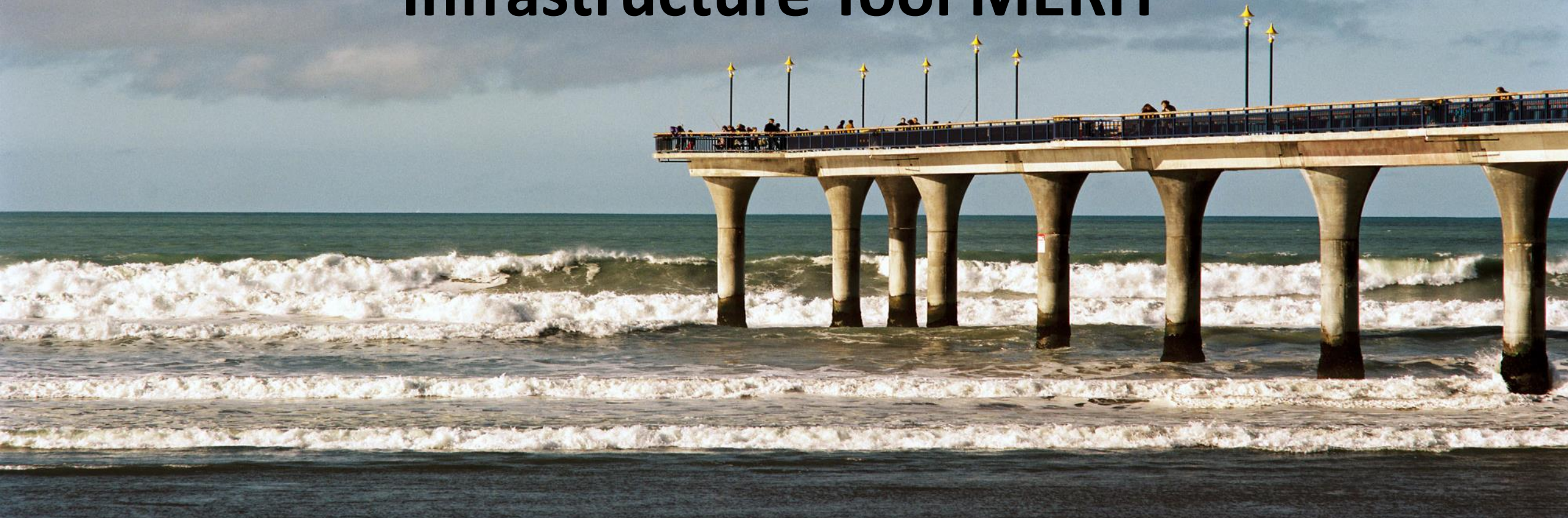




Measuring the Economics of Resilient Infrastructure Tool MERIT



MERIT

Develop understanding of the economic impacts of infrastructure failure

- Multi-scale impacts across space, through time for multiple stakeholders
- Changes in value added, income, employment etc
- Causal mechanisms through time – short vs longer term outages, infrastructure interdependencies, cascading events, feedbacks and lags, tipping points
- Impacts of different mitigation, adaptation and response options (policy, infrastructure, business) on economy
- Support business cases for infrastructure investment, recovery, rebuild planning
- Developed by MEResearch, GNS, ResOrgs through \$2.8m MBIE ERI and Resilience National Science Challenge funding

