



## Regional Infrastructure Vulnerability Studies

**Lisa Roberts**  
**NZ Lifelines Committee**

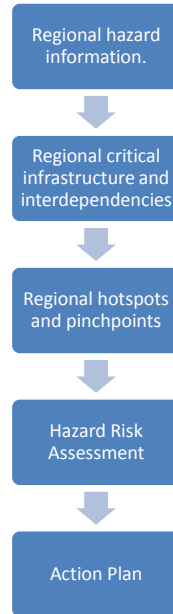


### **NZLC's three themes**

- *Robust **assets**, or satisfactory alternative service continuity arrangements*
- *Effective **coordination**, pre and post-event, at national and local levels*
- *Realistic end-user **expectations**, so that users are risk-aware and better able to consider options*

# Lifelines Vulnerability Studies

- To assess the potential impacts of hazards on the region's lifelines infrastructure and identify mitigation strategies to reduce that risk.'

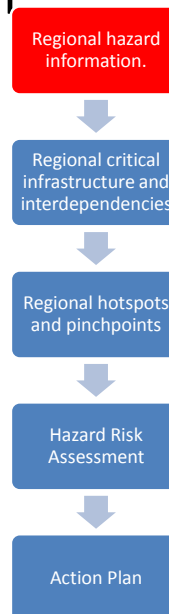


## Lifelines Vulnerability Studies in NZ

- 4: Completed in last 3 years
- 6: Underway in this financial year (5 are updates)
- 5: Multi-hazard vulnerability assessment not undertaken (3 focussed on single hazard)

## Regional Hazard Information

- Collation of regional GIS hazard layers (if they don't exist). Typical layers include:
- Tsunami – 'red, orange, yellow' plus more detailed local modelling.
- Flooding – wide range of data sources and methodologies.
  - River / urban modelling.
  - Rain induced slope instability.
  - Historic flooding areas
- Earthquake
  - Faults
  - Liquefaction prone (soil type, etc)
  - Land instability (slope, geology)
- Volcano
  - Destruction zones.
  - Ashfall areas/depths (scenario specific)



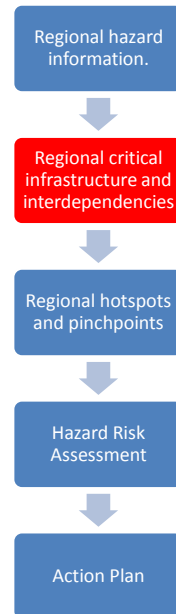
## Regional Hazard Information – Challenges to be managed

- Importance of communicating appropriate use of information
- Determining parameters for hazard use
- Equivalent probabilities of hazard information (and consistency across regions).

## Regional critical community sites and infrastructure and inter dependencies

Determine scope of sectors covered:

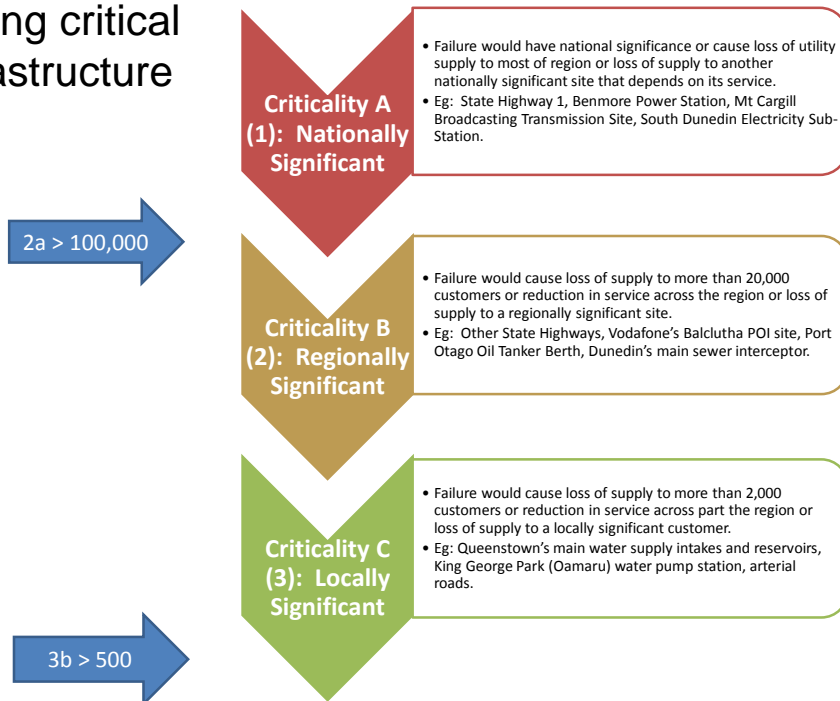
- CDEM Act lifelines – transport (land, sea, air), water supply, wastewater, electricity, fuel, gas, telecommunications, broadcasting.
- ‘CDEM-Critical Customers:
  - Police
  - Fire
  - Ambulance
  - Health – hospitals
  - Fast Moving Consumer Goods
  - Banking
  - Education
  - Corrections
  - Large industrial customers.



