



Masters Thesis

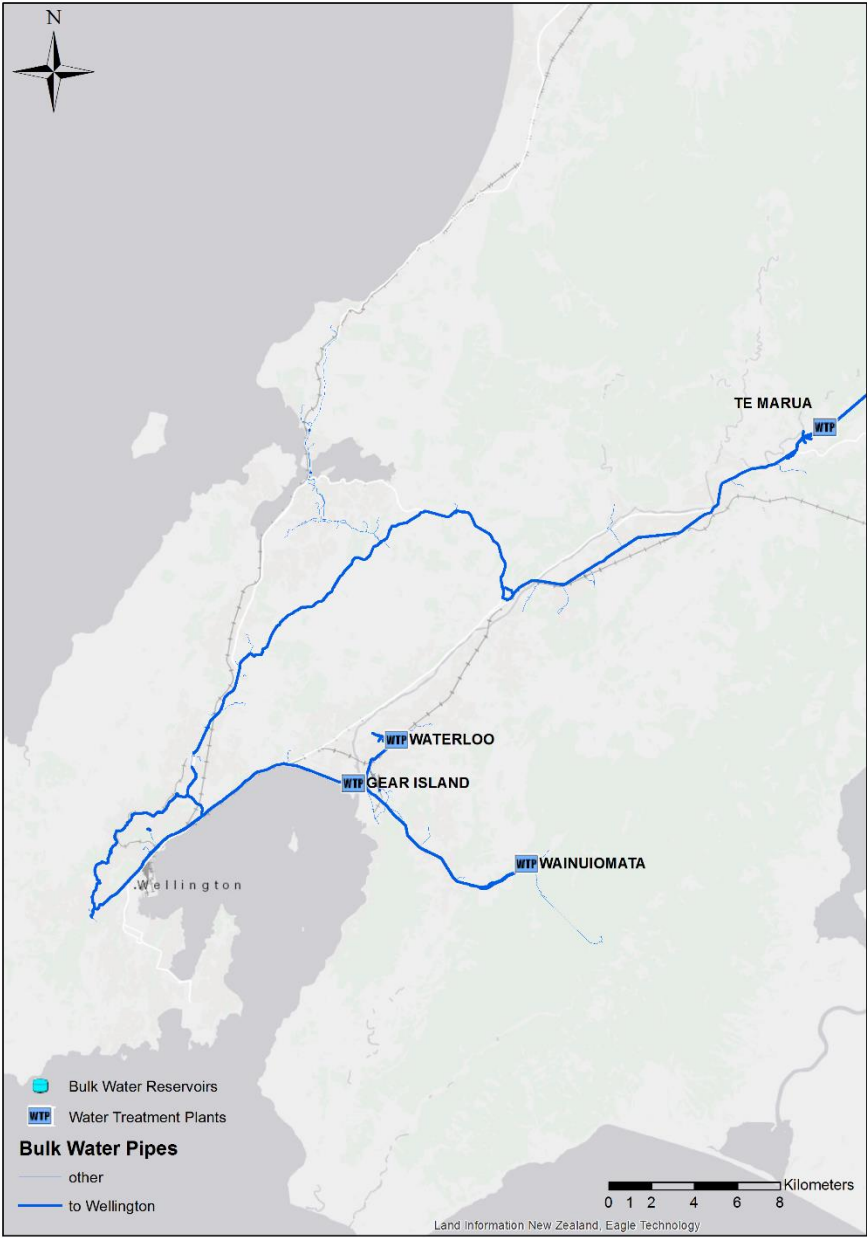
Water pipe repair-  
times post  
earthquake



# Context



(GNS Science, n.d.)