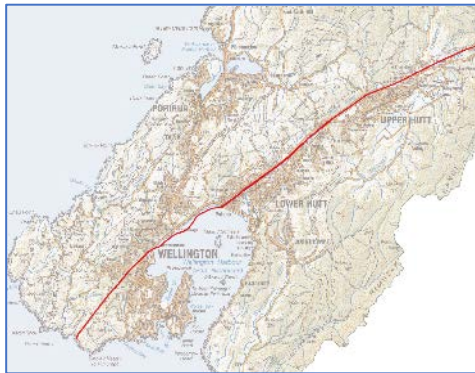


Scenario Event

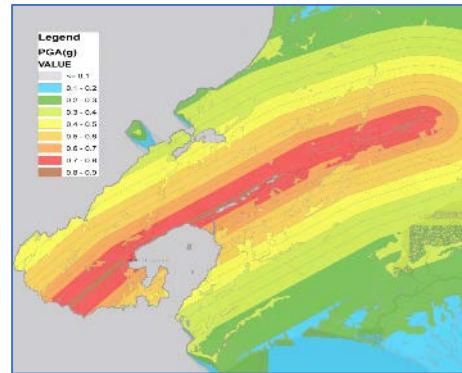


- M7.5 Earthquake
- ~1 in 1000 annual likelihood

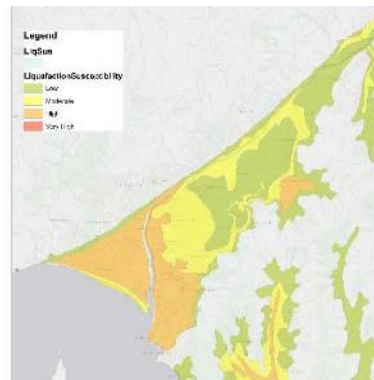
