



NORTHLAND
EMERGENCY MANAGEMENT

GROUP

Northland Civil Defence Emergency Management Group



Tsunami Response Plan

Northland Civil Defence Emergency Management Group “Resilient Communities Together”



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Section one: Introduction

As a narrow peninsular, on the edge of the Pacific 'Ring of Fire', the Northland region is at significant risk from tsunami. Recent studies have indicated that Northlands east coast is among the highest areas of vulnerability in New Zealand and is at a significant risk from tsunami. Tsunami can lead to damage to property and infrastructure as well as disruption to transport and lifeline networks. The effects of a tsunami will also impact on the districts economy and in extreme cases may cause injury and death.

To reduce the vulnerability of communities to disasters and to establish capabilities to respond effectively to disasters, the Northland Civil Defence and Emergency Management Group (CDEM) mandates response procedures that take action to save lives, reduce losses, speed response and reduce human suffering.

A number of communities are situated on the upper reaches of harbours or on low lying beachfront coastal land. This makes some of these communities vulnerable to inundation from tsunami.

As part of the readiness and response arrangements for the Northland region this plan has been developed to outline the manner in which the Northland CDEM Group will prepare for, respond and recover from a tsunami.

This plan has been developed in accordance with the Northland CDEM Group plan as a group level emergency operating procedure.

1.0 Purpose

The purpose of this document is to outline the proposed response arrangements within the Northland region to guide the response to a large Earthquake Tsunami generated from (the South American and the Tonga- Kermadec Subduction Zone sources) in advance of any planning under a national Tsunami framework. This Regional Response plan intends to provide a basis and starting point of regional planning for a large Kermadec event and fits within the Northland Response Planning framework.

The plan outlines the consequences and possible risk of a tsunami impacting on communities in the Northland region. It is also to provide details of the roles and responsibilities of various organisations and partner agencies and is intended to be used as a working document to assist in the response when a warning has been received.

1.1 Scope

The paper is designed to be a guide for the Northland Region CDEM Response to a large Tsunami. It has used credible magnitude 9.0Mw tsunami planning scenario as a tool to aid planning.

While many of the arrangements in this plan maybe applicable to a range of events, there may be some requirements to modify or develop new arrangements for some events.

1.2 Legislative enablers

Assuming a state of national or local emergency is in place, the CDEM Act 2002 will be the key piece of legislation used in response to a large 9.0Mw event.

The declaration of either a local or national state of emergency and the powers available within the CDEM Act 2002 will enable Groups to conduct an appropriate response.

It is critical to the success of any response that the procedures for a local declaration are well known and practised, and contingencies are in place for conducting the process in adverse circumstances if a national declaration is not in place.

Responding agencies have their own powers available under their respective legislation which may be used both before and during a state of emergency.

The initiation of any response will be supported by several key pieces of New Zealand legislation:

- Civil Defence and Emergency Management Act 2002
- Health Act 1956
- Safety in Workplace Act 2017
- Fire and Emergency Act 2017
- Police Act 2008.
- Land Transport Management Act 2003
- Resource Management Act 1991

1.3 Supporting Plans and documents

This plan includes an outline of the tsunami hazard and an analysis of the possible consequences and risk of a tsunami in Northland. It also contains details of the roles and responsibilities for the various government and non-government agencies during the warning and response to a tsunami affecting Northland.

This plan is reliant upon other plans to be enacted in support. This includes arrangements for coordination, evacuation, welfare provisions and lifeline utilities.

This plan should be read in conjunction with:

- National Civil Defence Emergency Management Plan 2015
- National Tsunami Advisory and Warning Plan
- Northland CDEM Group Tsunami Initial Actions SOP 2
- Regional Lifeline Utilities Tsunami Response Plans
- Northland Lifelines infrastructure Resilience Plan
- Northland Community Response Plans
- Northland CDEM EOP's:
 - EOP 1 Group EOC Structure, Staffing and Operations
 - EOP 2 Warnings System
 - EOP 3 Public Information and Media Management Plan
 - EOP 4 Welfare
 - EOP 5 Recovery
 - EOP 6 Lifeline Utility Coordination Protocols, Response and Recovery
 - EOP 10 Evacuation

1.4 Audience

The plan is intended to provide response guidance to the following audience:

- Northland CDEM Group members, namely
- Northland Regional Council
- Whangarei District Council
- Kaipara District Council
- Far North District Council
- The Emergency Services
- Te Whatu Ora Ti Tai Tokerau
- Regional Welfare providers
- Government Agencies including; Waka Kotahi, Ministry of Business and Innovation and Employment (MBIE), Ministry of Primary Industries (MPI), Department of Corrections.
- Lifeline Utility providers
- Northland Iwi and other Tangata Whenua
-

1.5 Review

This plan will inform the proposed National Emergency Management Agency National Earthquake and Tsunami Response Framework. Nevertheless, depending on national framework progress this paper may be reviewed every five years, or as necessary, should any information regarding the implementation of any aspects of the response contained within change.

1.6 Exercising

This document will be exercised as part of the review process to ensure that the arrangements contained can be effectively implemented as required.

Section Two: Regional Overview

2.0 Population

The Northland region of New Zealand borders the Auckland region. A boundary line that stretches from the south - east of Mangawhai across to the Kaipara harbour and up to New Zealand's northernmost point, Cape Reinga. A land area of 12,507.89km² with a coastline of 3200km in length.

The region has a population of approximately 201,500 as of June 2022 with around 21,000 living within the tsunami evacuation zones.

2.1 Local Government

The region has 3 territorial authorities and one regional authority as shown below:

- Northland Regional Council
- Whangarei District Council
- Far North District Council
- Kaipara District Council

2.2 Economy

The region's economy is based on agriculture (notably beef cattle and sheep), fishing, forestry, and horticulture

Tourism is a very important sector within the region particularly areas such as the Bay of Islands

2.3 Lifelines

The region is served by one main state highway and five interconnecting state highways between. These are detailed below:

SH 1	Auckland to Cape Reinga via Whangarei, Kawakawa, Kaitaia
SH 12	Maungaturoto via Dargaville to Kaikohe
SH 14	Whangarei to Dargaville
SH 15	Oakleigh to Kaikohe
SH 10	Pakaraka to Awanui
SH11	Kawakawa to Puketona

Section Three: Understanding the Tsunami threat

3.0 What is a Tsunami?

A tsunami is a series of waves generated by the rapid displacement of a large volume of water in the sea. There are five principal sources of tsunami, but for Northland the greatest threat of tsunami arises from a large submarine earthquake, resulting in significant uplift or subsidence of the seafloor.

In a tsunami, the whole water column from the surface to the ocean floor is affected. Waves radiate outwards from the source, until they either dissipate or collide with a coastline. Depending on the source of the earthquake, tsunami waves can arrive at nearby coasts within minutes, or travel across the ocean at speeds in excess of 500kmph

The time between successive tsunami wave crests can vary from minute to hours. The waves may come at irregular intervals, sometimes without complete withdrawal of the inundating water from previous waves. The first wave to arrive may not be the largest

The wave height of tsunami in deep water is generally less than one metre, producing only a gentle rise and fall of the sea surface and is not noticed by shipping, commercial or pleasure craft in open waters. When tsunami reach shallower waters, their speed decreases rapidly and at the same time the wave height increases. A tsunami wave that is only 500mm high in deep water can increase to a 10m wave travelling at 10 - 40km/hr.

Tsunami waves differ from the usual waves that are seen on the sea surface or breaking on the beach under normal conditions. Tsunami waves occupy the whole ocean depth and not just the top few metres, hence when they reach the shore they continue to flood inland over many minutes and retreat over as many minutes before the arrival of the next wave.

The first visible indication of an approaching tsunami may be unusual tidal movement characterised by a suddenly receding tide level. Alternately, a rise in water level may be the first indication. A bubbling or a boiling effect of the water has also been reported by persons prior to the first waves impacting.

3.1 What damage does a tsunami do?

Tsunami damage and casualties typically arise from four main factors

- The impact of swiftly flowing torrent or travelling bores (1) on vessels on waterways, and on buildings, infrastructure and people where coastal areas are inundated. Torrents and bores can also cause substantial erosion of both the coast and seafloor.
- Debris impact – many casualties and much building damage arise from impulsive impacts of floating debris picked up and carried by the in-rush (inundation) and out-rush (receding) flows.
- Fire may occur when fuel installations are floated or breached by debris. Breached fuel tanks can also be a source of contamination, as can flooded sewage pipes or works. Many businesses also contain harmful chemicals that can be spilled.
- The ponding of potentially large volumes of seawater can cause medium to long term damage to buildings, electronics, fittings, and to farmland.

However, the impact of a tsunami goes beyond the direct and tangible effects. In the days, weeks and months that follow a moderate to large tsunami. Indirect and intangible impacts can be observed in the social, built, natural and economic environments.

The possible impacts of a tsunami, both direct and tangible, and indirect and intangible, and how those impacts could affect the external operating environment and demand are discussed in more detail under 'Response' heading.

(1) A bore is a non-breaking step-like increase in water height, resulting in a wall-like change in water levels. They can travel 3 kilometres or more up a river with water many metres above normal levels

For the purpose of emergency management and the time needed to respond and act on warnings, tsunami are categorised as distant, regional or local source, depending on the shortest travel time from its source to the predicted area of impact. This is also consistent with where sources are located, in that distant sources for New Zealand are mainly the Pacific Rim, while local sources relate to New Zealand's "continent". Therefore, the following categories apply:

3.2 Northland Tsunami Hazard

A modelling- based assessment of tsunami hazard for Northland has been completed by the National Institute of Weather and Atmospheric Research (NIWA), with three credible sources of tsunami identified for the region *(2)*

- **Distant source:** South American origin. Return period 50 – 100 years. A distant tsunami comparable to either the 1898 northern Chile earthquake (Mw9.0) or the 1960 Chile earthquake (Mw9.5) represents the most probable tsunami risk in the next 50 – 100 years.
- **Local/Regional source:** Tonga Kermadec origin. The events modelled by NIWA were a magnitude Mw 8.5 earthquake and a Mw 9.0 earthquake. The return period for these events is (500 – 2000 years) but they represent a worse – case scenario for a tsunami striking the Northland coast. *(3)*

NEMA and GNS Science/GeoNet will seek to monitor for, detect, and provide threat advice for all tsunami. However, it may not be possible to issue warnings in sufficient time and/or accuracy in the case of local source tsunami. Local source tsunami can be generated by a large earthquake, volcanic activity or undersea landslide.

Different sections of Northlands coastline are at risk from tsunami from different sources. The location of the originating earthquake determines the primary direction the tsunami will propagate and therefore what section of the coastline is most at risk.

Distant source (>3hrs)

The predominant distant sources affecting New Zealand are large earthquakes where the Pacific plate is forced beneath other crustal plates. The New Zealand risk is dominated by South America sources.

Other sources which could produce tsunami are large submarine landslides either associated with an earthquake or in isolation. Huge sector collapses on the flanks of the Hawaiian volcano chain have been modelled and would produce large tsunami in New Zealand although the return period is considered to be 2500 years.

Tsunami caused by volcanic eruptions are considered rare but they do occur as witnessed in the 2022 January Hunga-Tonga Ha'apai volcano eruption causing tsunamis around the Pacific rim including strong tidal surges and tsunami waves around the Northland coastline that caused significant damage to Tutukaka marina.

The west coast of South America is one of the most frequent sources of tsunami in the Pacific, as a result of great earthquakes on the boundary between the Pacific and South American tectonic plates. Earthquakes along this coastline produce tsunami that are often well directed towards New Zealand both by the orientation of the plate boundary where the earthquakes occur and by focusing of the tsunami by the sea floor shape between South America and New Zealand.

