

Mātauranga House Risk Assessment – Seismic Events

16 May 2022

This risk assessment is being undertaken in response to a targeted seismic assessment report completed by Aurecon dated 30 March 2022 on Mātauranga House, 33 Bowen Street. While the seismic assessment report focused on the findings related to the building and its seismic assessment, this risk assessment focuses on the health and safety of Ministry staff and visitors in the building, in the event of a significant seismic event in Wellington or surrounding regions.

About this risk assessment

This risk assessment considers the inherent risk posed by Mātauranga House in the event of a significant seismic event. It also considers the practicality of several possible controls, and the residual risk that remains with each.

To do so we look at the known likelihood of a significant earthquake impacting the Wellington region and the likely impact on the health and safety of Ministry staff and visitors in Mātauranga House.

This risk assessment will be reviewed and updated as new information becomes available.

Background factors

There is a significant history of earthquakes within / impacting on the Wellington region:

- 1848 Marlborough earthquake (7.5) which damaged almost all brick buildings in the city and destroyed the brick chimneys of many wooden buildings.
- 1855 Wairarapa earthquake (8.2) raised land on the western side of Wellington Harbour by between 1 – 2m but caused relatively minor damage (attributed to the extensive rebuilding following the 1848 earthquake)
- 2013 Cook Strait earthquake sequence (6.5) caused moderate damage in the wider Marlborough area and Wellington, including partial floor collapse
- 2016 Kaikoura earthquake (7.8) which caused significant damage to buildings, including modern multi story office buildings, beyond repair.

Estimating likelihood

There is no scientific method yet to reliably know the time and location of the next large earthquake¹ And predictions as to possible future earthquakes are based on what is known at any given time, such as:

- known faults (Noting that the 2010 and 2011 Canterbury earthquakes were on previously unknown faults²),
- Return periods (or return times), the time between ruptures, and the
- Severity of past events.

¹ GNS Science: <https://www.gns.cri.nz/Home/Our-Science/Natural-Hazards-and-Risks/Earthquakes/Operational-Earthquake-Forecasting>. The US Geological Survey also note: "Neither the USGS nor any other scientists have ever predicted a major earthquake", see: <https://www.usgs.gov/faqs/can-you-predict-earthquakes>

² <https://www.gns.cri.nz/Home/Our-Science/Natural-Hazards-and-Risks/Recent-Events/Canterbury-quake/Hidden-fault>

A significant earthquake impacting the Wellington CBD is possible at any time, but it is unlikely to happen in the next 6 – 9 months. There are many active faults with the potential to impact on Wellington by way of a damaging earthquake. Table 1 summarises the main ones.

TABLE 1: Main faults / fault series with the known potential to impact on the Wellington CBD

Fault (or series)	Location (Please refer to Appendix A for fault maps)	Notable event/s (severity)	Estimated likelihood of an event at any given point in time
Alpine	SW – NE to the west of the Southern Alps.	1717 (8.1)	75% chance by 2070
Marlborough Fault System	A system of faults that extend in a SW – NE direction through the northern part of the South Island.	2016 (7.8) 1848 (7.5)	“Relatively high”. ⁴
Wellington region faults	A series of faults running SW – NE across the lower part of the North Island.	1855 (8.2) 300-500 yrs ago (7)	9(2)(g)(i)
			The Wellington region experiences a very strong or extreme earthquake about every 150 years (noting that the last was 1855, or 167 years ago). ⁵
			The Wellington Fault last ruptured 300 – 500 years ago and produces a large earthquake every 500 to 1000 years. This fault has the highest probability of rupturing next in the Wellington region. ⁶
Hikurangi Subduction Zone	Located off the East Coast of the North Island, is where the Pacific tectonic plate subducts (or dives underneath) the Australian tectonic plate	Not yet known	New research indicates that the probability of an earthquake of at least magnitude 8 on the southern end of the Hikurangi subduction zone in the next 50 years is about 26%. ⁷

The Alpine Fault

The fault has ruptured four times in the past 900 years (~1100, ~1450, ~1620, and 1717) each time producing an earthquake of about magnitude 8. It is estimated there is a 75% chance of an earthquake on the fault within the next 50 years (by 2070), with an 82% chance it will be of magnitude 8 or higher.⁹

³ <https://www.gns.cri.nz/Home/News-and-Events/Media-Releases-and-News/Media-briefing-New-Alpine-Fault-research-20-04-2021>

