



Simulation of post eruption time variant land use and economic impacts of the Mangere Bridge volcanic eruption scenario







Volcanic Eruption Impacts

Infrastructure Disruption

Electricity

Fuel

Roading

Rail

Aviation

Port

Water Supply

Wastewater

Stormwater

Telecommunications

Other Effects

Building damage

Business behaviours

Population relocation

Reconstruction

Insurance

Tourism

Health



3/25/2011

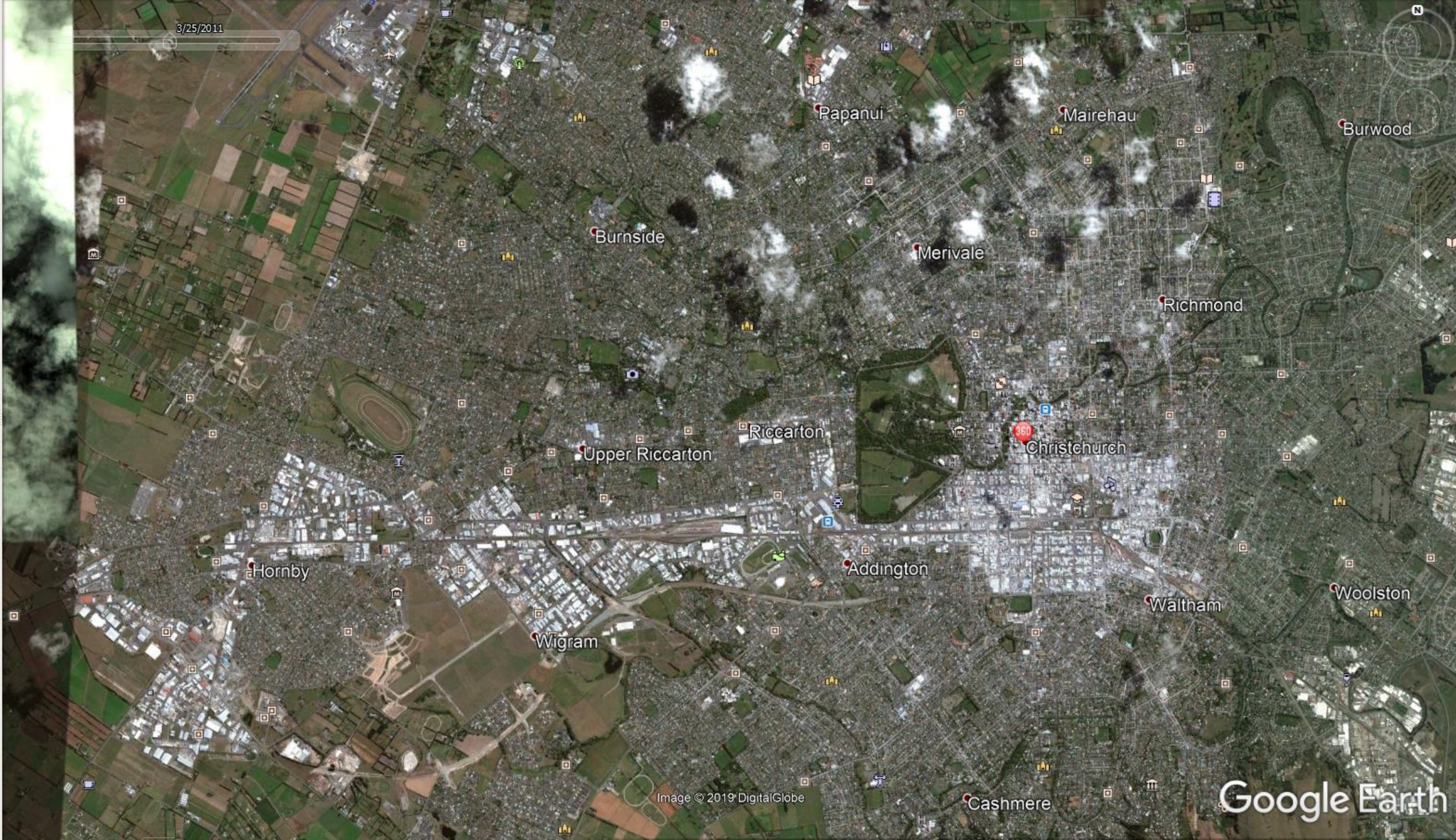


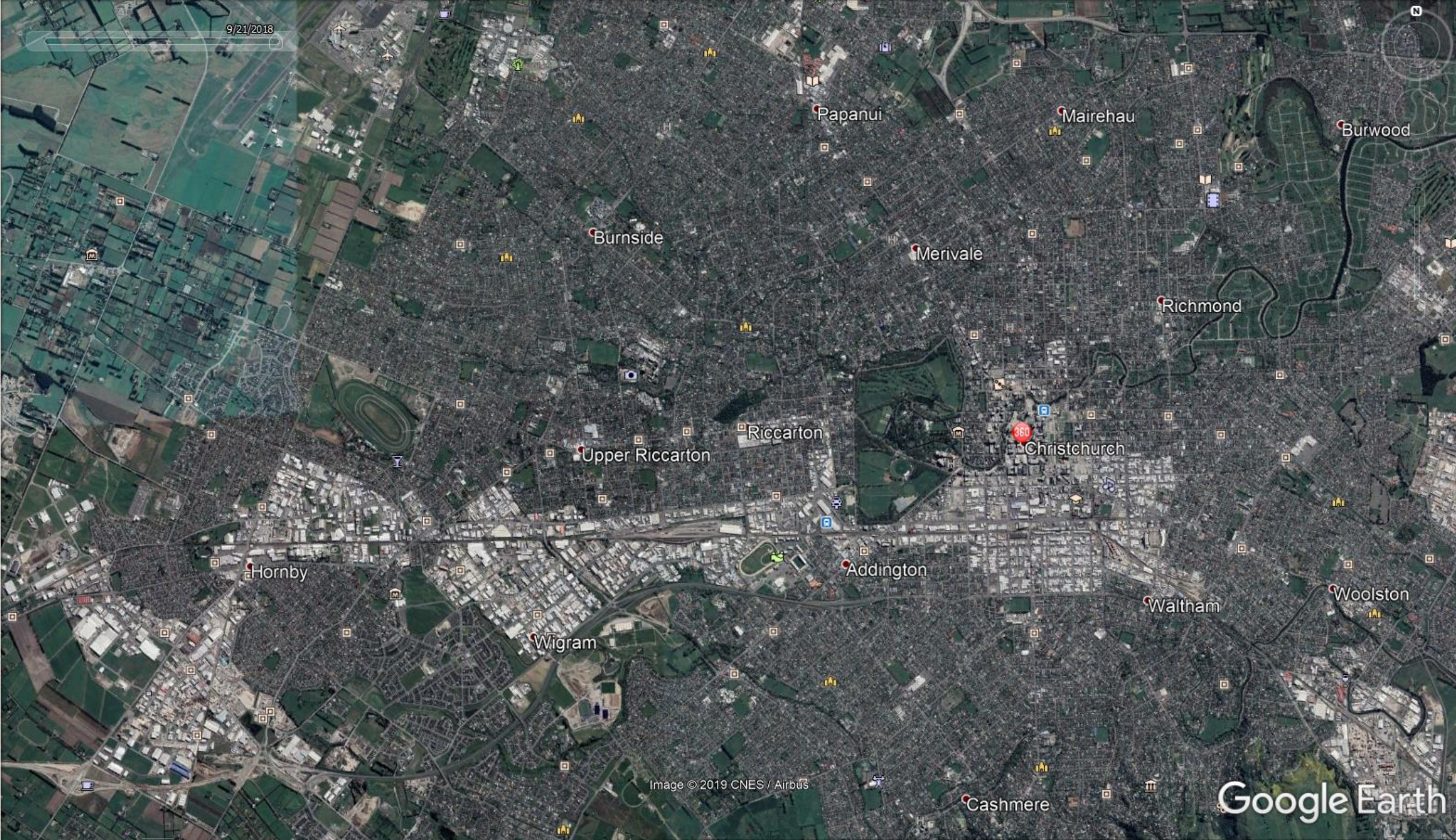
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Google Earth

2004

Imagery Date: 2/26/2011 43°33'35.68" S 172°36'36.11" E elev 28 ft eye alt 47146 ft