The location of the earthquake, combined with the magnitude and source geometry, determines the primary direction that a tsunami will propagate and hence if it will hit or miss New Zealand.

Regional Source (1 -3 hrs)

The 1-3 hours warning time for regional source tsunami presents a real challenge for monitoring and warning agencies. To locate an event, evaluate its tsunami potential and issue a warning in so short a time is problematic. A regional source tsunami may represent a significant hazard and risk, and these may be catastrophic on rare occasions.

Local source (<30 min)

Local sources are defined as having less than one hour travel time to the nearest New Zealand coastline but may have a travel time of less than 30 minutes and some travel times are as short as 10 minutes.

Local earthquakes have a potential to produce catastrophic tsunami, with 7 – 10m or more run up, over a small length of coast or over a longer length of coast (regional impact over hundreds of kilometres of coast). The impact depends on the extent of the fault rupture and seafloor deformation, which in turn depends on the magnitude of the earthquake.

Kermadec Trench

The Kermadec Trench is both a regional tsunami source and local source. The 1400km long Kermadec Trench has a moderate level of historical seismic activity but presents the greatest risk in a worst case scenario event. The largest event modelled by Power et al. (2012) was an Mw 9.4 earthquake rupturing the plate interface along the entire Kermadec Trench.

3.3 Historic tsunami in Northland

Since the time of European settlement, Northland has experienced five moderate tsunami, resulting from the following events

- 1868 – magnitude Mw 8.5 earthquake in northern Chile
- 1877 – magnitude Mw 8.3 earthquake in southern Peru/northern Chile
- 1883 – Krakatau eruption
- 1960 – magnitude Mw 9.5 earthquake in southern Chile
- 2010 – magnitude MW 8.8 earthquake Chile

The reported damage resulting from these tsunamis was minimal. The most significant tsunami damage was caused by the 1960 Chilean earthquake, with damage to a bridge abatement at Tutukaka and a cottage at Ngunguru.

The biggest runup height reported across all these events was 3.0 metres, which occurred in Waitangi after the 1877 earthquake and in Opua and Tutukaka after the 1960 earthquake.

From the paleotsunami record it is also believed that there was not one, but several, large tsunami that inundated the New Zealand coast around the 15th century. Recent work around the Northland coast has produced paleotsunami deposit evidence for run-ups in excess of 10m at many sites. There is also a mystery event (or events) showing up in the paleotsunami deposit elevations from the 15th century at several sites in Northland where the run up exceeds 20 to 30m above mean sea level (MSL) (NIWA 2006)

3.4 Northland's Coastline

The degree of onshore inundation from a tsunami varies widely depending on local submarine topography. For example, where there are streams and creeks that discharge into the sea, waves can travel considerable distances inland along these waterways. (4)

The topography of the coast will also have an impact on inundation depth, run-up and the resulting level of damage, with factors such as the depth of the water near the shore, beach slopes and coastal orientation and configuration playing a role. Bays, inlets, rivers, streams, islands can amplify wave height and increase local damage. (5)

(2) NIWA Northland Regional Council Tsunami modelling Study 1 September 2007

(3) GNS Science Consultancy Report 2013/131. Review of Tsunami Hazard in New Zealand August 2013

(4) NIWA, Numerical modelling of Tsunami inundation for Whangarei Harbour and environs. April 2011

(5) GNS Consultancy Report 2013/131. Review of Tsunami Hazard in New Zealand August 2013

Section Four: Tsunami Mapping

4.0 Tsunami Hazard Zones

As part of New Zealand's tsunami planning response, Northland's coastline has been assessed and classified as one of four tsunami hazard zones (*figure 1*)



Figure 1. Summary of estimated hazard risk (source; National Institute of Water and Atmospheric Research (NIWA) June 2006)

4.1 What lies in Northlands Tsunami hazard zones (2021)

- Over 21,000 residential buildings
- 2,700 industrial and commercial buildings
- 377 government buildings
- 243 educational facilities
- 800km of road
- 20km of rail lines

4.2 GNS Tsunami mapping

GNS Science has developed tsunami inundation maps for the Northland coastline. These maps are based on three evacuation zones.

RED ZONE	Higher Probability	30cm – 1 metre
ORANGE ZONE	Moderate Probability	1 metre – 5 metres
YELLOW ZONE	Lower Probability	5 metres – 8 metres

- The **Red Zone** is intended as the marine and beach exclusion zone (including harbours, rivers and estuaries) that can be designated off limits in the event of any unexpected tsunami that is above the minimum warning threshold (20 cm amplitude) up to 1 m amplitude. This represents the highest risk zone and it the first place people should evacuate from in all types of tsunami warnings (i.e. natural or official). People could expect activation of this zone several times in their life.
- The **Orange zone** is intended to be the area evacuated in most if not all distant and regional source official warnings. This zone is for tsunami with a wave heights up to 3 metres high and average recurrence intervals of 500 years
- The **Yellow zone** should cover all maximum credible tsunami, including the highest impact events. The intention is that the yellow zone provides for local source maximum credible event, based on locally determined risk. People should evacuate this zone in natural or informal warnings from a local source event. Such tsunami are very infrequent having wave heights up to 8 metres and an average recurrence interval of 2500 years or greater

4.3 Tsunami Threat Level Maps

Tsunami risk is a combination of three factors:

- The nature and extent of the tsunami hazard
- The characteristics of the coastline
- The degree of exposure and vulnerability of people and the built environment.

This includes factors such as the tsunami source and predicted critical wave height and plays a significant role in directing what sort of response will be required. The source of the tsunami dictates the approximate arrival time of the first wave, as well as the largest wave, and which coastlines are most at risk. The predicted wave height gives an indication of what tsunami hazard areas will require evacuation and the level of inundation to be expected.

The amplitudes at shore and threat definitions that can be assigned for the coastal zones are contained in the table below. Threat levels are displayed in map/ or table format in NEMA national warning messages as they become available.

The threat indicators, including consideration of wave run-up must be used to decide on appropriate evacuation zones (see notes).

	Maximum expected amplitude at shore	Threat definition
	<0.2m	No threat
	0.2 – 1m	Marine & Beach Threat
	1 -3m	Marine and Land Threat
	3 – 5m	
	5 – 8m	
	> 8m	

Notes:

1. The stated threat level may apply to any one of the series of waves generated by the event and not necessarily to the first wave. The first wave is not always the largest or highest and waves are likely to continue for many hours.
2. The threat levels suggest the largest wave at any coastal point inside the zone. Wave heights will vary within a zone.
3. The amplitudes do not include the tidal state (sea level) at the time the wave reaches the shore
4. The estimate is for the maximum expected wave amplitude at shore. Run-up can be up to twice as high on steep slope onshore near the coast, ie. a wave measuring 5m at shore can run up as high as 10m on-land near the shore.
5. The expected wave amplitudes (crest to sea level) at the shore are likely to be different to the measurements given in the PTWC bulletins. PTWC measurements are taken at sea level gauges in the open ocean or at coastal points offshore from New Zealand. NEMA information represents the official threat estimates.

4.4 Tsunami Impacting on Northland

New Zealand has a tsunami warning system for both remote and local source tsunami. For remote source tsunami resulting from distant earthquakes (such as South America) NEMA will receive a warning from the Pacific Tsunami Warning Centre (PTWC) in Hawaii. NEMA is responsible for evaluating the danger to New Zealand and issuing national or regional tsunami warnings (6)

(6) <https://www.gns.cri.nz/Home/Our-Science/Natural-Hazards-and-risks/Tsunami-in-New-Zealand>

For local source tsunami, there is a monitoring system that uses a network of offshore Deep-ocean Assessment and Reporting of Tsunami (DART) bouys. Twelve bouys have been deployed at selected points adjacent to the Hikurangi, Kermadec, Tonga and South New Hebrides trenches where they can detect tsunami that could reach our shores in less than two hours. In the event of a local earthquake, the National Geohazards Monitoring Centres uses data from the bouys to calculate the location of the earthquake and the likely hood of a tsunami. They then notify NEMA who issue a tsunami warning if required.

The most likely tsunami risk for the Region is the result of a South American (remote source) earthquake in the vicinity of magnitude Mw 9.0 – 9.5. In this scenario, the first wave would arrive approximately 15-17 hours after the earthquake, with the largest wave considerably later than the first wave, approximately 17- 22 hours after the earthquake

Wave height at the shoreline from this scenario is typically 1 to 2 meters, with larger waves of around 3 metres or more in a few bays (depending on the resonance effects of the different bays). As the waves wrap around the North Cape, similar wave heights are to be expected in the upper part of the west coast, but these will diminish as the waves move southward (refer figure 2,3)

While inundation from a tsunami of this size may not be extreme, it would still cause significant scouring of dunes and estuary channels, effecting river flows and beach dynamics

Evacuation of the shoreline and Orange inundation Zones (refer tsunami hazard zones) would be required in response to the threat of a 1-3 metre wave such as those predicted in the South American scenario.

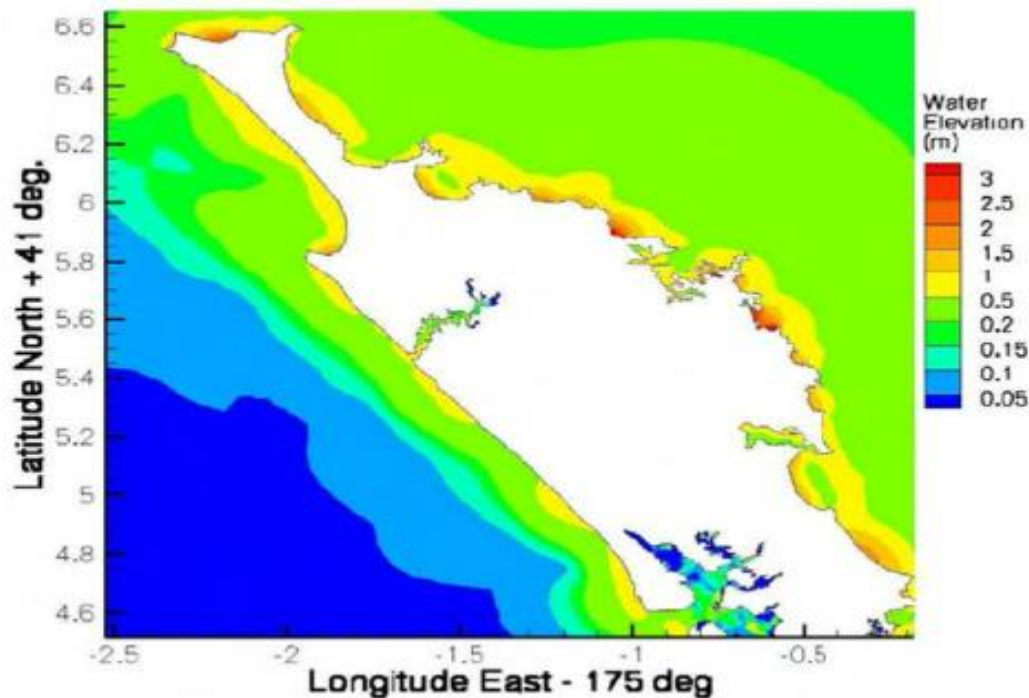


Figure 2 maximum water surface elevations for an eastern distance source tsunami: (Source NIWA,2006)

The worst-case scenario for a tsunami impacting Northland is an earthquake originating from the Tonga- Kermadec subduction zone (local/regional source) in the vicinity of a magnitude Mw 8.5-9.0. In this scenario, the first wave could arrive at the outer coast approximately 60 -170 minutes after the earthquake and up to 4 hours after in the Hokianga and Kaipara Harbours. For some of the most exposed eastern coastline, the first wave would be the largest wave, However, on the west coast, the largest wave may occur up to 4 hours after the first wave arrives.