⁴ Zachariasen J.; Berryman K.; Langridge R.; Prentice C.; Rymer M.; Striling M.; Villamor P. (2006). "Timing of late Holocene surface rupture of the Wairau Fault, Marlborough, New Zealand". New Zealand Journal of Geology and Geophysics. 49 (1): 159–174. See:

<https://www.tandfonline.com/doi/pdf/10.1080/00288306.2006.9515156>

⁵ <https://www.gns.cri.nz/Home/Learning/Science-Topics/Earthquakes/Major-Faults-in-New-Zealand/Wellington-Fault/How-often-do-earthquakes-occur-along-the-fault>

⁶ <http://www.gns.cri.nz/Home/Learning/Science-Topics/Earthquakes/Major-Faults-in-New-Zealand/Wellington-Fault/How-do-we-know-which-fault-is-most-likely-to-rupture-next-in-Wellington>

⁷ <https://www.eastcoastlab.org.nz/our-science/our-projects/hikurangi-subduction-earthquakes-and-slip-behavior-research-project/article/200/1-in-4-chance-of-a-magnitude-8-hikurangi-subduction-zone-earthquake-in-the-next-fifty-years?t=featured&s=3>

⁸ <https://www.gns.cri.nz/Home/Learning/Science-Topics/Earthquakes/Major-Faults-in-New-Zealand/Alpine-Fault>

⁹ <https://www.gns.cri.nz/Home/News-and-Events/Media-Releases-and-News/Media-briefing-New-Alpine-Fault-research-20-04-2021>

The Marlborough Fault System

All parts of this fault system are seismically active. Earthquakes that have impacted Wellington have occurred on the Awatere (1848) and Hope (2016) Faults. The Wairau Fault, another fault within the system, is nearing the end of its inter-seismic period and the chance of a rupture is considered relatively high.¹⁰

Wellington region faults

There are five “main” faults near Wellington that are considered active. The Wellington Fault (which passes just to the west of the CBD) last ruptured 300 - 500 years ago and is estimated to cause a major earthquake every 500-1000 years. Other faults around Wellington are also active and capable of generating major earthquakes. The Wairarapa Fault last ruptured in 1855 causing an earthquake that severely affected Wellington. With several active faults, the frequency of large earthquakes affecting the Wellington Region is higher.¹¹

Hikurangi Subduction Zone

The Hikurangi subduction zone is poorly understood, yet potentially the largest source of earthquake and tsunami hazard in New Zealand. It is understood that the Hikurangi subduction zone can produce large earthquakes and tsunamis, and that these events have occurred in the past. However, it is not yet known how often these earthquakes tend to happen, or how large they can be, though earthquakes of magnitude 8.0 or larger are certainly plausible, and 9.0 may be possible.¹²

Estimating consequence

The harm (consequence) of a seismic event is a function of several factors, including:

- The location of the epicentre, depth, and (magnitude) of the earthquake,
- What time of the day and what day of the year the earthquake strikes, and
- How the building performs in the earthquake.

The impact to humans could therefore (credibly) be anywhere between NIL and catastrophic (multiple deaths).

¹⁰ Zachariasen, J.; Berryman K.; Langridge R.; Prentice C.; Rymer M.; Striling M.; Villamor P. (2006). "Timing of late Holocene surface rupture of the Wairau Fault, Marlborough, New Zealand". *New Zealand Journal of Geology and Geophysics*. 49 (1): 159–174. See:

<http://www.tandfonline.com/doi/pdf/10.1080/00288306.2006.9515156>

¹¹ <https://www.gns.cri.nz/Home/Learning/Science-Topics/Earthquakes/Major-Faults-in-New-Zealand/Wellington-Fault/How-often-do-earthquakes-occur-along-the-fault>

¹² Wallace, Laura M.; Cochran, Ursula A. (June 2014). "Earthquake and Tsunami Potential of the Hikurangi Subduction Thrust, New Zealand: Insights from Paleoseismology, GPS, and Tsunami Modeling". *Oceanography*. 27 (2): 104–117. See: <https://tos.org/oceanography/article/earthquake-and-tsunami-potential-of-the-hikurangi-subduction-thrust-newzeal>

The inherent risk

For a Major earthquake, based on the likelihood, and the maximum credible consequence combined, the overall risk assessment is “high.”

