KINGDOM OF TONGA

NATIONAL TSUNAMI PLAN

June, 2012

Ministry of Infrastructure

CONTENTS

List of Appendices

ACRONYMS

EEZ	Exclusive Economic Zone
EMWIN	Emergency Managers Weather Information Network
GSU	Geological Services Unit
JATWC	Joint Australia Tsunami Warning Centre
JMA	Japan Meteorological Agency
MLECCR	Ministry of Lands, Environment, Climate Change and Natural Resources
NEMC	National Emergency Management Committee
NEMO	National Emergency Management Office
NEMP	National Emergency Management Plan
NEOC	National Emergency Operations Center
NTC	National Tsunami Coordinator
NTWC	National Tsunami Warning Center
NTWFP	National Tsunami Warning Focal Point
PTWC	Pacific Tsunami Warning Center
TBC	Tonga Broadcasting Commission
TCC	Tonga Communications Corporation
TMS	Tonga Meteorological Services
USGS	United States Geological Survey

1. INTRODUCTION

1.1 Plan Purpose

The purpose of this plan is to explain in detail the mitigation, preparedness, warning, response and recovery arrangements for tsunami event that might affect Tonga.

1.2 Plan Development and Review

This plan has been produced under the leadership of the National Tsunami Working Group and endorsed by the National Emergency Management Committee (NEMC).

The core members of the National Tsunami Working Group comprise of the Tonga Meteorological Services (TMS), The National Emergency Management Office (NEMO) and Geological Survey Unit (GSU). Other members are called upon from time to assist in the work of the working group as required by the Emergency Management Act 2007.

The plan is to be reviewed regularly and following each tsunami event that affects Tonga. The responsibility for coordinating the review of this plan rests with the Ministry of Infrastructure.

1.3 Plan requirement

The development of this plan is a requirement under Section 28 (a) & (b) of *the Emergency Management Act 2007 and the National Emergency Management Plan 2007 (Specific Threat).*

1.4 Definitions

Local tsunami (peaukula fakalotofonua) - refers to a tsunami generated from a nearby source normally within 100km.

Regional tsunami (peaukula fakafeitu'u) - refers to a tsunami generated near a source which is generally more than 100km but less than 1000km away.

Response agency (kautaha pe potungaue kuo tu'utu'unia hano fatongia ngaue kiha fakatamaki) - means the agencies which are tasked with responding to emergency situations under the Tonga Emergency Management Act 2007 and National Emergency Management Plan.

Response agency plan (palani ngaue 'o ha kautaha pe potungaue kuo tu'utu'unia hano fatongia ngaue kiha fakatamaki)- means the Agency's Emergency Response & Business Continuity Plan as stipulated in Part C of the National Emergency Management Plan (NEMC).

Tsunami (peaukula) - refers to a series of travelling waves of extremely long length generated by earthquakes occurring below or near the ocean floor, volcanic eruptions, meteorites and landslides

Distant or Tele-tsunami (peaukula fakamamanilahi) - refers to tsunamis originating from a far away source more than 1,000km away.

Urgent Tsunami Alert (fanongonongo ke tokateu fakavavevave na'a hoko ha peaukula) - refers to an alert to the public and all response agencies informing that a shallow (≤70km in depth) earthquake of 6.8≤M<7.6 magnitude has occurred within the EEZ of Tonga and reported from PTWC or GSU or any verified source (or estimated Intensity 8 on Mercalli intensity scale by direct observation) but it is not yet known whether a tsunami wave has been generated.

Tsunami Warning (fakatokanga peaukula) - refers to confirmation that a tsunami has been generated and that a warning is in force.

Urgent Tsunami Warning (fakatokanga peaukula fakavavevave) - refers to a warning that is in force following a felt shallow earthquake (≤70Km depth) or 7.6M or more verified from GSU within the Tonga EEZ before any information is received for PTWC or observed intensity of 9 or more on the Mercalli Intensity scale. This warning is based on the magnitude, depth and intensity of the earthquake alone with no verification that any tsunami wave has been generated.

Local Information Bulletin (fakamatala mofuike fakalotofonua) - refers to an alert of an earthquake greater than or equal to magnitude 4.5 and less than or equal to 6.7 with the depth of ≤70km within the Tonga EEZ. Local Information Bulletins will be issued by the TMS in consultation with the GSU unit, USGS and PTWC and will be distributed to members of the NEMC as a watch only and not to the general public. Warnings may follow.

Tsunami Information Bulletin (fakamatala mofuike fakavaha'apule'anga) - an alert of an earthquake ≥6.5 issued by the PTWC for anywhere in the world. This message will be distributed to the NEMC as information only and not to the general public.

Cancellation (kaniseli o ha fakatokanga ke tokateu pea ha fakatokanga peaukula) - refers to the cancellation of any tsunami warning or alert which has been issued earlier.

All Clear (fanongonongo fakaataa ke foki ki 'api) - message is issued by the National Controller through NEMO to inform people that the threat or hazard has now passed and it is safe to return home. However, all safety precautions should be taken when moving back.

