



# ASSET MANAGEMENT GROUP

## Technical report

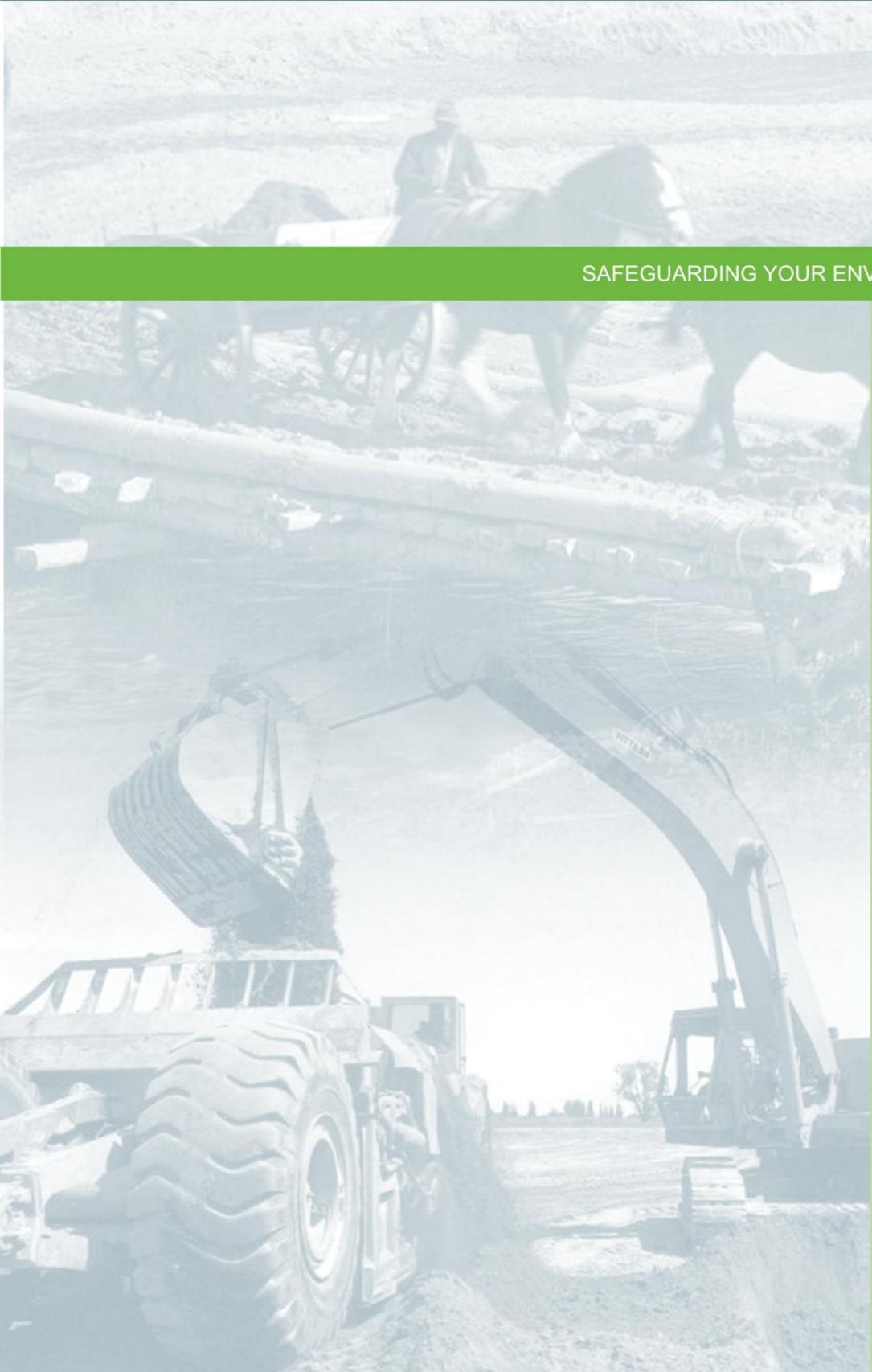
ISSN 1174 3085



SAFEGUARDING YOUR ENVIRONMENT + KAITIAKI TUKU IHO

### Chile Tsunami Event Impacts in Hawke's Bay February 2010

April 2010  
AM 10/07  
HBRC Plan 4195





## **Asset Management Group Technical Report**

**ISSN 1174 3085**

**Asset Management Section**

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## **Chile Tsunami Event Impacts in Hawke's Bay February 2010**

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**April 2010  
AM 10/07  
HBRC Plan Number 4195**



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## Background

Tsunami from a distant source is ranked in the Hawke's Bay Civil Defence Emergency Management Plan as Priority 3, as while it presents a real risk, impacts are limited to particular communities and the frequencies of these events equates to about one event every 900 years (J Goff, June 2008). Given the infrequency of these events, it makes them all the more interesting when they do occur hence the decision to collect the relevant information relating to this event.

## Executive Summary

A tsunami originated off the coast of Chile, following an 8.8 magnitude earthquake at a depth of 55km, which occurred at 19:34 on Saturday 27th February. The Pacific Tsunami Warning Centre (PTWC) issued an 'Expanding Tsunami Regional Warning – Initial' on Saturday 27 February 2010 at 19:47.

Based on initial scientific advice from GNS Science that the earthquake was unlikely to have caused a tsunami that would pose a threat to New Zealand, the Ministry of Civil Defence and Emergency Management (MCDEM) issued a "National Advisory: Tsunami - No Threat to New Zealand" at 20:38 hrs, 27 February 2010. Following further assessment by the GNS-convened Tsunami Experts' Panel, and observations of wave activity from close to the earthquake, at 23:18 hrs on 27 February 2010 MCDEM issued a national warning stating that waves of up to 1 metre high were likely for the eastern and later the entire New Zealand coast. A subsequent warning message issued by MCDEM at 1:06 hrs 28 February 2010 noted that some land threat also existed (i.e. wave heights between 1 and 3 metres) for the Chatham Islands and Banks Peninsula. It also stated that based on historical events it was expected that the greatest wave heights would occur between 6 and 12 hours after the initial arrivals.

The Emergency Operating Centres at Central Hawke's Bay, Hastings and Wairoa District Councils and Napier City Council, as well as the Hawke's Bay CDEM Group Centre were all operational during this event.

By 03:00 all vessels at the Port of Napier had been asked to depart and by 06:30 all ships were clear of the port, proceeding to water depth of > 30 metres and the port closed until tsunami risks eased to workable level.

All Councils notified affected coastal communities and where appropriate instigated access restrictions to beaches and boat launching ramps which were monitored by NZ Police and/or CDEM staff. Police and the Fire Service went door-knocking in the coastal communities of Te Awanga, Haumoana, Clifton and Whirinaki warning residents it would be a good idea to leave and Hastings District asked Te Awanga residents with homes right on the beach to self-evacuate just before 09:00. The coastal settlements of Ocean Beach and Waimarama were also evacuated. The remainder of the response activities were involved in information collection and dissemination.