A magnitude Mw 8.5 earthquake in the Tonga-Kermadec subduction zone would result in waves of 4 metres or greater around the mainland coast adjacent to the Cavalli Islands, and south near Whangamumu Peninsula. Wave heights of around 3 metres would be experienced around most of Northland's coastline (refer figure 2)

However, there would be a significant increase in wave heights in the event of a magnitude Mw 9.0 earthquake in the Tonga- Kermadec subduction zone. Wave heights of around 8 metres or greater would be observed around much of the Northland coast (refer figure 3) noting the change in scale for the maximum waver height).

Both Tonga-Kermadec subduction zone scenarios would require the evacuation of the shoreline, as well as the Orange and Yellow inundation zones.

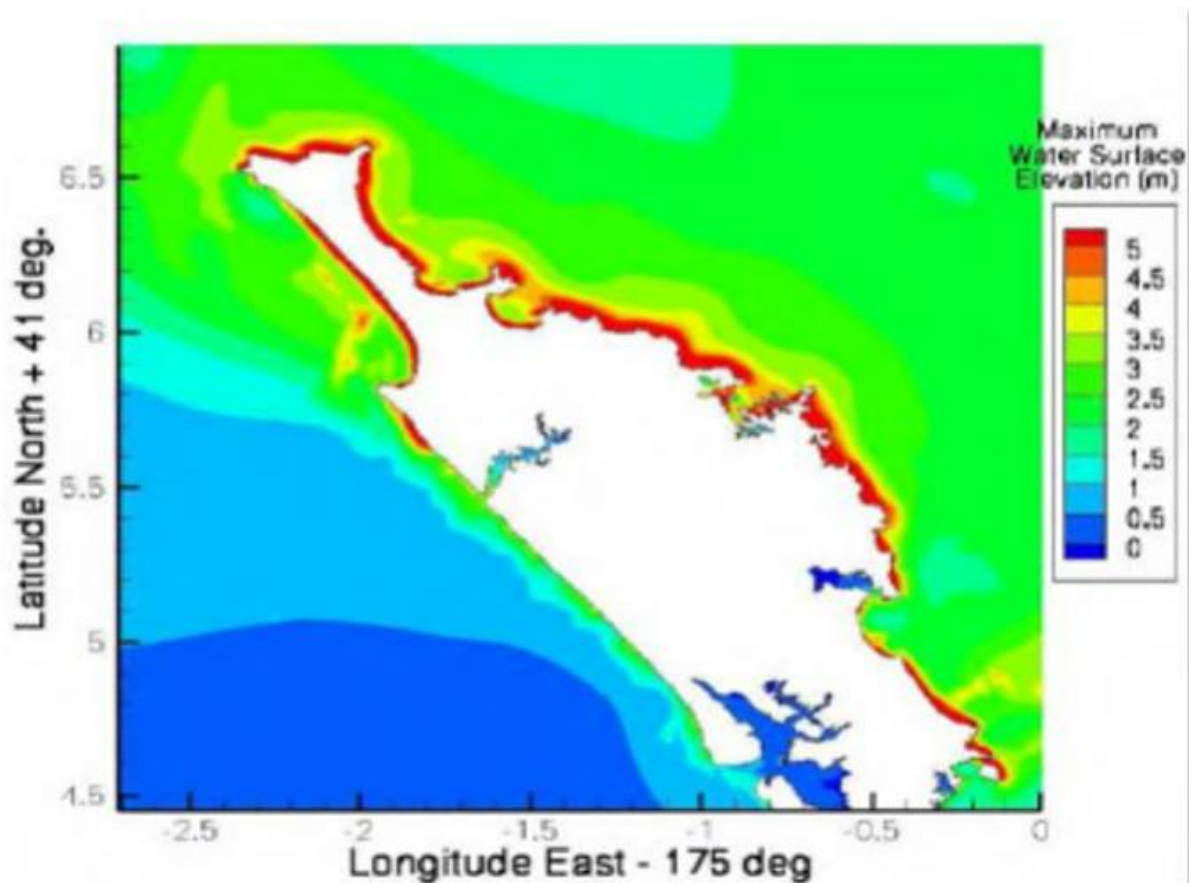


Figure 3 Maximum water surface elevations for the Mw 9.0 Tonga – Kermadec subduction zone Scenarios at MHWS for the Northland coast. (Source NIWA, 2006)

Section Five: Tsunami Warnings

In the case of an impending tsunami, warning messages and signals to the public can come from several sources – natural, unofficial or official.

5.0 Natural Warnings

Natural warning signs are of key importance in response to a local source tsunami and they may be the only warnings possible for local and regional source tsunamis. In these instances, it may be unlikely that the official warning message if generated at all will reach recipients.

In Northland, we may not feel the earthquake which will generate a local source tsunami especially from a tsunami generated in the southern Kermadec region between 25° S and 33° S.

Natural signs of a tsunami in Northland (not including feeling an earthquake) include:

- Out of the ordinary sea behaviour, such as unusual sudden sea level rise or fall
- The sea making loud and unusual noises, especially like the roaring of a jet plane.

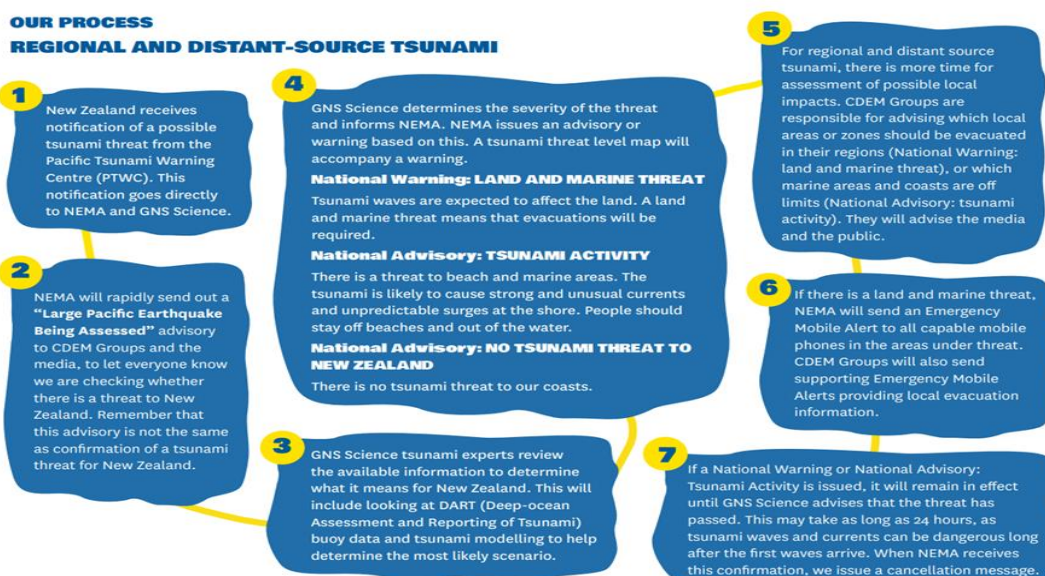
When any of these signs are experienced people must move to a higher ground or inland if the land is particularly flat. Since the first wave is not always the largest wave people should stay at higher elevations until an all-clear message is given.

5.1 Unofficial Warnings

People may receive unofficial warning of an impending tsunami in several ways:

- Media coverage, Pacific Tsunami Warning Centre (PTWC) watch/warning bulletin. People may receive unofficial warnings either directly through local or international media; or from friends within New Zealand or overseas who have the broadcasts.
- From people (eg. by phone) who have already experienced the arrival of the tsunami on the coastline closer to the source or observed a natural warning sign.

5.2 Official Notifications



Tsunami notifications in New Zealand are received from both the PTWC, located in Hawaii and GNS Science in New Zealand.

The PTWC monitors an expansive seismic and sea level network in the Pacific and issues tsunami bulletins, advisories and watches (using the location and magnitude of earthquakes as the only initial determinants).

NEMA receives the PTWC tsunami bulletins, advisories and watches and when necessary, engages with GNS Science to make an initial assessment of the threat to New Zealand.

NEMA uses the PTWC categories as one of several considerations to initial official advisories or warnings in New Zealand.

Given Northland may not feel the earthquake which could initiate a near source tsunami, the information contained in the tsunami warning statement from the PTWC may be utilised as the first decision parameters to activate the sirens and initiate evacuation messaging.

If possible, NEMA may issue two types of threat maps:

- Action maps – rapid threat evacuation map (local source only)
- Forecast map – a threat forecast map (all sources)

Action Map: An action map will be issued which supports fast and consistent evacuation advice. These maps show the coastal regions that are expected to experience land inundation and those still under assessment. These maps take 10-15 mins to produce for Region 1 – NZ Earthquakes and 5-10 mins for Region 1 – Southern Kermadec earthquake. Therefore, CDEM Groups and the public should not wait for this map and instead should apply the natural, felt warning signs and “Long Strong, Get Gone” in the first instance.

Forecast Map: These maps show wave amplitude forecasts, illustrated in colour scale for different threat levels for the coastal regions. They take approximately an hour to produce, therefore these forecast maps are unlikely to be in an initial National Advisory or Warning.

5.3 Initial tsunami threat assessment

The “Response Indicators” used by NEMA to initiate national tsunami advisories or warnings are contained in (table 1). The table details the thresholds for the respective originating locations and templates for NEMA notifications. The regions are shown in figure (4)

Region	Location	Thresholds	Possible notification issued via National Warning System
1	New Zealand (0-1hour to nearest coast local source)	M>6.5 and <100km depth	<p>Natural, felt signs are the primary warning for local source tsunami (Region1)</p> <p>If possible and as appropriate, NEMA will issue one of a sequence of the following Advisors and Warnings:</p> <ul style="list-style-type: none"> • <i>National Advisory: Earthquake Being Assessed</i> • <i>National Advisory: Tsunami Activity – Strong Unusual Currents</i> • <i>National Warning: Tsunami Threat</i> • <i>Emergency Mobile Alert (to areas where land inundation is forecast)</i> • <i>National Advisory: No Tsunami Threat</i> • <i>National Advisory: Earthquake – No Tsunami Threat</i>
	Southern Kermadec (<1 hour to nearest coast, Local source)	M>7.9 and <150km depth	<p>Natural, felt signs are the primary warning for local source tsunami (Region1). Southern Kermadec earthquakes located between 25 degrees S and 33 degrees S may not be widely felt in New Zealand</p> <p>If possible and as appropriate, NEMA will issue one of a sequence of the following Advisors and Warnings:</p> <ul style="list-style-type: none"> • <i>National Advisory: Earthquake Being Assessed (local/regional boundary holding message)</i> • <i>National Advisory: Tsunami Activity – Strong Unusual Currents</i> • <i>National Warning: Tsunami Threat</i> • <i>Emergency Mobile Alert (to areas where land inundation is forecast)</i> • <i>National Advisory: No Tsunami Threat</i> • <i>National Advisory: Earthquake – No Tsunami Threat</i>

2	<p>South- West Pacific</p> <p>(1-3 hours Regional source)</p>	<p>M>7.5 and <100km depth</p>	<p>Initial message:</p> <ul style="list-style-type: none"> National advisory: Large Pacific Earthquake Being Assessed (holding message) <p>Followed by (as appropriate, once confirmed data and advice received from GNS Science) National Advisory: Tsunami Activity – Strong Unusual Currents</p> <ul style="list-style-type: none"> National Warning: Tsunami Threat Emergency Mobile Alert (to areas where land inundation is forecast) National Advisory: No Tsunami Threat National Advisory: Earthquake – No Tsunami Threat
3	<p>Wider Pacific</p> <p>(>3 hours distant source)</p>	<p>M>8.0 and <100km depth</p>	



Figure 4 Tsunami Origin Locations

5.4 Further assessment for national warnings

When a National Advisory-Tsunami: Potential Threat to NZ is upgraded to a National Warning-Tsunami: Threat to New Zealand, information about expected arrival times and threat will be provided in the notification by NEMA. Where a National Warning-Tsunami: Threat to New Zealand was issued as the initial (first) notification, the additional information will be provided from the next (subsequent notification).