1.5 Plan Objectives

This National Tsunami Plan aims to achieve the following:

(a) To assist the coordination of the Tonga Meteorological Service, the National Emergency Management Office and the Geological Unit in the issuance and dissemination of tsunami warnings and alerts for Tonga.
(b) To provide a guideline to all communities and response agencies on tsunami warning and alert procedures and how to respond to a tsunami event.
(c) To minimize the impact of tsunami hazards in Tonga.

These objectives are achieved by:

(a) Fulfillment of roles and responsibilities outlined in this plan and the National Emergency Management Plan 2007.
(b) Implementation of agreed strategies, activities and programmes at all levels
(c) Implementation of response agency plans and activities
(d) Implementation community-based programmes supported by response agencies
(e) Frequent tsunami response simulations or exercise to be coordinated and monitored by the NEMO in collaboration with the NEMC.

2. TSUNAMI RISK PROFILE

2.1 Tsunami risk in Tonga

Tsunami risk in Tonga is rated as “extreme”. This is because Tonga’s Islands lies about 200km west of the Tonga Trench fault zone, where the Pacific Tech-tonic Plate sub-ducts beneath the Indo-Australian Plate on which the Tonga Islands are situated.

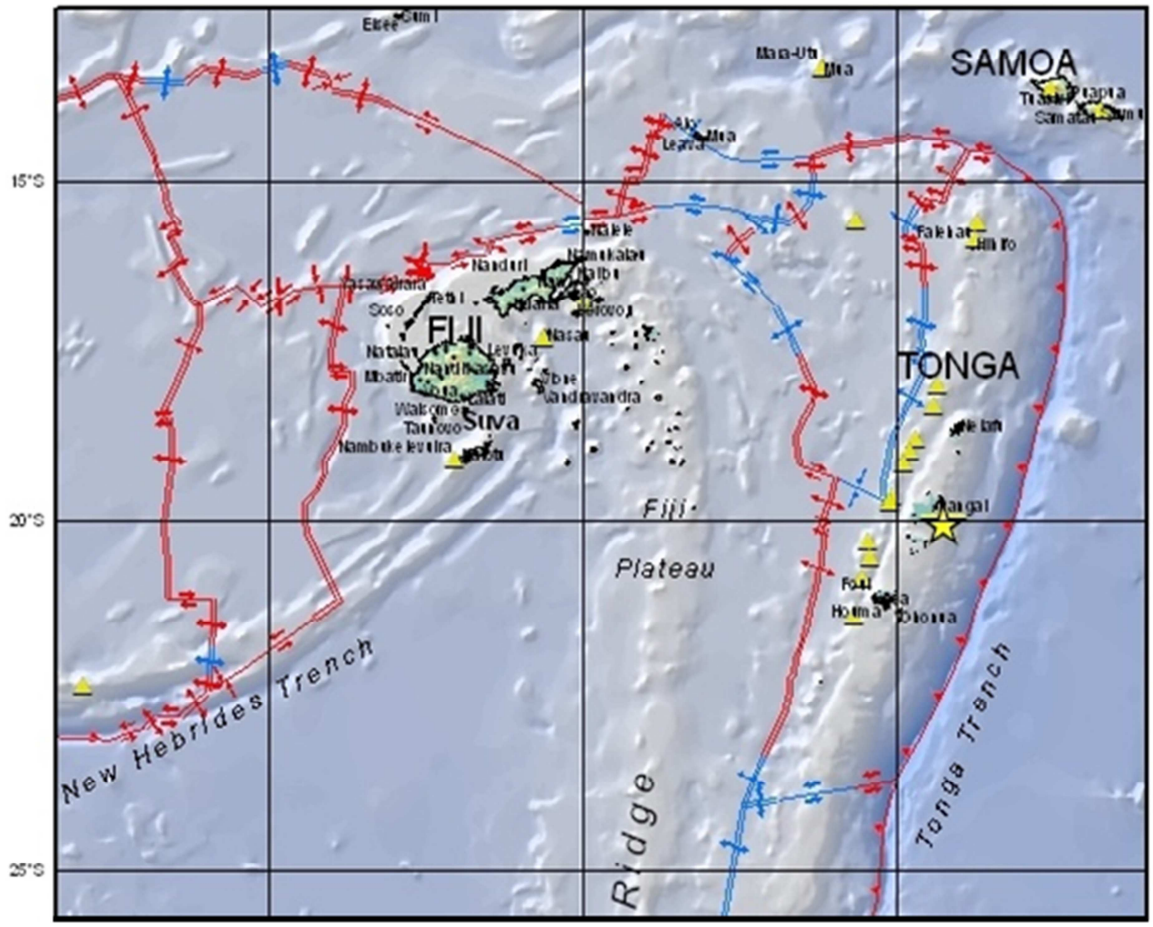


Figure 1: The populated islands of Tonga lie 200km west of the Tonga Trench (Indo-Australian/Pacific Tech-tonic plate boundary) and about 50km east of the volcanic arch which are local and regional tsunami source areas.

The Tonga Trench and Volcanic arc are potential sources for a fault or undersea landslide caused by an earthquake or volcanic eruption to occur, which could generate a tsunami.

The main areas at risk from tsunami are all low-lying coastal areas of the inhabited islands of Tonga.