Perils considered



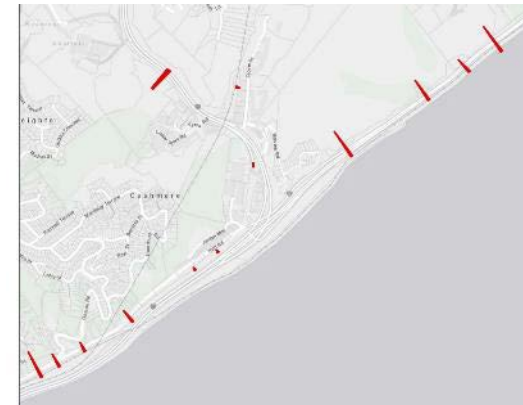
Fault Rupture



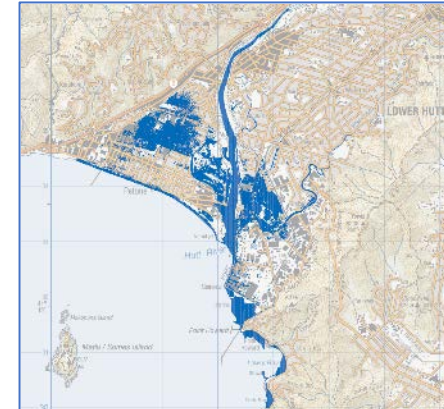
Shaking



Liquefaction

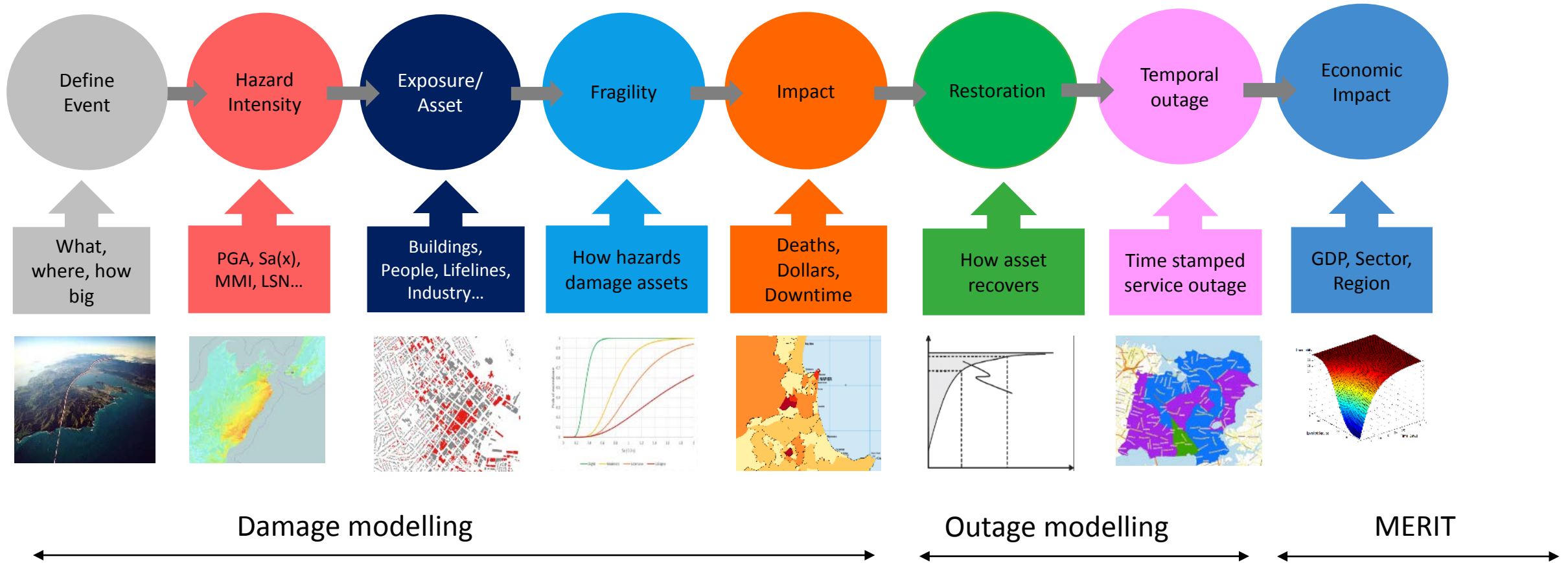


Landslide

