Tsunami Risk in the Wellington Region
&
Evacuation Mapping Project

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What is a Tsunami ?

- *Series of waves generated by the sudden displacement of a water surface*

- 3 main causes:
  - Submarine fault ruptures
  - Landslides
  - Volcanic activity

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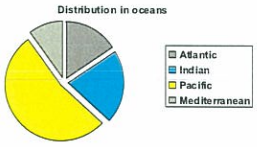
Fault Rupture Tsunami

- Approximately 90% of tsunami are caused by submarine fault ruptures
- Most commonly associated with shallow earthquakes (<30km), greater than M7.0
- Over 50% of all tsunami occur in Pacific Ocean due to plate boundary subduction zones (Hikurangi subduction zone)
- e.g. 1855 Wairarapa earthquake



Tsunami Characteristics

- Long period (10-60 min)
- Long wavelength (10's-100's km)
- Extremely high velocity (up to 700 kph)
- Behave like rapidly rising & falling tides
- Greater force than surf waves
- Not normally as breaking waves
- Usually occur as a bore
- 3rd-4th wave often highest, not 1st

Historic Examples

- Since 1848, 4 significant events over 1.0 m have affected Wellington region
- Further 7 events have been up to 0.35 m

23 January 1855 – Wairarapa earthquake (M8.2) - local source tsunami, Cook Strait (2000 yr event)

- *Waves reported to be 10 m in Palliser Bay & 3-4 m around Wellington*
- *Exacerbated by submarine landslide*

22 May 1960 Earthquake (M9.5) – distant source tsunami ex Chile (100 yr event)

- *Waves approximately 1.0 m in Wellington & 1.5 m at Ngawi*

Recent Examples

- Solomon Island's – 1 April 2007, 20-30 seiche wave in Wellington Harbour, 1.0 m at Westport.
- Samoa 30/09/09 – M8.0 EQ, 18 km deep, tsunami waves 6-8 m high, wave signal detected around Wellington
- Chile 27/02/10 – M8.8 EQ, 35 km deep, tsunami waves 3 m high, between 0.3-1.0 m along New Zealand's east coast.

How Can We Respond?

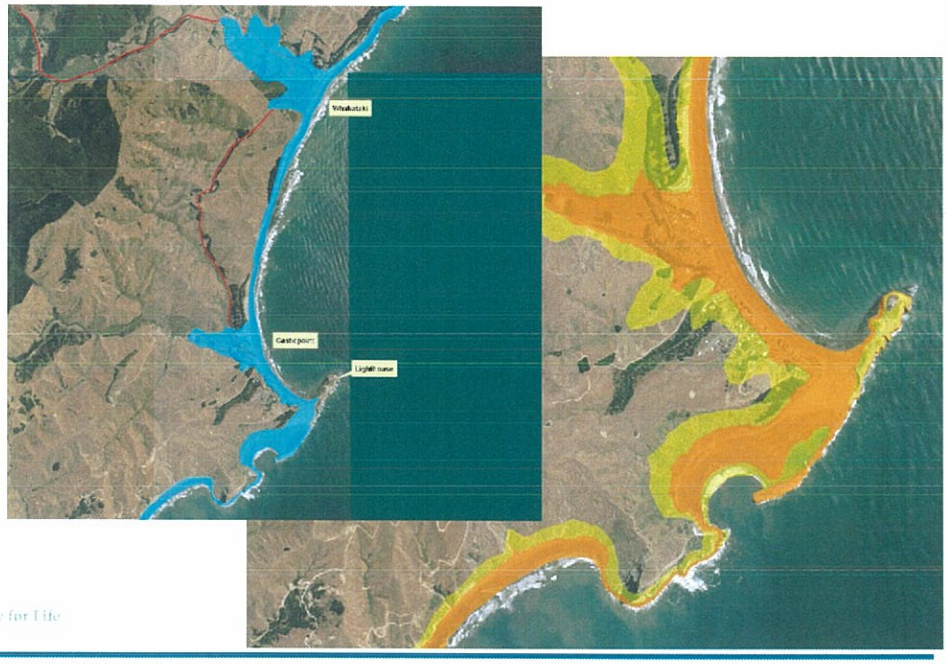
- Know our community's tsunami risk: hazard, vulnerability and exposure (science and research)
- Landuse planning – minimise development in high tsunami risk areas
- Locate, design and construct new buildings to mitigate tsunami damage
- Education (community and decision makers)
- Evacuation planning