## Rating asset criticality

- Initial assessment by utilities of importance within their own network
- Review dependency by other critical customers / sites on their network and revise criticality rating.
- Asset criticality is based on CONSEQUENCE of failure, not PROBABILITY (eg: condition).
- Trying to use existing criticality information where possible

## Rating critical infrastructure



## Rating asset criticality

- Standardised criticality rating systems versus allowing each organisation to assess what's critical to their organisation.
- Balancing getting a regionally prioritised picture versus engagement of less critical organisations
- Regional scope projects need to have common approach.
- Asset criticality is based on CONSEQUENCE of failure, not PROBABILITY (eg: condition).
- Trying to use existing criticality information where possible

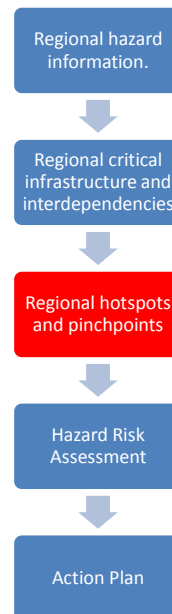
# Analysing Interdependencies – site and sector level

	Airport	Manufacturing	Healthcare	Food	Retail	Energy	Water Supply	Telecommunications	Transportation	Emergency Services	Other	Comments
Airport	1	1	1	1	1	1	1	1	1	1	1	Dominic Airport self sufficient 2-4 days with backup generation for terminal building and control tower plus 500,000 litres, and an air maintenance treatment (diesel) fuel oil tank but 2-3 days storage and larger aircraft could refuel at alternative airports. Road access critical for airport operations from 2 directions (including pharmacies if one closed).
Manufacturing	1	1	1	1	1	1	1	1	1	1	1	St-Georges Transitions Facility is self sufficient for generation / fuel for 20 + days.
Healthcare	1	1	1	1	1	1	1	1	1	1	1	Electricity and generation rely on Transpower network being operational. Fuel, roads and supplies become more critical. IT is coordinating and emergency response activities.
Food	1	1	1	1	1	1	1	1	1	1	1	Can generate fuel or use air compressors, pumps to supply from pipelines (could also be used at fuel stations but would be generated supply) if electricity fails. Water required at Peninsula sites (some) but self contained water supplies are required. All fuel comes in via dip and distributed via tanks.
Gas	1	1	1	1	1	1	1	1	1	1	1	Gas comes in via rail and port and is distributed by pipe and road. (Feyn Street is the main road to and from the terminal. Water supply required for fire fighting, though alternatives are gas-water pump. IT electricity operational at fire service substation (1 and 2A).
Power	1	1	1	1	1	1	1	1	1	1	1	Resiliency looking at fire emergency functions. > 24 hours could have significant impact on operations. 2/3 of cargo is transported by / from the port by rail, the rest by truck. Road also required for staff access. Fuel required for site banking. Water supply required for staff facilities being in.
Rail	1	1	1	1	1	1	1	1	1	1	1	Roads critical for transfer of freight and passengers. Electricity critical for network control. Fuel required to operate trains.
Roads	1	1	1	1	1	1	1	1	1	1	1	Main dependency is between NZTA and local road authorities. While traffic lights require electricity, manual traffic management can occur and in other phases traffic should divert to central road ways.
Telecomms	1	1	1	1	1	1	1	1	1	1	1	Requires electricity but main sites have generator backup while smaller sites have battery backup that can operate 4-48 hours. Telecommunications network is highly interconnected meaning many failures rely on other's assets. Roads required for access to sites - more critical in emergencies.
Wastewater	1	1	1	1	1	1	1	1	1	1	1	Dunedin's main Alameda RD is the only sewer RS with backup generation on site. Other RS have emergency storage to dry conditions of between 2 and 8 hours and designed with structures to discharge overflow safely to waterways. Treated effluent also not have backup generation though some biological treatment would still occur in ponds/landfills.
Water Supply	1	1	1	1	1	1	1	1	1	1	1	Water supply critical and treatment plants do not have on site generation, relying on treated storage reservoirs (typically holding 1-2 days supply) to maintain supply and electricity network. Reliance on telecommunications for automated control, loss of which could cause reduction in water quality.