TABLE 2: The inherent risk

Consequence ► Likelihood ▼	MINOR	MODERATE	MAJOR	SUBSTANTIAL
ALMOST CERTAIN	Medium	High	High	Extreme
LIKELY	Medium	Medium	High.	Extreme
POSSIBLE	Low	Medium	High	High
UNLIKELY	Low	Low	Medium	High
RARE	Low	Low	Medium	Medium

Please refer to Appendix B for more information on the risk matrix

An engineer’s view on building occupancy

For earthquake-prone buildings in Wellington, which is a high seismic risk area¹³, s. 133AM of the *Building Act 2004* sets a maximum time frame of 15 years for non-priority buildings¹⁴ such as Mātauranga House. This legislated period represents the time over which the Government considers the heightened risk can be tolerated and addressed without affecting occupancy.

The engineer engaged by the Ministry to assess Mātauranga House has indicated they have no objections to continued occupation of the building while the remediation strategy is developed and implemented. Members from the Ministry’s Engineering Strategy Group have reviewed the assessment and supports this position.

H&S Comment:

We understand that, even if it were deemed an appropriate risk to stay in the building in the medium term, the Ministry is unlikely to remain in the building while the strengthening work takes place due to the likely disruptive nature of the work.

The Ministry’s duty of care

Under s. 36 of the *Health and Safety at Work Act 2015* (the Act) the Ministry must ensure the health and safety of Ministry staff and others (eg. Visitors). This is the “primary duty of care”.

Under s. 7, the manager or controller of a workplace must ensure the workplace, the means of entering and exiting the workplace, and anything arising from the workplace are without risks to the health and safety of any person.

For both s. 36 and s. 37, the duty is qualified as being “so far as is reasonably practicable” (as defined under s. 22).

¹³ Refer to Appendix B: Seismic risk areas in NZ

¹⁴ <https://www.legislation.govt.nz/act/public/2004/0072/latest/whole.html#DLM7333546>

The Health and Safety assessment of what is “reasonably practicable”

The full text of s. 22 of the Act is:

22 Meaning of reasonably practicable

In this Act, unless the context otherwise requires, **reasonably practicable**, in relation to a duty of a PCBU set out in [subpart 2 of Part 2](#), means that which is, or was, at a particular time, reasonably able to be done in relation to ensuring health and safety, taking into account and weighing up all relevant matters, including—

- (a) the likelihood of the hazard or the risk concerned occurring; and
- (b) the degree of harm that might result from the hazard or risk; and
- (c) what the person concerned knows, or ought reasonably to know, about—
 - (i) the hazard or risk; and
 - (ii) ways of eliminating or minimising the risk; and
- (d) the availability and suitability of ways to eliminate or minimise the risk; and
- (e) after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

TABLE 3: An overview of considerations under s. 22 of the Act

Part	H&S Comment
a	The best estimations are somewhere between “relatively high” and up to “75% within 50 years”.
b	The harm could be anywhere between NIL and catastrophic (multiple deaths).
c (i)	There are several active fault systems very or relatively close to Wellington, there is a history of large earthquakes impacting on the Wellington region, and large earthquakes can severely damage buildings, causing loss of life.
c (ii)	It is not possible to eliminate risk from an earthquake. The risk could be minimized ¹⁵ by: <ol style="list-style-type: none"> i. Immediately closing Mātauranga House and sourcing another building with an acceptably high rating (while Mātauranga House is strengthened), ii. Immediately moving all staff into 1 The Terrace (in essence combining the buildings) or some alternative space, and making extensive use of WFH (while Mātauranga House is strengthened), and iii. Continuing to occupy Mātauranga House in the short term, while alternative plans are investigated, with additional controls such as: <ul style="list-style-type: none"> - greater use of WFH (depopulating the building), and / or - restricting access to parts of the building deemed an increased risk (eg. the steel stairs)
d	The options above (I – IV) will be considered below.
e	Option 1: This is the most expensive option. It unlikely to be a cost grossly disproportionate to the risk however the availability and suitability of an alternative building is still being investigated and is likely to take several months to resolve. Option 2: A relatively low-cost option, however arguably the most disruptive for the Ministry. Option 3: Of a similar cost to Option 1, but with some delay on any costs of the move or the new lease.

¹⁵ The likelihood of a significant earthquake cannot be influenced, but the consequences can.