9/21/2018



Papanui

Mairehau

Burwood

Burnside

Merivale

Richmond

Riccarton

Christchurch

Upper Riccarton

Hornby

Addington

Waltham

Woolston

Wigram

Cashmere

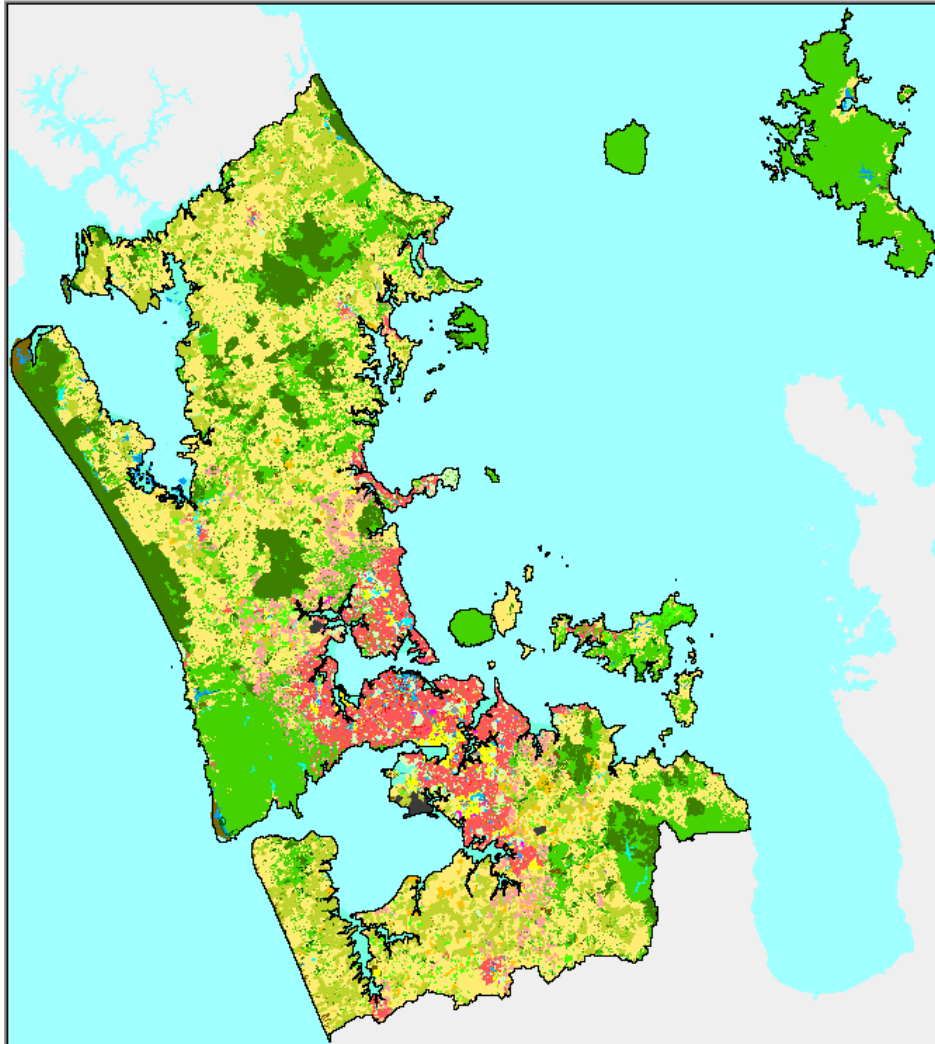
Google Earth

2004

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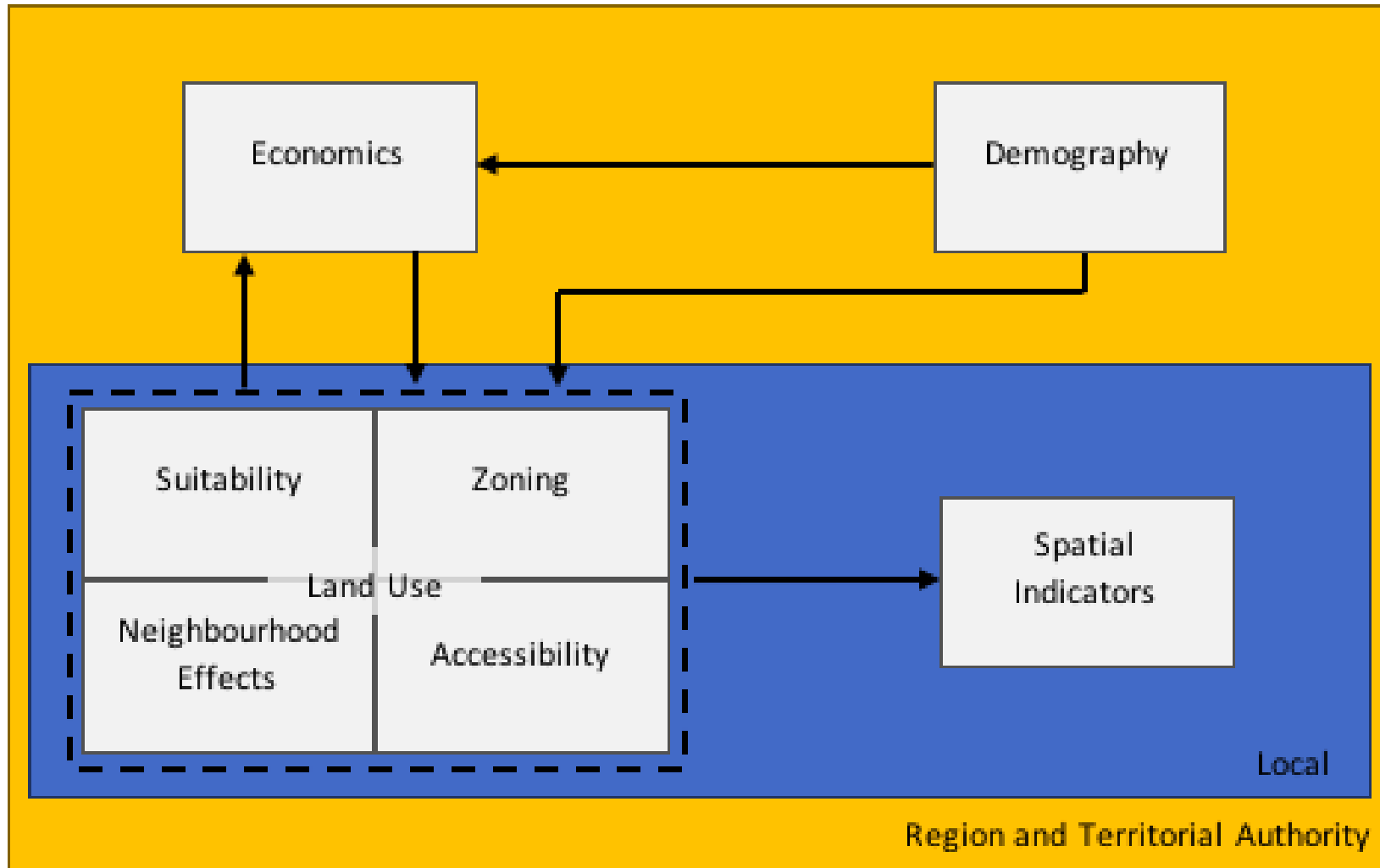
Imagery Date: 9/21/2018 43°31'48.65" S 172°35'40.67" E elev 27 ft eye alt 47146 ft

Integrated Scenarios Explorer (ISE)

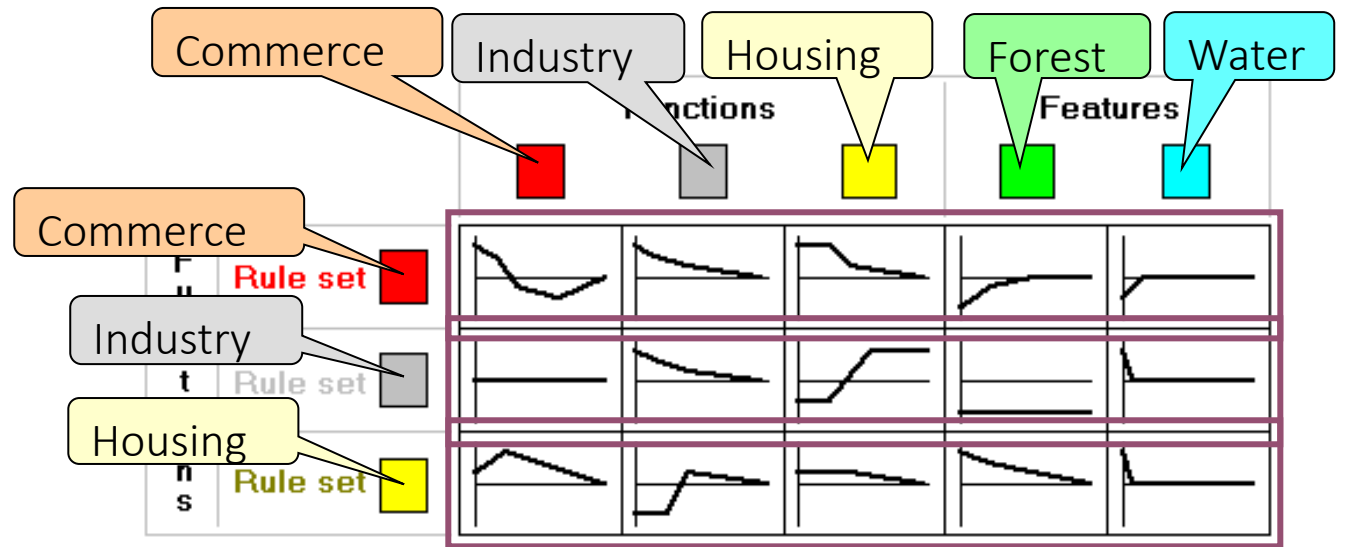
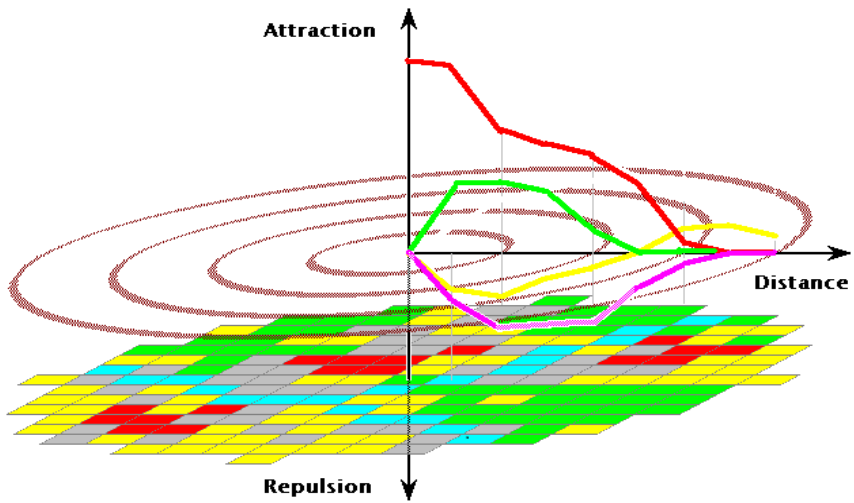