Siren activation:

The tsunami siren network within the Whangarei, Kaipara and Far North Districts will be activated. If the situation warrants immediate action (ie. a local source tsunami) the sirens can be activated by the duty officer if Controllers cannot be contacted and time is critical. Information on the tsunami threat must be available on radio and/or websites before the sirens are activated. (*refer Appendix links - CDEM Tsunami Initial Action Plan*)

Emergency Mobile Alerts:

The Emergency Mobile Alert (EMA) system delivers alerts directly to people's mobile phones in targeted areas, without subscription required. CDEM groups will alert people via EMA once a credible tsunami threat has been established.

If there is at least one coastal region within Northland with land inundation, then it is appropriate to use the EMA to send out locally appropriate evacuation messages. The message should come after the national message is issued and should support the national message. (*refer Appendix links - CDEM Tsunami Initial Action Plan*)

Section Six: Response Arrangements
6.0 Response Plan

The Response plan is designed to be a guide for the Northland Region CDEM response to a large Tsunami. The Response plan whilst overviewing likely Tsunami events affecting Northland coastal areas is focused on credible source scenario of a worst case Mw 9.0 + Kermadec event that has the potential to cause catastrophic damage to Northland coastal areas on both coasts.

The largest event modelled by Power et al. (2012) was an Mw 9.4 earthquake rupturing the plate interface along the entire Kermadec Trench.

Numerical models show that such an event could produce tsunami causing tremendous damage throughout the coastal areas between Gisborne and Northland. On parts of the north eastern coasts of Great Barrier island and Northland, calculated tsunami run-up heights would be about 15 – 20m above the normal level. Tsunami waves of over 10m amplitude would also strike the southwestern coast of the Aupouri Peninsula and Ahipara bay on the west coast of the northern Northland.

Roles and responsibilities within the response plan are formulated that will clearly identify reporting lines across CDEM, local authorities and Emergency services.

6.1 Response Outcomes

The following table lists the key workstreams and response outcomes for a Mw 9.0+ Kermadec subduction Tsunami event to aid the regional response planning process.

Workstream	Response outcome
Coordination command, control and communication	Coordination, command, control and communications structures and protocols are established as soon as possible for regional responding agencies and organisations
Reconnaissance and information	Key decisions during response are supported and informed by good situational awareness including and understanding for the environment, situation, likely developments and implications

Rapid disaster relief and welfare service delivery	People are put at the centre of the emergency, to provide for the needs of affected people, prevent escalation of suffering and minimise the consequences of the emergency for individuals, families, Whanau and communities
Operational response (Health, FENZ, NZ Police)	Emergency and health services are enabled to minimise the consequences of the emergency for people, property and the environment as per their roles and responsibilities within the National CDEM Plan (2015)
Procurement of resources and services	Resource requirements not able to be fulfilled by the CDEM Group are quickly communicated to appropriate coordination facilities to enable the response and increase the speed at which the immediate and basic needs of those affected are met
Emergency supply chain and people movement	The emergency supply chain is re-established in an efficient manner within and between Group areas, to enable skilled personnel and resources to move in and between the region, and critically injured to leave for health care where appropriate
Lifeline utilities restoration	Lifeline services are supported to restore services they normally provide to the fullest possible extent during the response (even though this may be at a reduced level)
Public information engagement	Life safety advice and information is communicated in a way which results in positive outcomes for communities, is consistent with support agency messaging, and maintains public confidence in the response
Environment	Environmental impacts and risks are prioritised appropriately within the response to minimise the consequences of the event on people and the environment

6.2 Response assumptions

In order to enable effective planning a number of assumptions have been made regarding coordination of the event at a regional and national level, availability of resources, the ability to respond, and the activities of the community. The core assumptions regarding this event are listed below:

- *The process of declaring local states of emergency will be initiated immediately.*
- *A state of national emergency is likely to be made by the Minister of Civil Defence within the first 24 hours of the response; however, this will depend on the scale of the impact.*
- *CDEM Coordination of local responses will be initially reduced due to the immediate impact of the event.*
- *The National Crisis Management Centre will be activated (Wellington or Auckland) but is initially operating at reduced level.*
- *Neighbouring CDEM Groups may not be able to immediately assist*
- *Local government within the Northland will continue to operate but with reduced capacity and capability*
- *Responding agencies will be functional but operating with reduced capacity and capability*
- *Secondary hazards will occur throughout the response affecting response and recovery.*
- *Standard communications may be limited, where available, alternate communications will be considered.*
- *Lifeline utilities will be limited.*
- *Movement corridors will be affected, and many roads will be unusable*

- *Rail will be affected and may be unusable*
- *Regional Airports are likely to be unaffected with the exception of Whangarei airport and is likely to be isolated due to inundation of the surrounding areas.*
- *Ports will be impacted*
- *Health and welfare services will be overwhelmed*
- *Communities will be isolated*
- *Spontaneous self-evacuation will occur*
- *Depending on the time of day significant numbers will be displaced from their homes locations*
- *The community led Tangata Whenua response will work to meet communities immediate and basic needs where possible.*
- *Ordered mass – evacuation will not automatically occur.*
- *There will be significant and long term environmental impacts*
- *National and regional assembly areas will be established in accordance with national and regional plans*
- *Offers of international assistance will be made and coordinated through the NCMC*

6.3 Northland CDEM Group Response arrangements

The initiation of a response will be as a result of notification relating to a significant event earthquake subduction at either regional or distant source. Focus on a regional source being the Tonga-Kermadec Trench and distant source being South America.

6.4 Group Controllers intent:

To immediately initiate a coordinated, timely response to minimise loss of life and prevent escalation of suffering. Provide reassurance and information to our communities and meet their immediate and short term needs as soon as possible. Risks, from, or created by, the event will be mitigated as far as possible and response personnel will not be put into any situations that present additional danger beyond accepted levels to conduct their roles.

This will be achieved by:

- The safety and wellbeing of people is kept at the centre of all response decisions.
- A CIMS coordinating structure is established with a clear chain of command from the CDEM Group to responding organisations. (*Appendix 1 CIMS Command chart*)
- Information is readily shared between response organisations to improve situational awareness and decision making.

Group Controllers Priorities

- Conduct life safety activities
- Identify and source key resources needed for response
- Establish response coordination arrangements
- Ensure immediate needs of the population are met
- Provide the public with appropriate response information
- Gain situational awareness
- Prioritise and manage resources

All priorities described above are underpinned and linked to response objectives in the National CDEM Plan and Guide (2015)

6.5 Coordination arrangements

In the early stages of any response there will be difficulty coordinating the activities of responding agencies until an appropriate command and control structure can be implemented.

6.6 Response structure

The Northland CDEM Group will endeavour to establish the Northland CDEM Group ECC response structure according to the Coordinated Incident Management System (CIMS)

(Appendix 1 CDEM CIMS Structure Credible Tsunami Event Mw 9.0+ Kermadec subduction)

6.7 Establishing Response facilities

It is highly likely that some key response facilities of core agencies will be heavily impacted by the event. The key response facilities that will be established as soon as practicable are shown in the table below:

Response Facility	Location
Group Emergency Coordination Centre (GECC)	Northland Regional Council
Whangarei EOC	Whangarei District Council
Kaikohe EOC	Kaikohe District Council
Kaipara EOC	Kaipara District Council
Kaitaia EOC	Kaitaia District Council
NZ Police DCC	Whangarei Police station
Fire and Emergency NZ Regional Control Centre	Whangarei Fire station
Te Whatu Ora Ti Tai Tokerau	Northland base Hospital
Civil Defence Centres	TBA

6.8 Response phases

Three response phases have been used to describe the outcomes, actions and core response activities following a large (Kermadec, South American, Northland) Tsunami event. The response phases cover.

- **Phase 1 (Immediate response)**

The immediate response, where emergency services are reacting to the Tsunami which has just occurred. This phase is dominated by activities which enable lifesaving and life preservation.

- **Phase 2 (Initiation of sustained response)**

The gap between the immediate, uncoordinated response and one that starts to become self-sustaining. During this phase response agencies have interim operating capability.

- **Phase 3 (Sustained response)**

A self-sustaining response bolstered by domestic and/or international resources where required. All responding entities are at full operating capacity and capability.

Phase One – Immediate response activities

6.9 Phase 1 response priorities:

The following priorities exist for Phase 1 of the response in the Northland Region

- Conduct lifesaving activities
- Protect key resources needed for response
- Establish response coordination arrangements

Core objectives

- To ensure that responding agencies within the region are alerted to issues relating to the event.
- To ensure the timely provision of key emergency information to people impacted by the event
- To provide life safety activities where safe to do so and support self-evacuation through the provision of clear information and direction.
- To activate appropriate response facilities to enable coordination of the response at all levels
- To establish appropriate communication to enable coordination of the response and information sharing between key agencies.

Activity	Core Objective	Agency Responsibilities	
Phase 1 – Immediate response activities			
Alerts and notifications	<i>To ensure responding agencies within the region are alerted to issues relating to the event</i>	Northland CDEM GECC	<ul style="list-style-type: none"> • Ensure that regional warning system is utilised where possible to keep all responding agencies informed • Implement alternate alerting methods where regional warning system is not able to be used
		All other agencies	<ul style="list-style-type: none"> • Ensure all alerts and notifications are disseminated to all key staff
Warning and informing the public	<i>To ensure timely provision of key emergency information to people impacted by the event</i>	Northland CDEM GECC & Local EOC's	<ul style="list-style-type: none"> • Coordinate the provision of emergency information to the community across all available platforms
		All other agencies	<ul style="list-style-type: none"> • Ensure key emergency information is provided to the community in coordination with the Northland CDEM and local CDEM PIM functions
		Northland CDEM GECC & Local EOC's	<ul style="list-style-type: none"> • Provide clear direction with regard to safe zone locations and evacuation routes • Ensure "All clear" message is disseminated as soon as received to enable

Self evacuation and Life Safety	<i>To provide life safety activities where safe to do so and support self evacuation through the provision of clear information and direction</i>		emergency services to begin life-saving activities in coastal areas
		NZ Police	<ul style="list-style-type: none"> Direct people to evacuate from areas at risk of inundation. Support traffic management where safe to do so
		Fire and Emergency NZ	<ul style="list-style-type: none"> Coordinate USAR activities in impacted areas as the situation allows.
		St John Ambulance	<ul style="list-style-type: none"> Provide medical assistance to those impacted by the event as the situation allows. Support FENZ with USAR activities by providing medical assistance Transport injured persons to healthcare facilities
		Northland Te Whatu Ora	<ul style="list-style-type: none"> Ensure capability to meet the medical needs of the impacted population
Response activation and mobilisation	<i>To activate appropriate response facilities to enable coordination of the response at all levels</i>	Northland CDEM GECC	<ul style="list-style-type: none"> Utilise all systems available to mobilise response staff and activate the GECC Support key staff to access the GECC facility as required
		Local EOC's	<ul style="list-style-type: none"> Utilise all systems available to mobilise response staff and activate the EOC Support key staff to access the EOC facility as required
		Emergency services	<ul style="list-style-type: none"> Activate response facilities, mobilise resources to respond and provide liaison to the GECC
Establishing communications	<i>To establish appropriate communication to enable coordination of the response and information sharing between key agencies</i>	Northland CDEM GECC	<ul style="list-style-type: none"> Ensure the operability of the Northland CDEM Group VHF network to support the communications between responding agencies Deploy satellite communications to enable communication with the NCMC and emergency services
		All other agencies	<ul style="list-style-type: none"> Ensure operability of VHF equipment to enable communications between

			GECC and all responding agencies and internally with key response staff
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Alerts and notifications

It is assumed that a national warning will have been issued via the Emergency Mobile Alerting system and that has been received.