TABLE 4: Assessment of identified options “availability and suitability” (vis-à-vis if they are reasonably practicable)

Pros	Cons
<p><i>Option I: Immediately moving to a safer building</i></p> <p>Occupying a building with an appropriate seismic rating will greatly reduce the possible impact of any large earthquake on our people.</p>	<p>Alternative accommodation may not be readily available.</p> <p>Due diligence and negotiation would need to take place, and this would delay the process (3 – 6 months).</p> <p>The “cons” are dependent on the physical characteristics (including location) of the building. There could be a possible negative impact on the ability of staff at national office (eg. Mātauranga House and 1 The Terrace) to physically interact.</p>
<p><i>Option II: Move all staff into 1 The Terrace (or some alternative space) and make greater use of WFH</i></p> <p>Can be acted on reasonably promptly (even as an interim measure while searching for suitable alternative accommodation).</p>	<p>Impact and inconvenience on existing staff at 1 The Terrace.</p> <p>As a longer-term solution, it is at odds with stated preferences from Te Kawa Mataaho Public Service Commission which have expressed a view that WFH should not be viewed as the norm within the public service (but, as noted, it could be a short-term measure).</p>
<p><i>Option III: Continuing to occupy Mātauranga House in the short term (up to 9 months) while alternative plans are investigated</i></p> <p>On a day-to-day basis this is the least disruptive.</p> <p>Provides an opportunity to make robust and well-considered decisions before committing to a new lease arrangement.</p>	<p>This exposes our staff to greater risk in the interim (possibly months) and this risk, while small, is cumulative (each additional day we have staff in MH adds to the risk).</p> <p>At the time of writing this risk assessment, the Ministry was unaware of the building owners' intentions in relation to these reports undertaken by the Ministry or any subsequent reports commissioned by the building owner.</p> <p>Depopulation will reduce the possible impact of any seismic event, but a catastrophic outcome (multiple deaths) remains a possibility.</p>

The residual risk

For staff who work in Mātauranga House, the residual risk of a significant seismic event is greatly reduced by moving them out of the building at the earliest opportunity (Options I and II).

Under Option III the risk is reduced due to depopulation of the office and the relatively short time frame occupation continues (up to 9 months) while suitable alternative arrangements (a planned withdrawal) are made.

The table below summarises the residual risk of the 3 options.

TABLE 5: The residual risk of the option

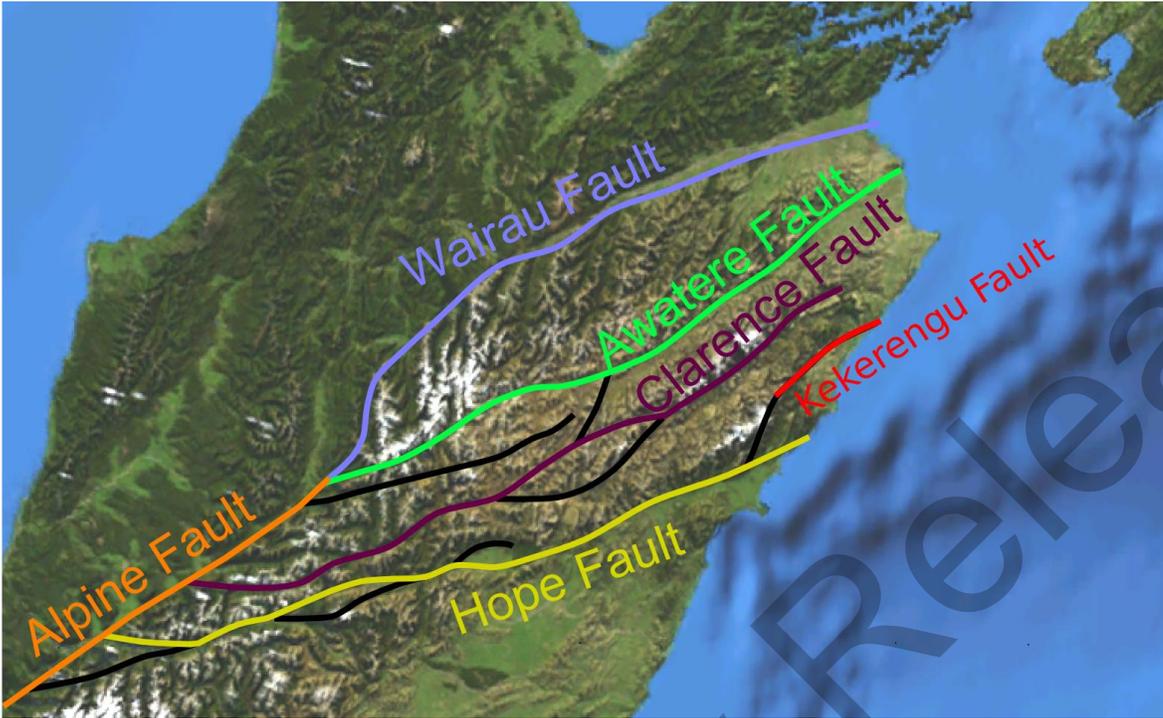
Consequence ► Likelihood ▼	MINOR	MODERATE	MAJOR	SUBSTANTIAL
ALMOST CERTAIN	Medium	High	High	Extreme
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RARE	Low	Low	Medium	Medium