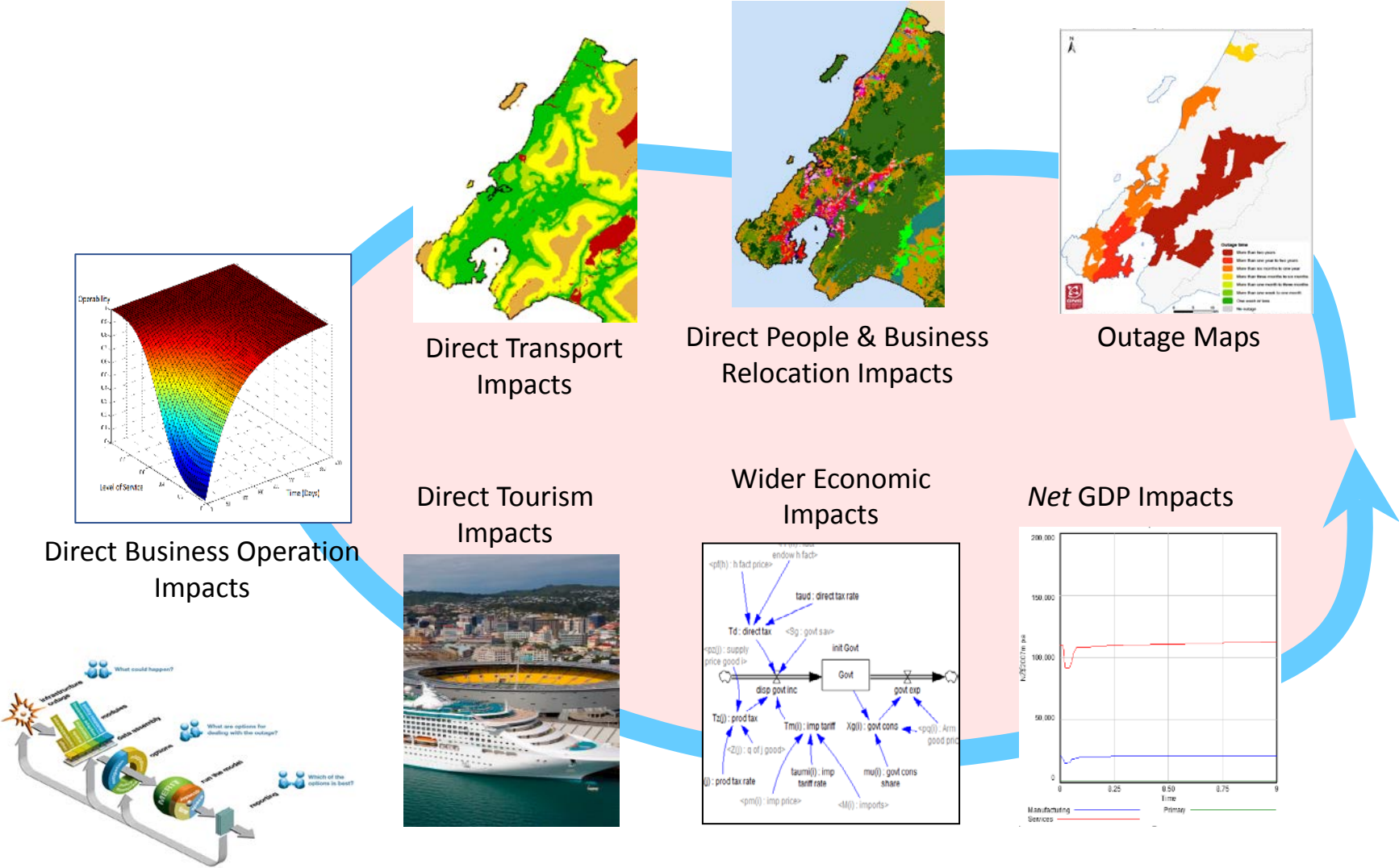


Co-seismic
subsidence

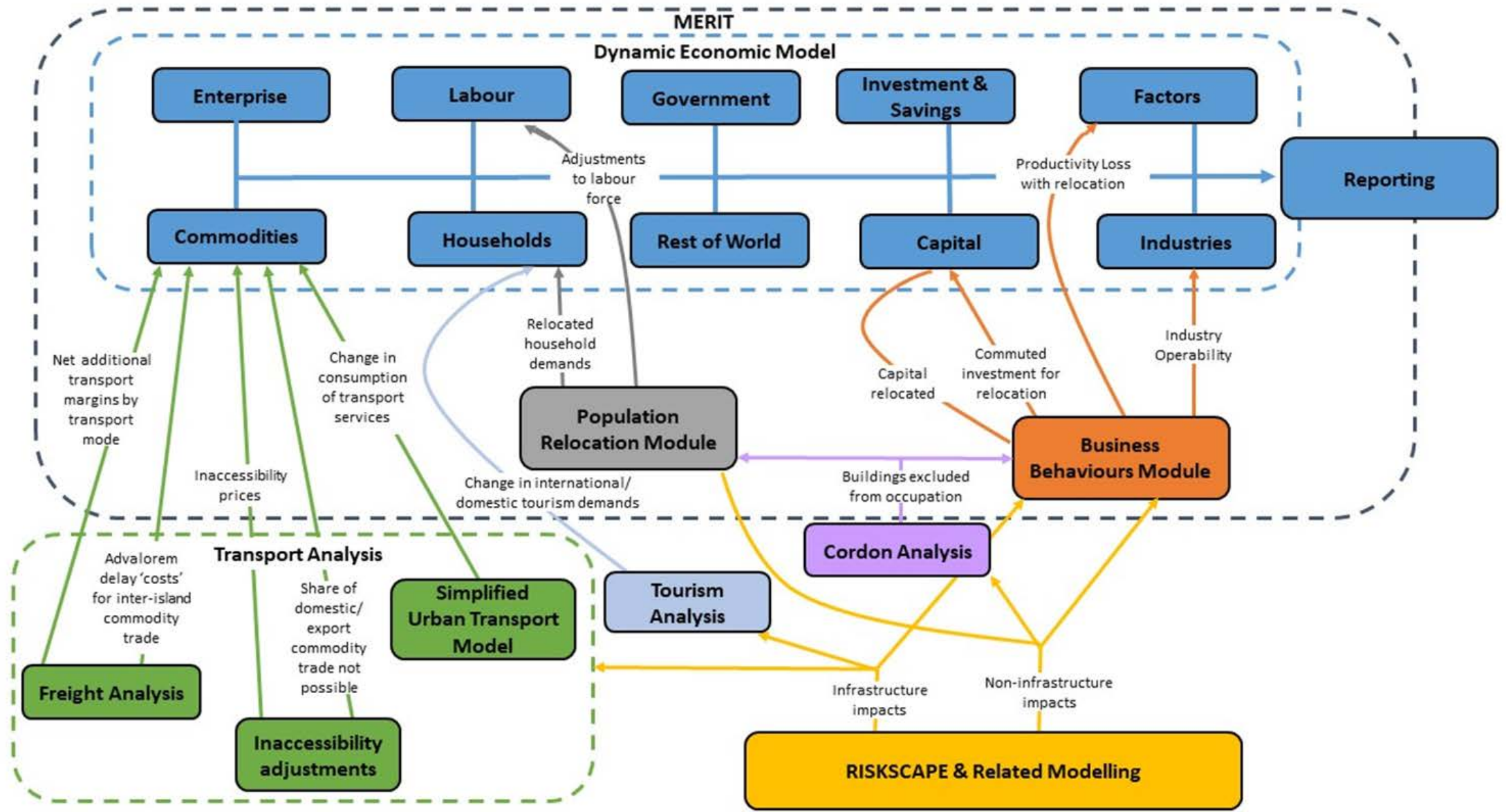
Impact Model Framework



The MERIT Modelling Process

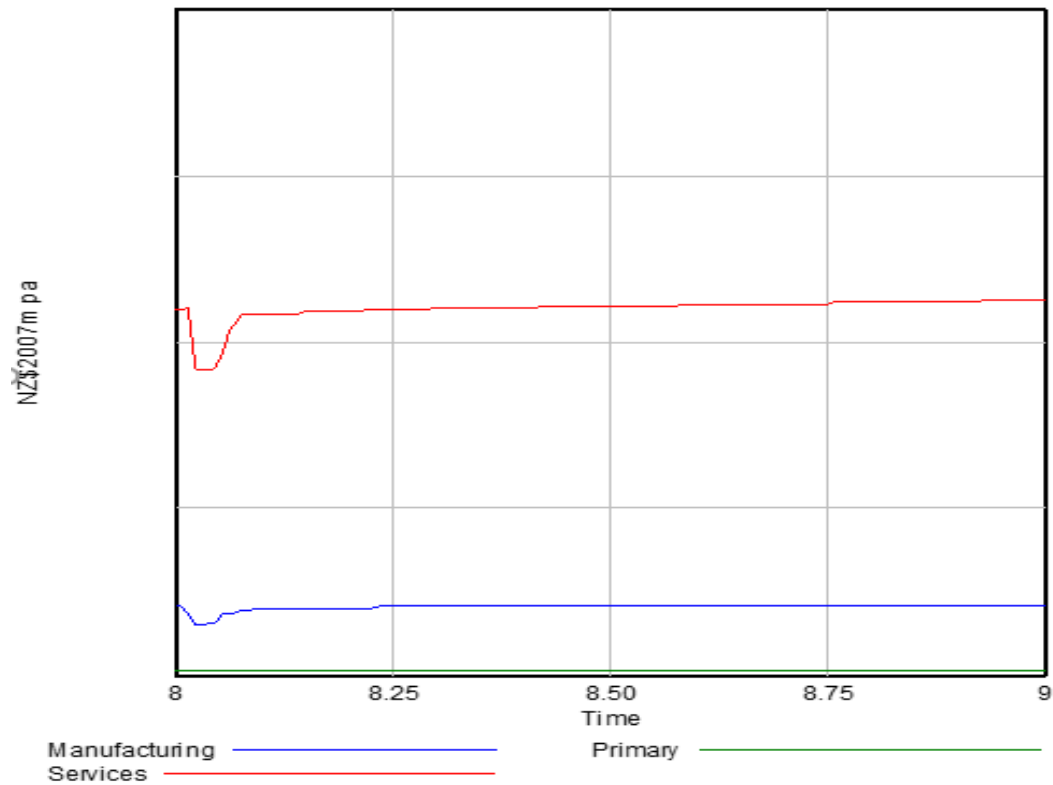


- Economic impacts of distributed infrastructure through time and space
- Key economic indicators – GDP, income, trade, prices, labour
- Unique and accounts for adaptations of people and businesses

