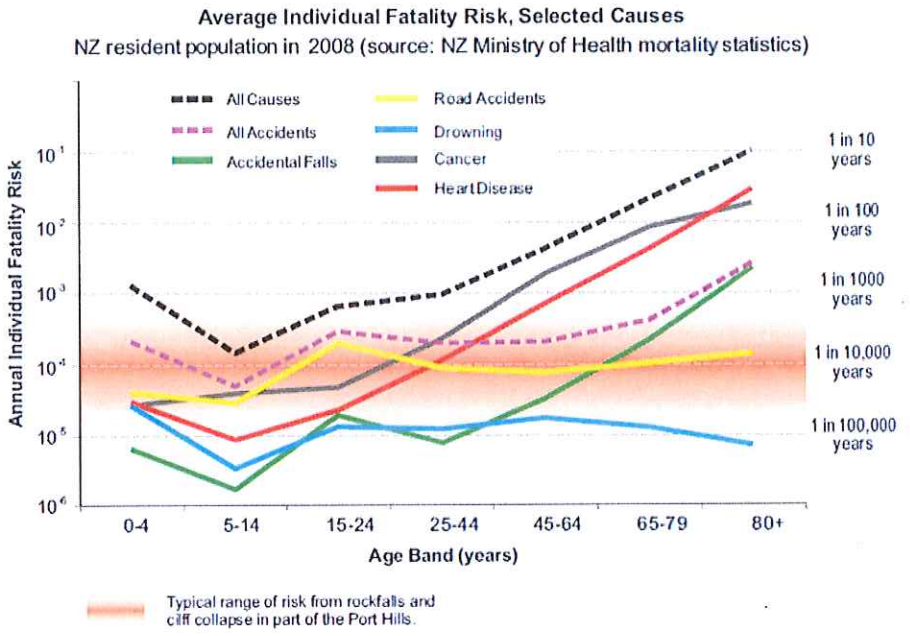
Table 6: Explanation of AIFR Levels

10^{-x} per year	Is the same as (per year)	Is approximately the same as	Is the same as
10^{-3}	0.001 or 0.1%	1,000 years	8%* per lifetime
10^{-4}	0.0001 or 0.01%	10,000 years	0.8% per lifetime
10^{-5}	0.00001 or 0.001	100,000 years	0.08% per lifetime
10^{-6}	0.000001 or 0.0001%	1,000,000 years	0.008% per lifetime

* Based on an average New Zealand life expectancy of about 80 years from 2008 mortality and population data.

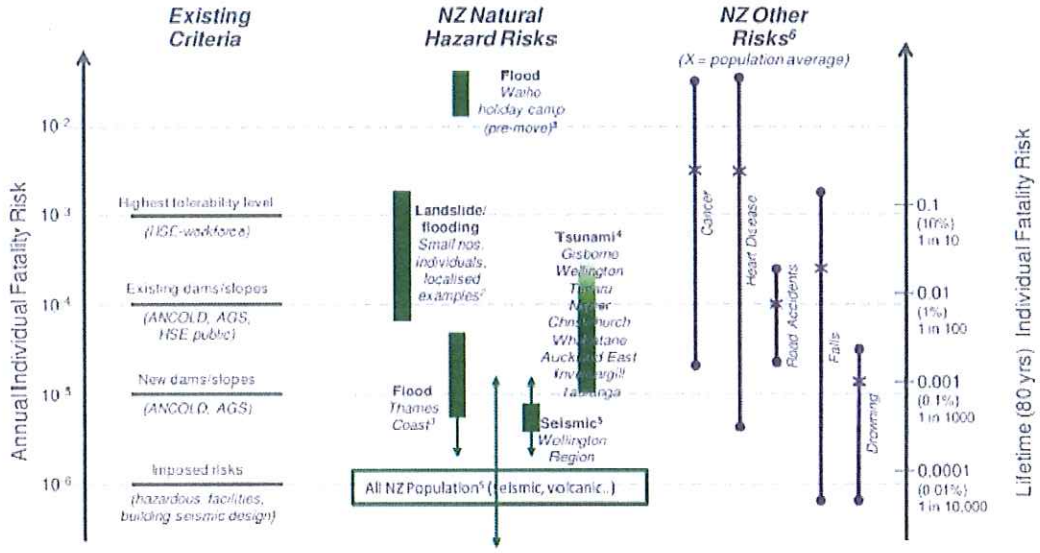
3. Figure 2 below shows a comparison of other risks in New Zealand with the rockfall and cliff collapse risk in the Port Hills as assessed by GNS.

Figure 2: Risk Comparison with Rockfall and Cliff Collapse in the Port Hills



4. Figure 2.1 below, taken from the MWH report *Relative Risk at Redcliffs School*, p. 2 provides the typical ranges of AIFR associated with common risks that New Zealanders are exposed to.

Figure 2-1 – Typical Annual Individual Fatality Risks



Notes:

1. Derived by the authors from results of MCDEM risk assessment (Optimx, 2002)
2. Estimated by the authors based on reasonable event return periods and likely consequences - see Report Section 4.1.2
3. Upper estimate for High Risk zones; arrow denote wide range of risks downwind (URS, 2003)
4. AIFR at 2-4m above sea level, no effectiveness assumed for warning (Webb, 2005)
5. Averages over large populations, arrows denote likelihood of substantial groups of people at higher/lower risk
6. Bars show range of values across age bands for men and women (Ministry of Health, 2008)