- | | |
|---------------------------------------|---------------------------------|
| Vacant | <u>Lifestyle blocks</u> |
| Indigenous forest and vegetation | Education |
| Other exotic vegetation | Culture, recreation and defence |
| <u>Horticulture and fruit growing</u> | Mines |
| <u>Livestock and crop farming</u> | Freshwater |
| <u>Dairy cattle farming</u> | Wetlands |
| <u>Other farming</u> | Airports and ports |
| <u>Exotic forest</u> | Motorway |
| <u>Industrial</u> | Open space |
| <u>Commercial</u> | Estuaries and mangroves |
| <u>Central Government</u> | Bare land |
| <u>Residential - low density</u> | Land Outside Study Area |
| <u>Residential - medium density</u> | Marine Area Outside Study Area |
| <u>Residential - high density</u> | |

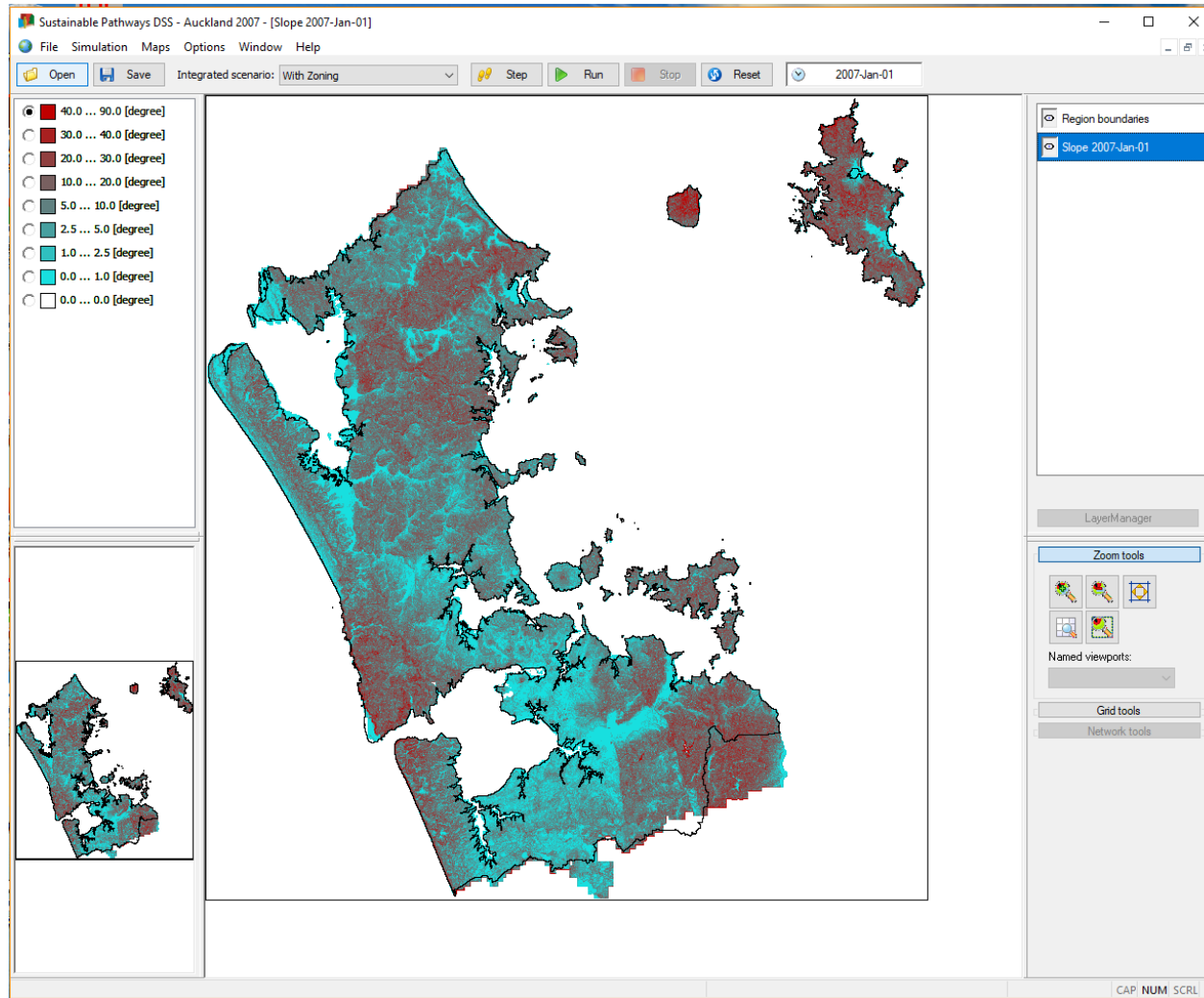
Integrated Scenarios Explorer (ISE)