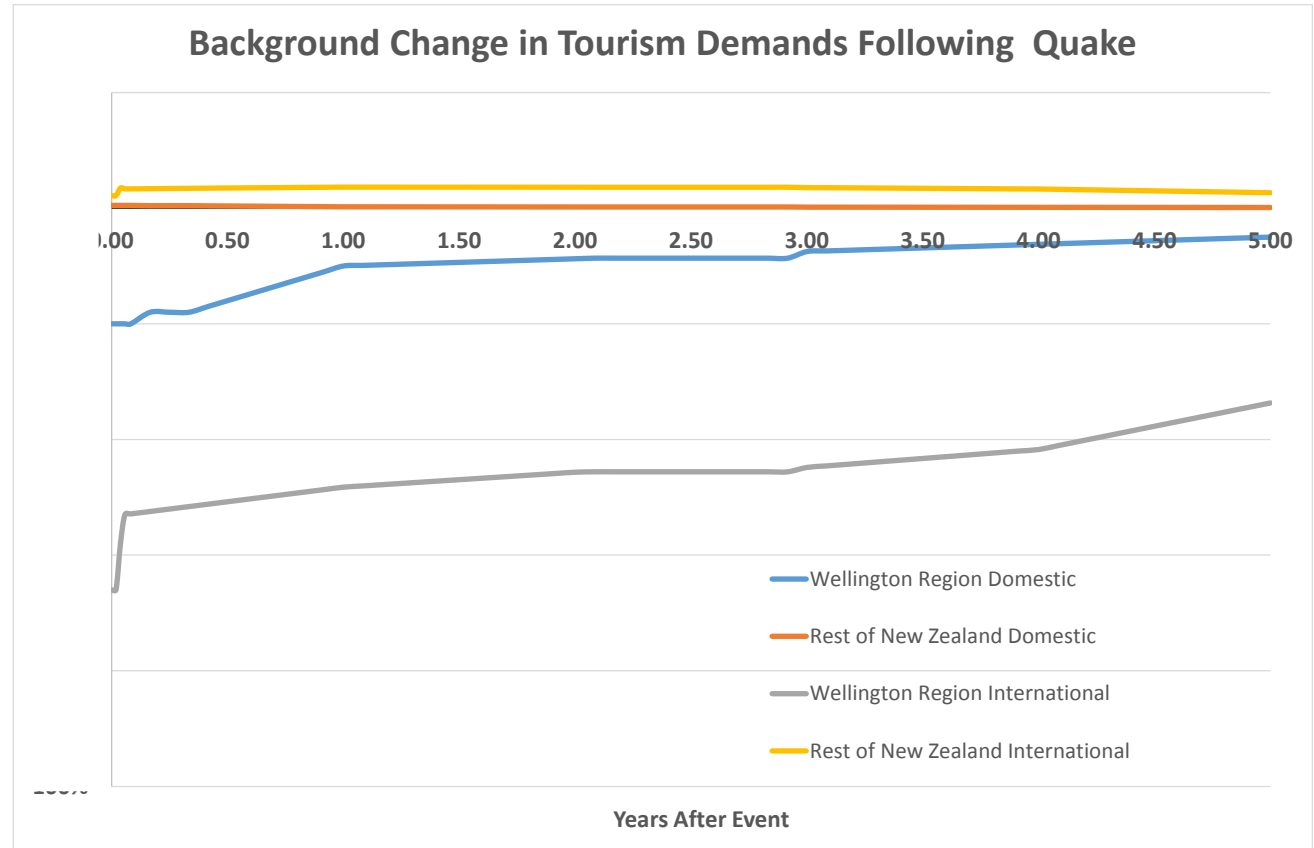


Economic impacts

Net GDP Impacts



Background Change in Tourism Demands Following Quake



Auckland Power Outage Scenario

- Scenario involves loss of all of Transpower's 220kV lines north of Whakamaru
 - with Otahuhu generation
 - without Otahuhu generation
- Only two of the eight major 220kV circuits into Auckland remain in service (Huntly-Otahuhu)
- Region-wide voltage collapse due to circuit overloads and fast voltage drop