At 09:37 on Sunday 28 February a regional warning confirmed the first wave had arrived at Napier at a height of 0.2metres, followed by a surge of waves around the Ahuriri Harbour. The tsunami was observed in Hawke's Bay with vertical changes in water levels around the coast and in harbours of around 1 metre.

By mid afternoon on Sunday, CDEM had downgraded the tsunami warning to an alert, while still advising that sea levels could change quickly for up to 24 hours from the initial surge.

The tsunami warning was cancelled for all countries except Japan and Russia in PTWC Bulletin 18 of 00:12 UTC on 28 February 2010, and the Ministry of Civil Defence & Emergency Management issued a cancellation of the National Tsunami Potential Threat at 08:35 on 1 March 2010.

## Abbreviations

Abbreviation	Meaning
CDEM	Civil Defence Emergency Management
HBRC	Hawke's Bay Regional Council
NZDT	New Zealand Daylight Time
PTWC	Pacific Tsunami Warning Centre

## Pre-Event

Normal tides were expected, high tide at Napier was expected at 05:32 NZDT 1.8 metres and low tide at 1151 NZDT 0.1 metres. and there were no weather warnings in place.

## Response

On Sunday 28 February 2010 at 00:02hrs the Duty Manager for the Hawke's Bay Civil Defence Emergency Management Group received a National Warning from the Ministry of Civil Defence Emergency Management advising of a 'Tsunami Threat to New Zealand'.

The Pacific Tsunami Warning Centre (PTWC) had issued a Tsunami Information Bulletin for New Zealand in response to the earthquake below:

Origin time:	06:34 Z
NZ time:	1934 Hrs NZDT
Co-ordinates:	36.1 South 72.6 West
Depth:	55 km
Location:	Near Coast of Central Chile
Magnitude:	8.8

The Ministry advised a tsunami had been generated and the first wave may arrive in New Zealand in the areas around Chatham Island (Waitangi, Western Side) at approximately 07:05 NZDT 28/02/2010. The travel and arrival times that had been calculated for the rest of New Zealand, included the following prediction for Napier:

Location	Place	Travel Time	Arrival Time
-39.5000 176.9000	Napier	12:49	8:23 (NZDT)

The Duty Manager for the Hawke's Bay Civil Defence Emergency Management Group sent out a regional warning at 00:16.

At 00:03 the Emergency Management Coordinator rang the Duty Manager, Harbour Master, HBRC Incident Controller and opened the HBRC Emergency Operations Centre by 01:00 on Sunday, 28 February.

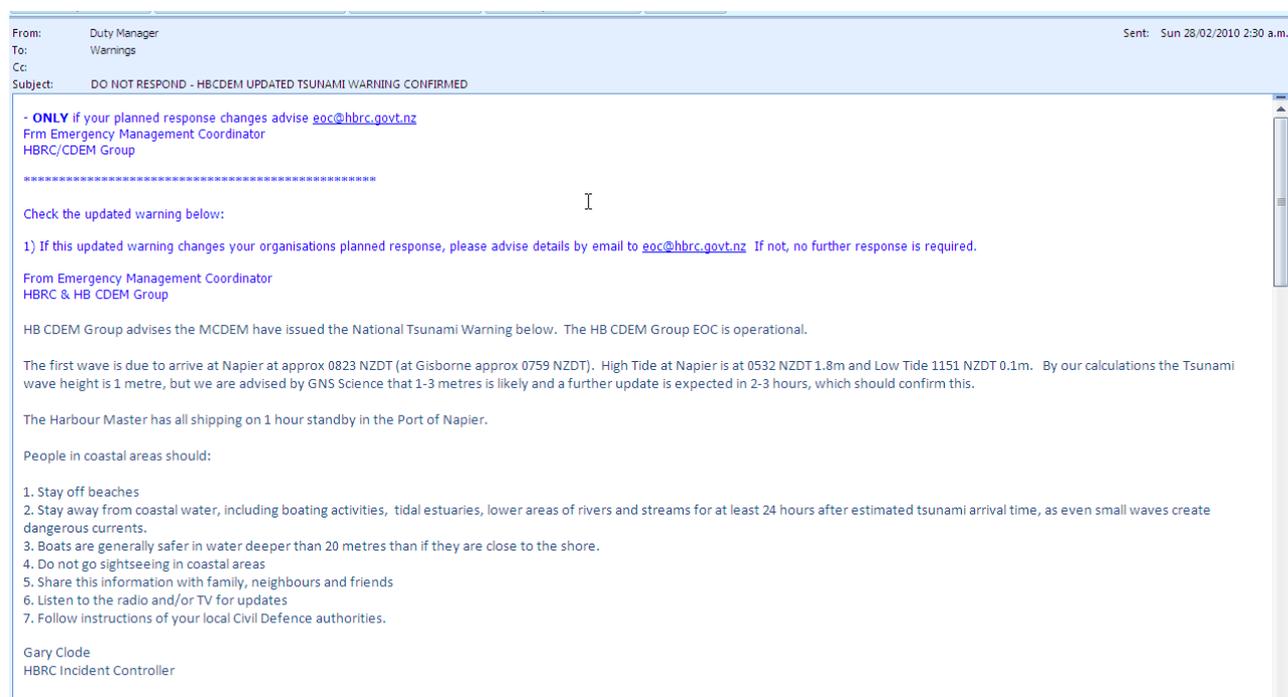
A 2nd National Warning "Tsunami Threat to New Zealand. Update Tsunami Confirmed" was received at 01:11 and a Regional Warning was forwarded on at 01:19. It noted that some land threat also existed (i.e. wave heights between 1 and 3 metres) for the Chatham Islands and Banks Peninsula. It also stated that based on historical events it was expected that the greatest wave heights would occur between 6 and 12 hours after the initial arrivals.

The Hawke's Bay Regional Council Incident Controller, Gary Clode and staff accessed threat information using their Tsunami Standard Operating Procedures and calculated possible run-up heights for Hawke's Bay.

A 3<sup>rd</sup> National Warning was received at 02:13 and Regional Warning sent out at 02:15, followed by a further Regional Warning at 02:30 with specific advice for Hawke's Bay (Figure 1). At 03:00 all vessels at the Port of Napier had been asked to depart.

The first wave was estimated to arrive at Napier at approximately 08:23 NZDT (at Gisborne approximately 07:59 NZDT). High Tide at Napier was at 05:32 NZDT 1.8 metres and Low Tide at 11:51 NZDT 0.1 metres. The Hawke's Bay Regional Council staff estimated the wave height would be 1 metre water level at that time.

