SAMOA
Post-Disaster Needs Assessment

Following the Earthquake and Tsunami of 29th September 2009

Government of Samoa

December 2009

THE WORLD BANK

GOVERNMENT OF SAMOA

GFDRR
Global Facility for Disaster Reduction and Recovery

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This Post-Disaster Needs Assessment (PDNA) is a joint initiative of a cross-agency group comprising the World Bank (WB), the Asian Development Bank (ADB), the United Nations International Strategy for Disaster Reduction (UN-ISDR), the United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP) working jointly with the Government of Samoa, and with technical support from the Global Facility for Disaster Reduction and Recovery (GFDRR)[1] and financial support from the Government of Australia. A number of multilateral and bilateral agencies and NGOs also made their each unique and outstanding contribution.

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Photographs used in this publication were taken by the assessment team unless otherwise indicated. To all of these contributors the team would like to express their deepest thanks and appreciation.

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ACRONYMS AND ABBREVIATIONS

CURRENCY AND EQUIVALENTS
Currency unit = Samoa Tala
US$1 = SAT$2.5
FISICAL YEAR
July 1-June 30

ADB	Asian Development Bank
AADT	Annual average daily traffic
AusAID	Australian Agency for International Development
CBS	Central Bank of Samoa
CIM	Coastal Infrastructure Management
DaLA	Damage and loss assessment
DLNA	Damage, Loss and Needs Assessment
DRM	Disaster Risk Management
EC	European Commission
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Production
GFDRR	Global Facility for Disaster Reduction and Recovery
GHGAS	Green House Gas Abatement Strategy
GOS	Government of Samoa
GWh	Giga Watt hour
HDI	Human Development Index
IFC	International Finance Corporation
IFRCC	International Federation for Red Crescent and Cross
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
kV	kilo Volt
LDC	Least Developed Country
LTA	Land Transport Authority
MAF	Ministry of Agriculture and Fisheries
MCIL	Ministry of Commerce, Industry and Labor
MESC	Ministry of Education, Sports and Culture
MFAT	Ministry of Foreign Affairs and Trade
MNRE	Ministry of Natural Resources and Environment

MOF	Ministry of Finance
MOH	Ministry of Health
MPMC	Ministry of Prime Minister and Cabinet
MWCSD	Ministry of Women, Community and Social Development
MWTI	Ministry of Work, Transport and Infrastructure
M&E	Monitoring and Evaluation
MVA	MegaVolt Ampere
MW	Mega Watt
NAPA	National Adaptation Programs of Action
NIP	National Implementation Plan
NGOs	Non-governmental Organizations
NZAID	New Zealand Agency for International Development
OFDA	Office of U.S. Foreign Disaster Assistance
PDNA	Post Disaster Needs Assessment
PUMA	Planning & Urban Management Agency
SAT	Samoa Tala
SBS	Samoa Bureau of Statistics
SDS	Strategy for the Development of Samoa
SRC	Samoa Red Cross
SPA	Samoa Ports Authority
STA	Samoa Tourism Authority
SWA	Samoa Water Authority
TA	Technical Assistance
UN	United Nations
UNEPRT	United Nations Emergency Preparedness and Response Team
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNCHR	United Nations Commission on Human Rights
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNICEF	United Nations International Children Emergency Fund
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
UN-ISDR	United Nations International Strategy for Disaster Reduction
US$	United States Dollar
USAID	United States Aid for International Development
USP	University of the South Pacific
WB	The World Bank
WFP	World Food Program
WHO	World Health Organization

EXECUTIVE SUMMARY

At 6:48am on the 29 September 2009, a powerful 8.0 magnitude earthquake close to the main Samoan Island chain with its epicenter 190 km south of the Samoan capital of Apia. This was followed only 10 - 20 minutes later by two tsunami waves that impacted American Samoa, The Independent State of Samoa, and the small northern island of Niuatoputapu in the Kingdom of Tonga. The highest swell of the water was reportedly 11m and caused unprecedented fatalities, and serious damage, to the affected Pacific Island countries.

The response from the Government of Samoa and the international humanitarian community was immediate, swift and efficient. Affected roads were cleared and recovered rapidly and light vehicles permitted into the areas whilst search and rescue efforts continued. The Samoan Government enacted emergency plans quickly and mobilized the police and other emergency response unities. With support from the Australian and New Zealand military and disaster relief teams the Government provided medical facilities, tents and clean water. Strong social networks responded effectively, despite the devastation, and many homeless were accommodated by family and friends.

There have been 143 reported deaths and a further 5 missing and 310 seriously injured. An estimated 5,274 people about 1 out of 50 Samoans have been affected, mainly on the southern, eastern and south-western coast of Upolu Island.

SUMMARY OF DAMAGE AND LOSSES

The total value of the disaster effects caused by the tsunami in Samoa is estimated at SAT$310.11 million (US$124.04 million). This would be equivalent to more than 22 percent of Samoa's Gross Domestic Product (GDP). Despite affecting a relatively limited geographic area of the country, the economic impact of the tsunami was considerable especially because of the tourism significance of the affected area and the damage caused to the transport infrastructure by the coast.

Of the total disaster effects, an estimated SAT$212 million (US$84.8 million) refers to the value of the destruction or damage to physical assets existing in the affected areas, and an additional SAT$98.16 million (US$39.26 million) represents losses in the flows of the economy that are expected to occur in the country over the next couple of years as a result of the temporary absence of the destroyed assets.