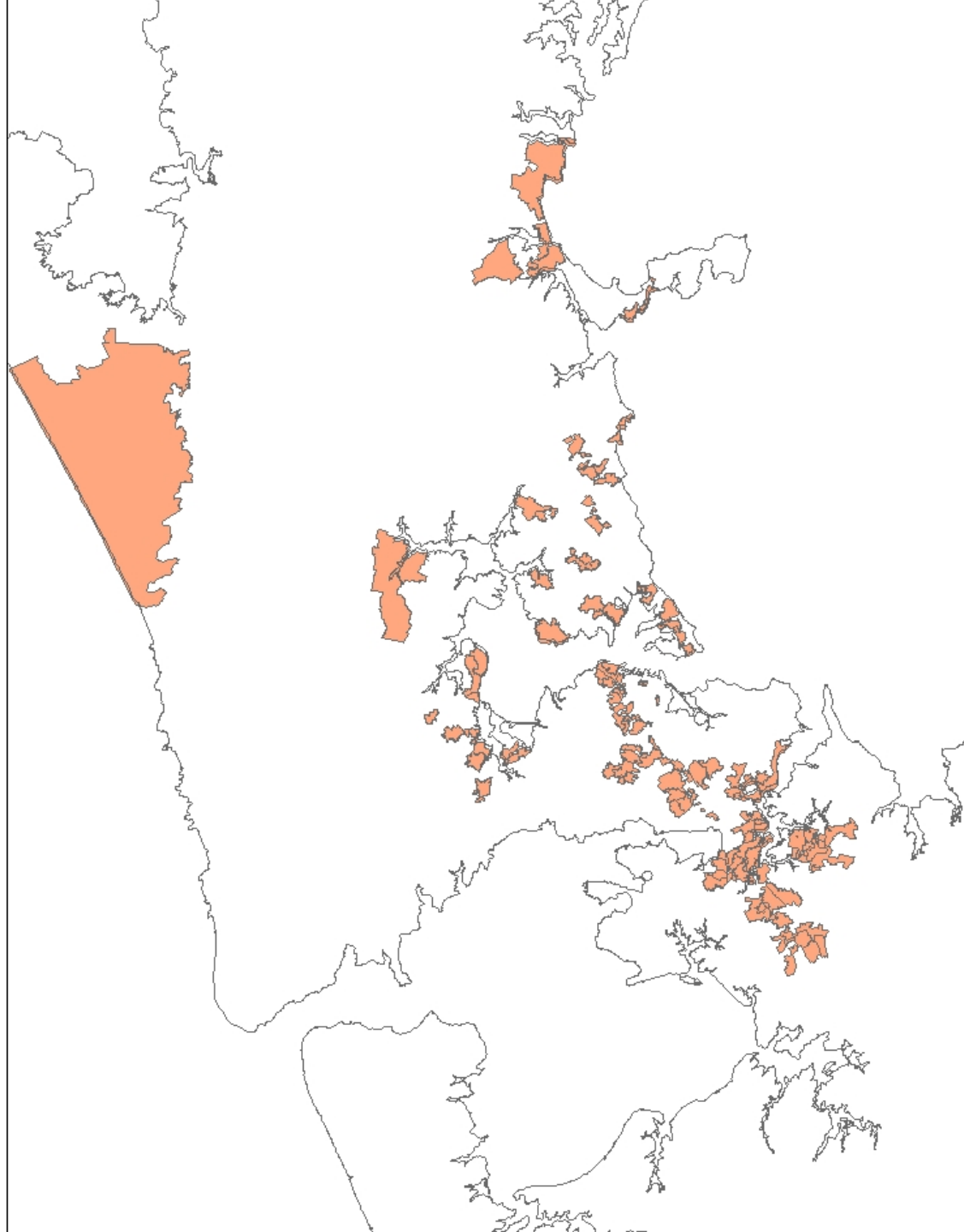
Auckland Power Outage Scenario

Generation conditions	Load served in AKL and NAAN regions (MW)		% peak demand (MW) able to be served at each GXP		% regional energy (MWh) able to be served	
	N	N-1	N	N-1	N	N-1
Without OTAHUHU CCGT	1350MW	650MW	50%	25%	75%	40%
With OTAHUHU CCGT	1730MW	1030MW	65%	40%	90%	60%