There were a number of agencies involved in the response including Central Hawke's Bay District Council, Hastings District Council, and Hawke's Bay Regional Council, Napier City Council and Wairoa District Council, New Zealand Police, Eastern Fire Region and Port of Napier Limited.



**Figure 1: Copy of Regional Warning sent out 2:30am Sunday, 28 February 2010 from the Hawke's Bay Regional Council**

The Emergency Operating Centres at Central Hawke's Bay, Hastings and Wairoa District Councils and Napier City Council, as well as the HB CDEM Group Centre were all operated during this event.

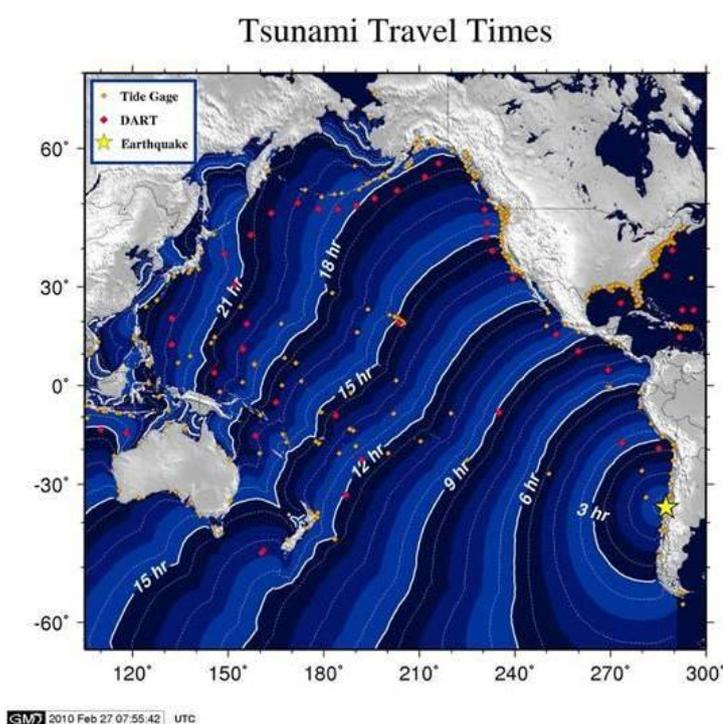
The first media release from the Hawke's Bay CDEM Group was issued at 03:15 and Andrew Newman took up the first shift as Group Controller at 04:00 and participated in a National Conference Call at 04:30. This was followed by a meeting of the Hawke's Bay Emergency Services Coordinating Committee.

At 06:00 Regional Council staff closed boat ramps and warned recreational boaties not to go to sea. They remained posted at ramps throughout most of the day. By 06:30 all ships were clear of the port, proceeding to water depth of > 30m and port remained closed until tsunami

risks eased to workable level. HarbourMaster commenced notifying Napier Inner Harbour berth holders and commercial fishing companies of tsunami risk to their vessels. At 09:30 the Port was evacuated of all personnel apart from four key staff including the Harbour Master. This included stevedores and reefer care personnel.

All Councils notified affected coastal communities and where appropriate instigated access restrictions to beaches and boat launching ramps which were monitored by NZ Police and/or CDEM staff. Police and the Fire Service went door-knocking in the coastal communities of Te Awanga, Haumoana, Clifton and Whirinaki warning residents it would be a good idea to leave. Hastings District asked Te Awanga residents with homes right on the beach (21) to self-evacuate just before 09:00. The coastal settlements of Ocean Beach and Waimarama were also evacuated. The remainder of the response activities were involved in information collection and dissemination.

The Pacific Tsunami Warning Centre issued a map showing the estimated tsunami travel times (Figure 2).



At 08:01 National Warning No. 9 was received from the Ministry confirming the following:

**“As at 0735 NZDT 28 February 2010 wave activity was confirmed on the coastal tsunami gauge at the Chatham Islands. At this stage, the change in sea level measured is approximately 0.2 metres. It is important to note that this is the first arrival and larger waves may follow over a period of several hours. The situation continues to be closely monitored.”**

Based on the actual arrival time in the Chatham Islands, the Ministry updated indicative arrival times estimating wave arrival at Napier at 0853 NZDT 28 February 2010.

At 09:37 a regional warning confirmed the first wave had arrived at Napier at a height of 0.2metres and by 12:59 Regional Warning No. 14 confirmed significant surges were still occurring at the Port of Napier with up to 0.7 metre variance within one hour. The recordings taken at the Port of Napier Wave Buoy are shown in Figure 7.

At 12:00 Hastings District gave advice that the more than 200 people who self-evacuated to Haumoana School may return home but need to refrain from seaside activities and keep away from the lower reaches of the rivers. Other Council also advised people who had self evacuated from their coastal homes they could return home but should stay away from the beach for the rest of the day. Boaties were advised of the need to take extra care launching or coming back in as strong currents and tidal effects would continue for up to 12 hours.

By late afternoon local CDEM staff stepped down their tsunami watch but continued to monitor the situation. CDEM Officials continued to repeat earlier warnings for Hawke's Bay people to stay away from beaches and estuaries for the rest of the day.

On Monday, 1 March 2010 at 01:30 the port was reopened by the Harbourmaster and normal shipping movements resumed and by 08:35 the National Advisory of Tsunami Potential Threat was cancelled.

A declaration of local emergency was not made for this event.

None of the Hawke's Bay Territorial Local Authorities made emergency expenditure claims to the Ministry of Civil Defence & Emergency Management, as no expenditure in either category "A" or "B" was incurred.

Hawke's Bay Regional Council did not make a claim, as no expenditure in either category "A" or "B" was incurred.

## Tsunami Observations

The tsunami was seen in Hawke's Bay with changes in water levels around the coast and in harbours of around 1 metre. Wave surges were seen around Ahuriri Harbour as were abnormal water level and wave patterns along the coast. A member of the Napier Sailing Club, Jeff Lynex took pictures showing the changes in water level (Figure 3). The 1<sup>st</sup> picture taken at 14:41 hours compares with the 2<sup>nd</sup> taken at 15:04 (23 minutes later). The 3<sup>rd</sup> picture taken at 15:22 shows a subsequent drop 18 minutes later which he measured at 1.42 metres.

Mr Lynex prepared an observation report which is included in Annex A of this report.



**Figure 3: Changes in water levels graphically shown in the Inner Harbour at Napier on a floating pontoon.**

In Waimarama, a man Leon Mickelson was fishing for paua when he was swamped by a metre-high surge of water, followed by two more waves. He had no idea a tsunami alert had been issued. He was quoted by the media (Annex D) as follows:

"This wall of water just hit me. I was getting tumbled across all the rocks, it was unbelievable. The force was just unstoppable. There was no way you could fight it, you just had to roll with it."

