

Planning for seismic resilience of water networks - a case study for Rotorua Lakes Council



SR Uma, PhD.

Team Leader (Risk and Engineering Team)

s.uma@gns.cri.nz

Finn Scheele

Elizabeth Abbott

Jose Moratalla



Why resilience initiatives for water networks?

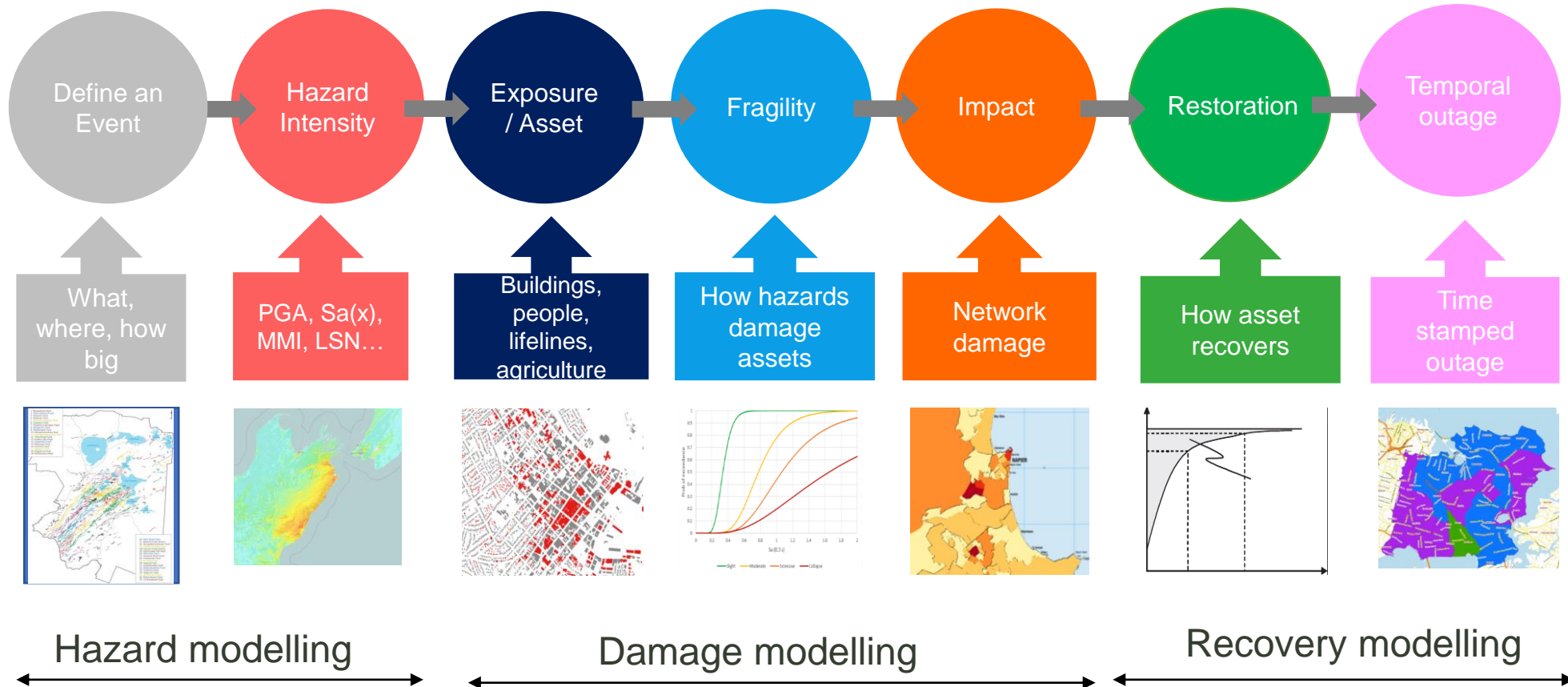
- Statutory requirements from Local Government Act
 - “infrastructure strategy” - identifying and managing risks to natural hazards and planning for financial provisions
- National Infrastructure Unit’s 30 year plan
 - shift from independent infrastructure failure to interdependencies, levels of service and community preparedness.
- Thinly spread planning budgets, so within the risk & resilience space there is a need for sound investment