Wellington Region Tsunami Evacuation Mapping Project

First Phase

- **Bathtub Inundation Mapping**
- Fast
- Flags risk
- Low resolution

Second Phase - 1st Order Modelling



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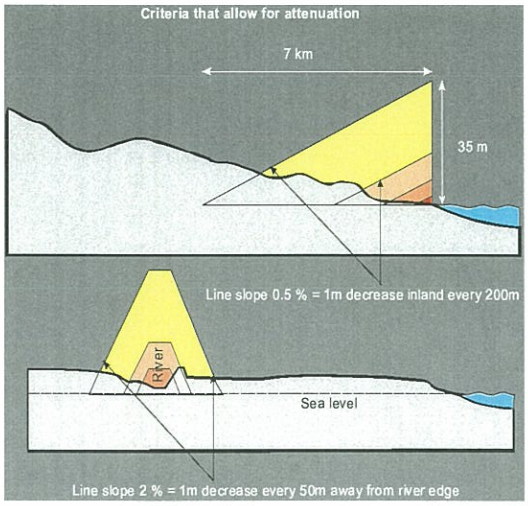
Modelling Zone Calculations

An 'inundation wedge' (attenuation rule)

Pros: Fast, simple (can be run by GIS operators), clearly understood

Cons: May not adequately reflect the way tsunami inundate land



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GIS modelled outputs

Corse resolution

Required refinement for evacuation maps

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Evacuation Zones

Three Zones:

1. Red - Shore exclusion zone (all sources)
2. Orange - official CDEM directed zone (500 yr - distant source event)
3. Yellow - self evacuation zone (2500 yr - local source event)

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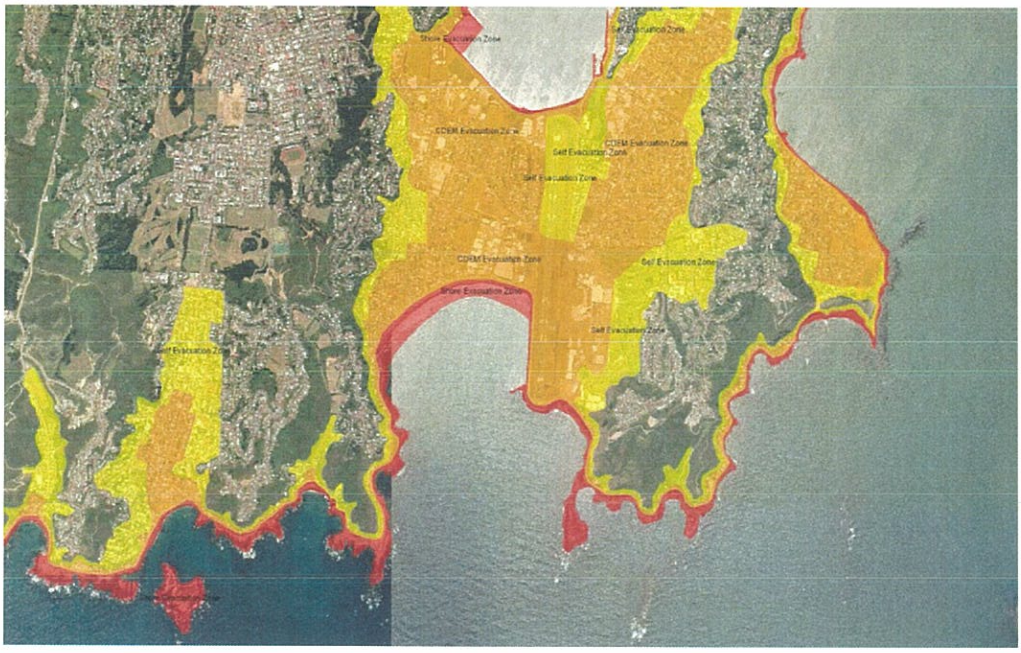

Evacuation Plans – Local CEDM Groups

- Develop evacuation routes and methods with community
- Safe routes
- Evacuation points
- Welfare centres