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**Report 01.374**

30 May 2001

File: X/13/3/6

[Report 2001.Env01.374.RGSB:sw]

Report to Environment Committee  
from Rosalind Groves, Hazard Analyst and Sam Barrow, Section Leader, Hazards and  
Emergency Management (Wairarapa)

## **Wellington Regional Tsunami Hazard Scoping Project**

### **1. Purpose**

To report the findings of a scoping study to determine the risks posed by tsunami hazards in the Wellington Region.

### **2. Background**

'Tsunami' is a Japanese word meaning "harbour wave or waves". Tsunami inundate low-lying coastal areas and can cause substantial damage through initial destruction and longer-term saltwater contamination. The Wellington Region has experienced at least three Chilean tsunami (1868, 1877 and 1960), which all arrived at low tide, averting major damage. A tsunami caused by the 1855 Wairarapa earthquake washed over Lyall and Evans Bays, flooded shops along Lambton Quay and caused erratic tides for 8-12 hours afterwards.

In 1990 the Regional Council commissioned research into tsunami hazards, generating a numerical model for tsunami scenarios in Wellington Harbour. The current tsunami hazard scoping study builds on and updates the previous research and examines the entire coastline in more detail. The scoping study forms part one of a potentially two-stage research project. The objectives of the scoping study were to:

- Define and assess the effects of tsunami and tsunami-related hazards likely to occur in the Wellington Region;
- Identify and define the risk tsunamis pose to the Wellington Region;
- Identify mitigation measures the Wellington Regional Council can undertake, based on currently known information, to reduce the risks from tsunami to the Region;
- Assess the uncertainties in the available information;
- Identify gaps in the current knowledge and prioritise studies to fill those gaps;

- Identify key stakeholders in the Wellington Region with an interest in tsunami hazard assessment;
- Compile a bibliography of relevant sources and readings regarding tsunami hazards likely to occur in the Wellington Region.

The tsunami scoping study is identified in the Resource Policy Department's 2000/2001 Operating Plan. It relates to Natural Hazards Method 5 of the Regional Policy Statement.

GeoEnvironmental Consultants were commissioned to undertake the study. A copy of their draft report will be tabled at the Committee meeting.

### 3. **Tsunami hazards in the Wellington Region**

Tsunami may be locally or distantly generated by earthquakes, submarine or terrestrial landslides or volcanic eruptions. The most likely sources of tsunami affecting the Wellington Region include:

- Earthquakes along the west coast of South America and parts of North America (e.g. Alaska);
- Submarine landslides in the Hikurangi Trough or the Cook Strait Canyon system;
- Earthquakes on local submarine faults (e.g. the Wairau Fault, which runs alongside the Kapiti Coast, the Wairarapa Fault, which was responsible for the 1855 tsunami and the Palliser-Kaiwhata Fault, which runs parallel to the south-eastern Wairarapa coastline).

Tsunami hazards include inundation, strong currents, bores (wall-like waves of water travelling up rivers or into estuaries), seiching ('sloshing' in a harbour or semi-enclosed area), sediment scouring and deposition, sandblasting, and floating debris.

During a tsunami, people may be drowned, crushed, dismembered or injured by floating debris. Inundation may affect land productivity, sensitive ecosystems, buildings and infrastructure through saltwater contamination, particularly as a result of slow rising, non-breaking waves, which are the most common. The effects of saltwater inundation may last for some time, even after the water has receded. While destructive on their own, tsunami are often associated with a large earthquake which may have already caused considerable damage.

### 4. **Areas at risk from Tsunami**

The areas in Wellington Region at risk from tsunami are:

- West Coast (Porirua and Kapiti)

This area has a higher risk than has often been thought. A zone of faulting extends offshore from Kapiti Island to onshore Manawatu, which causes this area to be at risk from locally-generated tsunami. Furthermore, Kapiti and Mana Islands may trap tsunami between the mainland causing the waves to 'bounce' back and forth. All the coastal urban areas from Otaki Beach to Makara are at risk, particularly Porirua Harbour and northward of Paekakariki. An estimated return period of 250-

400 years for a 10 m tsunami is suggested, although further modelling work is required in the Kapiti/Mana area before the effect of the islands is known.

- South Coast (Wellington Harbour)

This area is at risk from both locally and distantly generated tsunami. Seiching may occur in the harbour or on a larger scale in Cook Strait. Areas at most risk include the populated areas of the Central Business District, Breaker, Lyall, Island and Owhiro Bays, Seatoun and the eastern bays. Substantial infrastructure is at risk, including the port, airport, main roads and the Cook Strait cable at Oteranga Bay. An estimated return period of 100-250 years for a 10 m tsunami is suggested.

- East Coast (Wairarapa)

This area has the highest risk from tsunami, being exposed to the tectonically active area immediately offshore of Cape Palliser and the Wairarapa coast, the Hikurangi Trough and the South American coastline. Although sparsely populated compared with the East and South Coasts, areas such as Riversdale and Castlepoint are at substantial risk. An estimated return period of 100-150 years for a 10 m tsunami is suggested.

The estimated return period for a 5-10 m tsunami for some parts of the Wellington coast is about 84 years. This return period is based primarily on palaeotsunami work, which has yet to be fully integrated with numerical models. Palaeotsunami are identified by physical evidence (sediment deposits), sometimes associated with archaeological sites. Please refer to attachment 1 for a summary of the areas at risk.

## 5. Risk Management

A number of suggestions are made to minimise the risks from tsunami. Key areas are the publication of hazard information, land use and contingency planning, warnings (for examples refer to Attachment 1) and construction of protective measures.

## 6. Study Recommendations

The study highlights a number of areas where our knowledge on tsunami hazards in the Wellington Region is incomplete, and where future investigations could be directed. The study recommended that we:

- Obtain detailed coastal topography for the Wellington Region, at 1.0 m intervals up to 30 m above sea level.
- Identify residential and commercial shoreline facilities that could be damaged or cause damage (and their associated values).
- Determine the significance of landslides (coastal and submarine) for tsunami generation.
- Undertake key site-specific studies to assess the risks to people, lifelines and structures (e.g. Kapiti and Wairarapa).

- Develop public education and mitigation plans (including an analysis of possible future demands for coastal development).
- Complete the database of historical events.
- Provide better quality observational data from the open coasts (from water level recorders).

## 7. **Where to from Here?**

The results of the study will be presented to Regional Council staff, territorial authority emergency management and planning officers, lifeline utilities, insurance and geological organisations and other interested parties. Discussions will be held with territorial authorities to determine the need for any stage two work. The objective of stage two would be to provide more location specific information on the risks and potential mitigation measures.

## 8. **Communication**

The study will be communicated to others through:

- Presentations and follow up discussions with territorial authority staff and other interested organisations.
- Distribution of the written report or a summary fact sheet to territorial authorities and other interested parties, including the news media.

## 9. **Recommendation**

*That the report be received and its contents noted.*

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Attachments: 1 (one)