He reported the water then sucked him 20 metres out into the ocean, bouncing over rocks. "It was like being in a washing machine. It just completely and utterly caught us out." Mr Mickelson, 30, managed to swim ashore, and suffered cuts and bruises.

## **Social and Economic Effects**

### **Number of Casualties**

There were no casualties, injuries, or deaths as a result of this tsunami event.

### **Rescues and/or Evacuations**

People from twenty one houses at Te Awanga were asked to self-evacuate as a precautionary measure and many coastal residents in Te Awanga, Haumoana, Clifton and Whirinaki, Ocean Beach and Waimarama also self-evacuated. The media reported about 300 people in total were moved out of coastal settlements around Haumoana, in Hawke's Bay, for a few hours.

### **Number of houses**

No houses were destroyed or damaged as a result of this tsunami event.

The Earthquake Commission (EQC) received less than 10 claims nationally for this event, but none from the Hawke's Bay.

No information on the cost to insurers was obtained.

### **Other Buildings**

No reports of other buildings destroyed or damaged as a result of this tsunami event.

### **Forestry & Conservation Assets**

No forestry areas or conservation areas were significantly affected or impacted as a result of this tsunami event.

### **Number of farms**

No farms were significantly affected or impacted as a result of this tsunami event.

### **Number of businesses**

The business most affected by this tsunami event was the Port of Napier Limited. While operations were delayed, it was still affective. Nevertheless the estimated total cost of losses to their business is between \$80,000 - \$100,000. Losses were incurred as a cruise vessel was not able to enter the port and another vessel that chose to not re-enter the port and reduced its visit by 3 days. This loss includes labour that was ordered and stood down when vessels were unable to work but which still had to be paid. Also the extra costs of pilotage (pilot, tugs/crew and launch/crew) with taking the vessels out and then bringing them back into the Port once the all-clear was given by the Harbour Master.

No other significant impacts on business were reported.

### **Infrastructure – Bridges and Culverts**

There was no reported damage to bridges or culverts. There were reports of strong currents under the Westshore Bridge in Napier (Figure 4).

### **Infrastructure – Roads**

No state highways or roads were closed.

## Infrastructure – River, Lake & Coastal Protection Works

There was no damage caused to river or coastal protection works.



*Figure 4 Strong currents from the tsunami move under the Westshore Bridge, Napier.*

## Other Infrastructure

No damage or problems were reported to any telecommunications infrastructure, water supplies, power generation assets, electricity supply or gas reticulation networks.

No damage or problems were reported to any airports, ports, other significant fixed assets such as marinas, marine farms, wharves and jetties.

## Event Data

### Earthquake

The 8.8 earthquake was the fifth largest recorded world-wide since seismograph recordings began (Figure 5). It struck at 03:34 local time at the epicenter, rupturing a section of the plate boundary 500km long and 100km deep beneath the offshore and coastal regions of central Chile. Strong shaking lasted for more than 90 seconds affecting approximately 80% of Chile's population and damaging at least 200,000 households. The fault rupture also warped the ocean floor and produced local tsunami waves that were devastating at various points along the coast in Chile as well as sending tsunami across the Pacific.

## Magnitude 8.8 - OFFSHORE MAULE, CHILE

2010 February 27 06:34:14 UTC

Details	Summary	Maps	Scientific & Technical	Tsunami	Additional Info
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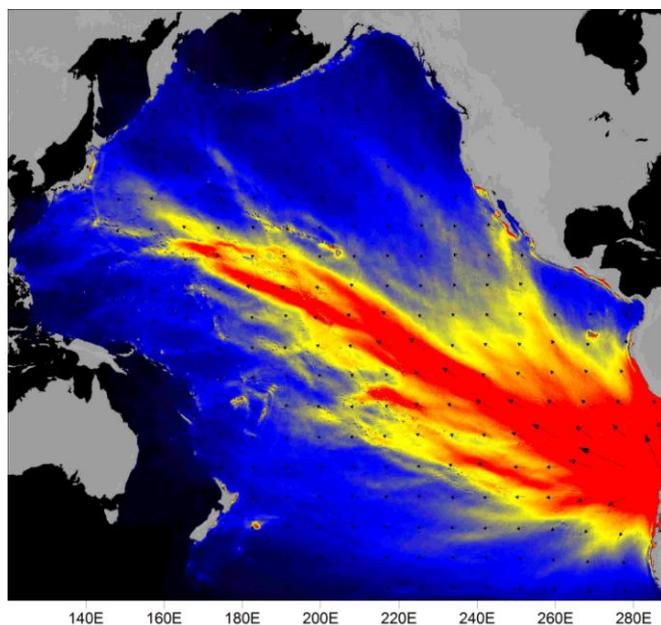
### Earthquake Details

<u>Magnitude</u>	8.8
<u>Date-Time</u>	Saturday, February 27, 2010 at 06:34:14 UTC Saturday, February 27, 2010 at 03:34:14 AM at epicenter <a href="#">Time of Earthquake in other Time Zones</a>
<u>Location</u>	35.909°S, 72.733°W
<u>Depth</u>	35 km (21.7 miles) set by location program
<u>Region</u>	OFFSHORE MAULE, CHILE
<u>Distances</u>	95 km (60 miles) NW of <b>Chillan, Chile</b> 105 km (65 miles) NNE of <b>Concepcion, Chile</b> 115 km (70 miles) WSW of <b>Talca, Chile</b> 335 km (210 miles) SW of <b>SANTIAGO, Chile</b>
<u>Location Uncertainty</u>	horizontal +/- 6.2 km (3.9 miles); depth fixed by location program
<u>Parameters</u>	NST=391, Nph=391, Dmin=987.2 km, Rmss=1.17 sec, Gp= 14°, M-type=teleseismic moment magnitude (Mw), Version=8
<u>Source</u>	USGS NEIC (WDCS-D)
<u>Event ID</u>	us2010tfan