Land information New Zealand, Eagle Technology



(Hancox & Perrin, 2010, p22)



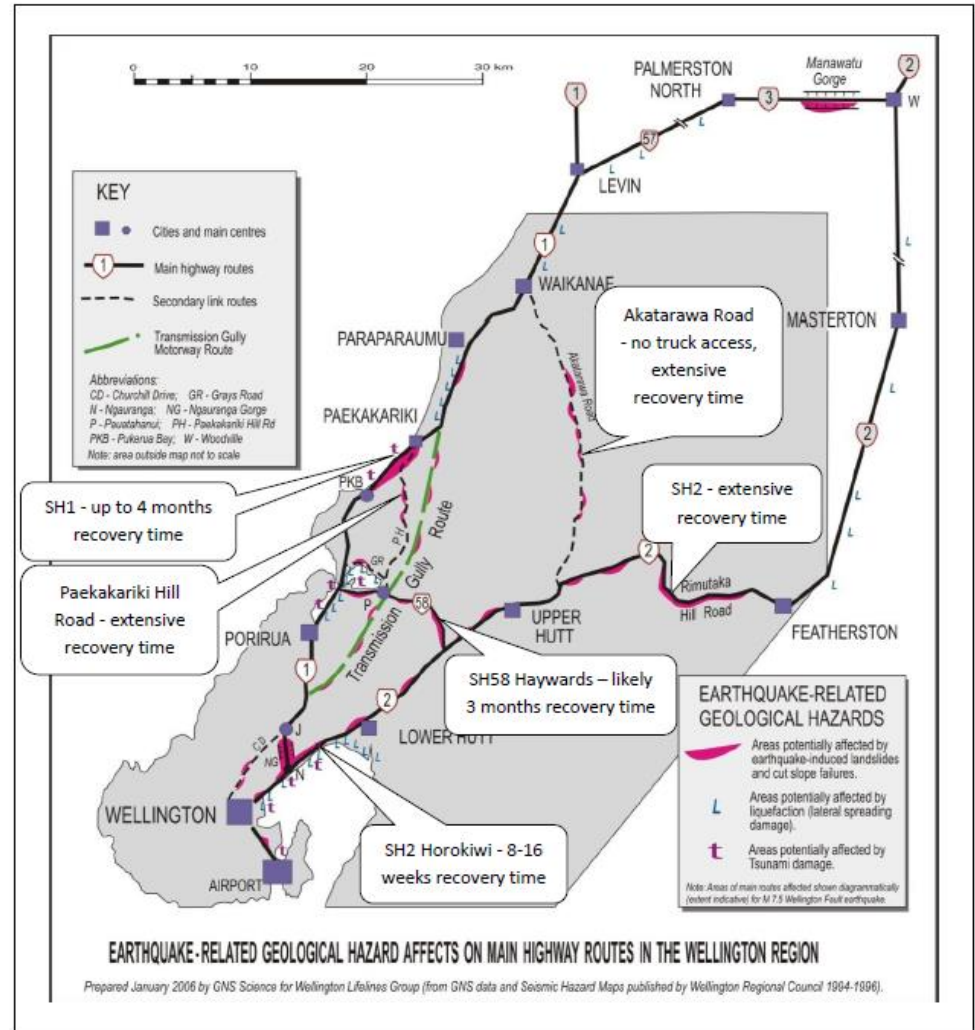
Otago Daily Times. (February 22, 2016)



(Ford, 2017)

# Factors Raised

- Road access



(Mowll, 2012)

# Factors Raised

- Road access
- Pipe diameters
- Topography
- Staff Inexperience
- Repair Coordination



# Factors Raised

- **Road access**
- **Pipe diameters**
- **Topography**
- **Staff Inexperience**
- **Repair Coordination**
- Competition for equipment
- Politics



New Zealand Defence Force, 2017



# Factors Raised

- **Road access**
- **Pipe diameters**
- **Topography**
- **Staff Inexperience**
- **Repair Coordination**
- Equipment acquisition
- Politics
- Reservoir damage
- Hazards
- Environmental impacts and regulations