2.2 Historical tsunami that have affected Tonga

Historical accounts and records indicate that some 10 tsunamis have affected the Tonga islands in recent history. An earthquake in 1919, located close to Tonga, apparently caused tsunami waves of 2.5m in the Ha'apai Group. Three tsunami waves caused by the 1977 earthquake were recorded. More recently, the Great Samoa/Tonga Earthquake of September 2009 (8.3 earthquake) near Niuatoputapu caused a major tsunami with waves reaching 17 meters as they hit the island, resulting in 9 deaths, 60 percent of houses destroyed and extensive damage to infrastructure with seawater inundating 50% of the island.

Table 1 below shows tsunami events that have affected Tonga

Year	Date	Cause	Source	Comments
1853	24 Dec	Tech-tonic	Tongatapu Island	Changes in land level and flooding
1855	17 Nov	Tech-tonic	Tonga Islands	1 meter wave height at reported Tau near Tongatapu
1881	24 Nov	Tech-tonic	Tonga Islands	Land subsided but no tsunami reported
1901	9 Aug	Tech-tonic	Tonga Islands	No information on extent of damage
1908	1 Jan	Volcanic	Tonga Islands	Submarine volcano eruption but extent of damage not known
1919	30 Apr	Tech-tonic	Tonga Islands	2.5m wave height in Ha'apai and no information of damage from other islands
1928	19 May	Volcanic	Ha'apai Islands	Earthquake felt, tsunami wave appeared and pumice littered the shores
1948	16 Sep	Tech-tonic	Tonga Islands	Small Pacific wide tsunami recorded
1963	10 Dec	Tech-tonic	Tonga Islands	Strong swell reported in Tahiti
1968	25 Jul	Tech-tonic	Kermadecs Is	0.1 m tsunami recorded in Suva
1977	2 Apr	Tech-tonic	Tonga Trench	3 tsunami waves observed
2009	30 Sep	Tech-tonic	Niuatoputapu	17 meter waves washed up in Niuatoputapu and Tafahi Islands in Northern Tonga killing 9 people

Table 1: Near source tech-tonic and volcanic generated tsunami events that have affected Tonga in recent times.

2.3 Tsunami Impacts

Tsunami are a serious threat for Tonga's socio-economic, natural and built environment given that 80% of Tonga's population and infrastructure are located on low lying coastal areas including the capital of Nukualofa, the center of commerce and economic activity.

2.3.1 Human and Social Impacts

Due to the strength and speed of tsunami waves and their ability to cause structural damages as well as carrying debris, many people can die or become injured. For locally generated tsunamis, there is little or no time to warn the coastal communities and given that the coastal communities are located close to the shoreline any tsunami can cause mass casualties and/or fatalities.

People also become traumatized due to the loss of life or property as well as the financial implications of reconstruction or rehabilitation. Tsunami survivors may be psychologically affected over a long period of time.

In worst case scenarios, the functionality of village social structure can also be affected as individuals and families primarily focus on their own recovery from a tsunami event; it may take some time to recognize social structures within village communities.

2.3.2 Impacts on the Economy and Environment

The primary source of locally generated income for Tonga comes from agriculture, fisheries and tourism. These sectors are highly vulnerable to tsunami. Tsunami impact also has the capability to cause extensive damage to coastal infrastructure which the primary sectors are depended on.

Tonga's natural environment could also be affected by tsunami. The beauty of beaches and natural coastal features are highly vulnerable with risk of coastal or land erosion.

3. TSUNAMI RISK REDUCTION ARRANGEMENTS

Part B of the *National Emergency Management Plan 2007* sets a general framework for disaster risk reduction. This section lists the measures to reduce Tonga's risks and vulnerabilities to main hazards including tsunamis; some of these measures are currently implemented through government and non-government organizations' risk reduction programmes.

3.1 Tsunami risk analysis of development projects

It is encouraged that tsunami risk analysis be included in Environment Impact Assessments for all new developments projects and that appropriated mitigation measures are incorporated into the design of such projects.

For existing developments, appropriate retrofitting programmes should be considered. In addition tsunami contingency plans should be prepared for occupants and users.

3.2 Tsunami Risk Signs

Tsunami risk signs should be strategically placed to forewarn residents of coastal village communities and users of public infrastructure and services within the low-lying coastal areas. District and Village Emergency Management Committees with the assistance of NEMO should play a leading role in the design, installation and ownership of these signs in each coastal village community.

3.3 Evacuation Routes, Safe Zones and Shelters

Tsunami inundation maps should be prepared to determine high risk areas and guide the preparation of evacuation routes and identification of safe zones. The preparation of accurate tsunami inundation maps is the responsibility of the Ministry of Lands, Survey and Natural Resources.

Evacuation routes and safe zones should be clearly marked and made known to all residents of villages and users of public infrastructures and services within these coastal areas. The preparation and erection of tsunami risk signs and identification of strong and safe buildings to shelter evacuees, as well as informing residents of safe evacuation routes shall be coordinated by NEMO and assisted by the relevant agencies and stakeholders.

4. PREPAREDNESS ARRANGEMENTS

Part C of the *National Emergency Management Plan 2007* details preparedness arrangements to be implemented at the national and community level for any disaster. The following sub-sections provide specific preparedness arrangements for tsunami.