Areas affected by the rolling power outage **with** Otahuhu generation

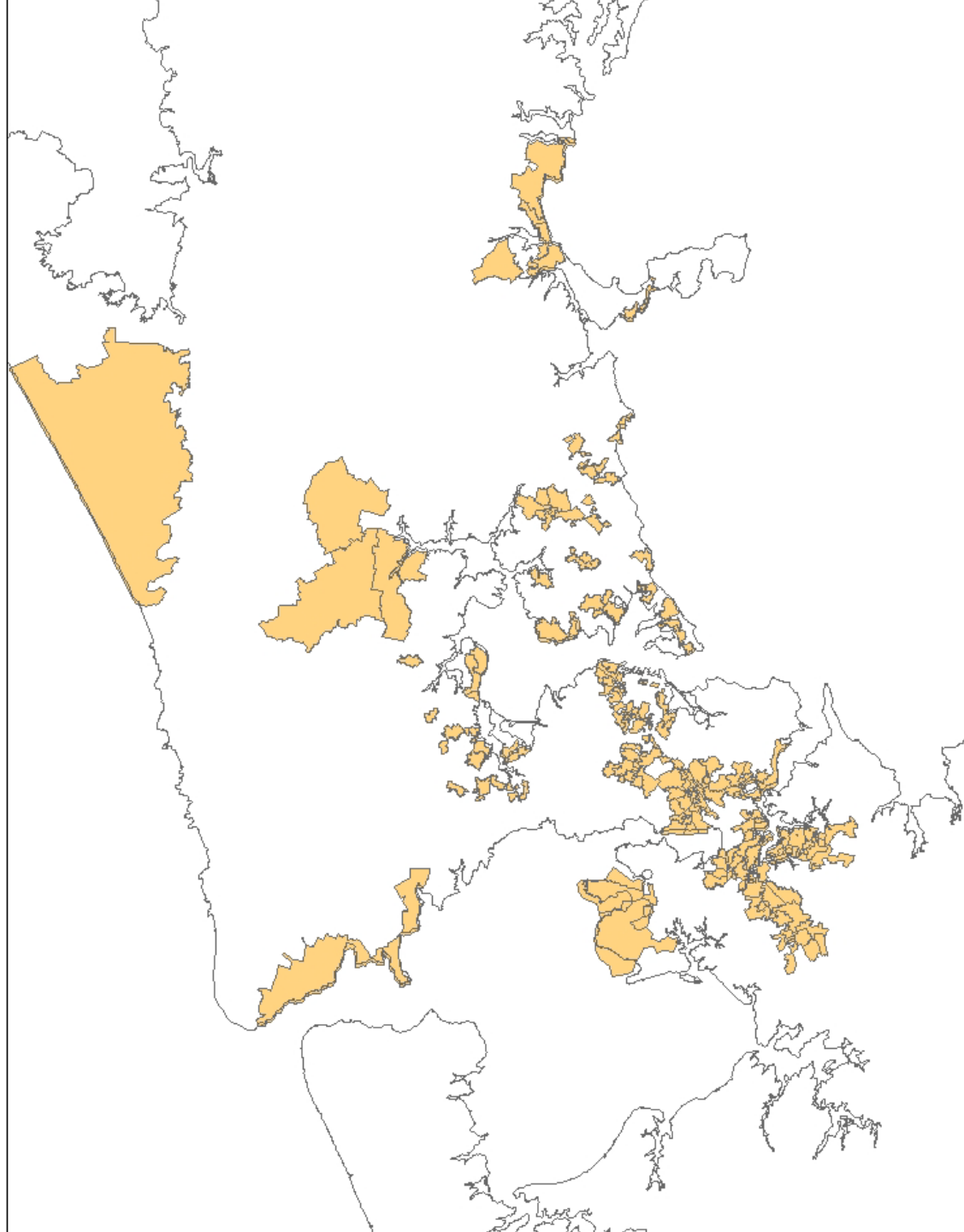


ECONOMICS *of*
RESILIENT
INFRASTRUCTURE





Areas affected by the rolling power outage **without** Otahuhu generation



ECONOMICS *of*
RESILIENT
INFRASTRUCTURE



Share of Auckland affected by outage

Share of Workers	Sector	With Otahuhu Generation (% of total Auckland)	Without Otahuhu Generation (% of total Auckland)	Total Auckland (Heads)
	Electricity, Gas, Water and Waste Services	34%	53%	4,059
	Health Care and Social Assistance	11%	17%	68,487
	Information Media and Telecommunications	22%	35%	22,693
	Transport	12%	27%	36,196
	Retail trade	17%	24%	68,469
	Manufacturing	21%	32%	75,816
	Professional, Scientific and Technical Services	18%	25%	185,110
	Financial and Insurance Services	12%	19%	30,131
	Accommodation and Food Services	18%	25%	46,154
Education and Training	15%	22%	55,942	
Arts and Recreation Services	20%	34%	13,665	





Impacts on Economy

Decrease in Economic Production Over One Week								
Value Added		With Otahuhu Generation		Without Otahuhu Generation		Normal Weekly Value Added		
		Without Consumption Decrease	With Consumption Decrease	Without Consumption Decrease	With Consumption Decrease			
		Auckland	20	34	33			55
		1.9%	3.2%	3.0%	5.1%	100%	Percentage	
	New Zealand	22	39	36	64	2,924	\$ ₂₀₀₇ mil	
		0.8%	1.3%	1.2%	2.2%	100%	Percentage	



Impacts on Auckland Economy

Decrease in Economic Production Over One Week						
Value Added Loss	Sector	With Otahuhu Generation (% of Auckland Weekly Total)		Without Otahuhu Generation (% of Auckland Weekly Total)		Normal Weekly Value Added \$ ₂₀₀₇ mil
		Without Consumption Decrease	With Consumption Decrease	Without Consumption Decrease	With Consumption Decrease	
		Electricity, Gas, Water and Waste Services	4.2%	6.7%	7.2%	
Health Care and Social Assistance	1.0%	1.3%	1.6%	2.0%	56	
Information Media and Telecommunications	0.9%	2.1%	1.4%	3.5%	57	
Transport	1.7%	2.3%	3.7%	5.0%	51	
Retail trade	2.4%	7.0%	3.5%	10.4%	57	
Manufacturing	2.5%	3.3%	4.0%	5.3%	141	
Professional, Scientific and Technical Services	1.7%	2.8%	2.6%	4.4%	180	
Financial and Insurance Services	1.5%	2.8%	2.5%	4.6%	96	
Accommodation and Food Services	1.8%	4.1%	2.5%	5.8%	20	
Education and Training	1.6%	2.0%	2.6%	3.1%	46	
Arts and Recreation Services	7.4%	19.9%	13.1%	35.0%	15	



Applications

- Various road outages SH3-4, Manawatu Gorge, Harbour bridge, Newmarket viaduct, Online tool for asset managers
- MoT/MBIE Kaikoura earthquake
- Welly Resilience Business Case (Dame Fran Wilde)
- MBIE Fuel security – international supply disruption, Marsden Point failure, Wiri pipeline/terminal
- Watercare outages, Wellington Water outages
- Various port/airport outages – Lyttelton, PoA, AIAL