Scope of the study

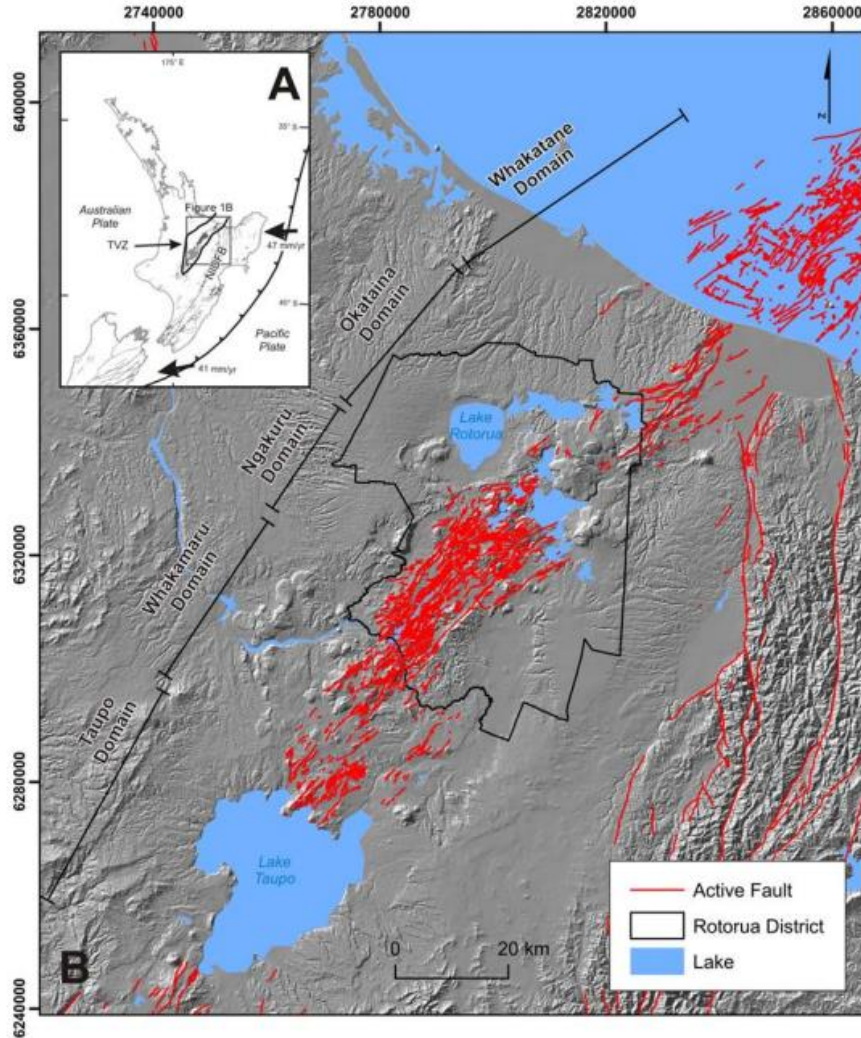
Scenario-based risk assessment

- Define an earthquake hazard scenario
- Vulnerable parts of the network components
- Estimate likely outage time of services in the area of interest
- Estimates of ground motion intensities at critical components sites