4.1 Public Awareness

Information delivery on the nature of tsunamis including safety procedures and preventative measures should be ongoing and coordinated by the Community Awareness and Education Programme of NEMO.

4.2 Tonga Tsunami Early Warning Systems

At present, there is no comprehensive tsunami warning system in Tonga. However, a process is in place for the development of a tsunami warning system. The warning process includes consideration of the following:

(a) Detection – the hazard is observed, analysed, monitored and threat assessed.

(b) Warnings – to ensure warnings are accurate, timely produced and easy to understand

(c) Dissemination – to ensure that warnings are disseminated through most effective means available to ensure delivery to response and the public in a timely manner.

(d) Response – to ensure authorities and communities are able to respond effectively to save lives and properties.

4.2.1 Detection, Observation and Monitoring Network

4.2.1.1 Seismic Network

Tonga has five stations in its national seismic network located on Tongatapu, Vava'u, Ha'apai and the Niuatoputapu and Niuafo'ou. The maintenance of these stations are the responsibility of Geological Services Unit (GSU of the Ministry of Lands, Environment, Climate Change and Natural Resources (MLECCNR) with some assistance from the Tonga Meteorological Services on Niuafo'ou and Niuatoputapu. The data collected from the Tonga-Fiji seismic network are analyzed by GSU to determine earthquake parameters. In the event of a local earthquake, GSU is responsible for providing earthquake parameters including its location, magnitude, depth and intensity to TMS and NEMO. It has a lead role is assessing a tsunami threat for Tonga.

4.2.1.2 Tide Gauge & Dart Buoys

There is only one tide gauge located at Queen Salote Wharf. This gauge is part of the South Pacific Sea Level Rise and Climate Monitoring Project funded by the Government of Australia. The data from this gauge inputs directly to the Australian Bureau of Meteorology via satellite link where it is processed automatically before near real time data can be accessed locally via internet.

Three coastal gauges located in the Tonga are managed by the Joint Australia Tsunami Warning Centre (JATWC). These are Nukualofa, Tonga Trench (west) and South of Minerva Reef.

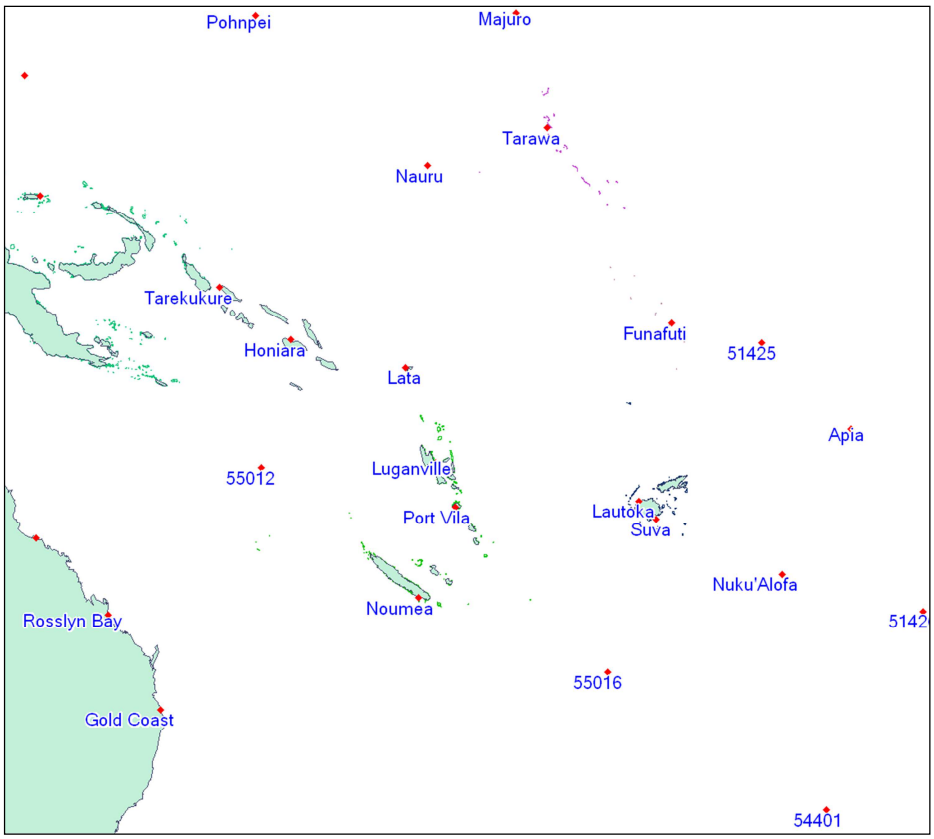


Figure 2: Coastal sea-level gauges and DARTS as of July 2010.

4.2.2 Tsunami Warning Service for Tonga

At the present time, if an earthquake occurs that can or has triggered a tsunami that may affect Tonga, the Pacific Tsunami Warning Centre (PTWC) will issue a warning to the Tsunami Warning Focal Point (TWFP), the official agency responsible for receipt of the warning message.