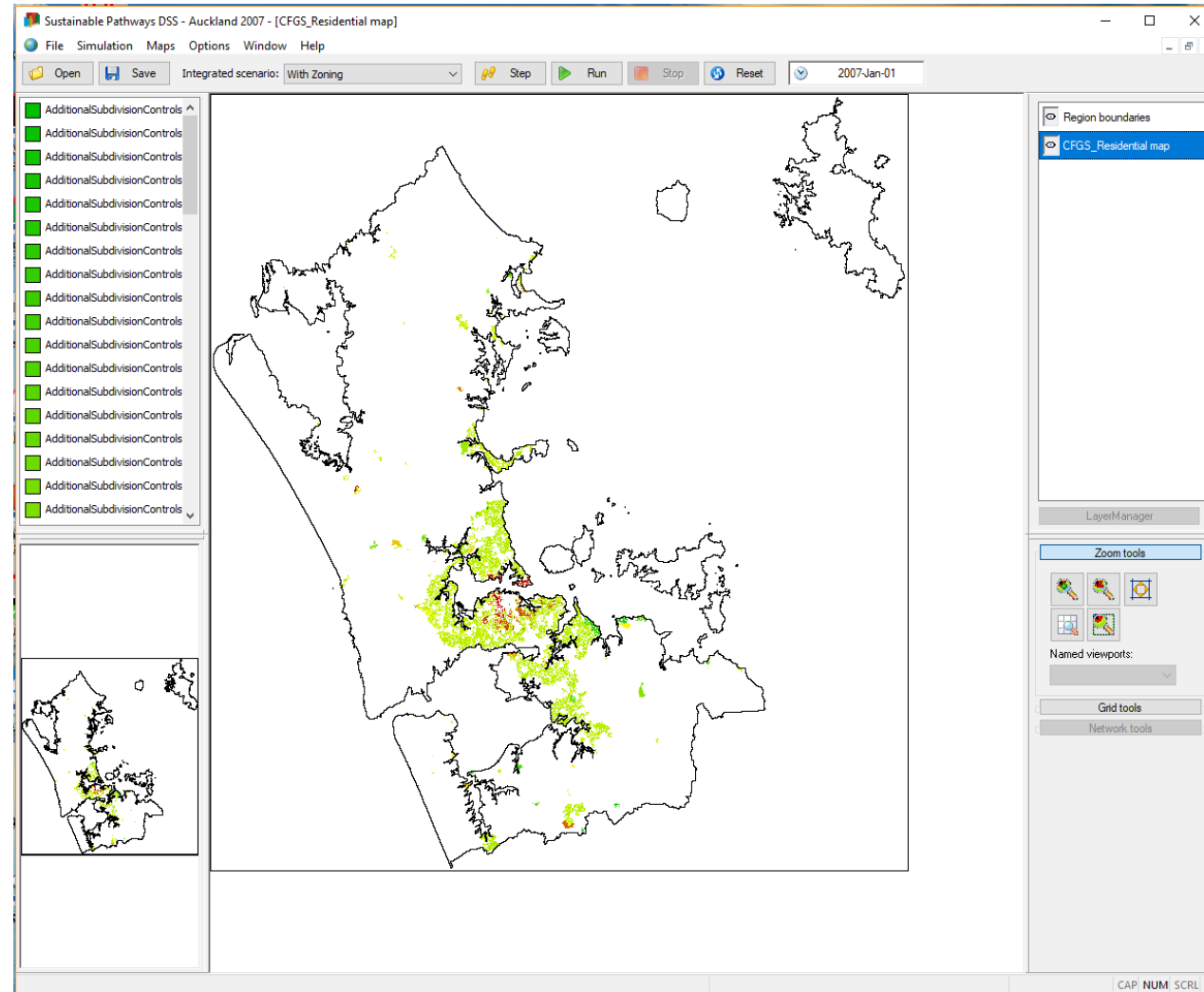
Neighbourhood Interaction



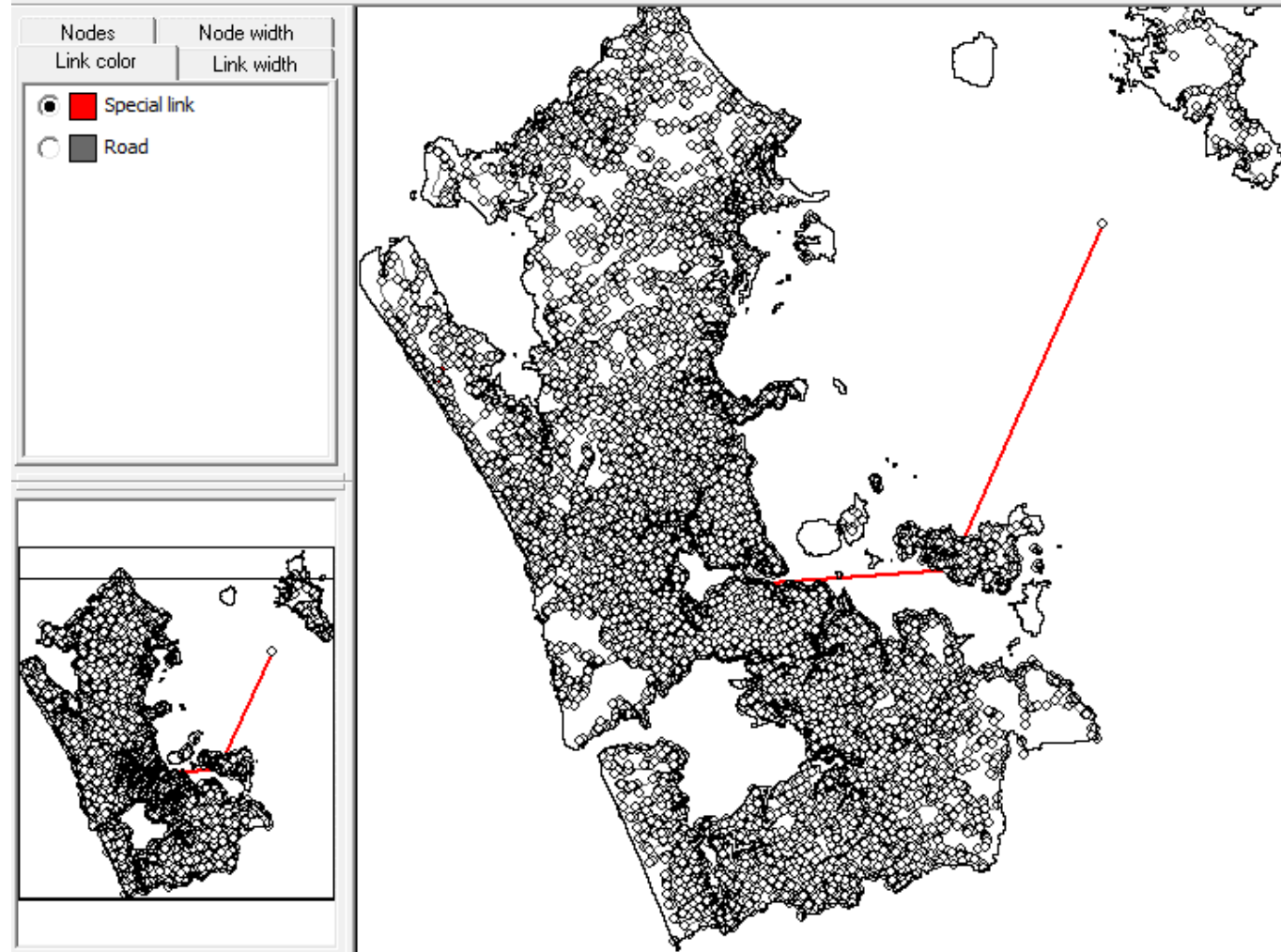
Suitability



Zoning



Accessibility





Transition Potential Formula

$$TP = (1 + (-\log(1 - \text{random}))^\alpha) \times N \times A \times S \times Z$$

Where

TP = transition potential

$(1 + (-\log(1 - \text{random}))^\alpha)$ = random component

N = neighbourhood effect value

A = accessibility

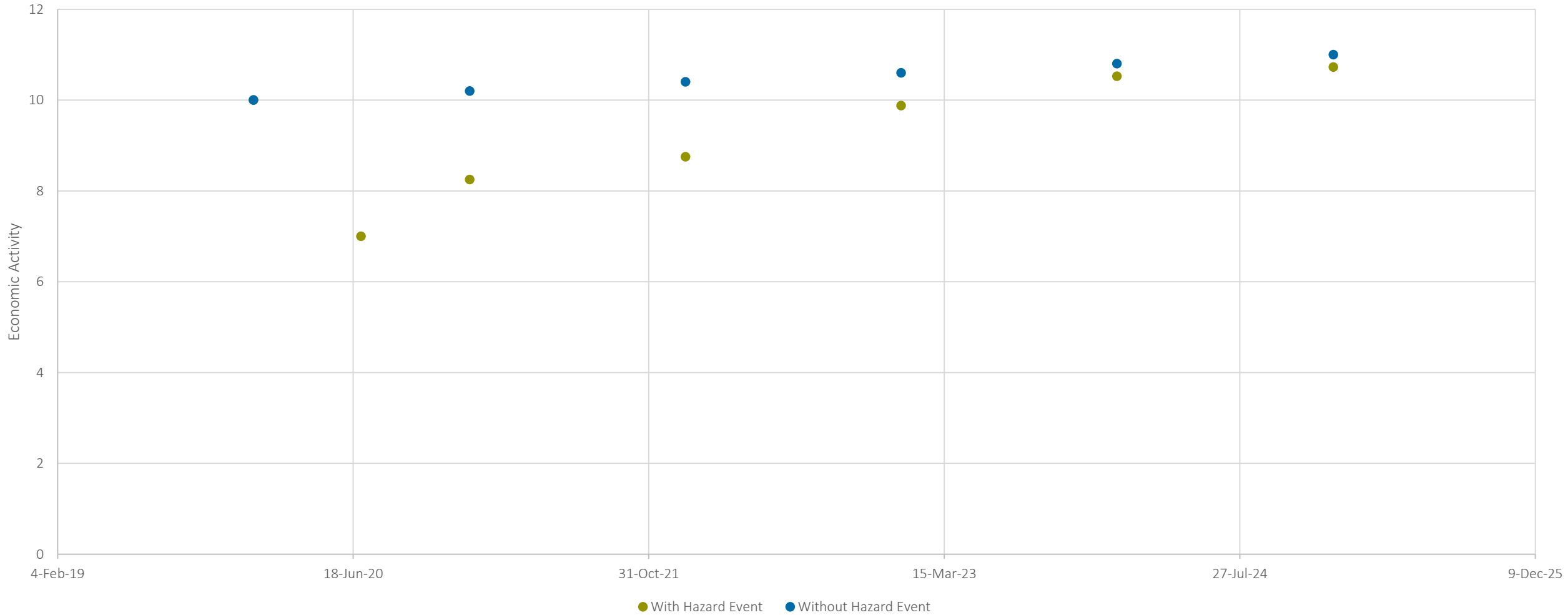
S = suitability

Z = zoning



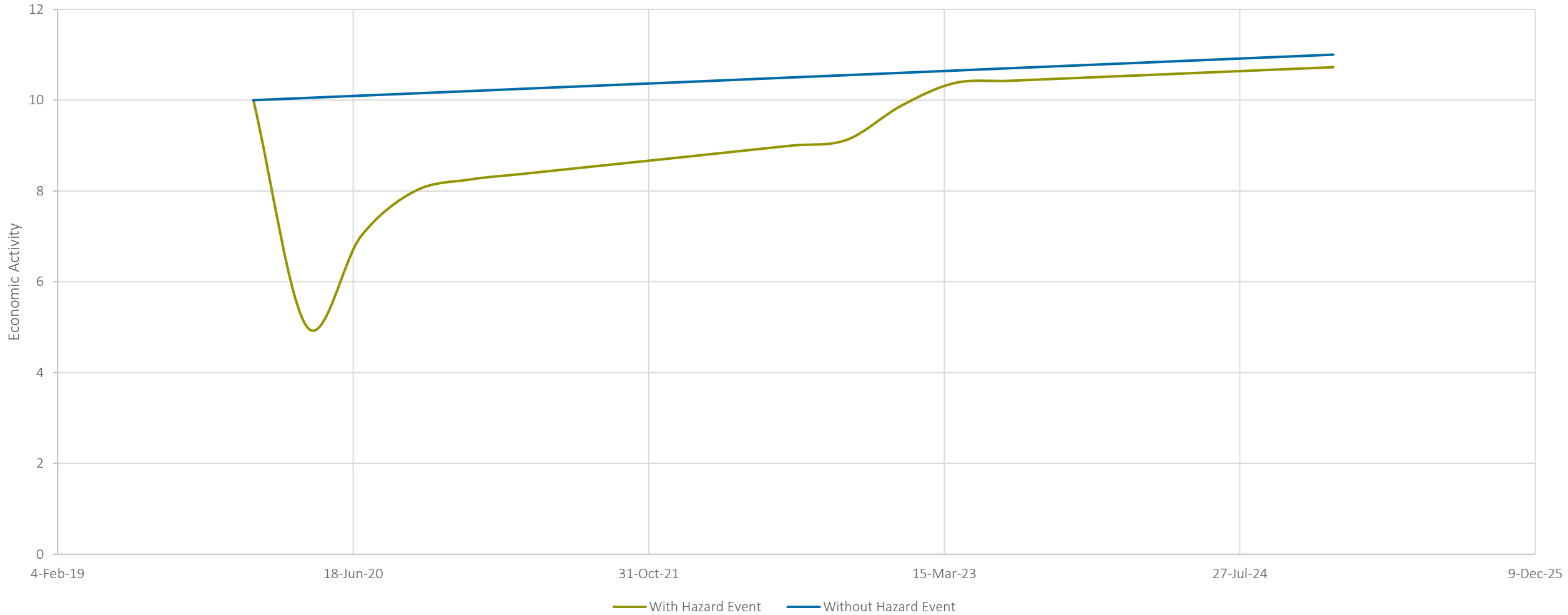
Static Economic Model

Static Economic Model Results



Dynamic Economic Model

Dynamic Economic Model Results



Mangere Bridge Eruption Scenario



A) Cumulative damage (Edifice, Surge, Lava, Ballistics)