Figure 5: Chile Earthquake Details from USGS Website <http://www.usgs.gov/>

## Waves & Surges

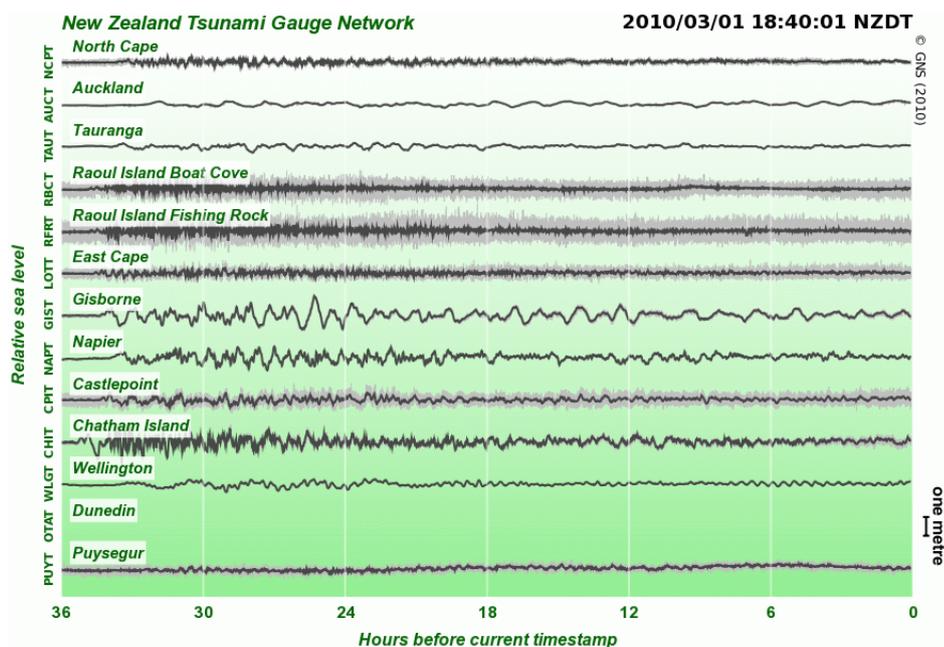
A tsunami warning was first declared for Chile and Peru, and a tsunami watch for Ecuador, Colombia, Antarctica, Panama and Costa Rica. The warning was later extended to a Pacific Ocean-wide warning, covering all coastal areas on the Pacific Ocean except the west coast of the United States, British Columbia, and Alaska.



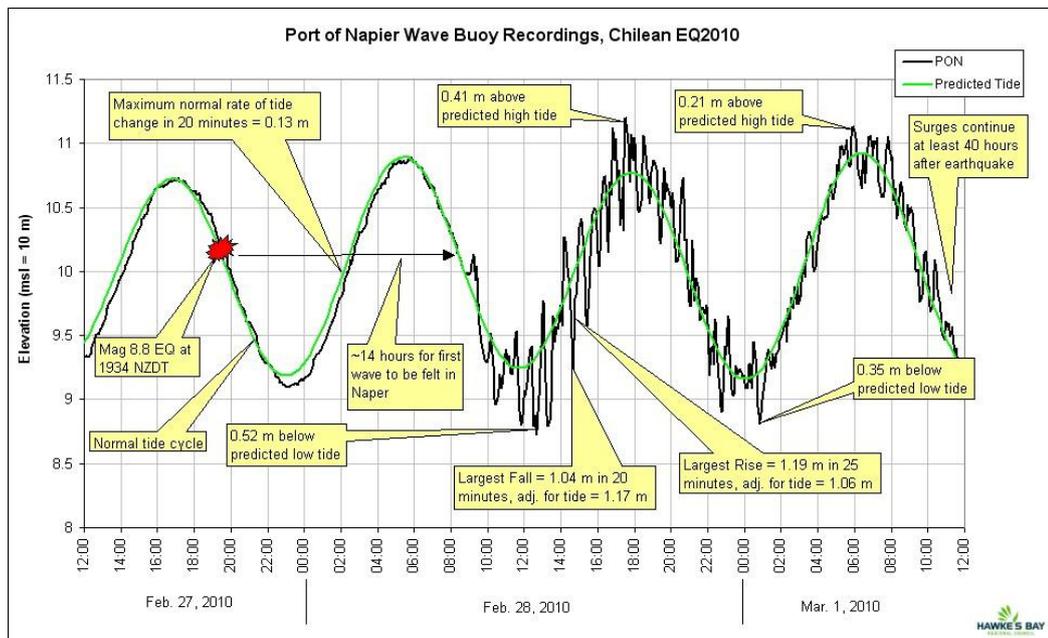
**Figure 6: Tsunami Energy Flux by Isaac Fine (IOS) Chilean tsunami Feb 27 2010**

The national tsunami warning advised the Tsunami Experts Panel estimated there was a marine threat (i.e. threat to beach and small boats corresponding to wave heights less than 1 metre) for the entire east coasts of the North and South Island of New Zealand.

Recordings on the New Zealand Tsunami Gauge Network showed fluctuations around 1 metre (Figure 7), while the Port of Napier Wave Buoy showed surges up to 1.2 metres (Figure 8).

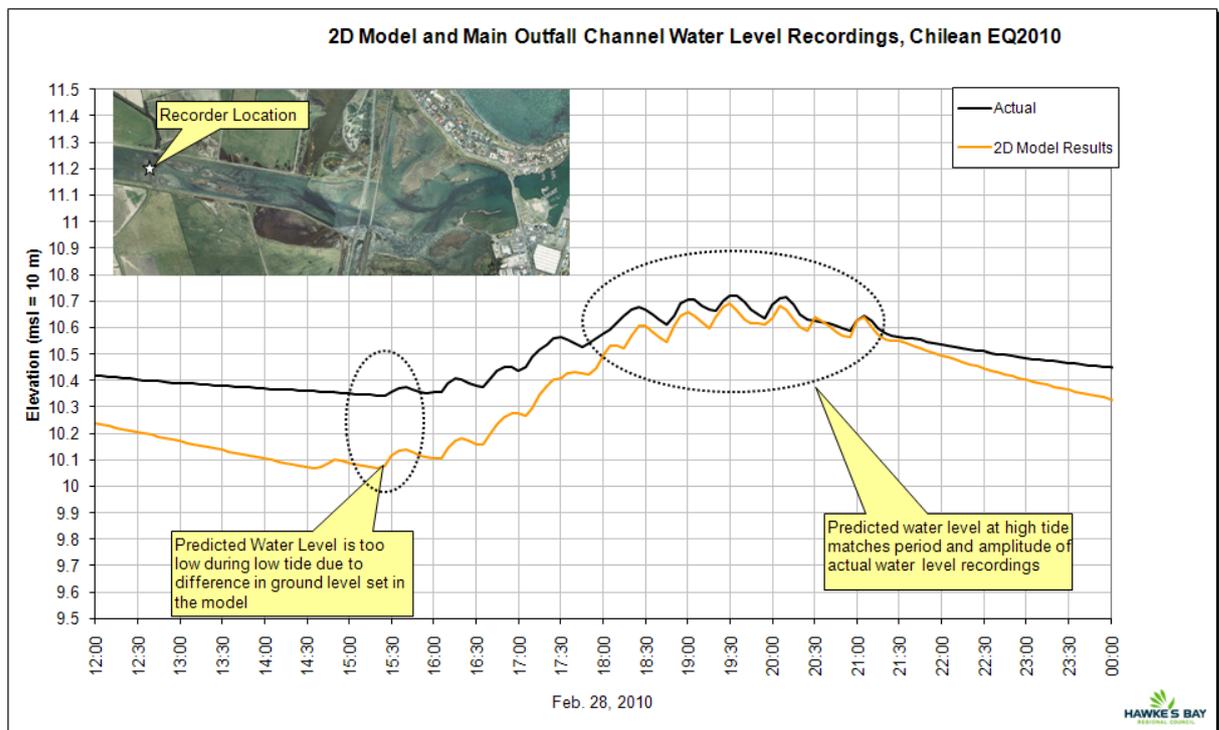


**Figure 7: Recordings of New Zealand Tsunami Gauge Network on 1 March 2010 showing the changes in relative sea level for the 36 hours previous.**