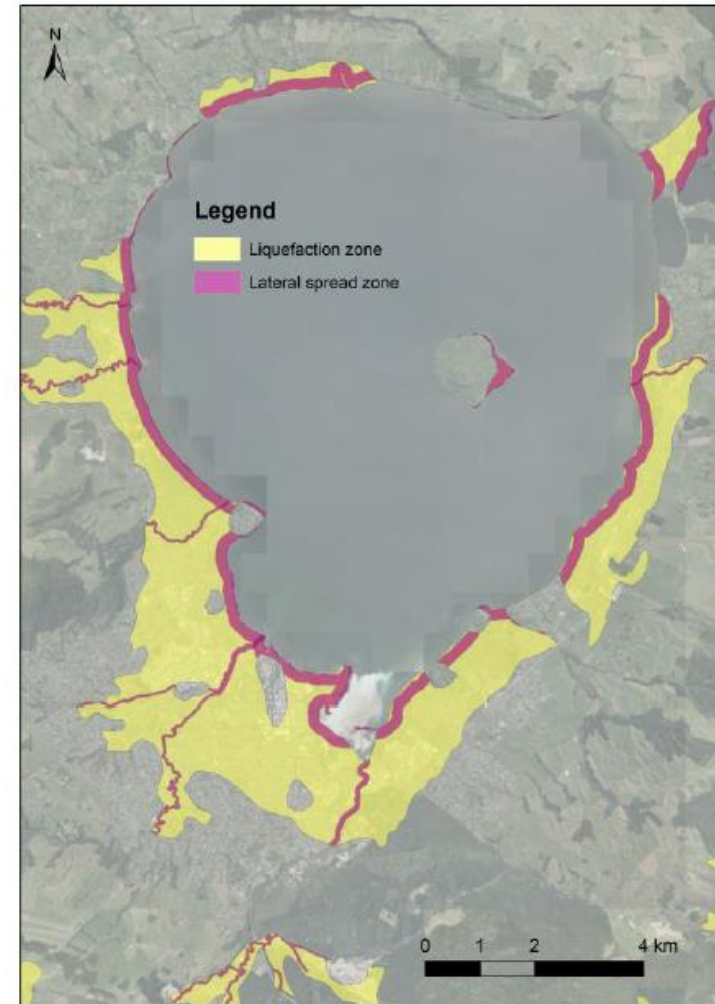
Risk Assessment Framework



Region's key hazards



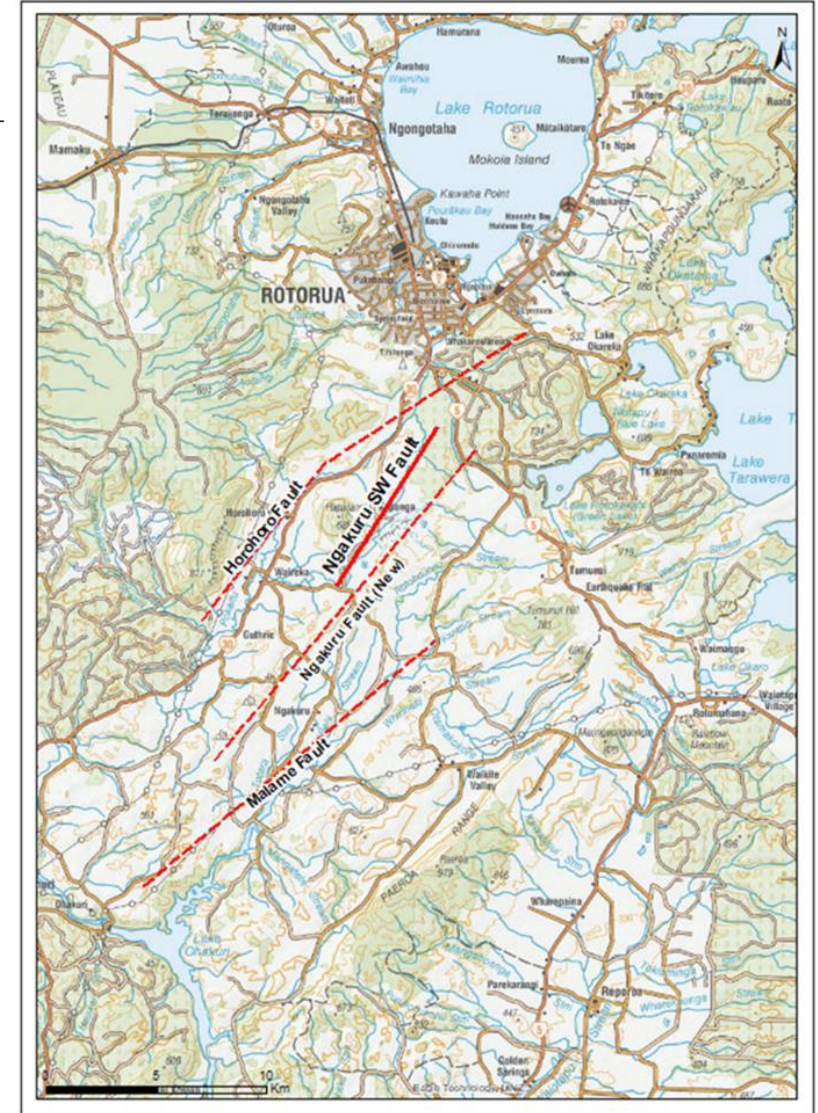
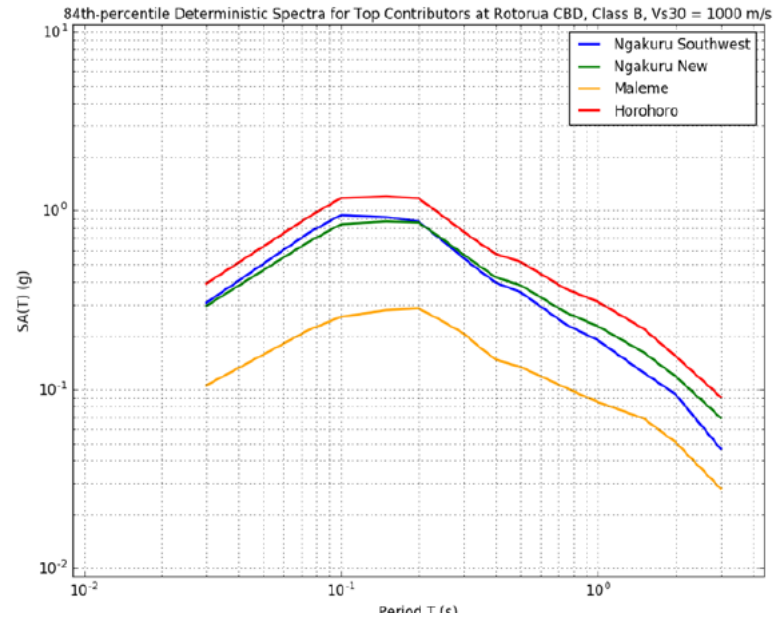
Earthquake



