



Electricity Engineers'
Association

**ASSET
MANAGEMENT**

Resilience Guide

Asset Management Group

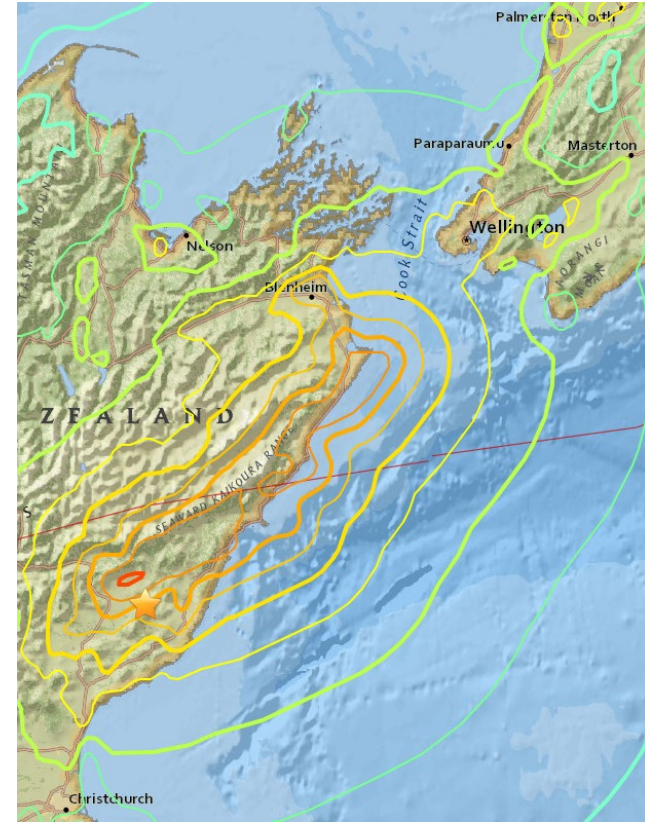


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Kaikoura Earthquake

- The 2016 Kaikoura earthquake caused widespread damage throughout the region, including to the Wellington Electricity office building.
- 28,000 customers lost supply, this was largely due to overhead faults.
- There was an elevated rate of cable failure for two years following the earthquake.
- Wellington Electricity were challenged by Government to improve resilience.



Wellington Earthquake Risk

- There are 3 major fault lines in the Wellington Region and numerous smaller ones.
- Any of these has the potential to cause a severe earthquake
- Combined, these fault lines cause major earthquakes within the region approximately 150-300 years apart.
- A return period of 300 years was used for the benefit analysis.

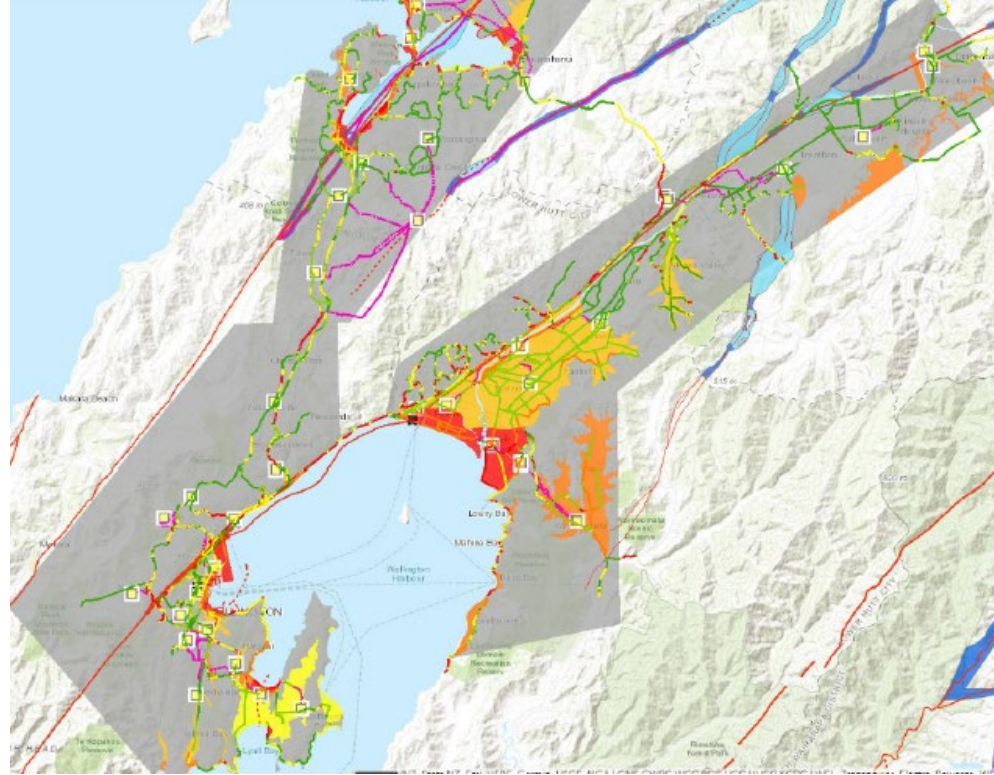


Damage Modelling

- Looked at the network by area and asset class, estimating the risk of four types of earthquake hazard (Shaking, Liquefaction, Fault Line Movement, Slope Failure)
- Main cause of network damage is expected to be liquefaction damage to cables
- Damage estimates were based on failure rates in the Christchurch earthquakes of 2010 and 2011
- Older type cables are more vulnerable, especially oil/gas pressurised, but ground type is expected to have much more effect.
- Cable type was not considered for failure rate estimates.



Damage Modelling



Outage Estimation

- Outages were estimated at the zone substation level. With load loss based on average values since this could occur at any time of year.
- 11kV load lost was as a percentage based on the liquefaction risk in that area.
- Supply from adjacent zones was considered and depended on the number of zones that the substation was connected with and the damage risk in that zone.
- Hardest hit areas are expected to be the Wellington CBD, Petone and Miramar, including the Airport
- Damage to transport network is the driving factor for most outages.



Cost Benefit and Mitigation

- Mitigation options were listed and the effects that these would have on restoration times were estimated.
- The difference in restoration time was used to calculate the benefit of each option.
- Monetary benefit was calculated by multiplying outage reductions with the Value of Lost Load (VOLL).
- Options were assessed individually but for the final application, care needed to be taken to ensure that overlapping benefits were only counted once.



The “Streamlined” CPP

- Concentrated on allowing repairs to begin before road access was restored
- Subtransmission faults – Emergency Overhead Lines
- Zone Substation Damage – Mobile Substations
- 11kV Cable Damage – Spare cable and joints
- Distribution substation damage – Transformers and switchgear
- Substation building damage – Seismic strengthening programme (reduction)
- Communications links – Backup data centres

Wellington Electricity's earthquake readiness plan

WELL delivers electricity to approximately
166,000
homes, businesses and
government agencies in and
around Wellington

We're allowing WELL to spend
an additional
\$31 million
to make its network more earthquake
resilient including strengthening
substations and buying emergency
equipment and spares

Consumer bill impact

We expect the average consumer's
bill of **\$185** a month will
increase by \$1.70.
However, the total price a consumer
pays also depends on other
components including generation,
transmission, and retail.

Our monitoring

If WELL does not make the
improvements, money will be returned
to customers through lower prices



More information at www.comcom.govt.nz



Questions?



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