5 - 30 April Water Supply Level of Service

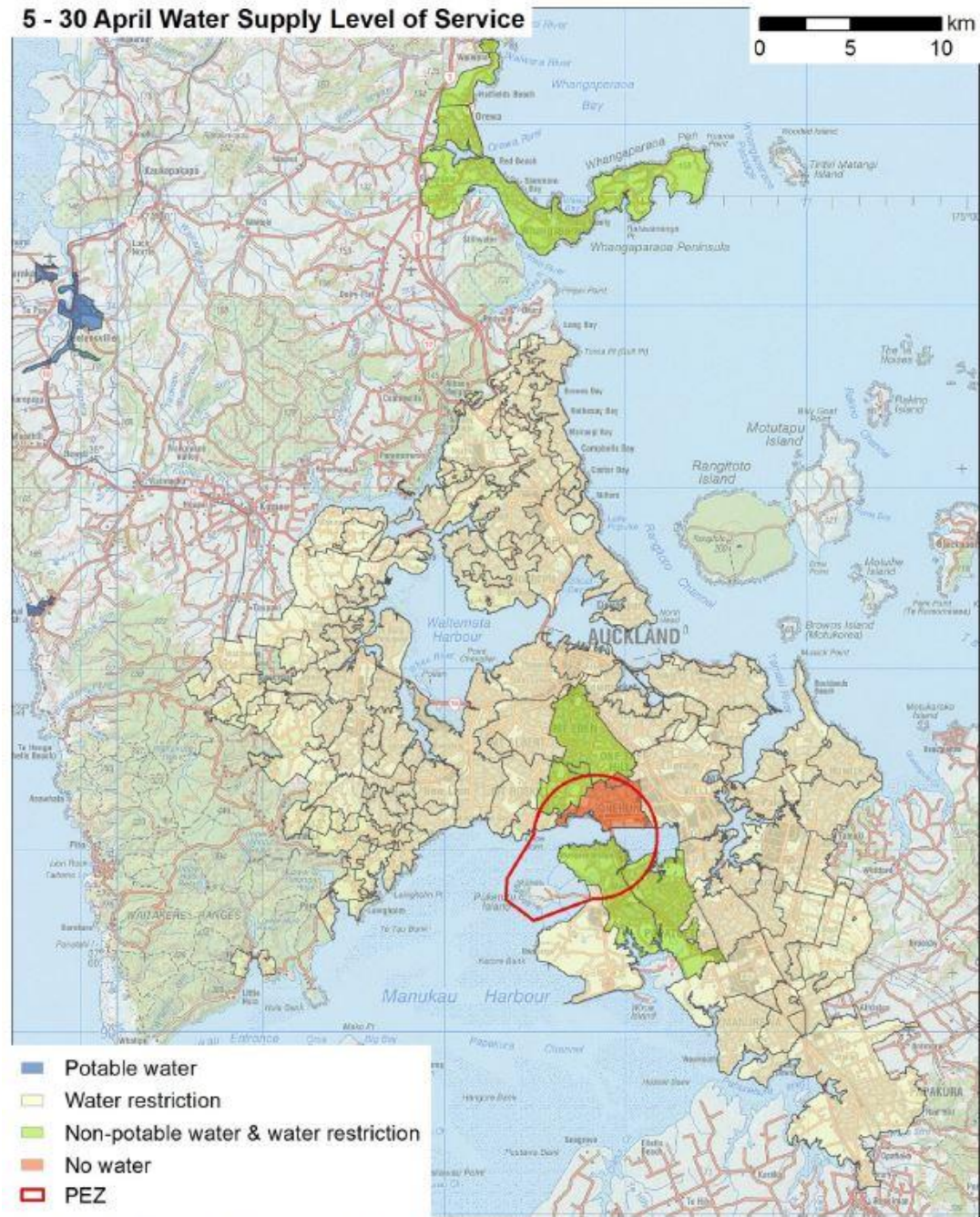


Figure 12.8 Water supply level of service map for period 5 April–30 April. Water balance zones are colour coded according to service level, with blue for potable water, yellow for water restrictions, green for non-potable water and water restrictions, and red for no water. The PEZ (red outline) for this period is indicated.

1 May - 14 July Power Level of Service

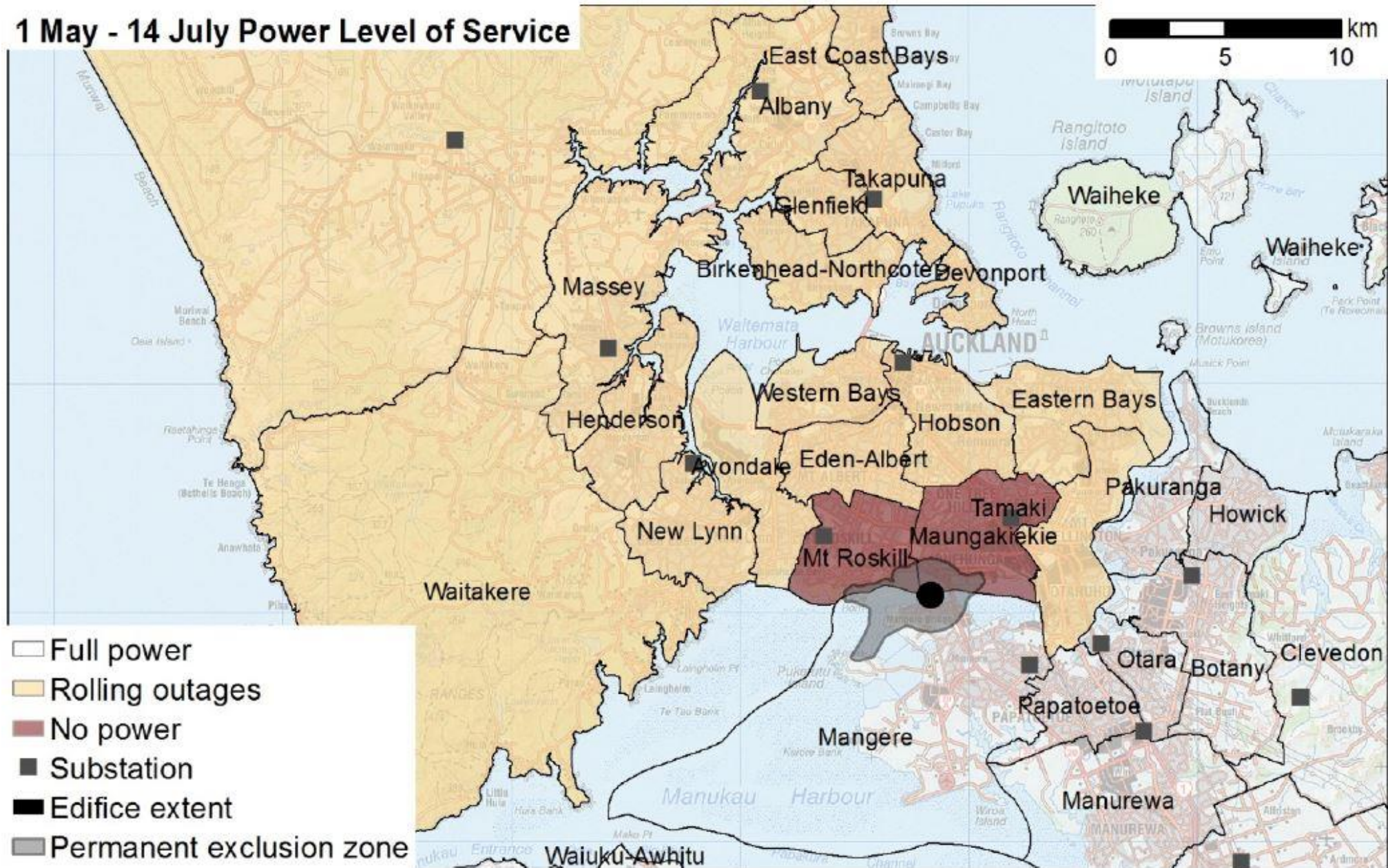


Figure 6.9 Electricity level of map for 1 May–15 July by community board. In yellow are areas with rolling outages and in red are areas with no power. The permanent exclusion zone is indicated, and substations are shown as grey squares for reference. The Mt Ruamoko edifice is shown in black.