The Tsunami Warning Focal Point for Tonga is the Tonga Meteorological Service and is responsible for initiate warnings in collaboration with key local agencies including the National Emergency Management Office (NEMO) and the Geological Survey Unit of the Ministry of Lands, Survey and Natural Resources. The Tonga Meteorological Service operates on a 24hrs basis and maintains a constant tsunami watch and is designated as the National Tsunami Warning Centre.

For warnings against distance tsunami, TMS will rely on receiving (VIA EMWIN) and disseminating warnings from the PTWC and other Centers in collaboration with NEMO and the GSU. However, due to the eminent dangers and urgencies of disseminating warnings associated with local tsunami and the likelihood that warnings from PTWC will not be received on time to issue warnings for Tonga, the following table sets out the warning criteria for local tsunami.

Earthquake	Product type	description
4.5 ≤ M ≤ 6.7 Magnitude and shallow (≤ 70km) within Tonga's EEZ	Local information bulletin	Issued to response agency members only
≥ 6.8 ≤ 7.5 Magnitude and shallow (≤ 70km) OR Mercalli Intensity ≥ 8 observed directly within Tonga's EEZ	Urgent tsunami Alert	Issued to whole of Tonga
≥7.6 and shallow (≤70km) OR Mercalli Intensity ≥ 9.0 observed directly within Tonga's EEZ	Urgent tsunami warning	Issued to whole of Tonga

Table 1: Criteria for issuing alerts and warnings for local tsunami

4.2.2.1 Warnings associated with Local and Regional Tsunami

When an earthquake is felt with significant shaking or there are signs of a volcanic eruption, or it causes the ocean to recede quickly, people should move immediately in land and then to higher ground without waiting for an official warning. Often it is not possible to issue an official warning for a local tsunami. A local tsunami or a relatively nearby centered regional wave may arrive at a coast within minutes of an earthquake.

Nonetheless, the TMS will attempt to issue a warning immediately after a significant earthquake is felt in accordance with the criteria stipulated in Table 1 or observed from the national seismic network operated by GSU. It will do the same for violent volcanic eruptions when such events are reported or observed.

4.2.2.2 Warnings Associated with Distant or Tele-Tsunami

Upon receiving a PTWC bulletin that carries a “watch” or “warning” for Tonga, the TMS and NEMO will make immediate contact with the GSU. They will jointly carry out an assessment of threat for Tonga and determine whether to maintain a watch, cancel or issue warnings.

In the event a warning is warranted, TMS will activate the NTWC and issue the warnings. NEMO will follow up on the warnings with appropriate public advisory messages on preparedness measures and any necessary evacuation response or otherwise.

If a tsunami information bulletin (TIB) is issued by PTWC then it shall be relayed by the TMS to members of the NEMC for information only. A TIB is a one off bulletin and will be followed by either a warning if a tsunami eventuates or nothing at all if no tsunami eventuates.

4.2.2.3 Frequency of Warnings

All warning bulletins will be generally updated and issued hourly, unless information becomes available to warrant earlier updates.

4.2.2.4 Tsunami Warning Cancellation

TMS will issue a “Warning Cancellation Message” upon advice from PTWC, or once it is ascertained that threat from a local tsunami is over.

4.2.2.5 All Clear Message

Upon receipt of “Warning Cancellation Message” from TMS, NEMO will assess the threat and situation on the ground, and will issue an “All Clear Message” advising people that they may return to their homes or place of work.

4.2.3 Pacific Tsunami Warning Center (PTWC) Bulletins

The Pacific Tsunami Warning Centre (PTWC) in Hawaii provides regional tsunami warning and advisory services covering all Pacific countries including Tonga. TMS is the main agency to receive the PTWC bulletins because of its 24/7 capability. However, the bulletins are simultaneous received by GSU and are required to advise and coordinate with the TMS/NEMO when PTWC Bulletins are received. Bulletins are received via, fax, EMWIN, SMS & email.