1 = Critical for service to function; 2 = Critical for service to function but some backup or port function; 3 = Not required for service to function; 0 = Not applicable

## Hotspots & pinchpoints

- **Hotspots:** where a number of critical infrastructure assets from different sectors converge in a single area.
- **Pinchpoint:** significant single points of failure for a network or organisation
- Manual versus GIS analysis.
- Hazard versus non-hazard approach.

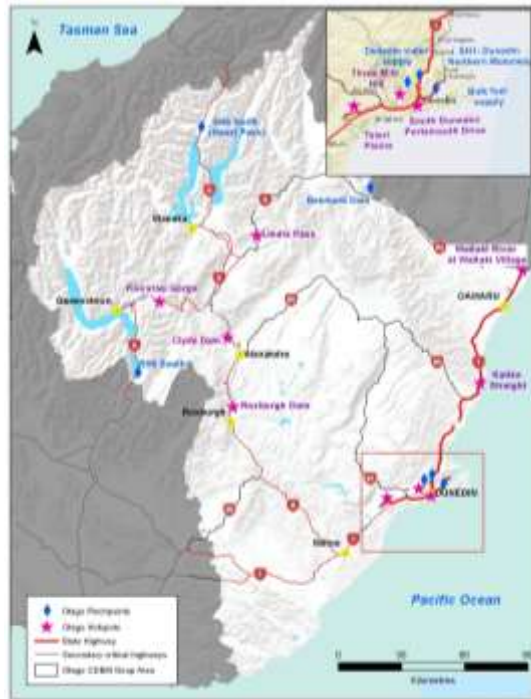


In Otago:

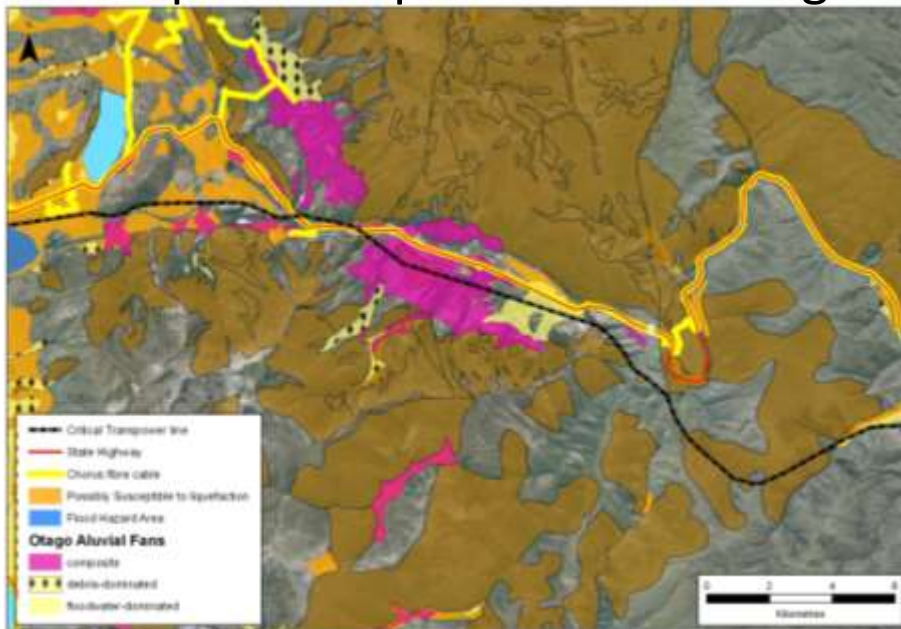
- 9 hotspots
- 6 pinchpoints



[www.orc.govt.nz](http://www.orc.govt.nz)

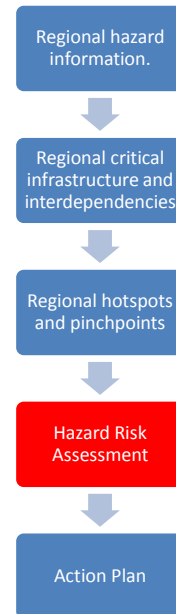


## Hotspot Example: Kawarau Gorge



## Hazard Risk Assessment

- Variety of methodologies applied over the years.
  - Spreadsheet based 'MCA' risk rating approaches.
  - GIS/hazard overlay supported by qualitative analysis (SMEs).
  - Fragility / economic modelling.