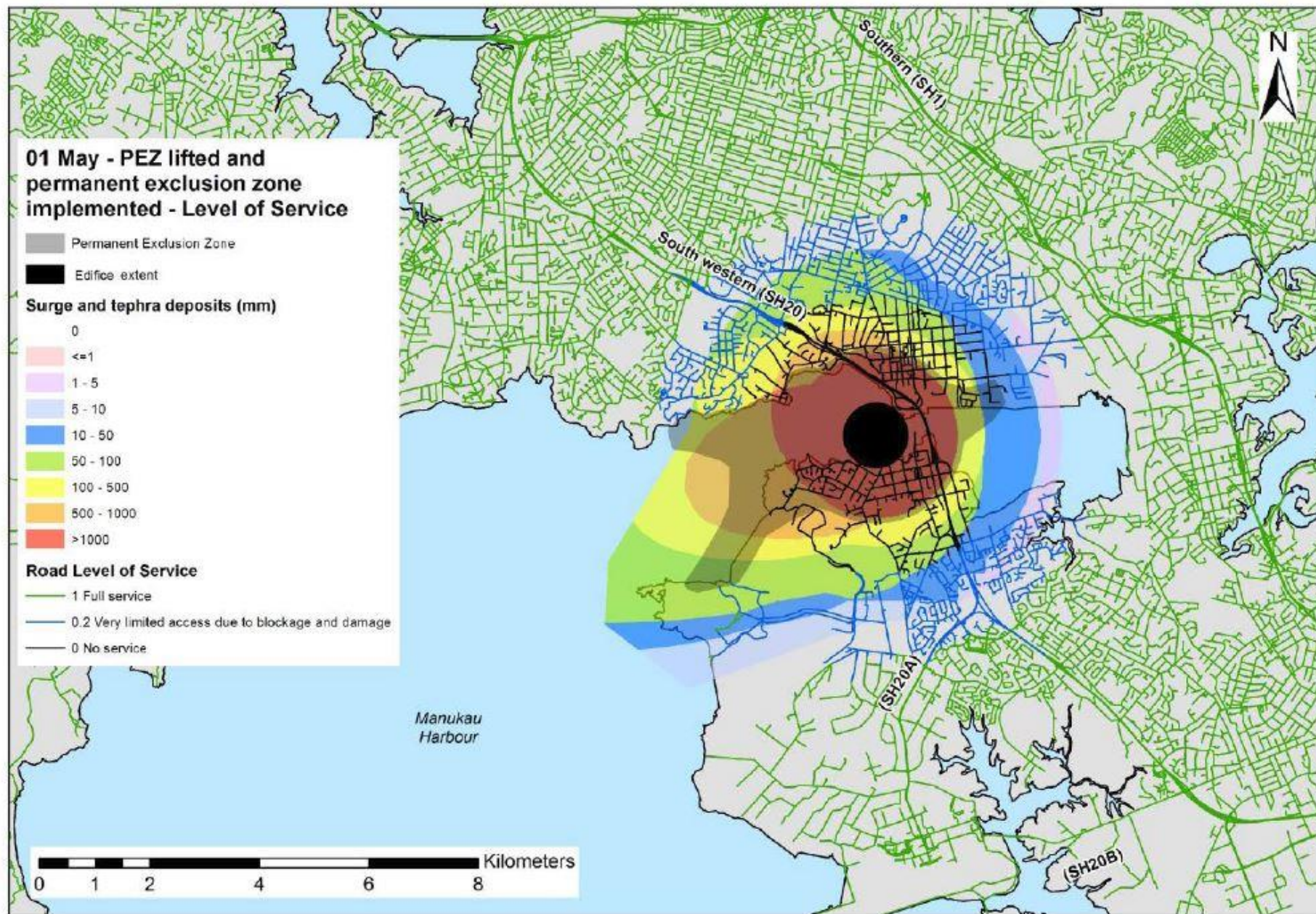


Figure 8.20 Road network level of service on 1 May following further clean-up, lifting of the PEZ and implementation of the permanent exclusion zone (dark grey). Hazards and level of service are coloured according to severity as in Figure 8.19.



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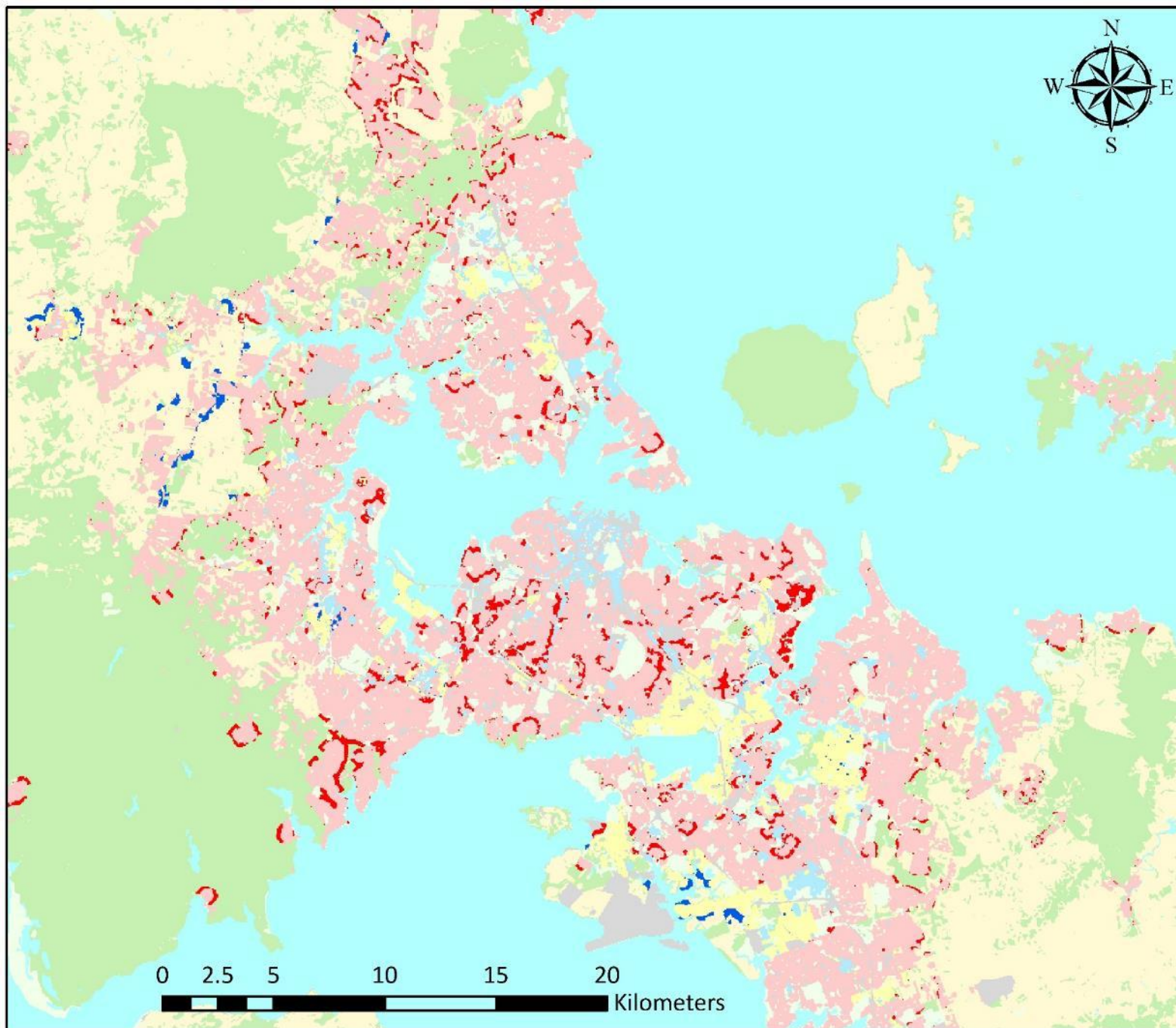
Insurance