4.2.4 Warning Contingencies

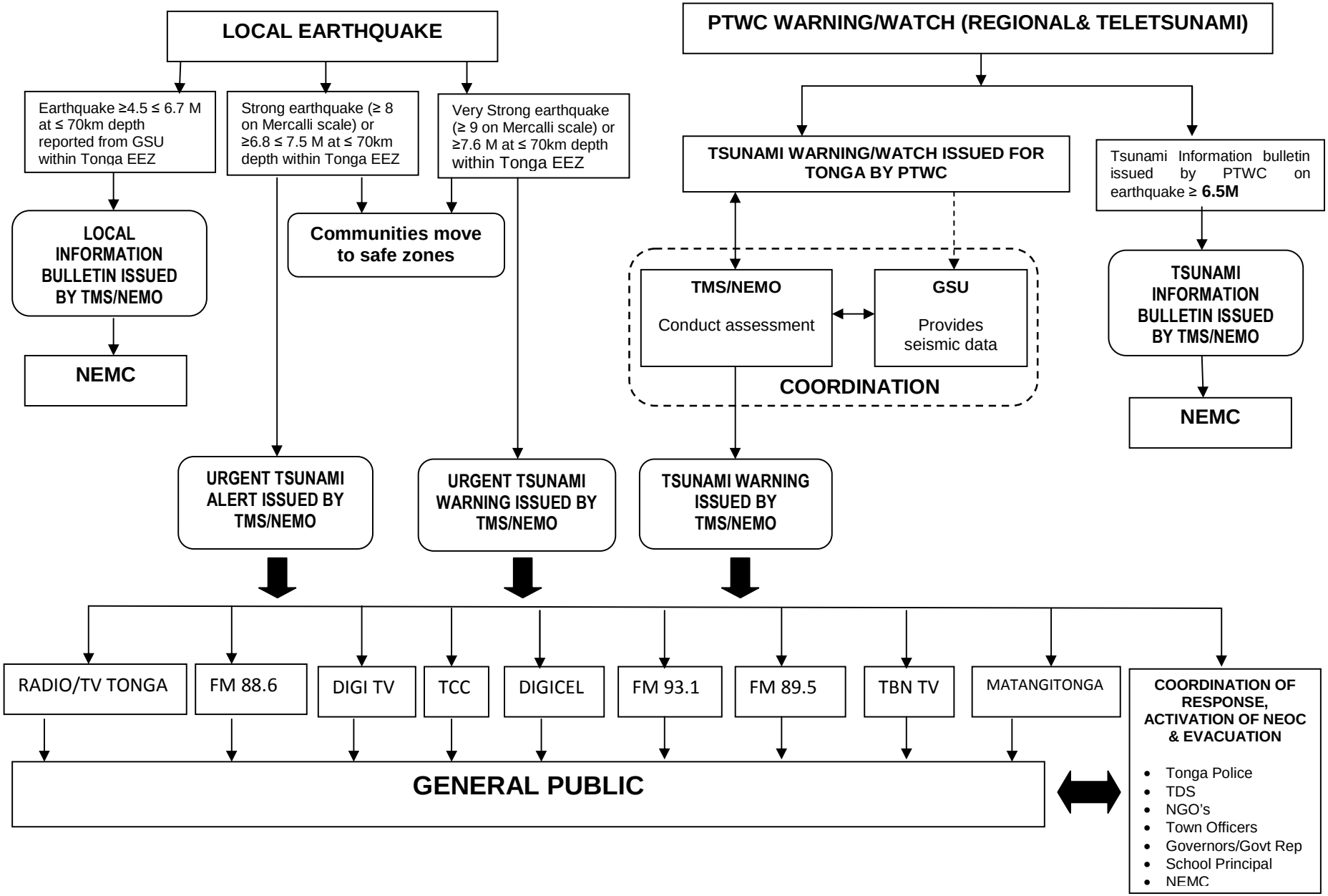
In the unlikely event that the Pacific Tsunami Warning Centre fails for reasons beyond their control, the West Coast/Alaska Tsunami Warning Centre (WCATWC) will issue warnings for the Pacific Basin including Tonga.

During emergencies and unlikely failures in the warnings system, the TMS/NEMO and GSU will act on information on hand and any available information available from other regional centers such as the JATWC or the Japan Meteorological Institute.

4.2.5 EEZ Limits defined

For the purposes of this plan the EEZ is defined as Tonga’s Maritime Boundary bounded by the following coordinates 173 deg W, 15 deg S to 173 deg W, 23 deg 30 min S to177 deg W, 23 deg 30 min S to 177 deg W, 15 deg S as per Figure 3 in Appendix III.

TONGA TSUNAMI WARNING SYSTEM FLOW CHART



4.3 Warning Dissemination

Warnings will be disseminated by TMS/NEMO through the most effective and practical means of communication through relevant media and available telecommunication networks. These include will include delivery by:

(a) Facsimile
(b) Telephone
(c) Email
(d) Websites (TMS & Ministry of Information and others).
(e) Short Text Message (SMS) by UCALL and DIGICEL to pre-selected disaster representatives as well as the key personnel of responding agencies and members of the NEMC.
(f) AM Radio A3Z and All FM RADIO to reach as wide a public as possible
(g) Tsunami siren activation where available.

4.4 Warning Response

Response to warnings will be coordinated by NEMO which will ensure activation of siren systems where available and coordinate government and public response.

Upon receipt of warnings:

1) Governors and Government representatives are required to activate their Island Emergency Management Committee.
2) Town Officers are required to activate their Community Disaster Plans.
3) Heads of Government Ministries are required to activate their Agency Response Plans.
4) School Principals are required to activate their School Evacuation Plans.
5) Private Sectors are required to activate their Business Continuity Plans.

4.5 Simulations and Exercises

The TMS/NEMO in collaboration with and GSU and relevant agencies will organize and conduct tsunami simulations regularly. The Simulations should aim at testing the following:

(a) Early Warning System
(b) Standard operational procedures
(c) Island, community and agency response plans
(d) Communication systems
(e) Coordination of response agencies

5. EVACUATION AND SHELTERING

Evacuation centers should be pre-determined within the Tsunami safe zones and appropriate personnel identified to manage when activated. This may include Town Officers, District Officers, School Principals and Church Leaders. In instances of mass evacuation from high risk areas, NEMO will enlist the services of Tonga Police and Tonga Defense Service and other relevant agencies to control movement of people and traffic to safe zones. Police will be also deployed to provide safety and security to evacuees.