**Figure 8: Port of Napier Wave Buoy Recordings**

The tsunami also caused a series of surges in the inner harbour at Napier. The surges started at about 09:00 on Sunday 28 February (about 14 hours after the earthquake) and carried on for several days. Peak surges were just over 1 m (peak to trough, approximately 0.5m above water level at time), with a cycle time of about a 40 minutes. HBRC had recently developed a 2D model of the Napier Inner Harbour and Main Outfall Channel and results from the 2D model run indicate excellent correlation with observations. A comparison of the water level at the outfall channel recorder is shown in Figure 9.



**Figure 9: Comparison of Actual and Modelled Water Level at Outfall Recorder by HBRC**

Several visual observations in the inner harbour near the Napier Sailing Club were also compared to model results, as shown in Figure 10.



**Figure 10: Comparison of Actual and Modelled Water Level at Inner Harbour by HBRC**

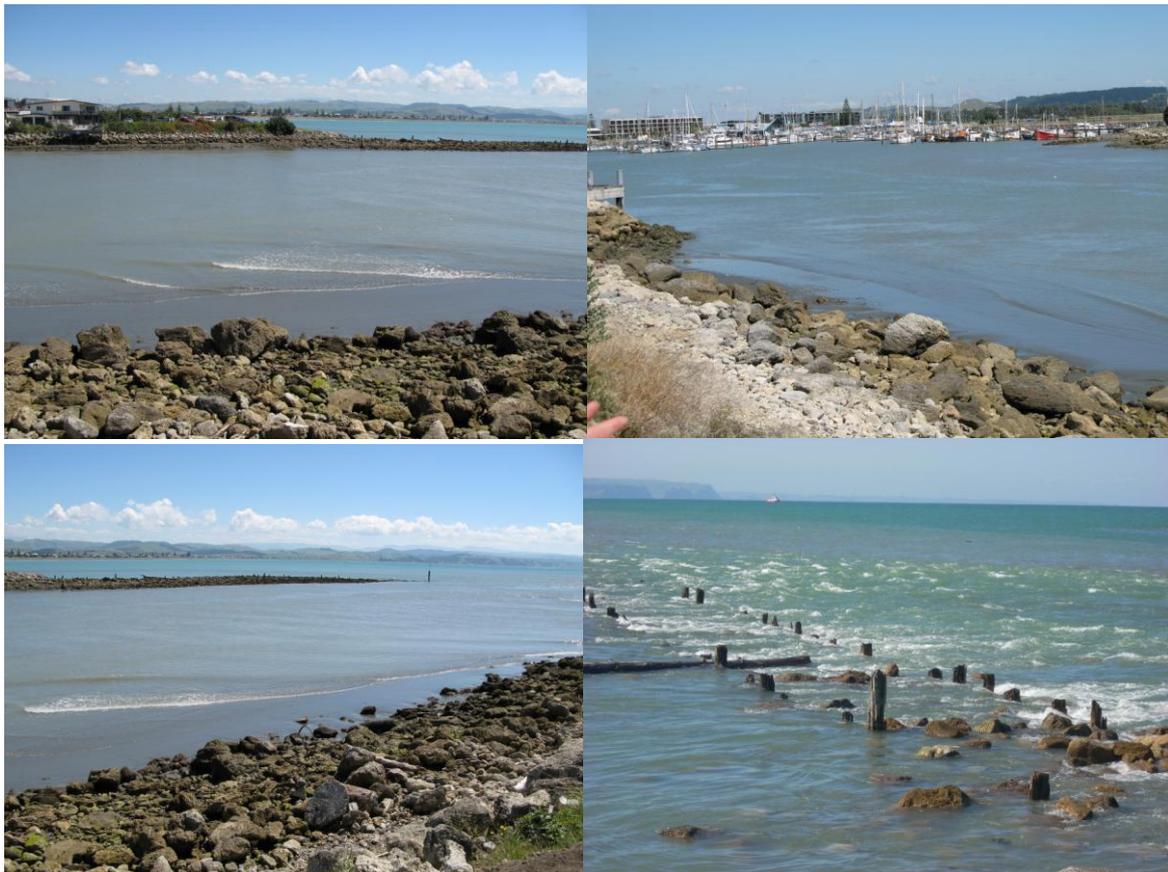


**Figure 11: Disturbed currents and discolouration of water at entrance to Inner Harbour at 1345 on 28th February 2010 taken by Acting Harbour Master John Paston**

A number of photos were taken during the tsunami event. Some of these are included here.



**Figure 12: A rare sight - Clifton Reefs exposed on 28 February 2010, Hastings**



**Figure 13: Unusual slow moving wavelets at entrance to Napier Inner Harbour morning of 28 February 2010**

## **Annexes**

### **A: Other Reports Produced**

The following reports were produced following this tsunami event:

- 'Tsunami Surges at Port Ahuriri' an observation report prepared by Jeff Lynex

### **B: Scientific Studies**

No scientific studies have been completed or commissioned at the writing of this report.

### **C: Log of Events**

Attached is a log of events provided by the Harbour Master.

### **D: Newspaper Articles**

A copy of a Dominion Newspaper article dated 1 March 2010.

## Tsunami Surges Port Ahuriri, 28 February 2010

### *Summary of Observations made by Jeff Lynex, Teacher at Karamu High School, Hastings and member of the Napier Sailing Club.*

Note:

Most observations were made from the floating pontoon where the Hawke's Bay Wine Country Cat berths; this is to the north of the West Quay wharf and just south of the entrance to the Iron Pot. Google Earth gives the position as 39° 28' 54.22"S and 176° 53' 40.75" E.