Tourism











Health



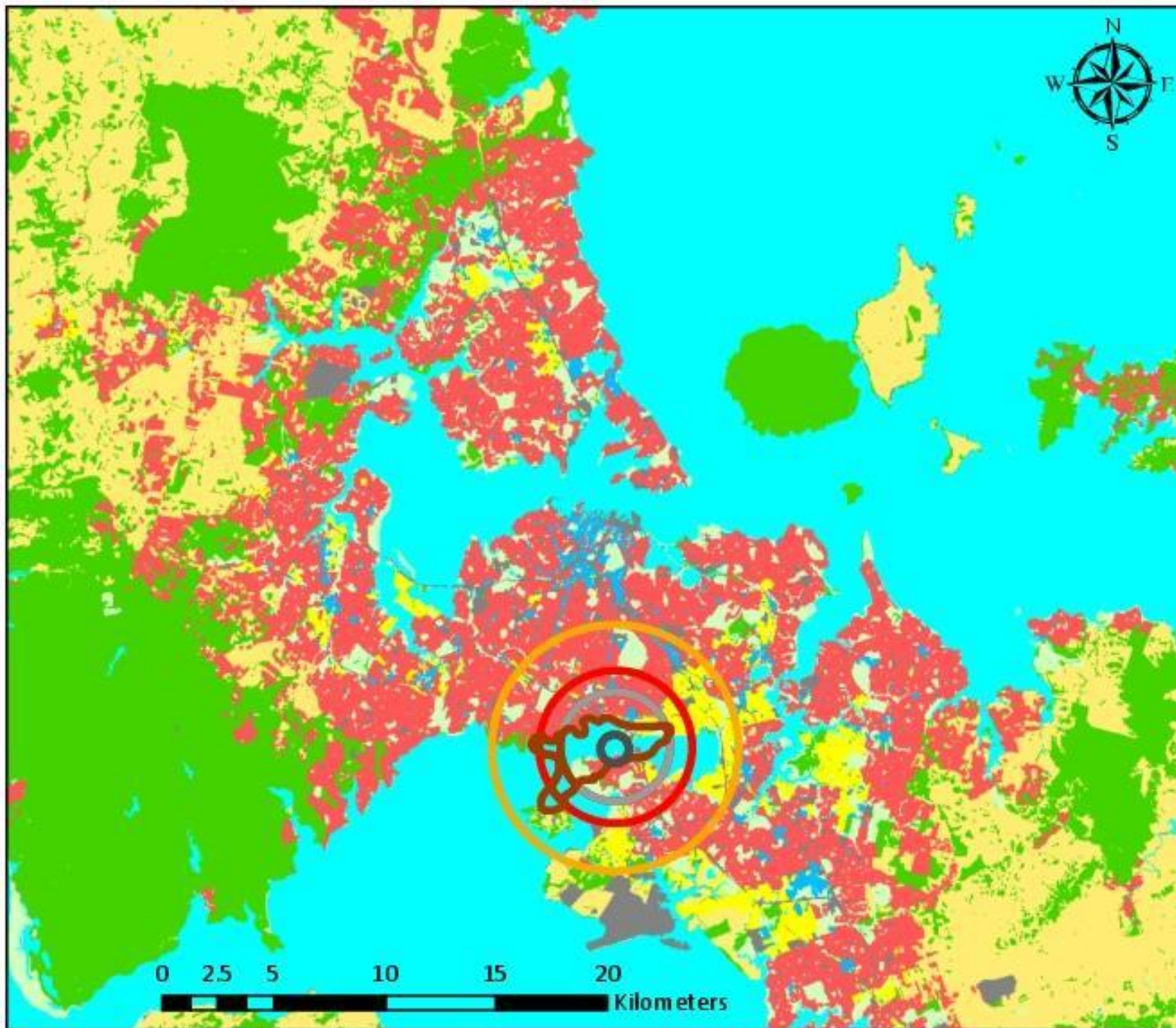
Change in industrial and residential land use in the baseline scenario between 2020 and 2024



Land Use

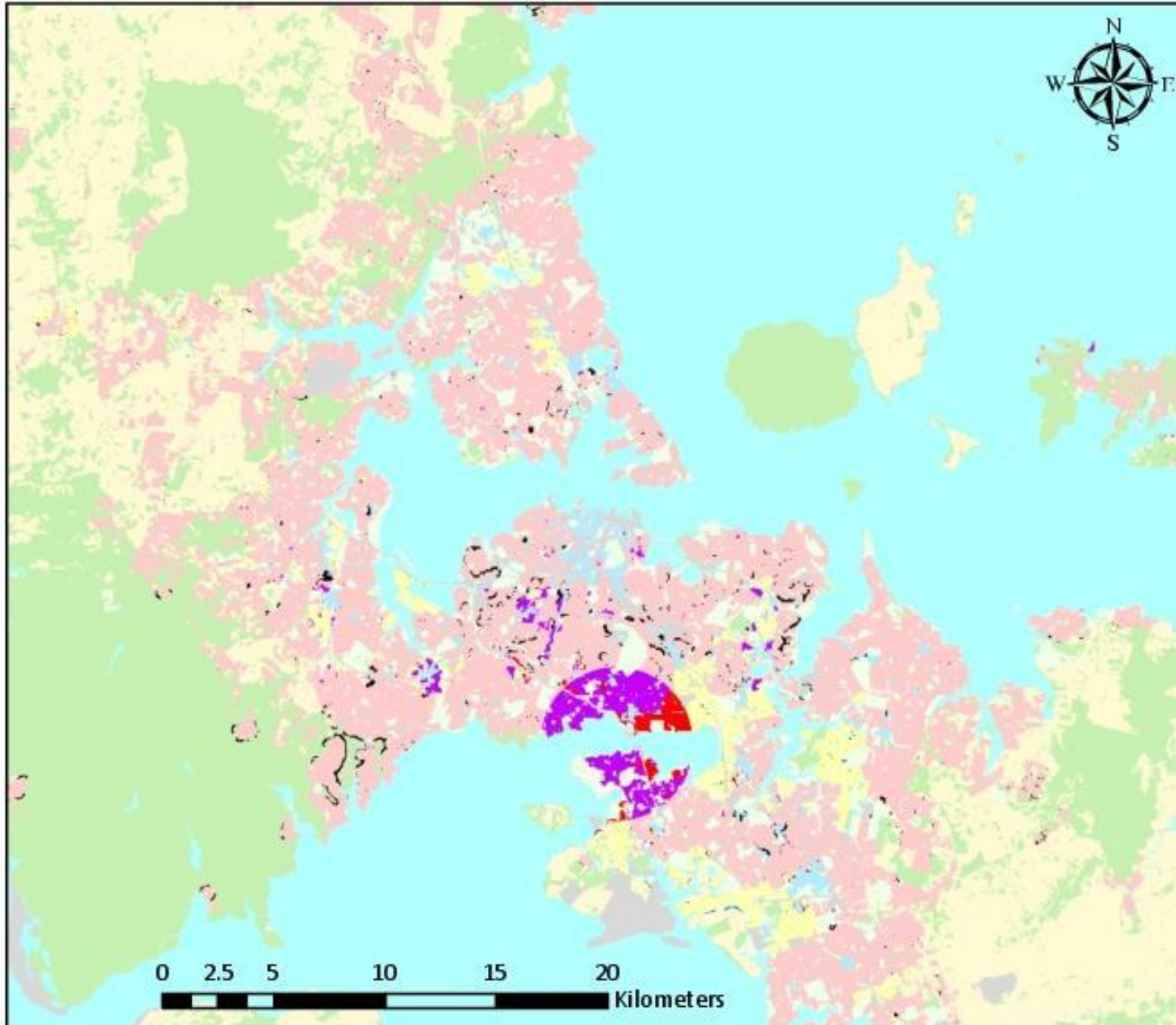
- | | |
|--|--|
|  Other urban |  Industrial |
|  Vegetation |  Commercial |
|  Agriculture |  Residential |
|  Water bodies |  New industrial land use |
|  Open space |  New residential land use or residential land use that has increased in density |