All evacuees MUST NOT return to their homes unless an “All Clear” notice is given indicating that it is safe to return home. If the emergency period exceeds more than eight hours than food and water should be provided to the evacuees. The provision of food and water is the responsibility of the residents.

6. RECOVERY ARRANGEMENTS

After any tsunami event, the recovery provisions of the National Emergency Management Plan and the National Recovery Plan immediately applies.

APPENDIX I - FUNCTIONS REQUIRED DURING A TSUNAMI EVENT

Ref	Function	Lead Agency	Role	Support Agency	Role
1.	Issuing local tsunami information bulletins or urgent alerts or warnings	Meteorology and Emergency Management Division, Ministry of Infrastructure	-Receive tsunami Information bulletin and/or warning or watch from PTWC -Make Mercalli estimate	PTWC GSU NEMO	Provide tsunami information bulletins, and or urgent tsunami alerts or warnings and ensure consultation with TMS
2.	Calculation of local parameters and verification	Geological Survey Unit (MLECCNR)	-Calculate local parameters -Assess threat -Determine possible impacts -Verify the information received	TMS/NEMO	Receive advice on tsunami threat and likely impact.
3.	Issuance of Tsunami warning/watch/advisory/cancellation	Meteorological Division, (Ministry of Infrastructure)	-Prepare and issue local tsunami bulletin to media, TCC and DIGICEL and NEMC and NEOC	Radio Media Internet Media TCC/DIGICEL NEMO	Broadcast/disseminate the Tsunami warning immediately
4.	Alert Response Agencies and public	TMS/NEMO, TCC, Digicel Local Media	Send text messages, advice NEMC, National Disaster Council, District & Village Committees and Responding agencies	-Church Minister -School representative -Government Representatives -Hotel/Motel/Beach Resorts -Fire & Emergency Services -Ports Authority -Airport Authority -All response agencies -District/Town Officers -District Emergency Committees -NGOs	- Ring church bell fast & continuous - Ring school bell fast & continuous - use word of mouth to alert families & neighbors - use word of mouth to inform staff & tourists - activate siren to run continuously - carry out response functions

APPENDIX II: TSUNAMI SAFE PROCEDURES AND RULES

1. Tsunami's have occurred in Tonga in the past and can occur in the future.

2. All earthquakes do not cause tsunamis, but many do. When you hear that an earthquake has occurred or feels a strong shake from an earthquake, prepare for emergency evacuation.

3. An earthquake in your area is one of nature's tsunami warning signals. If you are a the coast and you feel a very strong earthquake shaking leave immediately and head inland to higher ground.

4. Tsunamis are sometimes preceded by a noticeable fall in sea level as the ocean recedes. A roar like an oncoming train may sometimes be heard as the tsunami wave rushes toward the shore. These are also nature's tsunami warning signals.

5. A tsunami is not a single wave, but a series of waves. Stay out of danger areas until an "all-clear" is issued by competent authority.

6. A small tsunami at one point on the shore can be extremely large a few kilometers away. Don't let the modest size of one make you lose respect for all.

7. All warnings to the public must be taken very seriously, even if some are for non-destructive events. The tsunami of May, 1960 killed 61 people in Hilo, Hawaii because some thought it was just another false alarm.

8. All tsunami like hurricanes are potentially dangerous, even though they may not damage every coastline they strike.

9. Never go down to the shore to watch for a tsunami if there is a warning. When you can see the wave you are too close to escape it.

10. Never try to surf a tsunami; most tsunamis are like flash flood full of debris and they do not curl or break like surfing waves.

11. Most of tall buildings and concrete complexes are located in waterfront for better view. The upper floors can provide a safer place for refugee if you are slow to move inland that quick. This procedure is not recommended for a small and wooden buildings that sometimes would not withstand the might of the tsunami impact.

12. If you are in a boat at sea move to open and deep (depth of 400m is recommended) ocean. In a local tsunami, make sure to leave your boat behind and head for higher grounds. Contact ports authorities to verify the condition before navigation and berthing.

13. Sooner or later, tsunamis visit every coastline in the Pacific and other oceans. If you live in any coastal area, be prepared and know nature's tsunami warning signs.

14. During a tsunami emergency, the National Emergency Management Office, Ministry of Police and other emergency organizations will try to save your life. Give them your fullest cooperation.

15. Do not wait for an official warning before evacuating as there may not be enough time to issue one.

16. A tsunami is a series of waves that can come ashore for hours and the first wave is not necessarily the largest or most deadly.

17. After the tsunami stay out of the danger area until an “all-clear” is issued by national competent authority

Preparedness Actions:

Before a tsunami:

- Find out if your home, school or office is in a danger area by knowing the distance it is from the coast. Inundation charts are currently being developed for Tonga but as a rule of thumb. You are in a tsunami danger area if your house is within 1mile from the coast.

- If you live, work or go to school in a low lying area – for instance near the beach learn the quickest way to get inland and to high ground. A tsunami safe area would be at least 30m above sea level and 3km inland. Teach and practice your evacuation plan with all family members and work colleagues.

- Ensure that all family members, students and work colleagues know how to detect natural tsunami signs.

- Discuss tsunami with your family, friends, students and work colleagues.