- 1) Comparison of events at the Wave Buoy and the inner Harbour suggest that arriving surges took approximately 8 to 10 minutes to travel from the buoy to the observation point.
- 2) The first smaller surges of less than 0.5 metres recorded by the Wave Buoy were noticeable only as very small wavelets (*a result of meeting of outflow and incoming surge??*) and the flow was non-turbulent.
- 3) The larger surges of 0.6+ metres tended to be swirling; wavelets were not observed in these instances.
- 4) The surges tended to be crescent shape – slowing rising with the incoming surge but then dropping before the last of the surge passed. There was no evidence of rise or steepening of the surge in shallows (e.g. outside the Game Fishing Club or the opposite side of the channel).
- 5) The maximum variation - as measured by tape against the wetted area of a pile - was 1.42 metres and another was measured at 1.00 metres. Comparative photo studies suggest this occurred for a number of waves. This suggests some amplification of the wave as recorded at the wave buoy; this may be due to an incoming surge arriving before the lagoon had drained completely, or the shape of the outer coastline/bay.
- 6) Larger surges took approximately 20 to 23 minutes to rise from the maximum outflow (low point) to the crest (high point).
- 7) Surges were flowing at an estimated 4 to 5 knots (based on sailing experience). As surges generally took up to 30 minutes to pass completely, this suggests a wavelength of 2 to 2.5 n/miles or 3.5 to 4 kilometres.
- 8) Sediment scouring from the upper harbour was obvious in outflow following the first small wave and arrival of the second. The wave buoy suggested a fall of approximately 0.8 metres due to tsunami action and tidal fall.
- 9) The volume of water coming in with each surge was sufficient to clear the (490m as measured from Google Earth) channel of silted water with clean water.

10) It was only with the coinciding of high tide and a tsunami surge did water rise above normal extreme high tide levels. It entered the Yacht Club car park on at least three reported occasions but did not top the fixed jetty along West Quay.

11) No damage was observed in the inner Harbour.

- With the coinciding of high tide and a storm surge, one end of the floating pontoon became wedged in a high position as the surge receded.
- Yachts moored both parallel and across the flow did not appear to be noticeably influenced.
- Had the larger surges coincided with high tide (approximately 3 hours difference) areas around the Yacht Club and Blue Water Hotel may have been inundated and there was some risk of yachts on older piles floating off their piles.

10) Most people were oblivious to events occurring. Children still played, fished and swam from the pontoon during incoming surges. A number of adults who ventured onto the pontoon were surprised to learn that tsunami surges were occurring.

## Tsunami Photo Details by Jeff Lynex Port Ahuriri, 28 February 2010

*In coming surges appeared to approximately 10 to 12 minutes after recording at wave buoy.*

Photo No.	Time	Tide	Comment	Flow
01	09.22	<i>Falling</i>	Pleasure craft heading out – wavelets/ripples possible sign of first wave??	<i>In?</i>
02	09.31		First sign of possible increase in out-flow under bridge	<i>Out</i>
03	09.34		First noticeable sign of out-flow (and incoming surge?) at channel entrance	
04	09.35		Outflow (and incoming surge?) at channel entrance noticeable	
05	09.38		As above	
06	09.42		Outflow from under bridge very apparent	
07	09.46		First evidence in basin of sediment scouring from upper harbour	
08	09.48		Sediment scouring continues towards channel entrance	↓
09	10.24		Outflow and probably incoming surge very noticeable ( <i>Wind on moving water?</i> )	<i>Out</i>
10	10.30		First noticeable surge; slow moving wavelets with non-turbulent flow	<i>In</i>
11	10.43		First surge is noticeable as a series of very small waves	<i>In</i>
12	10.51		Outflow noticeable	<i>Out</i>
13	11.16		Drying of beach opposite noticeable	↓
14	11.17		Draining from upper lagoon noticeable – beyond bridge Pandora Pond exposing	<i>Out</i>
15	11.20		New surge as series of small waves – not a swirling surge as later	<i>In</i>
16	11.20		Water on beach opposite up	<i>In</i>
17	11.44		Half metre drop in upper harbour ( <i>Site opposite side of Harbour to other photos</i> )	<i>Out</i>
18	11.46		Flow noticeable despite incoming tide ( <i>Site opposite side of Harbour</i> )	<i>Out</i>
19	11.59	<b>Low</b>	Beach opposite dry ( <i>Back to main observation site</i> )	<i>Out</i>
20	11.59		Outgoing flow? Wavelets	↓
21	12.00		Beach outside Game Fishing Club exposed	<i>Out</i>
22	12.07	<i>Tide Rising</i>	Incoming wave now noticeable a swirling inflow	<i>In</i>
<b>23</b>	<b>12.07</b>		<b><u>Video</u> of swirling at entrance to Iron Pot</b>	<b><i>In</i></b>
24	12.26		Discolored outflow	<i>Out</i>
25	12.34		Meeting of the waters (in and out?)	
26	12.34		Meeting of the waters (in and out?)	
27	12.37		Beach opposite exposed to rocks – beyond low tide level	
28	12.39		Beach alongside Game Fishing club exposed	↓
29	12.41		Beach opposite exposed to rocks – beyond low tide level	<i>Out</i>

30	13.28		Low point	↓
31	13.30		Beach and boat opposite just about minimum	<i>Out</i>
32	13.34	<i>Rising</i>	Surge very noticeable as a swirling inflow of water (note kids)	<i>In</i>
33	13.43		As above	↓
34	13.43		As above	<i>In</i>
35	13.45		Beach and boat opposite just after maximum - beach just beginning to expose	<i>Out</i>
36	13.58		Low Point	<i>Out</i>
37	14.18		High Point	<i>In</i>
38	14.38		Inner Harbour	<i>Low</i>
39	14.41		Low Point	<i>Out</i>
40	15.04		<b>High Point</b>	<b><i>In</i></b>
41	15.22		<b><u>Low Point - Difference between high and low measured at 1.42metres</u></b>	<b><i>Out</i></b>
42	15.23		<b><i>Low Point</i></b>	
43	15.46		Following surge maximum	
44	1806	<i>High</i>	Pontoon jammed as a result of surge and high tide coinciding	
45	1829		Diners semi oblivious to events	
46	1839		Possible max (wetted area) on fixed wharf with high tide and surge	
47	1839		Drop despite surge still incoming	
48	1858		Evidence of flooding in Yacht Club car park (x3) with high tide and surge	
49	1859		Wetted area of old piles showing tide and surge brought float approx 0.5m	
50	1906	<i>Falling</i>	New piles suggest considerable leeway	
Map			Predicted surge height	
Map			Travel times	



01 09:22



02 09:31



03 09:34



04 09:35



05 09:38



06 09:42



07 09:46 First discolouration noticed



08 09:48 Scoured sediment from upper harbour



09 10:24 Outflow noticeable



10 10:30 1<sup>st</sup> surge noticeable as small wavelets



11 10:43 First surge as series of small waves



12 10:51 Outflow



13 11:16 Drying of beach opposite



14 11:17 Outflow from lagoon



15 11:20



16



17 11:44 0.5 metre drop



18 11:46 Outflow under bridge



19 Water low on beach



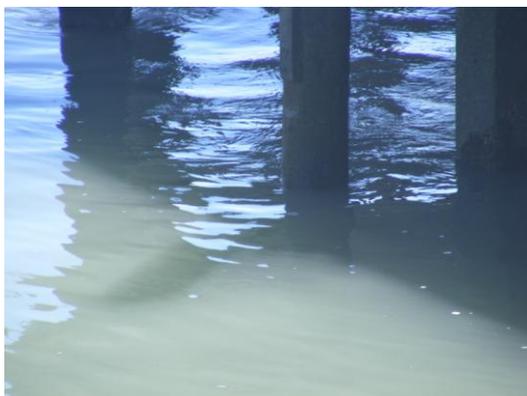
20 11:59



21 12:00



22 12:07



24 12:26



25 12:34



26 12:34



27 12:37



28 12:39



29



30 13:28 Low



31 13:28 Low



32 13:34 Incoming surge



33 13:34 (compare 30)