Liquefaction and lateral spreading

Earthquake Scenario Identification

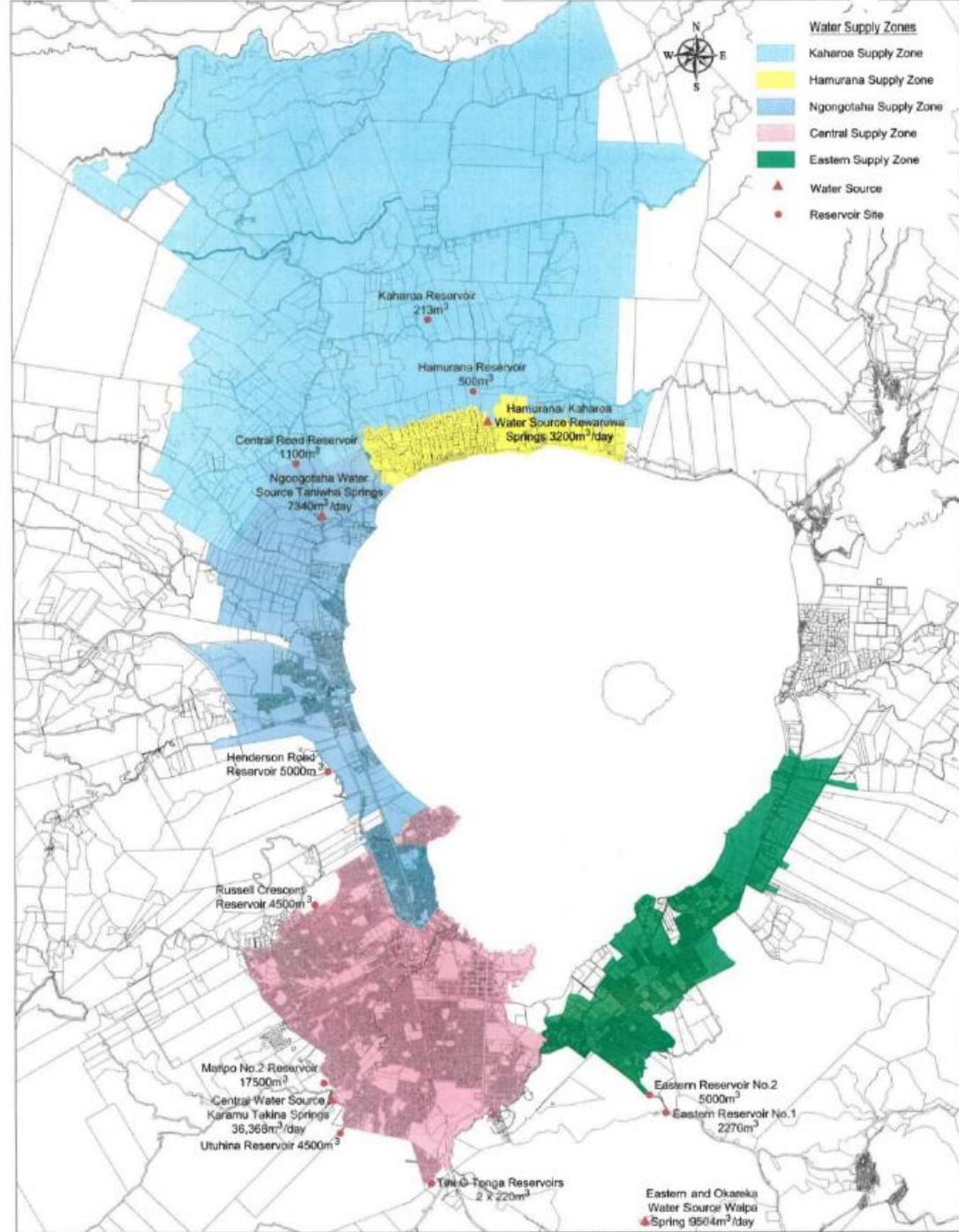
Fault	Magnitude	Mechanism	Recurrence Interval (years)	Shortest Distance to Site (km)	Source Contribution Rank		
					100 Years	500 Years	2500 Years
Ngakuru Southwest	6.0	Normal Volcanic	970	8	1	1	1
Maleme	6.4	Normal Volcanic	310	16	2	3	4
Ngakuru New	6.5	Normal Volcanic	2300	9	4	-	-
HoroHoro	6.5	Normal Volcanic	7400	4	-	4	2