Options I and II: Leave MH immediately Option III: Stay in MH (6-9 mths) MH inherent risk

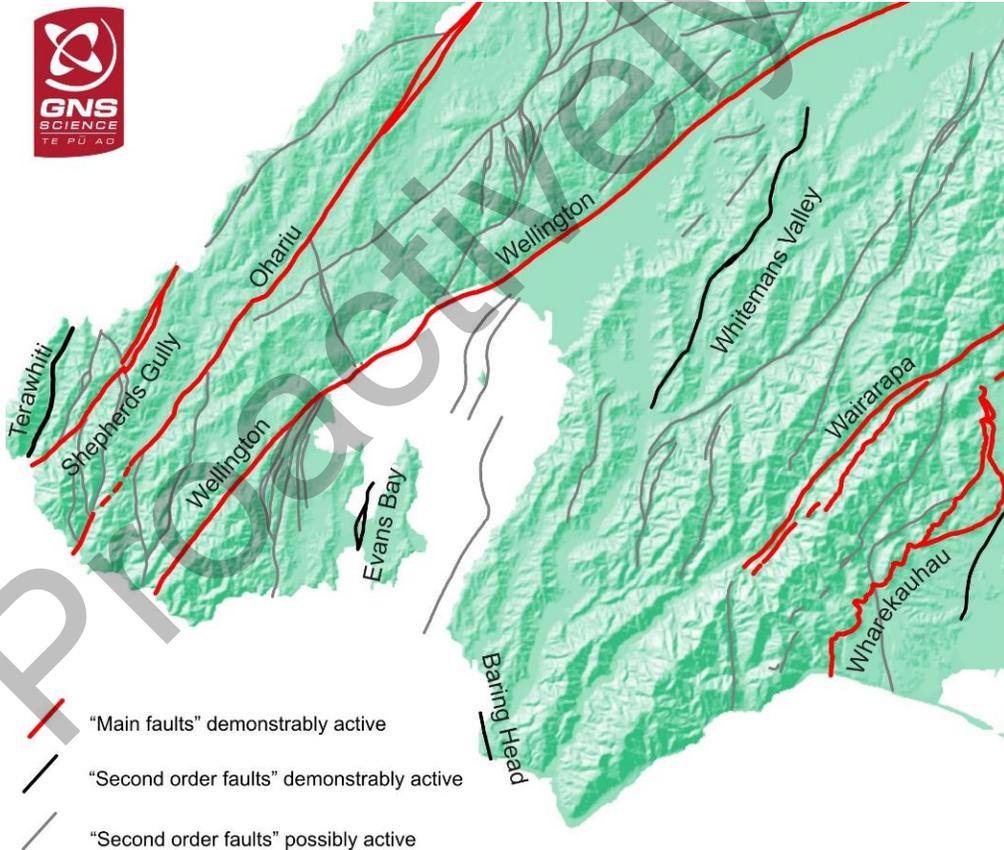
Proactively Released