# Model Calculation

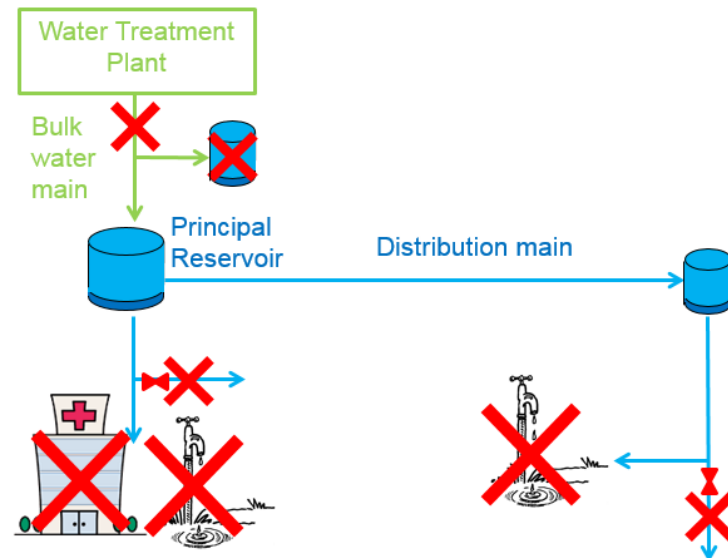
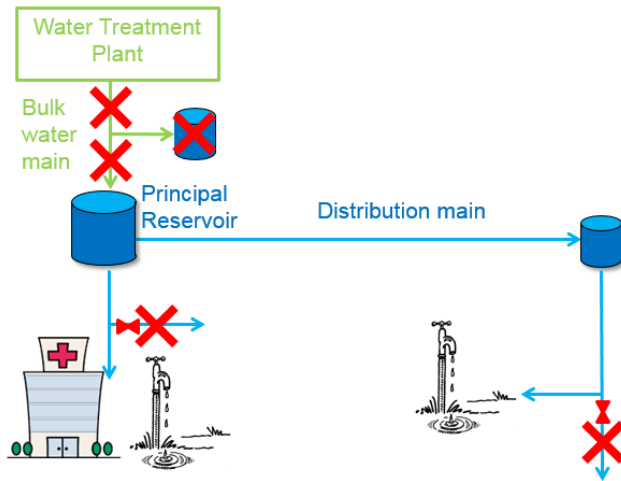
- *Pipe Failure Probability =*

$$\frac{\left( \left( 1600 \times 10^{\left( \frac{-40}{MMI - 0.6} \right)} \right) \times SM \times LIQ \times LS \times \text{Segment length} \right)}{\text{(Redundancy factor)}} \times 1000$$

# Results

Source	Total (original model)	Inspection	Oddball pipes	Staff logistics	Total	Landslides and access	Grand totals
Kaitoke	53	0.1	1	3	56	28	84
Wainuiomata	81	4	0.5	10	94	98	192
Waterloo	65	4	0.3	8	76	98	174
Gear Island	61	4	1.6	7	73	98	171

# Current and future work



# Conclusions

1. Local factors have a significant impact adding up to 13 days (111 days when incorporating land sliding)
2. Need for in-depth research, like that being conducted currently by WWL.

# References

- Ford, M. (July 12, 2017). Dynamic landscape makes NZ prone to slips. *Stuff*. Retrieved from <https://www.stuff.co.nz/national/94625277/dynamic-landscape-makes-nz-prone-to-slips>
- GNS Science. (n.d.). *Wellington Fault*. Retrieved from <https://www.gns.cri.nz/Home/Learning/Science-Topics/Earthquakes/Major-Faults-in-New-Zealand/Wellington-Fault>
- Hancox, G. T., & Perrin, N. D. (2010). *Sites of potential landslides that could damage water pipelines in the Greater Wellington Region during a Wellington Fault Earthquake*. GNS Science
- Mowll, R. (2012) Lifeline utilities restoration times from metropolitan Wellington following a Wellington Fault Earthquake: Report to the Wellington CDEM Group Joint Committee for the Wellington Lifelines Group Wellington Lifelines Group. Retrieved from <http://www.gw.govt.nz/assets/Emergencies--Hazards/Emergency-Planning/12-11-13-WeLG-report-to-CDEM-Joint-Committee-restoration-times-FINAL.pdf>
- Otago Daily Times. (February 22, 2016) *Major study probes NZ's big landslide threat*. Author. Retrieved from <https://www.odt.co.nz/news/national/major-study-probes-nzs-big-landslide-threat>
- Radio New Zealand. (November 16, 2016) Hundreds still stranded in Kaikoura. Retrieved from <https://www.radionz.co.nz/news/national/318126/hundreds-still-stranded-in-kaikoura>