As the event progresses alerts may need to be issued via other methods such as Social Media, VHF and satellite communications.

Warning and informing (Public)

Due to the nature of the event warning and information the public may not be possible across many platforms.

In the early stages of the event (immediately after the initial tsunami has occurred) there would be a reliance upon the population acting based on the messaging that is used to promote natural warning signs.

There may be limited phone coverage in some areas, but it is assumed that a national warning would be put out using the Emergency Mobile Alerting platform and where the capability was still operational this could be received by anyone with a mobile phone.

As the event progresses other platforms for communicating with the public may start to become available with the restoration of communications, however, during Phase 1 and 2 of the response communicating will be restricted

Self – evacuation and life safety activities

It is assumed that there will be self- evacuation from coastal areas prior to and following the tsunami and this will be strongly encouraged in any warnings that are issued. However, it is likely that there will be severe congestion, and some may be unable to evacuate due to damage as a result of the tsunami, or their distance to a safe area. All efforts should be made by responding agencies to assist people to evacuate while ensuring that critical staff and resources are evacuated to safety to support the response.

The Tsunami is likely to cause considerable damage within the region resulting in injuries. Initial focus for life safety activities should be directed towards those who have evacuated to a safe area or have been impacted by the event until an 'all clear' message is received. Once it is safe to do so, and there is reduced risk to personnel and assets, the focus of life safety activities will move to those impacted by the tsunami near the coast.

Response activation and mobilisation:

In the initial phase of the event responding organisations will be utilising existing SOP's to respond accordingly. However, in order to ensure coordination across all agencies there will be a need to establish response facilities and mobilise personnel and resources to carry out key response activities.

The process of activation and mobilisation may be made extremely difficult by the lack of communication and accessibility of facilities. It is also highly likely that some staff and resources will have been lost due to their location at the outset of the event.

Focus should be on ensuring the Group ECC is activated as soon as possible to provide a base for the coordination of the response. In addition, local EOC's should be established as soon as practicable to direct the response at the local level. Emergency services should focus on establishing response facilities to manage the ongoing life safety activities.

Establishing communications

The ability to communicate between responding agencies and on the ground between responders is critical to enabling a coordinated and effective response to the impacts of the event.

It is highly likely that the standard form of communication normally used will either be severely compromised or completely inoperable (eg landline and mobile phone networks, internet) and therefore other methods will need to be utilised.

Event Timeline

	Event	Outcomes/ Actions	Core response activities
Phase 1	Tsunami alert issued	<ul style="list-style-type: none"> Electronic national and regional warnings issued for tsunami Coastal populations begin self-evacuating inland and to higher ground in uncoordinated fashion Emergency services direct people to evacuate whilst moving key assets to safe locations and inland 	<ul style="list-style-type: none"> Alerts and Notifications Warning and informing (Public) Self-evacuating and life safety activities Response activation and mobilisation Establishing communications
	First Tsunami reaches shore	<ul style="list-style-type: none"> First tsunami waves have reached the shore with strong currents experienced Population on coast are continuing to self-evacuate 	
	Displaced population arriving in safe areas	<ul style="list-style-type: none"> Community unsure of what to do. Spontaneous first aid and assistance provided by locals with resources at hand Emergency services carry out initial action plans, responding to immediate needs of those in safe areas and triaging medical assistance Rapid impact assessments carried out in safe areas Response staff in affected areas check on their families Community led response begins USAR and general rescue operations activities begin with in situ regional resources 	
	CDEM Group activate response	<ul style="list-style-type: none"> Key staff alerted and begin travelling to GECC where able District and City councils establish EOC's to coordinate the local delivery of response activities. Emergency services activate response coordination facilities and provide liaison to the GECC 	
	Basic communications established	<ul style="list-style-type: none"> Information gathering begins, however, there is limited situational awareness Basic cellular, VHF and satellite communications is established between key agencies. 	

	Delivery of rapid relief	<ul style="list-style-type: none">• Community efforts to provide rapid relief to displaced and impacted persons bolstered.• Community halls, marae, schools and sports facilities opened to provide shelter and basic needs	
	Tsunami activity subsides	<ul style="list-style-type: none">• Ongoing tsunami waves subside but will have an impact on response activities and determined when risk of further tsunami assessed.	

Phase two – Initiating sustained response activities

6.10 Phase two response priorities.

The following priorities exist for Phase 2 of the response in Northland:

- Ensure immediate needs of the population are met
- Gain situational awareness
- Prioritise and manage response

Core objectives

- To ensure the provision of coordinated rapid relief to impacted persons as soon as practicable following the event.
- Develop a clear understanding of the impacts of the event as soon as possible to support decision making.
- To ensure impacted population is evacuated from at risk areas and are prevented from returning until safe to do so.
- To ensure a coordinated response through a consolidated planning process across all responding agencies.
- To ensure the most effective use of all available resources in response activities.

Activity	Core Objective	Agency Responsibilities	
Phase 2 - Initiating response activities			
Providing rapid relief	<i>To ensure the provision of coordinated rapid relief to impacted persons as soon as practicable following the event</i>	Northland CDEM GECC	<ul style="list-style-type: none"> • Establish a coordinated structure to support the provision of rapid relief both through formal and informal structures (community led response)
		Local EOC's	<ul style="list-style-type: none"> • Establish emergency shelters and CDC's to provide for the basic needs of people impacted by the event
		Welfare providers	<ul style="list-style-type: none"> • Ensure provision of rapid relief services in support of the GECC
Developing situational awareness	<i>Develop a clear understanding of the impacts of the event as soon as possible to support decision making</i>	Northland CDEM GECC	<ul style="list-style-type: none"> • Gather, analyse and disseminate information to develop a clear understanding of the event and its impacts across all responding agencies • Lead the welfare impact assessment process • Conduct building damage assessments • Conduct utility damage assessments
		Local EOC's	<ul style="list-style-type: none"> • Lead welfare impact assessment process • Gather, analyse and disseminate information to develop a clear

			understanding of the event and its impacts within the district
		FENZ	<ul style="list-style-type: none"> • Lead the rapid impact assessment process and coordinate the collection of information by other emergency services • Provide regular status reports to the Northland CDEM GECC
		NZ Police	<ul style="list-style-type: none"> • Support the rapid impact assessment process • Provide regular status reports to the Northland CDEM GECC
		St John Ambulance	<ul style="list-style-type: none"> • Support the rapid assessment process • Provide regular status reports to the Northland CDEM GECC
		Northland Te Whatu Ora	<ul style="list-style-type: none"> • Support the rapid impact assessment process • Provide regular status reports to the Northland CDEM GECC
		Welfare agencies	<ul style="list-style-type: none"> • Support the welfare impact assessment process • Provide regular status reports to the Northland CDEM GECC
		Lifeline Utilities	<ul style="list-style-type: none"> • Conduct utility damage assessments • Provide regular status reports to CDEM GECC
Managed evacuation and exclusion	<i>To ensure impacted population is evacuated from risk areas and are prevented from returning until safe to do so</i>	Northland CDEM GECC & Local EOC's	<ul style="list-style-type: none"> • Identify areas for evacuation/exclusion and coordinate resources to support NZ Police
		NZ Police	<ul style="list-style-type: none"> • Conduct evacuations as requested by the Northland CDEM Group • Establish cordons and exclusion zones
		Local authorities	<ul style="list-style-type: none"> • Support the establishing of cordons with appropriate resources

Operational planning	<i>To ensure a coordinated response through a consolidated planning process across all responding agencies</i>	Northland CDEM GECC	<ul style="list-style-type: none"> Coordinate the development of the Northland CDEM Group Action Plan
		Local EOC's	<ul style="list-style-type: none"> Coordinate the development of local action plans to ensure the delivery of the Northland CDEM Group action plan
		All other agencies	<ul style="list-style-type: none"> Contribute to the development of regional and local action plans by identifying key tasks, issues and resource requirements
Management of resources	<i>To ensure the most effective use of all available resources in response activities</i>	Northland CDEM GECC	<ul style="list-style-type: none"> Coordinate and prioritise available response resources Identify any critical resource needs and request from NCMC if not available within the region
		Local EOC's	<ul style="list-style-type: none"> Coordinate and prioritise the deployment of resources locally
		All other agencies	<ul style="list-style-type: none"> Identify all available and critical response resources and provide to the Northland GECC

Providing rapid relief:

Providing rapid relief in the early stages of the event is critical to ensuring that people can get through the initial impacts. Rapid relief includes food, water, shelter, and urgent medical needs.

This event is likely to require rapid relief provision to many hundreds of people. The provision of rapid relief is likely to be hampered by the dispersed population and the access to resources. In the initial phase of the response the rapid relief provided may be extremely basic and rely heavily upon community to support the effort until more coordination can be established and appropriate resources deployed.

Develop situational awareness

Gaining a clear understanding of the event and ensuring that all responding agencies have a shared understanding of what has happened is vital to enabling clear and effective decision making. In the early phase of the response developing situational awareness will be made difficult due to the lack of communications, restriction on movement due to road damage, potential loss of personnel and ability to establish response facilities.

Initial situational awareness may come from responders attending facilities and their observations of the event and the impacts. As the response progresses and communications are established between responding agencies coordinated impact assessments may begin to occur. These may be rapid impact assessments (general ground observations of the situation) in the first instance, but as time allows these will become more detailed and include street by street damage assessments, welfare assessments and lifeline asset damage assessments.

As the event progresses the situational awareness of all agencies should increase enabling more targeted response efforts in the worst impacted areas. For the development of situational awareness to be effective it is critical to establish clear communications between responding agencies as soon as possible to enable status reporting to the GECC and ensure that key information is disseminated to all agencies.

Managed evacuation and exclusion

As situational awareness increases and there is more ability to respond in impacted areas, evacuations and exclusions may need to be implemented to prevent further risk to the population. This may be as a result of additional risk from the impact (health risks, landslide risks etc) or to enable response activities to occur without risk to people in the area.

Evacuation of an area will require a door-to-door approach to be taken, as it is most likely that communications will be extremely limited in the early phases of the response. In addition, the resources to conduct managed evacuations are likely to be extremely limited.

Exclusion from areas will be required to prevent people returning where there is an increased risk to maintain security until residents are able to return. The establishing of cordons may not be possible in the early phases of the response until appropriate resources become available and may not be possible at all in some areas due to the logistical requirements.

Operational planning

The initial phase of the response most activities will occur based on existing SOP's and plans of each agency. While some of the activities will have a level of coordination on the ground, there is likely to be some duplication of effort and confusion in exactly what needs to happen, and a higher level of planning required to enable coordination across the entire response.

Initial action plans for the event are likely to be very basic and lack detail due to the limited information and scale of the event.

Operational planning can only begin to occur once clear communication has been established between agencies and there is a reasonable level of situational awareness regarding the impacts of the event and the issues that require response.