Appendix A (Part I): The Alpine, Marlborough and Wellington region faults

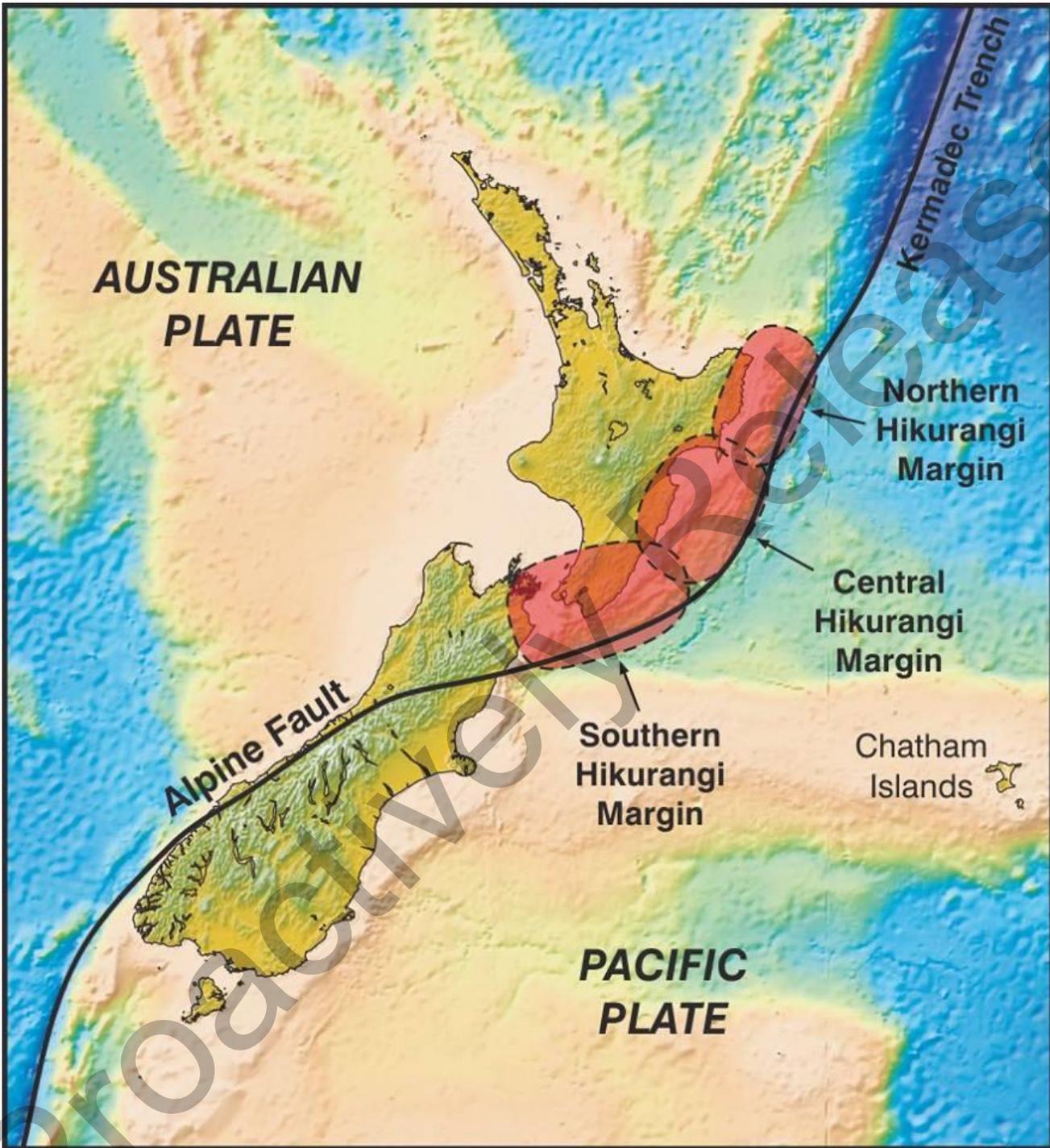
The Alpine Fault and the Marlborough Fault System