Water supply zones

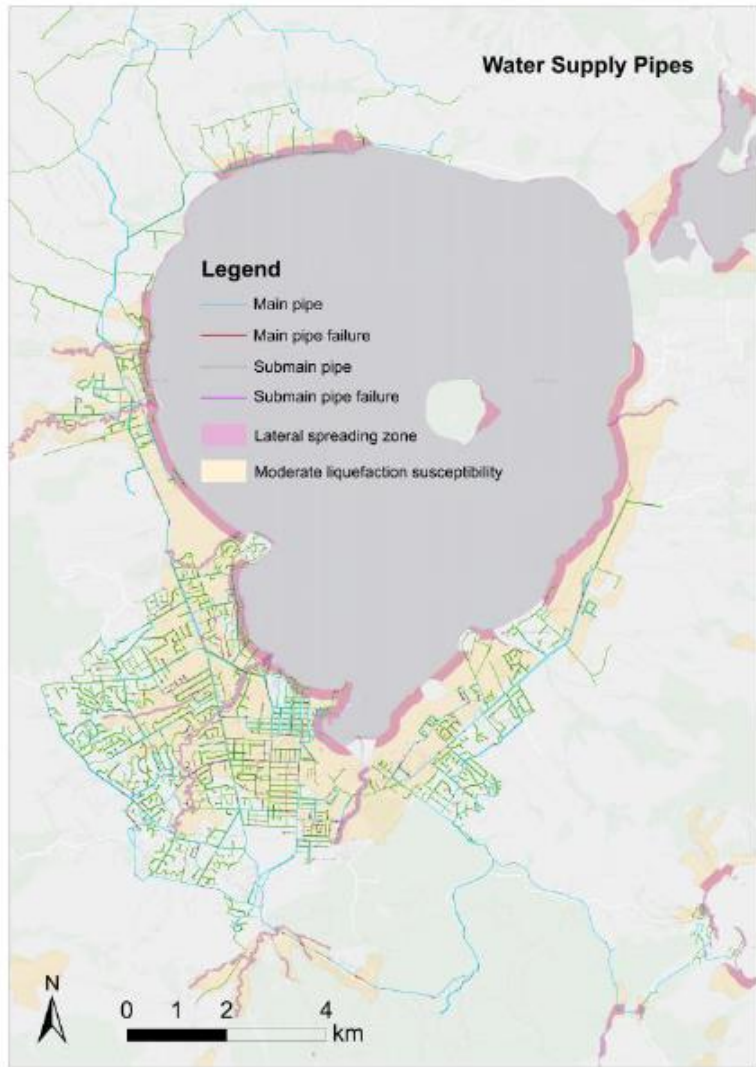
- Eastern - Waipa springs
- Central – Karamu-Takina springs
- Western - Taniwha springs
- Northern – Rewarewa springs

Water Supply Zone	Water Intakes	Reservoirs	Pump Stations	Pipes (km)
Central	1	10	7	345
Eastern	2	4	2	121
Western	1	2	1	67
Northern	1	6	3	87
Total	5	22	13	618