Management of resources

Due to the extent of the impacts, resources to respond are likely to be severely impacted. Careful management of these is required at an early stage to ensure that priority issues can be responded to effectively.

In order to manage resources effectively, the Northland CDEM Group will first need to understand what resources have survived the event and are available to respond. It will be critical for all responding agencies to identify their available resources at an early stage and provide this information to the Northland CDEM Group GECC so that resources can begin to be used in the most effective way. Any critical resources need to be identified and prioritised for use or requested from the NCMC if not available in the region.

There is also likely to have been significant damage to supply lines and retail outlets, such as supermarkets and fuel sources. Existing supplies within the region will need to be managed and prioritised to ensure these are used as effectively as possible until resources can be brought into the region.

Event Timeline

Event	Outcomes/ Actions	Core response activities	
Phase 2	Basic situational awareness gained	<ul style="list-style-type: none"> • CDEM Initial action plans initiated • Resources coordinated and deployed to priority areas. • Evacuation of other casualties as required begins, and as transport is available. • Identification of additional resource shortfalls and requests for support to NCMC begins • Coordinated impact assessments begins 	<ul style="list-style-type: none"> • Providing Rapid Relief • Developing situational awareness • Managed evacuative and exclusion • Operational planning • Management of resources
	Surge support arrives	<ul style="list-style-type: none"> • Some international and domestic assistance starts to arrive but is limited because of widespread damage to roading infrastructure and lifeline utilities. • USAR operations increase, with deployment of additional international teams into affected areas. • Preparation of Regional Assembly Areas begins 	

Phase three – Sustained response activities

6.11 Phase three response priorities

The following priorities exist for Phase 3 of the response in Northland:

- Ensure on-going needs of the population are met
- Restore key lifeline services
- Support community response activities

Core objectives

- To provide for the on-going needs of the impacted population through the coordinated delivery of welfare services.
- Restore basic services to the community to the maximum possible extent.
- Enable the community to lead the response effort where appropriate through the provision of resources and advice
- Manage debris to enable access and restoration of services while protecting the population from harmful substances and waste

Activity	Core Objective	Agency Responsibilities	
Phase 3- Sustained response activities			
Coordinated welfare delivery	<i>To provide for the on-going needs of the impacted population through the coordinated delivery of welfare services</i>	Northland CDEM GECC	<ul style="list-style-type: none"> • Coordinate the provision of welfare services to meet the on-going needs of those impacted by the event • Ensure critical resources required to provide for on-going needs are prioritised
		Local EOC's	<ul style="list-style-type: none"> • Ensure and coordinate the delivery of welfare services daily
		Welfare providers	<ul style="list-style-type: none"> • Support the provision of on-going needs as requested by the Northland CDEM Group • Identify any critical resource needs to enable the delivery of key welfare services
Restoration of essential lifeline services	<i>Restore basic services to the community to the maximum possible extent</i>	Northland CDEM GECC	<ul style="list-style-type: none"> • Coordinate and prioritise the restoration of lifeline services
		Local EOC's	<ul style="list-style-type: none"> • Coordinate the restoration of basic services to the community where possible to do so
		Lifeline utilities agencies and Local authorities	<ul style="list-style-type: none"> • Undertake the restoration of basic services to the community where possible to do so

Supporting community response and engagement	<i>Enable the community to lead response where appropriate through the provision of resources and advice</i>	Northland CDEM GECC & Local EOC's	<ul style="list-style-type: none"> Lead community engagement and provide supplies and resources to sustain community response efforts
		All other agencies	<ul style="list-style-type: none"> Support community response efforts through provision of information, advice and resources
Debris management	<i>Manage debris to enable access and restoration of services while protecting the population from harmful substances and waste</i>	Local EOC's & Local authorities	<ul style="list-style-type: none"> Coordinate the collection, removal and disposal of debris

Coordinated welfare delivery

The provision of welfare services to those impacted by the event will require coordination across multiple agencies and the community and will require significant resources to ensure people are able to manage through the event.

The region is likely to have displaced persons, including tourists, who cannot return to their homes or accommodation. Potentially there could be hundreds of people displaced long term as a result of the event, with many more only able to shelter in their homes and having limited access to utilities for a number of weeks. While some of these people may be able to stay with friends and family in areas not as heavily impacted, a large majority will be reliant upon help to find accommodation and meet their basic needs for an extended period of time. The supply of household goods and services will be a critical element of providing for the immediate and ongoing needs of the population.

In addition, several areas in the northland region are likely to be cut off from support due to inundation and infrastructure damage and may have to provide for their own welfare for several weeks until supplies can be taken in. Critical supplies may need to be brought in by air in order to support the needs of the population there.

Restoration of essential lifeline services

Lifeline services are likely to have been very heavily impacted as a result of the event. It is recommended regional response planning further quantifies and refines the likely damage to regional lifeline assets following a large Mw 9+ Kermadec event.

Electricity

Transpower's Marsden and Bream Bay substations are possibly impacted by the regional tsunami scenario and likely to be impacted by the local tsunami scenario, causing major supply loss to the region. A number of Northpower and Top Energy substations are also within inundation zones. Some restoration of service can be expected in a week but if substation damage is significant then full restoration could take months.

Fuel

The major impact for the fuel sector will arise from projected inundation of the Marsden Refinery. It could take weeks to months to establish an alternate supply (such as shipping refined fuel) and months to years for full recovery of the Refinery operations. Electricity outages will also impact on fuel station operation.

Telecommunications

There will be some localised tsunami impacts to the cellular and landline network, with cellular impacts likely to be a degradation of capacity than a total loss of coverage in any given area. However, power failure may have a significant impact as only large sites have generators on-site and some households and businesses need power for their phones.

Transport

A number of bridges along SH 10 and 11 are at risk with Coopers Beach bridge, Cable Bay culvert and Harris culvert having the most potential for damage to the structure. Inland route alternatives are available and it may take months for full restoration of coastal roads. The Port and the road to the Port are also likely to be damaged.

Water Supply and Wastewater

Many pump stations and treatment plants in coastal areas would be impacted including the Ruawai Water Treatment Plant and Mangawhai water supply bore.

Ports

Marsden Point will be affected by the tsunami and may suffer extensive damage. Whangarei port is anticipated to be inundated and suffer damage and Opua port area is anticipated to be inundated and suffer damage.

Airports

All airports within the region (Whangarei, Kerikeri, Kaitaia) are anticipated to be useable following the event. Whangarei will be isolated due to inundation flooding (Whangarei heads and Kissing point).

Lifeline restoration priorities

In tandem to the prioritised repair logistics enablers listed below; power, potable water and storm water supply restoration in areas where people are still able to live will need to occur as soon as possible to reduce dependency on services such as water tankers and emergency power generation. Emergency power resources should be prioritised for use by responding agencies.

In addition, fuel stations and regional fuel storage facilities may be severely impacted by the event due to loss of electricity or damage to key infrastructure. Without electricity, some fuel stations may require generator support to access fuel stocks. Fuel re-supply into the region will be unlikely in the initial phases of the response, therefore as a critical resource, distribution of fuel within the region may need to be managed to ensure there is enough available for emergency operations.

All lifeline restoration is dependent on the availability of contractors, resources and access to lifeline assets. As the following priorities are based on credible planning scenario and will need to be adjusted for the realised impacts of a future event.

1. Internal priority roads/access routes for emergency services

In the early stages of the event, priority will need to be given to clearing access routes across the region to enable emergency response to occur and isolated populations access assistance.

2. Airports

All regional airports (Whangarei, Kerikeri, Kaitaia) should be prioritised to enable the inwards movements of supplies and evacuation of critically injured persons.

3. Inter-regional road connections

Restoration of SH1 (Auckland- Cape Regina), SH11 (Kawakawa – Puketona), SH10 (Pakaraka – Awanui), SH12 (Maungatoroto – Dargaville- Kaikohe) should be prioritised to enable access to coastal communities and the flow of response resources between regions.

4. Northland Ports

Both Marsden Point and Whangarei ports are likely to sustain damage in the credible source scenario. Operationalising the Ports will enable the movement of resources between regions as part of the response.

Supporting community response and engagement

The community will play an integral part in the response and will be vital in ensuring that the wider community is able to manage through the impacts of the response.

In the early phases of the response, it is highly likely the community will provide for the immediate medical and welfare of those impacted by the event. While this may be sustainable short term, it will require support from the Northland CDEM Group as supplies become limited, or more expertise is required.

Communities are also likely to lead the response efforts in their area in terms of debris clearance and this will need to be supported by the Northland CDEM Group to ensure it occurs in a coordinated fashion and does not put anyone at risk.

Where possible, existing community groups should be utilised to provide information to the wider community and coordinate response efforts in their area.

Debris and environmental management

The event will create a huge amount of debris. This is likely to require a large number of resources to clear and there will be limited ability to separate any hazardous waste.

In the early phases of the response debris management may simply be piling up debris in place to clear access routes. Longer term, debris will need to be managed to ensure hazardous substances and waste are cleared and stored where they pose no risk to human life. This may require the establishment of a specific facility to receive and sort waste and the development of additional landfill facilities within the region for disposal of the non-harmful waste. Hazardous waste may need to be stored long term within region before it can be disposed.

Event Timeline

Event	Outcomes/ Actions	Core response activities
P h a s e	Welfare coordination established	
3	Supply chains established	
	Basic lifeline utilities re-established in inland areas	
	Community response supported	
	Sustained response activities occurring	

	<p>accommodation for displaced persons.</p> <ul style="list-style-type: none"> • Lifelines are continuing to be restored in impacted areas. • Communication is improving. • Supply chains are improving, and increased resources are arriving to support the resources. • Environmental clean-up occurring 	
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6.12 Inter regional response requirements

The event will impact most regions in New Zealand given the scale of the quake and generated tsunami (Mw 9 + Tonga-Kermadec subduction). As a result, support from neighbouring regions may need to be sought to assist parts of the Northland region.

Requesting Support

Requesting support from a neighbouring Region will require discussion between the National Controller at NEMA and the Regional Controllers. Memorandums of Understanding (MOU's) created in readiness may facilitate this occurring more quickly in response.

6.13 USAR arrangements and management

In the event of an emergency necessitating the use of domestic and international USAR teams, Fire and Emergency will deploy representatives from the UMT to lead and coordinate those activities. A member of the UMT may be positioned within the NCMC and/or CDEM Group ECC.

Offers of international assistance or requests for international assistance may result from an emergency. When these occur, they are to be considered by the National Security Committee of Cabinet (NSC), via the Officials Committee for Domestic and external Security Coordination (ODESC) system.

NZ's USAR capability is owned by FENZ and the majority of personnel come from within their ranks i.e., there is not a standing group of USAR specialists ready to deploy, rather they are firefighters on a duty roster who will have other primary role responsibilities for FENZ. This means at any one time there would likely only be around half of the total USAR personnel available to deploy. The remainder of the teams is made up of search dog volunteers (SDA), externally contracted structural and geo-tec engineers, St John Paramedics and Medical Doctors.

The likelihood of a USAR response being available to support smaller regional areas is low given their effort is likely to be concentrated in the larger metropolitan areas (such as Auckland) where structural collapse of larger structures is likely to be the priority.

In a catastrophic event such as a Kermadec Mw 9+ rupture, the other reality is that movement of USAR teams into more remote regions will be difficult given the expected damage to roading infrastructure etc. The likelihood of teams flying directly to Northland is unlikely for international teams who will be arriving in widebody aircraft with around 80+ personnel and upwards of 15 tonnes of equipment.

