SOPAC Member Countries National Capacity Assessments:

Tsunami Warning and Mitigation Systems

Samoa

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SOPAC

1. Results Outline

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1.1. Executive Summary

The National Capacity Assessment of Pacific Islands Applied Geoscience Commission (SOPAC) Member Countries: Tsunami Warning and Mitigation Systems project aims to work in collaboration with the member countries of SOPAC to assess their capacity to receive, communicate and respond effectively to tsunami warnings. The Tsunami Capacity Assessment of the ability of the Independent State of Samoa (hereafter referred to as "Samoa") to receive, communicate and effectively respond to tsunami warnings took place in a workshop held from 28 April – 1 May 2008 in Apia, Samoa.

The workshop was facilitated by a team of visiting experts and attended by some twenty Samoa Government agency representatives, Non-Government Organisations (NGOs), regional and international organisations and the private sector to discuss key areas of tsunami warning and mitigation in Samoa by completing a comprehensive questionnaire in session, presentations and site visits.

As well as outlining Samoa's current status, strengths and opportunities for improvement with regard to tsunami warning and mitigation, a list of recommendations were formulated by the Visiting Assessment Team in consultation with national participants. The aim of these recommendations is to guide further capacity development programs to target ongoing improvements in Samoa's tsunami warning and mitigation system.

Samoa's National Tsunami Plan (2008, D5, D5.1) states that anecdotal evidence indicates a total of 60 tsunami events have been recorded in Samoa between the years 1937 and 1980. Samoa is susceptible to tsunami from local, regional and distant sources. The Tonga trench, lying to the south of Samoa, is the country's most significant regional source of potential tsunami (Thomas and Burbidge, 2009). In its National Disaster Management Plan (NDMP, 2006, D1) and National Tsunami Plan (2008, D5, D5.1), Samoa has rated tsunami, as an "extreme risk". The National Tsunami Plan (D5, D5.1) states that "the main areas at risk of a tsunami are all low-lying coastal areas of the inhabited islands of Samoa; that is areas less than 10 metres above sea level". Samoa's national response to the Tonga Trench tsunami (May 2006) and the Solomon Islands tsunami (April 2007) were reviewed during the workshop to enable the Visiting Assessment Team gain an understanding of how Samoa's system operates in a real event.

Samoa's sound tsunami warning and mitigation system currently in place is underpinned by the country's Disaster and Emergency Act (2007, D3). The Act focuses on inter-agency cooperation, community awareness and engagement by high level political officials. The Act includes provisions for disaster risk reduction and preparedness in addition to emergency response. Other strengths of Samoa's current system include:

- A responsible agency for issuing tsunami warnings operating 24/7 under a comprehensive set of Standard Operating Procedures (SOPs);
- An active and effective Disaster Advisory Committee (DAC) and Disaster Management Office (DMO) exist, reporting to the National Disaster Council (NDC);
- A strong dissemination system to the population using Digicel and SamoaTel mass SMS broadcast in the first instance to key community leaders. The media, sirens, Church and school bells, boat horns and word of mouth are then used to reach the wider community;
- Samoa conducts regular tests of their tsunami warning system and follows up with appropriate evaluation;

- Response agencies are outlined in the NDMP and agency responsibilities for emergency response are clearly defined;
- Each response agency must prepare and implement a response agency plan;
- Mitigation projects such as Coastal Infrastructure Management Plans have already been completed for villages to assist in building the resilience of Samoa's coastal communities to natural hazards; and
- Community education and capacity building is being progresses through projects such as village Disaster Risk Management workshops (otherwise known as the "Village Program") which are planned to be rolled out in Samoa's 329 villages by the end 2013.

Participants in the workshop stated a number of priority areas for improvement that need to be addressed. Recurring themes included enhancement of seismic monitoring infrastructure, more funding for public awareness and relocation of the National Emergency Operations Centre (NEOC) to a safe location. In addition to ensuring maintenance of the strong current system already in place the workshop's resulting recommendations reflected the priorities raised by workshop participants. Very high priority recommendations made include:

- Investigate the permanent relocation of critical warning and response functions within Ministry of Natural Resources and Environment (MNRE) including the DMO and NEOC to a location outside of any likely tsunami impact;
- Investigate obtaining further resources to allow the Village Program to be completed within the designated timeframes (end 2013);
- That all agencies with key roles to play in the tsunami warning system be adequately resourced to carry out their legislated functions under the Disaster and Emergency Management Act and/or the NDMP;
- Continue development and implementation of tsunami public awareness and education in a multi-hazard context;
- That an analysis be undertaken on aspects of redundancy in the total tsunami warning system; and
- Continue the development of tsunami plans for local communities including warning and evacuation procedures.