## Hazard / Asset Overlay





# Hazard / Asset Intersections

Liquefaction		Asset	
OBJECTID *	Description	owner	Criticality_Rating
	42 Green Island Substation	Aurora	3
	44 King Edward St, Dunedin, Substation	Aurora	3
	49 Neville St Substation, Duendin	Aurora	3
	53 Andersons Bay Substation, Dunedin	Aurora	3
	59 Zone Substation 6 Quarry Rd	Aurora	3
	62 Grid Exit Point 28 Orari St	Aurora	3
	68 Zone Substation 17 Crawford St	Aurora	3
	96 Zone Substation 822 Great King St	Aurora	3
	130 Alexandra zone substation	Aurora	3
	168 Queenstown Zone substation	Aurora	3
	176 Frankton Zone substation	Aurora	3
	80 Chevron fuel storage terminal	Chevron	1
	116 Roxburgh Pump Station	CODC	2
	122 Alexandra Pump Station	CODC	2
	123 Alexandra Pump Station	CODC	3

## Hazard Risk Assessment

	1	2	3	4	5	6
	Unlikely to cause damage post event	Possible damage, short term repair (days)	Possible damage, long term repair (weeks/months)	Complete failure - full reconstruction required		
	Flooding	Landslip	Winds	Equake	Tsunami	Snow
<b>Electricity</b>						
Electricity transmission lines - overhead	1	2	2	2	1	2
Electricity distribution lines - overhead	2	2	3	3	3	3
Electricity Substations / Switchyards	3	3	1	2	3	1
Underground electricity cables	1	3	1	1	1	1
<b>Fuel</b>						
Storage Tanks	2	1	1	3	2	1
Pipelines	1	1	1	3	2	1
<b>Transport</b>						
Roads	2	3	1	3	2	1
Bridges	2	4	1	4	3	1
Wharves	1	1	1	3	3	1
Airport	3	1	1	1	2	1
Rail lines	3	4	1	3	3	2
<b>Water Supply</b>						
Pipelines	1	4	1	3	1	1
Pump stations	1	4	1	3	3	1
Water treatment plant	1	1	1	3	4	1
<b>Wastewater</b>						
Pipelines	2	4	1	3	1	1
Pump stations	3	4	1	3	3	1
Water treatment plant	1	1	1	3	4	1
<b>Gas</b>						
Pipelines	1	2	1	2	1	1
Storage Tanks	2	1	1	3	2	1
<b>Telecommunications</b>						
Transmission tower	2	3	3	3	3	3
Cell sites	2	2	2	2	2	2
Roadside cabinets	2	2	2	2	2	1
Exchanges	2	2	3	1	2	1
Fibre cable	2	2	1	1	2	1



## Action Planning

- Specific lifelines mitigation projects
- Sector-specific Regional Contingency Plans (fuel, electricity)
- Hazard-specific Regional Lifelines Contingency Plans.
- Regional Reconnaissance Plan
- Regional Emergency Generator Management Plan
- Lifelines – CDEM Sector Communication Protocols
- Monitoring of lifeline utilities mitigation actions.
- Resilience assessment and benchmarking.
- Detailed hotspots risk analysis

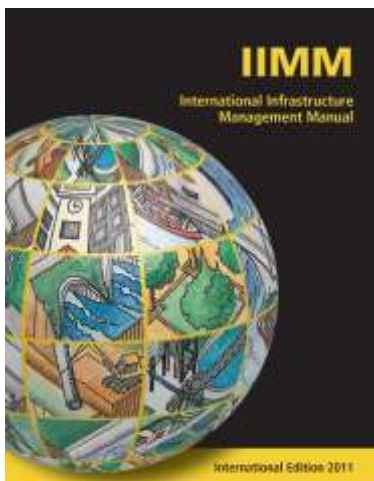
## Reflecting on changes to latest vulnerability studies

- Hazard mitigation programmes in place, particularly national utilities.
- Resilience building as part of renewal programmes.
- Driving more operational than mitigation projects.
- Identifying and scoping mitigation projects more clearly the mandate of utility organisations.
- GIS-based asset and hazard information.
- Increased recognition of cross-boundary issues and nationally managed resources and infrastructure.
- Stronger integration with asset management planning and infrastructure strategies

## The Next Phase

- Potential to incorporate summary of resilience approach by each sector / agency.
- Defining regional levels of service relating to performance following hazard events.
- Use of strategic lifelines project outputs to prioritise more focussed detailed modelling efforts.
- Inclusion of technical / cyber hazards.

## Risk, Resilience and the IIMM



Any Questions?