In a localised type event NZ USAR capability would be available, initially likely out of Auckland with surge support available from other locations. The key deliverable for USAR is heavy rescue from structural collapse, although they have diversified beyond this to provide reconnaissance and rapid damage assessments (RDAs), advanced drone capability (UAS) for aerial mapping and recon, water production (desalination and purification), light reconstruction, shoring up structures to make them safe, C³ elements including advanced satellite capability, hazardous materials identification and mitigation and accessing high risk areas to retrieve items of importance.

USAR Surge Support

Any arriving USAR capability for Northland will likely arrive from overseas in the first instance – this is based on a scenario where damage to NZs larger cities is the priority for NZ USAR capability.

NZ USAR consists of three teams located in Christchurch, Palmerston North and Auckland of around 75 people each who can operate independently or come together to form a larger domestic capability for a single location (as occurred for the Chch earthquakes).

The likely arrival points for international teams is primarily Auckland. Northland may have NZ USAR capability flown in, but it is dependent on the damage scenario and where the priorities for the domestic capability will be.

The most likely scenario is teams arriving by road (if passable) or by rotary wing, assuming these resources can be accessed. Experience has demonstrated that RNZAF support will be limited and the availability of private aircraft is questionable when foreign governments contract them *en masse*.

Section Seven: Roles and Responsibilities

This section is to provide a brief overview of the responsibilities of organisations responding to a tsunami event.

7.1 NEMA

NEMA is responsible for the initiation of national warning messages including official tsunami notification.

They are responsible for:

- Receiving notifications from the PTWC and GNS
- Assessing the information
- Seeking advice from GNS
- Making decisions on the appropriate response.

7.2 The Northland CDEM Group

The Northland CDEM Group and its members are responsible for planning for, deployment and maintenance of appropriate public alert and tsunami response systems for Northland. Actions in conjunction with the CDEM Tsunami Initial Action Plans. This includes

- Receiving, evaluating and disseminating of warnings to partner agencies
- Ensuring warnings are conveyed to the public when appropriate
- Monitoring and coordinating the situation across Northland
- Facilitating Group teleconferences
- Media liaison

7.3 Maritime New Zealand

Maritime New Zealand Maritime New Zealand's Operations Centre is responsible for safety of life at sea communications in the area of the Pacific and areas of the mid Tasman. This includes the dissemination of maritime safety in the areas it is responsible for. They are also responsible for providing advice and recommendations on any national implications regarding the status of particular maritime service and infrastructure.

7.4 Northland Harbour Master

The Northland Harbourmaster ensures that the local coastguard and marine radio services are disseminating information applicable to the Northland Coastline during a tsunami event. The Harbourmaster will determine what course of action to take with shipping in harbours.

7.5 Territorial Local Authorities:

Territorial Local Authorities must activate their own plans in response to an official tsunami warning or in response to a tsunami impacting Northland. TLAs on receipt of a warning shall:

- Take immediate action in accordance with their own EOPs to advise at risk communities of the warning
- Contact local police and fire service to ensure that they have received the warning.
- Acknowledge receipt of the warning to the CDEM Group Controller or their alternate within 30min
- Where necessary take the appropriate action to prepare communities to respond to warning messages.
- Analyse information and assess the likely local impact
- Coordinate response with other agencies including the Northland CDEM Group
- Coordinate with police to carry out evacuations
- If required, provide welfare

7.6 NZ Police

The NZ Police receive national tsunami advisories and warnings directly from NEMA and in Northland via the Northland CDEM Group. The police coordinate response within the CDEM Groups and activate their own arrangements. Police roles relative to civil defence are:

- Maintain the functions of the New Zealand Police as outlined in section 9 of the Policing Act 2008
- Assist with the dissemination of warning messages
- Assist the movement of rescue, medical, fire and other essential services
- Coordinate movement control over land, including communications and traffic control
- Conduct category 1 search and rescue operations
- Support category 2 search and rescue operations
- Carry out disaster victim identification
- Control access to and within an affected area so as to assist rescue, medical, fire and other essential services
- Conduct initial evacuations to ensure protection of life
- Coordinate inquiries to assist family, whanau and next of kin to make contact with each other
- Trace missing persons and notify next of kin
- Assist coroners as required by the coroners Act 2006, in close liaison with the Ministry of Justice and health services
- Support Controllers at the national CDEM Group, and local levels and, when requested, appoint Police liaison officers to ECC's and EOC's

7.7 Fire and Emergency NZ

The New Zealand Fire Service receives national tsunami advisories and warnings from NEMA and is responsible for disseminating this information to all Fire Stations including Rural Fire. The New Zealand Fire Service coordinates the response within CDEM Groups and activates its own arrangements.

NZ Fire is responsible for the following functions:

- Firefighting to control, contain, and extinguish fires
 - Containing releases and spillages of hazardous substances
 - Urban Search and Rescue
 - Limiting damage, including the salvage of essential material from endangered locations
 - Redistributing water, in consultation with relevant territorial authorities, for firefighting
 - Redeployment of appliances from those stations that are at risk in tsunami inundation zones
- The Fire Service may assist the Police with some of their activities on request. ie. evacuations, the placement of cordons and roadblocks to ensure safety. They may also coordinate the rescue of people and provide the resources for the rescue activity

7.8 Te Whatu Ora Ti Tai Tokerau

Te Whatu Ora is responsible for its own activation plans in response to an official tsunami warning or in response to a tsunami impacting Northland.

Te Whatu Ora is responsible for:

- Informing and alerting all health personnel and facilities of a tsunami threat or warnings
- Identifying how services will be delivered pre and post tsunami
- Ensuring that hospitals and health services are ready to function to the fullest extent during and after a tsunami
- Ensuring provision of continuity of care for existing patients and management of increased demand for services.

7.9 Waka Kotahi

The Waka Kotahi receives warning information as part of the Northland Lifelines Group. If an evacuation is required Waka Kotahi must support the CDEM Group and NZ Police to adjust and disseminate a Traffic Control Management Plan.

Waka Kotahi must also report to the CDEM Group on the status of the roading network and in an event when an evacuation is required must publicise the main evacuation routes.

7.10 Community Civil Defence Groups

During an emergency, communities and local groups are responsible for:

- The dissemination of warnings
- The activation of their local community response plans
- Assistance in the establishment and staffing of emergency control centres and welfare centres
- Assistance with Intelligence relative to damage assessment

Section Eight: Appendices

Appendix 1 Core Roles and Responsibilities

Appendix 2 Response Phase flow charts
Phase 1 – Immediate response activities
Phase 2 – Initiating sustained response activities
Phase 3 – Sustained response activities

Appendix 3 Glossary of terms


Links to CDEM Sites

[Northland CDEM Sitrep Template](#)

[Northland CDEM Action Plan Template](#)

[GECC FORMS AND TEMPLATES \(in Share point\)](#)

[Link to Emergency Management Acronym Sheet](#)

 [2. Emergency Operating Procedure 06 Lifeline Utility Coordination Protocols update July 2021.pdf](#)

<https://www.civildefence.govt.nz/assets/guide-to-the-national-cdem-plan/Guide-to-the-National-CDEM-Plan-2015.pdf>

<https://www.nrc.govt.nz/civildefence/tsunami-evacuation-zones/>

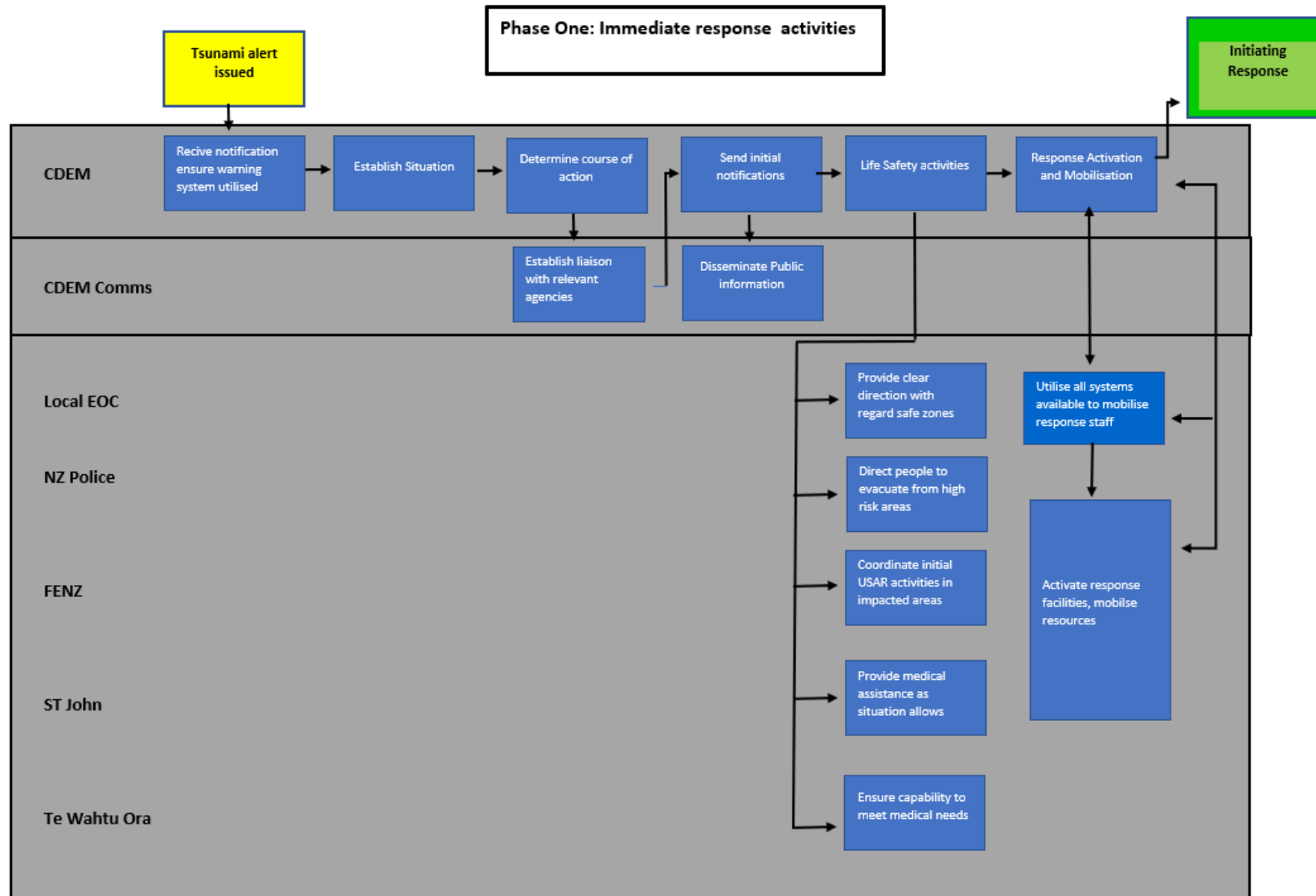
[Northland Tsunami Information Boards](#)