Samoa workshop participants are encouraged to use this National Tsunami Capacity Assessment report to guide both national projects and aid funded projects to achieve targeted improvements on Samoa's tsunami warning and mitigation system. In turn, this will assist in improving systems for other high priority natural hazards.

Contingent on the availability of human and financial resources, the Bureau and project partners will aim to work with potential donors to bring the findings of this project to their attention on a country and regional scale. This will be done in the hope of further capacity development projects being undertaken.

1.2. Recommendations (including priority and resource intensity)

Table 2 outlines the priority and resource intensity for recommendations made to improve Samoa's tsunami warning and mitigation system. Both the priority and resource intensity are based on the consensus of the visiting Tsunami Capacity Assessment team after discussions held within the Tsunami Capacity Assessment Workshop. It is recognised that these rankings may not reflect the opinions of all individuals involved in the workshop as priorities vary depending on personal responsibilities and areas of interest. Each recommendation is important in its own right to achieve holistic improvements in Samoa's tsunami warning and mitigation system.

The priority ranking and resource intensity scale used as a basis for allocating a priority and resource intensity to each recommendation is explained in Table 1. The Very High priority recommendations should be seriously considered as requiring urgent completion. Low resource intensity recommendations are considered the 'low-hanging fruit' that are achievable with very few additional resources.

Table 1: Priority ranking and resource intensity scale

PRIORITY	RESOURCE INTENSITY
Very High	**Low –** Recommendation currently being progressed or could possibly be progressed within the capacity of existing in-country resources (funds and staff).
High	**Medium –** Recommendation could be progressed by existing staff or with a low to moderate number of additional staff and/or expertise and a moderate level of additional in-country funds. May or may not require external funding.
Medium	**High –** Recommendation would require a high level of additional staff and/or expertise and funds. External funding support is likely to be required.
Low	**Very High –** Recommendation would require a very high level of additional staff and funds. External funding support will be required.

Table 2: Priority and anticipated resource intensity for completion of recommendations made for improving Samoa's tsunami warning and mitigation system.

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Very High	Share the findings of this report with international and regional organisations (those based in Samoa and others) to provide guidance on targeting future capacity development programs and projects for tsunami and other hazards.	Low	Regional and International Coordination	Multi-hazard	5
Very High	Investigate obtaining further resources to allow the Village Program to be completed within the designated timeframes (end 2013). Through the Village Program, continue to collect traditional knowledge about tsunami and warning signals.	Low	Public and Stakeholder Awareness and Education	Multi-hazard	33
Very High	A back up Emergency Managers Weather Information Network (EMWIN) system be placed at the Fire Services for receipt of PTWC and other warning messages. **(Update May 2009 –** Samoa is currently in process of negotiating with National Oceanic and Atmospheric Administration (NOAA) for an additional EMWIN system expected to be located at the Fire Service).	Medium	Communications	Multi-hazard	18
Very High	Investigate the permanent relocation of critical warning and response functions within MNRE including the DMO and NEOC to a location outside of any likely tsunami impact. A strong possibility is co-location at the new Fire Service building. Also consider the safety of locations of Red Cross Disaster Relief Depots.	High	Tsunami Emergency Response (including evacuation)	Multi-hazard	22
Very High	Samoa continues to maintain and strengthen the tsunami warning system in place and that the benefits of implementation of improvements in the warning system be incorporated across all hazards where appropriate.	High	Governance and Coordination	Multi-hazard	1