- Develop an emergency plan in the event that family members are separated (e.g. during the workday when adults are at work and the children are at school). Agree on a close friend or relative that should be contacted if children cannot reach their parents and vise-versa.

Gather disaster supplies:

- Flashlight and extra batteries
- Portable, battery-operated radio and extra batteries
- First aid kit and manual
- Emergency food and water (at least a 3-day supply)
- Medication for chronic conditions
- Cash

During a Tsunami

Sensing a Tsunami

Tsunamis are often accompanied by natural signs that can be sensed by an alert person. Recognizing **any** of these tsunami warning signs at the beach or coast may save your life.

FEEL

Do you feel the ground shaking strongly? Strong earthquakes at the coast may cause tsunamis. If you feel a strong earthquake RUN inland to high ground after the shaking stops, Do not wait for an official warning to be issued. You may have less than 10 minutes before the first tsunami wave arrives.

SEE

Do you see an abnormal withdraw of water? As a tsunami approaches land the ocean may pull a long way from the shore, exposing the ocean floor, reefs and fish. RUN inland and to high ground if the sea withdraws abnormally.

HEAR

Do you hear a strange roar? A roaring sound from the ocean is sometimes heard before a tsunami arrives. RUN inland and to high ground if you hear the roar.

- Sometimes tsunami may occur without the initial withdrawal of the sea. In this case, a massive wall of water maybe seen approaching land.
- If you are unable to move to higher ground go to an upper floor (3rd storey or higher) or roof of a building. As a last resort, climb tree e.g. coconut tree if trapped on low ground
- If swept by a tsunami, look for something to use as a raft.
- Abandon belongings. Save your life, not your possessions.
- Never go down to the beach to watch for a tsunami. If you see the wave, you are already too close to outrun it.
- A tsunami is not a single wave, but a series of waves that can come ashore for hours
- The first wave may not be the largest. During the Indian ocean tsunami it was the second wave that killed people, not the first.
- Heed official warnings. Play it safe, even if warnings seem ambiguous or you think the danger has passed.
- Stay out of danger zones until an “all clear” is issued by a recognized authority e.g. your National Disaster Organisation.

- If possible, listen to the radio for official updates and instructions.
- Have the telephone number for your National Disaster Organisation at hand.

After a tsunami

- Stay tuned to a battery operated radio for the latest emergency information
- Help injured or trapped persons and person requiring special attention (infants, elderly people and people with disabilities)
- Do not move people with serious injuries unless they are in immediate danger of fatal injury
- Stay out of damaged buildings. Return home only when authorities say it is safe to do so
- Shovel mud while it is still moist to give walls and floors an opportunity to dry
- Check for electrical shorts and live wires. Never attempt to move live wires
- Check for gas leaks
- Keep out of stagnant water
- Open windows and doors to help dry buildings
- Check for damage to sewer and water lines
- Check food supplies and have tap water tested by the local health department if possible. If not boil all water before you can confirm that the water is safe.
- Fresh food that has come into contact with the flood water and should be discarded
- Expect the waves to leave debris. A tsunami will leave behind sand, the remains of houses and bodies
- Expect earthquakes to lower coastal land. A large earthquake can leave nearby coastal areas lowered allowing tidal water to flood them.

APPENDIX III - LIMITS OF TONGA'S EEZ USED IN THIS PLAN

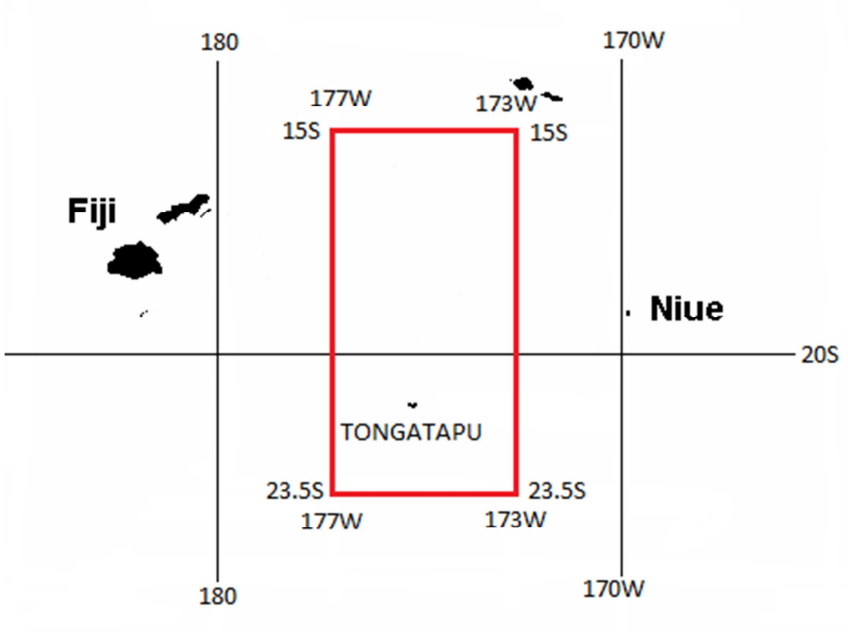


Figure 3: Definition of Tonga's EEZ used in this plan