Appendix 1 - Core Roles and responsibilities

Organisation	Regional Agencies roles and responsibility
Northland CDEM GECC	<ul style="list-style-type: none"> • Ensure coordination of the response across local authority EOC's, partner agencies and responding organisations
Local EOC's	<ul style="list-style-type: none"> • Ensure coordination of the response locally
NZ Police	<ul style="list-style-type: none"> • Ensure public safety • Maintain Law and Order • Manage public movement • Lead disaster Victim identification (DVI) process, mass casualty teams, reporting deaths to the coroner's office and provision of inquiry services for missing persons • Where mass fatalities occur as a result of a scenario which severely impacts the Northland region, NZ Police would be responsible for the establishment and management of mass fatality temporary morgue facilities on behalf of the Coroner. (These internal Mass Fatality Plans are already in place as part of the COVID-19 response planning) • Activate Business Continuity Plans
FENZ	<ul style="list-style-type: none"> • Lead response to all fire and hazardous substance related issues, urban search and rescue activities and coordinate the rapid assessment process
Te Whatu Ora Ti Tai Tokerau	<ul style="list-style-type: none"> • Ensure provision of hospital and key health services within the region • Activate Business Continuity Plans
St Johns	<ul style="list-style-type: none"> • Provide rapid response medical care as required and transportation of injured persons to health facilities • Activate Business Continuity Plans
Local Authorities	<ul style="list-style-type: none"> • Ensure staff are trained to support response both regionally and locally • Ensure provision of core services including key lifeline utilities • Activate Business Continuity Plans and continue to provide essential services even if at a reduced level
Welfare Agencies	<ul style="list-style-type: none"> • Ensure provision of welfare services to persons impacted by the event as required • Activate Business Continuity Plans and continue to provide essential services even if at a reduced level
Lifeline Agencies	<ul style="list-style-type: none"> • Ensure the provision of core lifeline services to the region to the maximum possible extent • Activate Business Continuity Plans
Iwi	<ul style="list-style-type: none"> • Coordinate links to Māori communities to provide key emergency information and status reports • Provide cultural and communications advice regarding the response to Tanga Whenua within the region • Activate Business Continuity Plans

Appendix 2

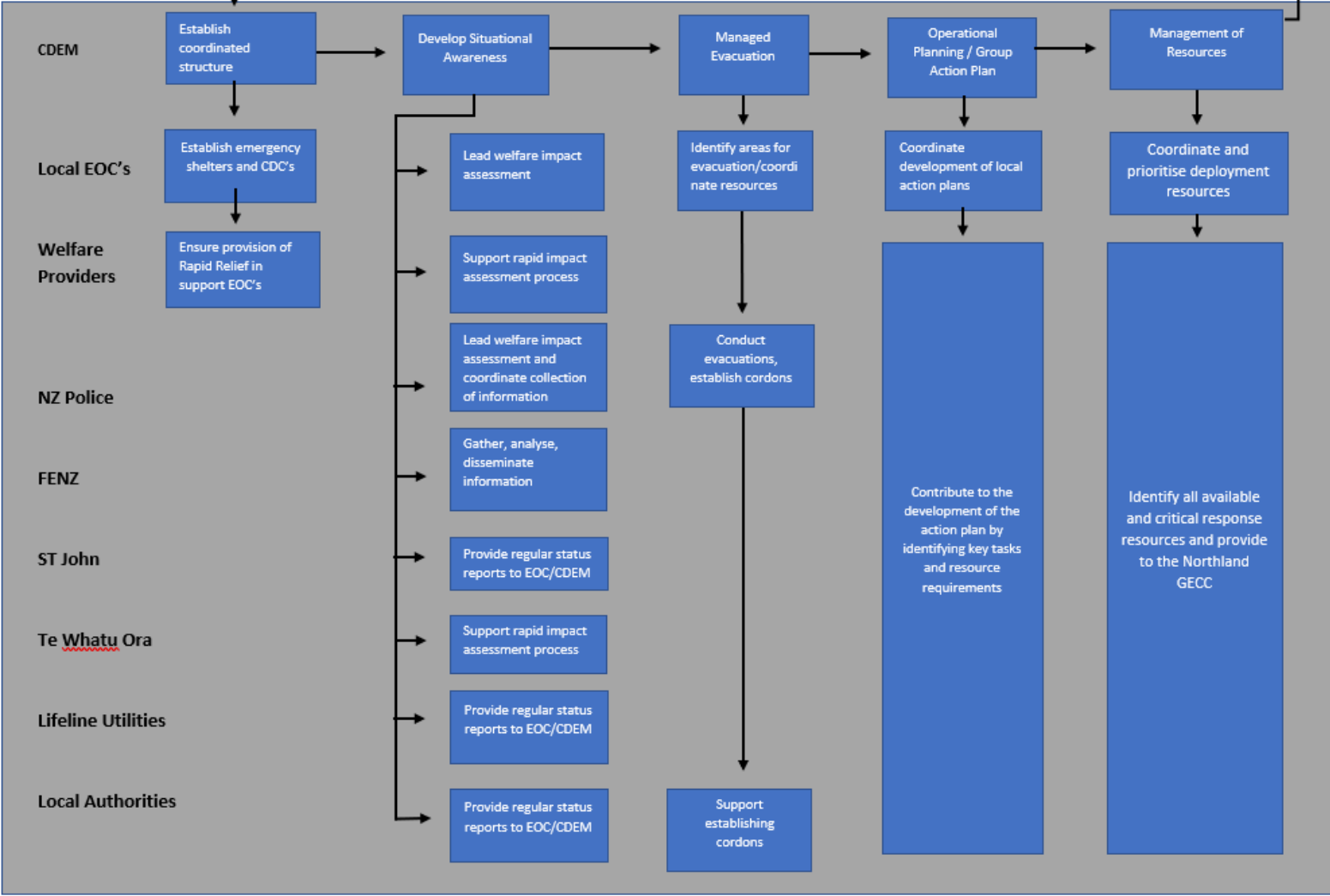
Response Phase flow charts



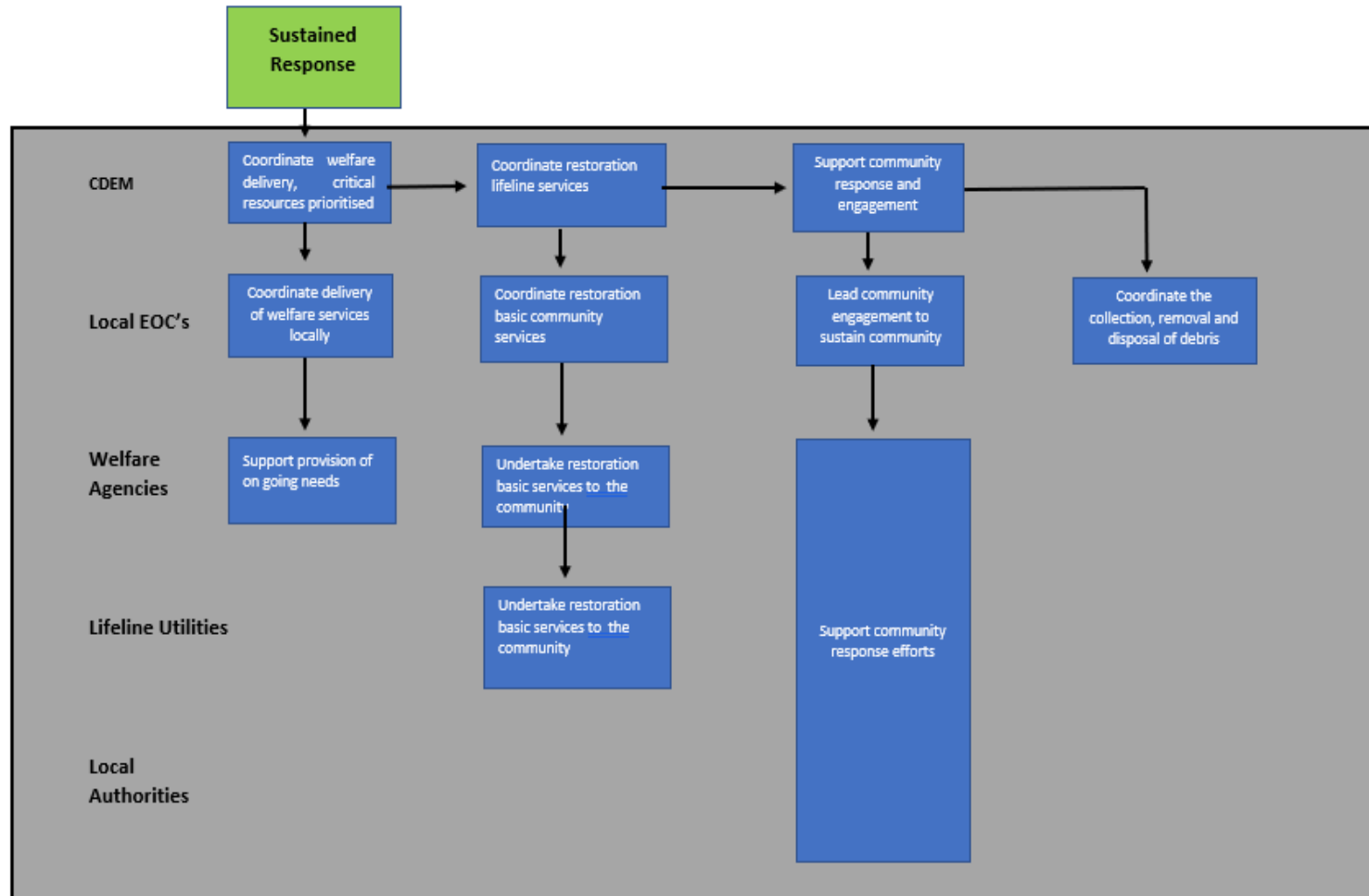
Response

Phase Two: Initiating Sustained Response Activities

Sustained Response



Phase Three: Sustained Response Activities



Appendix 3 Glossary of Terms

Bore	A bore is a non-breaking step-like increase in water height, resulting in a wall-like change in water levels. They can travel 3 kilometres or more up a river with water many metres above normal levels
NIWA	National Institute of Weather and Atmospheric Research
Distant Source	A tsunami originating from a remote source, generally more than 3 hours travel time to New Zealand
Regional source	A tsunami originating from a source 1-3 hours travel time from the nearest New Zealand coast
Local source	A tsunami originating from a source less than 1 hour travel time from the New Zealand coast
Arrival time	The time required for the first tsunami wave to propagate from its source to a given point on the coast
Magnitude (Mw)	The magnitude of an earthquake is a measure of its energy. The most widely used form of estimating magnitude is the moment magnitude
NEMA	National Emergency Management Agency
Tsunami run up (m)	This is the elevation of inundation above the instantaneous sea level at the time of impact at the farthest inland limit of inundation
Tsunami height (m)	The vertical height of waves above the tide level at the time of the tsunami. It is far from constant and increases substantially as the wave approached the shoreline. The term 'wave height' is often used
Tsunami	A natural phenomenon consisting of a series of waves generated when a large volume of water in the sea or in a lake is rapidly displaced
Mean High Water Spring (MHWS)	The average of the levels of each pair of successive high waters during a 24 hour period in each semi-lunation (approx. every 14 days), when the range of the tide is greatest (Spring range)
PTWC	Pacific Tsunami Warning Centre (Hawaii)
DART	Deep-ocean Assessment and Reporting of Tsunami buoys
Subduction zone	Are plate tectonic boundaries where two plates converge, and one plate is thrust beneath the other
Tonga-Kermadec subduction zone	It is the most linear, fastest converging, and most seismically active subduction boundary on earth stretching more than 3,000km north northeast from New Zealand's North Island
EMA	Emergency Mobile Alert – messages about emergencies sent by authorised emergency agencies to capable mobile phones
CDEM	Civil Defence Emergency Management
CIMS	Coordinated Incident Management System
GECC	Group Emergency Coordination Centre
ECC	Emergency Coordination Centre
EOC	Emergency Operations Centre
CDC	Civil Defence Centre
SOP's	Standard Operating Procedures
INSARAG	The International, Search and Rescue Advisory Group – is a network of disaster prone and disaster responding countries and organisations dedicated to urban search and rescue and rescue operational field coordination
USAR	Urban Search and Rescue
UMT	USAR Management Team
ODESC	Officials Committee for Domestic and External Security Coordination