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Very High	That all agencies with key roles to play in the tsunami warning system be adequately resourced to carry out their legislated functions under the Disaster and Emergency Management Act and/or the NDMP. In particular the DMO and Meteorology Division of the MNRE should closely analyse the resource requirements to maintain their functions effectively in the long term.	High	Governance and Coordination	Multi-hazard	2
Very High	Continue development and implementation of tsunami public awareness and education in a multi-hazard context including: **a.** Establishment of tsunami signage to international standards within populated coastal areas and tourism centres, such as the airport; **b.** Education on the operation of the tsunami warning system, procedures and expected community response; **c.** Education on environmental cues associated with local tsunami; **d.** Education after a tsunami event focused on the size of the event, impacts and reinforcing tsunami safety messages; **e.** Capitalising on existing regional and international education material; **f.** Development of programs tailored to groups such as maritime and tourism; and **g.** Provision of tsunami warnings and community awareness material on a website. **(Update May 2009** – Government improvement in July 2009 will improve internet speed).	High	Public and Stakeholder Awareness and Education	Tsunami specific	32

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Very High	That an analysis be undertaken on aspects of redundancy in the total tsunami warning system including: **a.** An efficient mechanism for informing and updating key disaster management agencies during an event; **b.** A backup process by which PTWC tsunami information arrives in the country; **c.** Regular cross checks to make sure key links in the warning chain are working; **d.** Development of a contingency plan to ensure warnings can be issued to the community should Meteorology Division staff be forced to evacuate or experience systems failure; and **e.** Backups to key power sources.	High	Tsunami Warnings	Multi-hazard	11
Very High	Continue the development of tsunami plans for local communities including warning and evacuation procedures. Preparation of these plans should include the production of evacuation maps and community consultation. When completed plans should be made available to the public and evacuation maps displayed in prominent locations within communities.	High	Tsunami Emergency Response (including evacuation)	Tsunami-specific	23
Very High	Consideration should be given to running an integrated messaging system that manages SMS, e-mail, fax and voice messaging that could be the database for all emergency contacts (including satellite phones), with the possibility of expanding this system to allow for public subscription. This system should maintain the details of active staff at all agencies their roles and operational status and be accessed by the web.	High	Communications	Multi-hazard	20

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	Continue to ensure regularly updated SOP documentation is made available to any person or organisation playing a part in the tsunami warning process and is shared between all agencies involved.	Low	Governance and Coordination	Tsunami-specific	3
High	To reduce community panic and maintain practiced operational systems and community awareness when there is a long time between events include in tsunami warning processes, issuing of "No threat" messages to the public and media for the following events: **a.** Tsunami that do not have the potential to threaten Samoa; and **b.** Under-sea and felt earthquakes that do not have the characteristics to generate a tsunami.	Low	Tsunami Warnings	Tsunami specific	15
High	Samoa MNRE Mapping Services Section, in collaboration with the Geophysics Section, complete an inventory of the geospatial data available for tsunami and multi-hazard hazard risk assessments, modelling and mapping of populated areas.	Low	Tsunami Hazard, Vulnerability, Risk and Mitigation	Multi-hazard	28
High	Continue active participation in the Southwest Pacific Tsunami Working Group (WG5) of the Intergovernmental Coordination Group (ICG) Pacific Tsunami Warning and Mitigation System (PTWS), Regional Meteorological Service Directors meetings and the Pacific Platform for Disaster Risk Management meetings, engaging Meteorological Division of MNRE as the responsible warning authority.	Medium (External assistance required)	Regional and International Coordination	Tsunami specific	4

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	That Samoa investigates the development of contingency plans that allow the issue of public warnings from another country thus building on lessons learned from the Tropical Cyclone Warning System.	Medium	Tsunami Warnings	Tsunami specific	10
High	Continue to develop and conduct national tsunami exercises which test emergency management arrangements at national and community level. Ensure each exercise is followed by an evaluation of the strengths and weaknesses of the tsunami system as well as recommendations for system improvements. Ensure these recommendations are implemented and that regular tsunami exercise regimes and exercise assessment processes are included in each agencies emergency response plan.	Medium	Tsunami Emergency Response (including evacuation)	Tsunami specific	24
High	Use the tsunami hazard studies that have been completed for the Southwest Pacific Nations to date, and any historical tsunami records (including physical evidence), to identify low-lying communities which may be potentially prone to tsunami impacts from all likely tsunami sources and commence tsunami mitigation, response and evacuation planning using local knowledge.	Medium	Tsunami Hazard, Vulnerability, Risk and Mitigation	Tsunami specific	27
High	Gain access to scenario based deep ocean tsunami modelling to assist in both risk assessment and warning decision making. Build the capacity within Samoa (the Meteorology Division and other relevant agencies) to analyse and use this tool.	Medium to High (for training requirements)	Tsunami Warnings	Tsunami specific	13
High	Continue plans to conduct a study into the interdependencies of critical infrastructure lifelines and services and incorporate this knowledge into the disaster planning process for all hazards.	High	Tsunami Hazard, Vulnerability, Risk and Mitigation	Multi-hazard	31