34 13:43



35 13:45



36 13:58 Out



37 14:18 In (Compare 36 (change in 20 mins))



38 14:38



39 14:41 Out compare 37 (23 mins) Measured 1.00m



40 15:04



41 15:22 Out 1.42 metre drop in 18 mins



42 15:23 Out



43 15:46 In compare 42 (23mins later)



44 18:06 Pontoon jammed after high tide & surge



45 18:29 Diners seem oblivious to event



46 18:39



47 18:39



48 18:58 Flooding in Yacht Club Car Park



49 18:59



50 19:06

## Copy of email from Regional Harbour Master

From: Charlie Rycroft [charlie@portofnapier.co.nz]  
To: Darryl Lew; Lisa Pearse  
Cc: Chilean tsunami - RC Harbourmaster response  
Subject: Chilean tsunami - RC Harbourmaster response  
Sent: Wed 10/03/2010 3:01 p.m.

Napier HM response to Chilean tsunami – key points

Saturday 27 Feb

I

- 8.30pm Relieving (on duty) HM John Paston informs me of 8.3 magnitude earthquake at Chile. I stand John down and take over HM duty role. Proceed immediately to the port.
- Check on port status and return home with laptop. No CDEM warning current. Inform duty pilot.
- Continue to monitor situation at home until first warning issued by CDEM. Proceed back to port with intention of directing all vessels out of the port.
- Inform Marine Manager of my intentions. Relieving HM assisting.
- 0300 - Direct mv *Asian Brier*, mv *Baldur* to depart port by 0700, and recommend to *HMNZ Endeavour* to depart port prior to 0700.
- 0630 - All three ships clear of port, proceeding to water depth of > 30m. Port closed until tsunami risks ease to workable level.
- Commence notifying Napier Inner Harbour berth holders and commercial fishing companies of tsunami risk to their vessels.
- 0600 RC staff close boat ramps and warn recreational boaties not to go to sea. Remain posted at ramps throughout most of the day.
- Ensure "live aboards" are aware of tsunami risk.
- 0853 - Monitor primary wave from port office.
- 0900 - Relieving HM stood down but remains on call.
- 1030 – HM departs port but remains on call, cellphone diverted to relieving HM.
- 2200 – Relieving HM handover to HM.
- 0030 / 1<sup>st</sup> – Containership mv *Italia* permitted to enter port
- 0130/1<sup>st</sup> – Moorings secure on containership. Port reopened by Harbourmaster. Normal shipping movements resumed.

**Captain Charles Rycroft | Regional Harbourmaster**  
HAWKE'S BAY REGIONAL COUNCIL



stuff.co.nz

NATIONAL

## Diver swept away by wall of water

By BRITTON BROUN, TOM HUNT and TIM DONOGHUE - The Dominion Post

Last updated 05:00 01/03/2010

EVA BRADLEY

**COSTLY CATCH:** Leon Mickelson suffered cuts and bruises when he was swept over rocks as he gathered paua at Waimarama.

A day after hundreds fled their seaside homes to escape a tsunami, people have been warned to stay away from the water, with massive earthquake aftershocks possible in Chile and the seas continuing to surge.

The death toll in Chile is also expected to rise, with at least 300 reported dead last night after Saturday's 8.8-magnitude earthquake, the seventh-largest on record.

The earthquake devastated Concepcion, Chile's second-largest city, and generated a tsunami that swept across the Pacific before hitting New Zealand yesterday morning.

It caused tidal surges of close to 1.5 metres in Napier and more than a metre on the Canterbury coast.

Leon Mickelson was fishing for paua at Red Rock Beach in Hawke's Bay when he was swamped by a metre-high surge of water, followed by two more waves. He had no idea a tsunami alert had been issued.

"This wall of water just hit me. I was getting tumbled across all the rocks, it was unbelievable. The force was just unstoppable. There was no way you could fight it, you just had to roll with it."

The water then sucked him 20 metres out into the ocean, bouncing over rocks. "It was like being in a washing machine. It just completely and utterly caught us out."

Mr Mickelson, 30, managed to swim ashore, and suffered cuts and bruises.

Lower Hutt teacher Joe Nawalaniec was left clinging to rocks near Cape Turnagain in southern Hawke's Bay when the surge hit.

"The water went milky and turbulent like it was boiling," he said.

"It's just a massive big surge of water that starts going up and up and up. You expect it to be a tidal wave but it's not a wave at all."

The 45-year-old paua fisherman was aware of the tsunami alerts but thought the wave had passed by.

Diane Ross, from Waikanae Beach Holiday Park in Gisborne, helped evacuate hundreds of people from the beachfront property at 6.45am to a marae on higher ground.

She was stunned by what had happened to Gisborne Harbour while the Turanganui River – which connects the harbour to the open sea – was virtually drained.

"I was blown away by how low the tide was and 15 minutes later it was all back again. The river dropped 1.5 metres in 10 minutes. It was really scary."

She said the tsunami threat was taken seriously, with the normally crowded beach empty yesterday.

At least 50 other Gisborne locals, and some families up the coast, were moved from their homes until the afternoon.

About 300 people were moved out of coastal settlements around Haumoana, in Hawke's Bay, for a few hours. Passenger ships and navy frigates in Auckland harbour left their moorings for deeper water.

Interislander ferries had to go through the Northern Passage after Tory Channel was closed. Ferry trips were delayed and trains operating on the coast stopped at the time the first surges hit.

Though the waves ranged from 30cm in Wellington to a metre in Gisborne Harbour and around Akaroa, near Christchurch, they were much more dramatic in the Chatham Islands, where swells of up to three metres were recorded.

Chatham Hotel owner Valentine Croon woke his 40 guests at 5am. "We thought nothing was going to happen, then [Petre] Bay emptied right out at about 8.30am. Everyone took it pretty seriously."

Civil Defence Minister John Carter said the tsunami warning system worked well, five months after it was heavily criticised in the wake of the Samoan tsunami.

Though the tsunami warning was called off yesterday afternoon, Civil Defence warned people to keep away from the water, with more waves possible today.