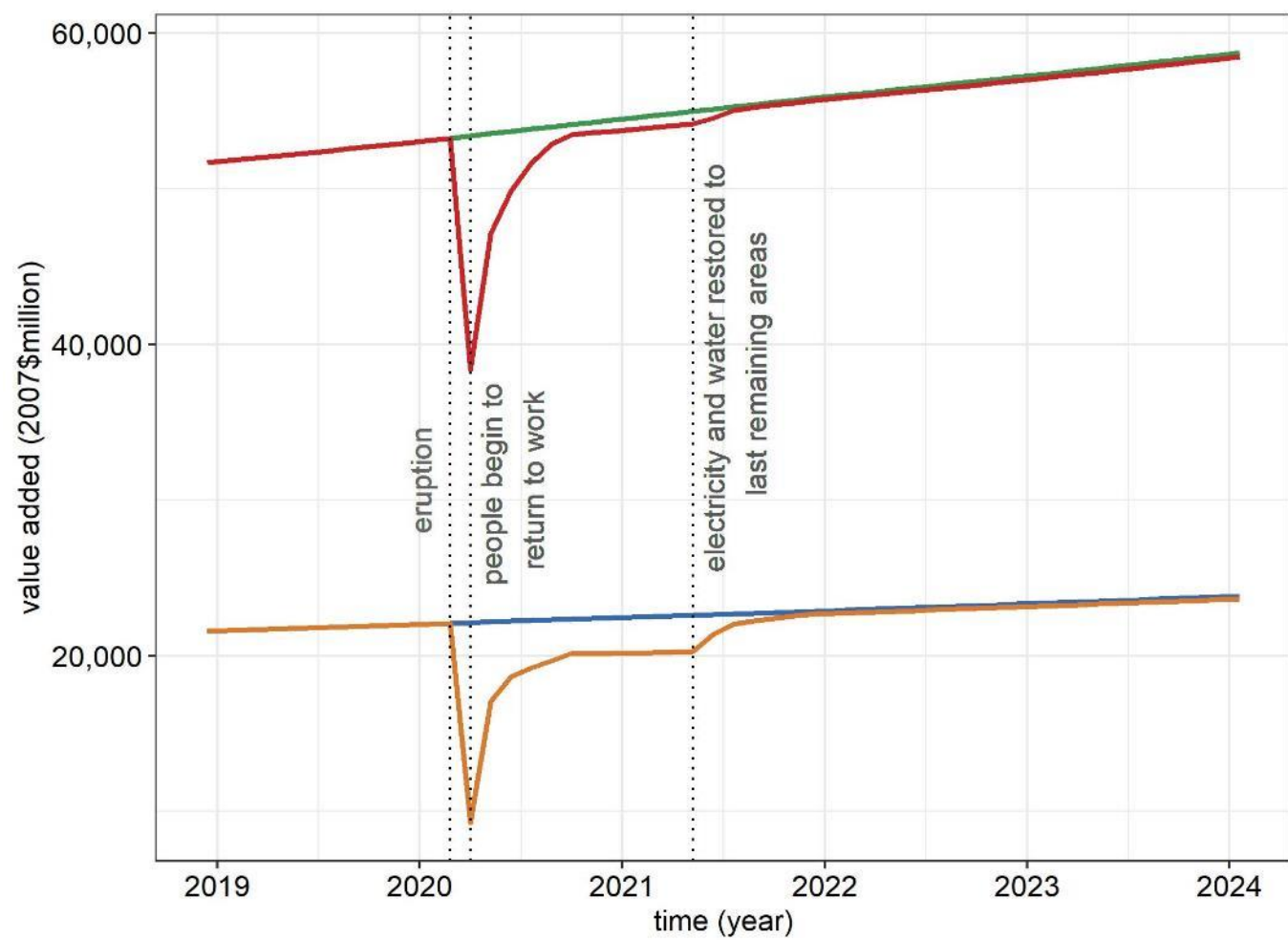
Cumulative Damage



0 2.5 5 10 15 20 Kilometers

Land use changes for volcanic eruption scenario, 2024 vs 2020

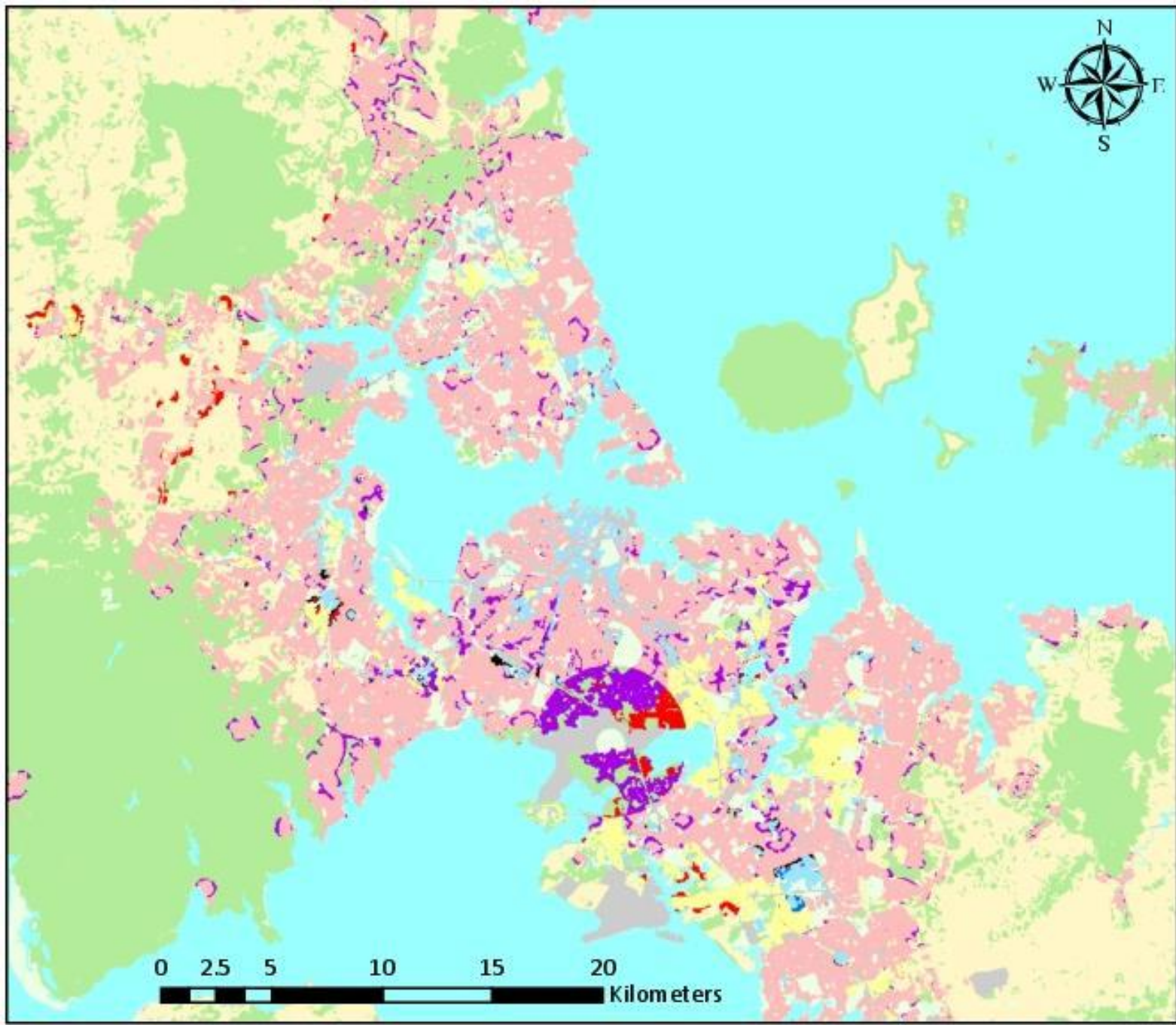




- Baseline Scenario - Value Added - Industry
- Volcanic Eruption Scenario - Value Added - Industry
- Baseline Scenario - Value Added - Commercial
- Volcanic Eruption Scenario - Value Added - Commercial

Fig. 8 Aggregate industrial and commercial economic activity for baseline and volcanic eruption scenarios

Industrial and residential land use at 2024 that occurs in volcanic eruption scenario relative to the baseline scenario



Land use

Other urban	Commercial
Vegetation	Residential
Agriculture	Water bodies
Industrial	Open space

Industrial land use only in baseline scenario	Residential land use that has disappeared or not increased in density in eruption scenario
Industrial land use only in eruption scenario	Residential land use that has remained or increased in density in eruption scenario

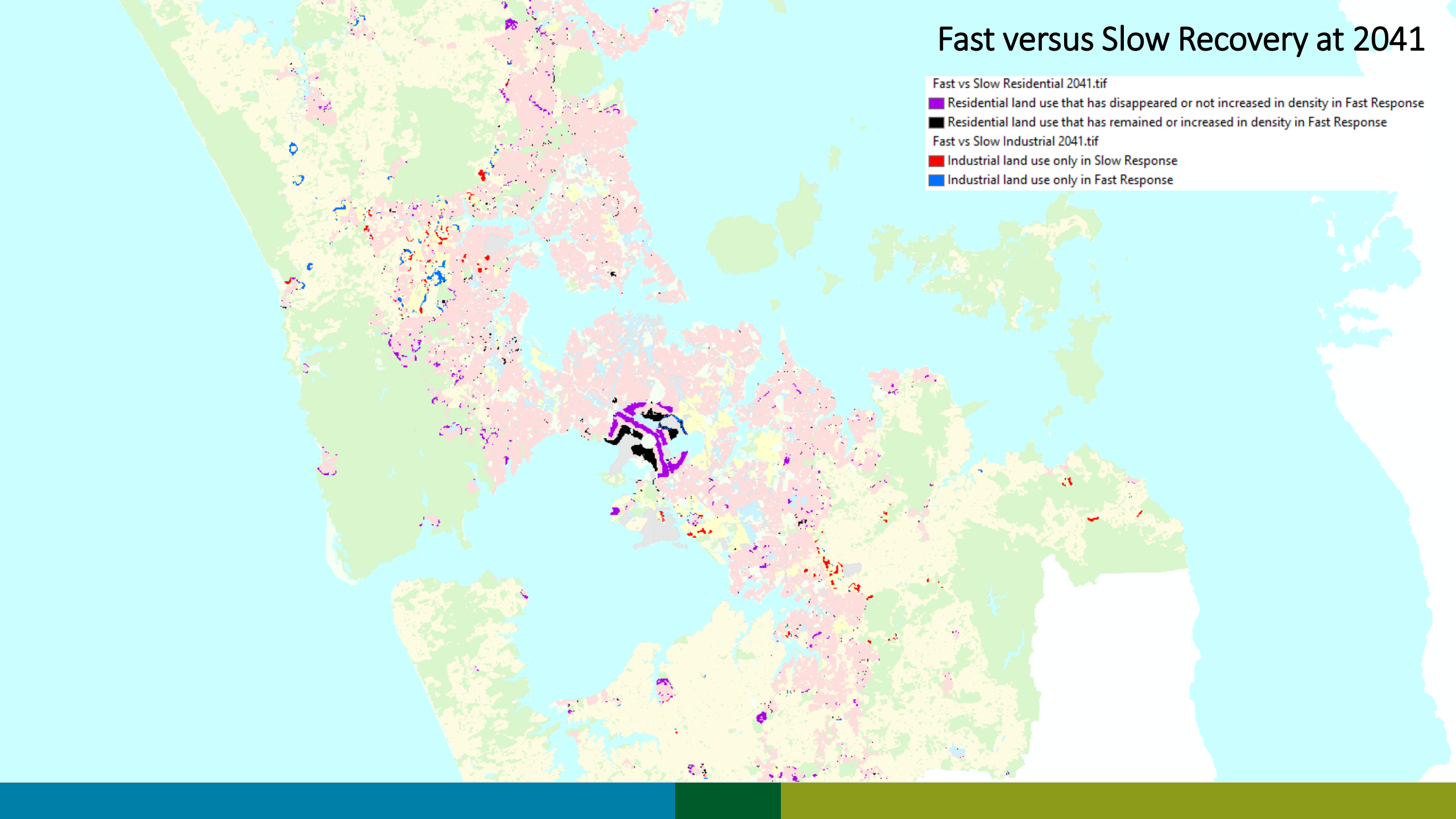
Fast versus Slow Recovery at 2041

Fast vs Slow Residential 2041.tif

- Residential land use that has disappeared or not increased in density in Fast Response
- Residential land use that has remained or increased in density in Fast Response

Fast vs Slow Industrial 2041.tif

- Industrial land use only in Slow Response
- Industrial land use only in Fast Response





Thank You