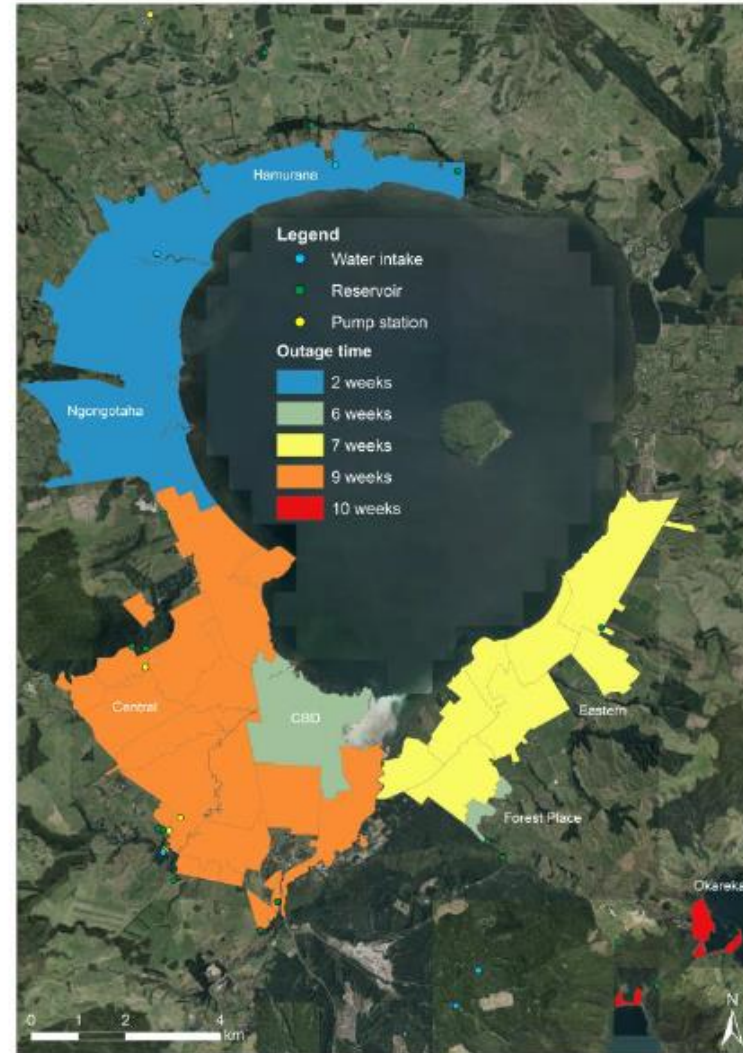


Outage time computation

- Levels of services considered: Emergency, Basic and Full
- Supply zones headworks and mains to reservoirs to be restored first for emergency, basic levels of services
- Full recovery to the supply zones
- 6 crews for first 2 weeks and then 12 crews
- Priority and order were followed, unless it was more efficient to begin repairs on a lower priority region