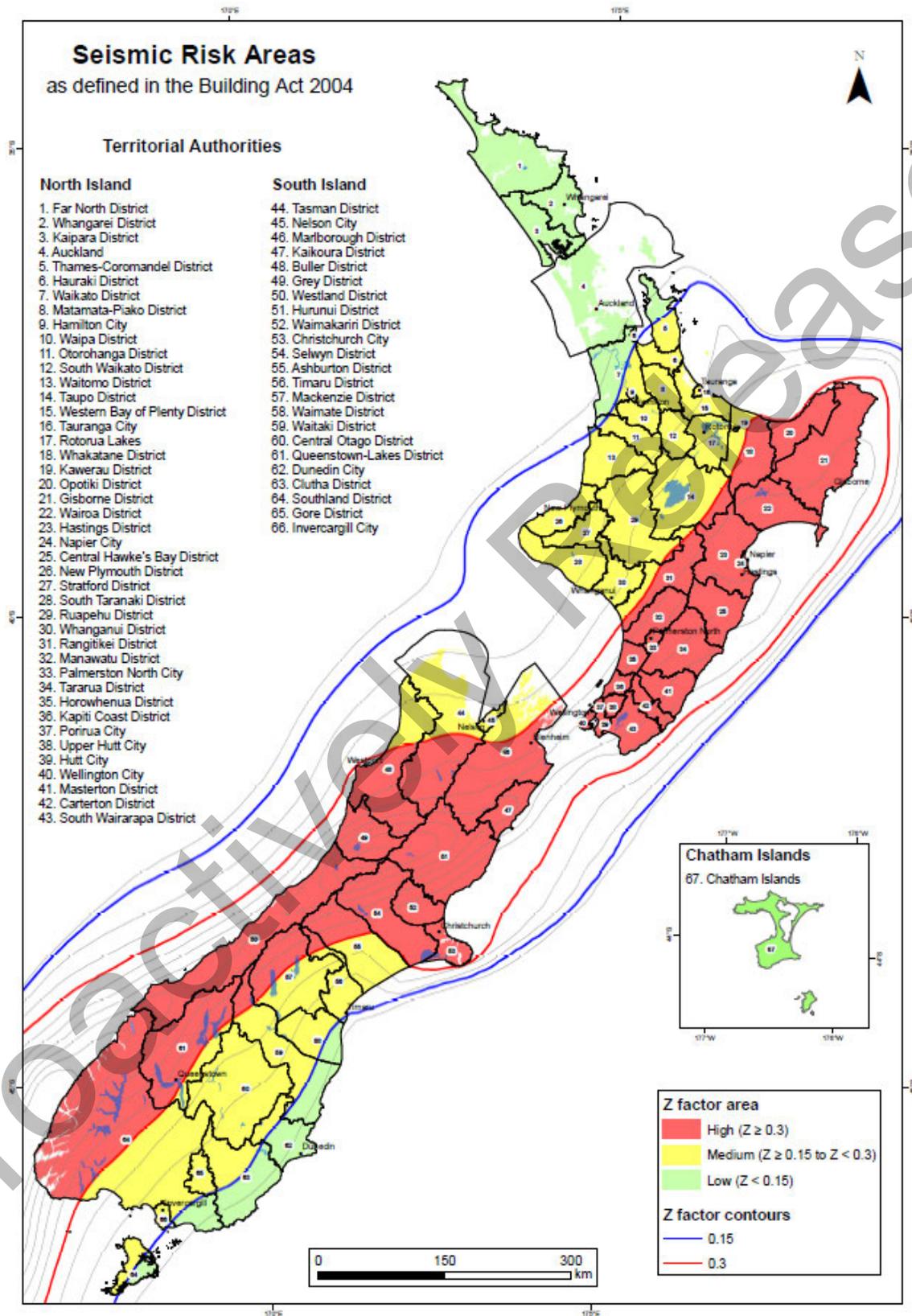
The main faults of the Wellington region



Appendix A (Part II): The Hikurangi Subduction Zone



Appendix B: Seismic risk areas in New Zealand



Appendix C: The Ministry of Education Risk Matrix

Consequence ► Likelihood ▼	MINOR	MODERATE	MAJOR	SUBSTANTIAL
ALMOST CERTAIN	Medium	High	High	Extreme
LIKELY	Medium	Medium	High.	Extreme
POSSIBLE	Low	Medium	High	High
UNLIKELY	Low	Low	Medium	High
RARE	Low	Low	Medium	Medium

Likelihood	Criteria
Almost certain	<ul style="list-style-type: none"> • Could be expected to occur in most circumstances • Virtually guaranteed to occur during an activity/process
Likely	<ul style="list-style-type: none"> • Could probably occur in most circumstances • Common occurrence during an activity/process
Possible	<ul style="list-style-type: none"> • Could occur at some time • Could occur during an activity/process or during an asset's life cycle
Unlikely	<ul style="list-style-type: none"> • Could occur at some time, but is improbable • Chance of occurrence during an activity/process
Rare	<ul style="list-style-type: none"> • Could occur in exceptional circumstances • Remote chance of occurrence during an activity/process

Consequence	Definition
Substantial	<ul style="list-style-type: none"> • Permanent incapacity (including fatality) or ill health.
Major	<ul style="list-style-type: none"> • Major injury(s) or illness resulting in long-term incapacity or ill health
Moderate	<ul style="list-style-type: none"> • Injury or illness requiring medical treatment or counselling.
Minor	<ul style="list-style-type: none"> • Minor injury or illness. First-aid treatment only.