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	Continue to develop the mobile radio network to assist in communicating critical information to key individuals within the warning system. **(Update May 2009 –** The DMO has requested assistance from Australian Maritime for their High Frequency (HF) radio system. A Japan International Cooperation Agency (JICA) project is assisting the Weather Service to improve its radio (audio and e-mail). New Zealand (NZ) is assisting the Fire service with more repeaters for Ultra High Frequency (UHF)).	High	Communications	Multi-hazard	17
High	Continue the establishment of Samoa's seismic network ensuring the system meets the needs of Samoa's tsunami early warning system as well as shares seismic data internationally in real-time and suitable data formats.	Very High	Tsunami Monitoring Infrastructure	Multi-hazard	7
High	Continue the establishment of a volcanic monitoring capability within Samoa and evaluate the tsunamigenic potential of Samoa's volcanos.	Very High	Tsunami Monitoring Infrastructure	Multi-hazard	8
High	That existing last mile tsunami warning communication methods are strengthened (for example, implementation of an improved siren system attached to local fire stations).	Very High	Tsunami Warnings	Tsunami specific	12
High	Acquire the necessary baseline data for populated areas to fill identified gaps as part of a multi-hazard mapping activity. This will include acquiring high resolution topography (Light Detection and Ranging (LiDAR)) data of low-lying populated areas as well as high resolution bathymetry data for multi-hazard assessments, modelling and mapping (storm surge, tsunami, climate change).	Very High	Tsunami Hazard, Vulnerability, Risk and Mitigation	Multi-hazard	29

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Medium	That an analysis be undertaken of the key individuals within agencies who would benefit from the Pacific Tsunami Warning Centre (PTWC) Short Message Service (SMS) alert service and the existing service be extended to those people.	Low	Tsunami Warnings	Tsunami specific	14
Medium	Ensure all agencies with satellite phones have them permanently on and operating with fixed external antennas when phone is indoors.	Low	Communications	Multi-hazard	21
Medium	Develop a national disaster recovery plan that further outlines arrangements for recovery, including the coordination of welfare, public health and infrastructure reconstruction.	Low	Tsunami Emergency Response (including evacuation)	Multi-hazard	25
Medium	Consider how Samoa can move towards determination of different threat levels in their tsunami warnings. For example, marine only or land inundation.	Low	Tsunami Warnings	Tsunami specific	16
Medium	That the licence requirements for primary communications means on boats are changed to radio.	Medium	Communications	Multi-hazard	19
Medium	That the MNRE use remote sensing data (such as high resolution satellite images) for post disaster damage assessments.	Medium to High	Tsunami Emergency Response (including evacuation)	Multi-hazard	26
Medium	Continue to actively engage with regional and international agencies that can assist with conducting scientific research and technical capacity building to enable Samoa to fully utilise cooperative research. Develop a protocol to ensure copies of scientific research reports are received.	High	Research Expertise	Tsunami specific	6

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Medium	Samoa investigates access to Pacific sea level data for tsunami warnings via the Global Telecommunications System (GTS) or Bureau Registered User Website.	High	Tsunami Monitoring Infrastructure	Tsunami specific	9
Medium	Progress discussions with SOPAC regarding inundation modelling in Apia and investigate future, long-term options for completing tsunami inundation modelling for other large population and infrastructure centres. **a.** The long term aim is to conduct a comprehensive tsunami risk assessment and management study specific to Samoa. The risk assessment and management study should: **b.** Develop a comprehensive suite of hazard maps to assist planning; **c.** Be completed using a standard template that can be used in all areas and across all hazards; **d.** Include an assessment of all possible structural and non-structural management options; **e.** Investigate the incorporation of tsunami inundation and seismic hazard in land use planning instruments, in particular for critical infrastructure; and **f.** Feed findings into Samoa's national tsunami management strategy and community education.	Very High	Tsunami Hazard, Vulnerability, Risk and Mitigation	Tsunami specific	30