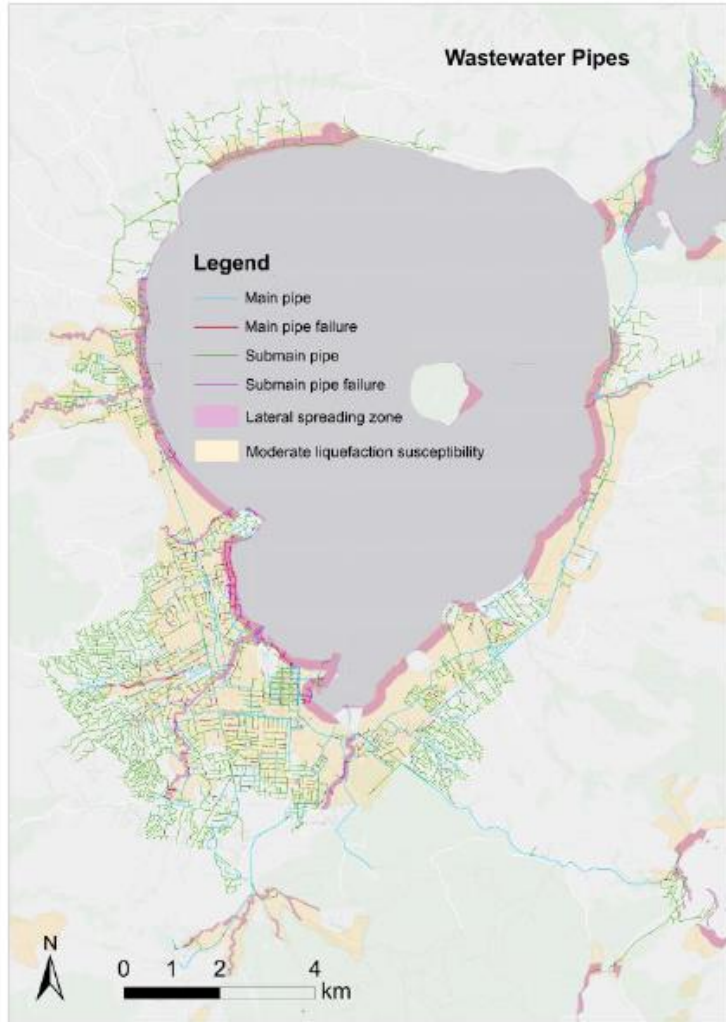
Pipe failures



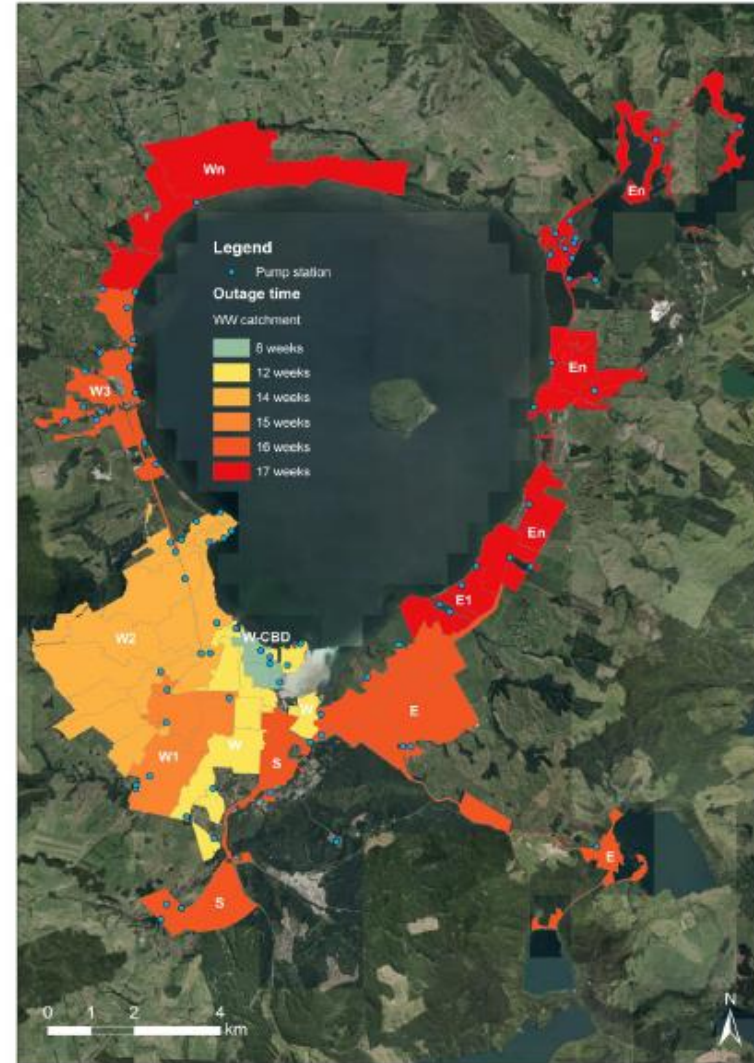
Outage of Supply Zones

Wastewater network





Pipe failures



Outage of Catchment Zones

Summary

- The present study exemplifies science-based pragmatic approach to plan for resilience improvement of water infrastructure.
- The approach is computationally efficient
- Distribution of vulnerable parts of the network at least in relative sense
- Outage maps are simple but effective means of communicating the impact of loss of services
- Interdependencies on road, electricity and fuel were not modelled. However, their effects can be added in a logical manner
- Continual engagement with the end user from the conceptualization to delivery
- Participatory method with council authorities
- Transparent risk assessment method

Acknowledgements

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- GNS Science

Thank you !

S.uma@gns.cri.nz