The share of the private sector of the total value of damage and losses is estimated at two thirds of the total (SAT$200.7 million or US$80.28 million), while the share of the public sector is estimated at one third of the total (SAT$109.42 million or US$43.77 million). This is a measure of the damages and losses to each sector and could be viewed as an initial starting point to assess the relative efforts that each sector must

bear in the post-disaster recovery and reconstruction activities. Nonetheless, it is clear that the government would be expected to assist in the funding of several initiatives that follow on damages and losses to the private sector, including inter alia support to the livelihoods of those who lost their job or income and to reconstruction of housing for limited income groups among other activities. As such, the Government's share of the reconstruction and recovery costs is likely to significantly increase.

Table 1. Summary of Damage & Loss due to the Tsunami in Samoa (SAT$ Million)

Sector	Sub-sector	Disaster Effects				Total
		Damage	Losses	Public	Private	
Social Sectors	Health	1.30	7.37	8.67	–	8.67
	Education	9.07	2.13	11.20	–	11.20
	Sub-total	10.37	9.5	19.87		19.87
Private Sectors	Agriculture	14.45	21.01	–	35.45	35.45
	Commerce	0.9	1.32	–	2.22	2.22
	Tourism	24.1	55	1	78.1	79.1
	Sub-total	39.45	77.33	1	115.77	116.77
Infrastructure	Housing	31.46	1.01	1.01	31.46	32.47
	Community	49	–	–	49	49
	Water	3.49	3.63	7.56	–	7.56
	Electricity	1.43	0.29	1.72	–	1.72
	Transport	73.35	4.76	75.26	2.85	78.11
	Communication	2.96	1.1	2.44	1.61	4.06
	Sub-total	162.14	10.78	88	84.92	172.92
Cross-sectoral	Environment	–	0.55	0.55	–	0.55
Total		**211.96**	**98.16**	**109.42**	**200.7**	**310.11**

The tsunami disaster has affected the different economic sectors in different ways. The productive sectors (agriculture, livestock, fishery, commerce and tourism) have the second largest number on damage, but the economic losses for these sectors account for 78.7 percent of total losses at SAT$77.33 million, or US$30.93 million. The infrastructure sectors (transport, power, water, telecommunications, community, religious centers, and housing) present a different picture. Infrastructure accounted for three quarters of the total damages at SAT$162.14 million (US$64.8 million), but only caused SAT$10.78 million economic losses; a little higher than social sector with losses estimated at SAT$9.5 million. The social sector (education and health) has similar number between damage and losses. No damages reported on cross-sector (environment).

The above analysis suggests the sectors where a post-disaster program for recovery and reconstruction should concentrate on.

MACROECONOMIC IMPACT OF THE DISASTER

Before the tsunami disaster, Samoa was performing strongly with real per-capita income growing steadily since the mid-nineties. However, the country has been affected by the global financial crisis with real GDP falling by more than 5 percent in FY 2008/9. Despite the global crisis the current account deficit narrowed, as remittances and tourism receipts (together accounting for more than 40 percent of GDP) continued to grow. Samoan authorities responded by lowering interest rates and increasing development spending. The deficit was budgeted to double to over 10 percent of GDP in FY 2009/10 and would be financed by soft loans and aid grants.

The tsunami will hamper Samoa's effort to recover from the financial crisis, as damages to social sectors and infrastructure exceed 20 percent of GDP and tourism receipts (accounting for 65 percent of all exports earnings) are likely to decline significantly in the immediate aftermath of the tsunami and until reconstruction is completed. The International Monetary Fund estimates that real GDP will contract by about 3 percent, but potentially up to 5 percentage points lower than the pre-tsunami baseline.

However, only when the tsunami reconstruction spending takes place fully could economic activity return to normal and potentially exceed the pre-tsunami baseline by 2 percentage points in 2011, before resuming its long-term trend.

Given the extent of the damages and the size of the public share of the economic impacts, the fiscal cost would exceed 18 percent of GDP. About 60 percent of the funding needs for the recovery have been identified through grants and concessional loans, but the fiscal deficit is expected to reach 12 percent of GDP to support the rehabilitation efforts. As long as the Samoan authorities manage to meet the post-tsunami increased financing needs through external grants or highly concessional borrowing, the debt would be manageable and fiscal sustainability can be maintained.

RECONSTRUCTION AND RECOVERY NEEDS

The table below provides a summary of estimated costs for reconstruction and recovery efforts following the tsunami, along with the allocation of such costs to public and private sectors. In general, reconstruction costs are commensurate with the damages, whereas recovery figures stem from the projected losses.

Reconstruction costs are provided for two options: (i) "build back", and (ii) "build back and relocate". Option (i) implies rebuilding assets and infrastructure facilities on the sites and as they were before the tsunami, incorporating some additional resilience features. Option (ii) is described in table 2.

Following the tsunami in Samoa a significant part of the affected population has moved away from the coastal areas and indicated a wish to settle permanently in new locations, away from the coast. Such population movements and attempts to rebuild communities away from natural hazard areas are common after tsunami disasters. However, the success —or failure— of communities' and governments' efforts to reduce vulnerability to natural risks by establishing resettlement areas, is highly dependent on whether basic services can be provided quickly and sustainably to relocated people.

Table 2. Summary of Recovery and Reconstruction Needs (SAT$ Million)

Sector	Sub-sector	Build Back			Build Back and Relocate		
		Public	Private	Total	Public	Private	Total
Social Sectors	Health	8.67	–	8.67	18.62	–	18.62
	Education	11.2	–	11.2	21.13	–	21.13
	Sub-total	19.87	–	19.87	39.75	–	39.75
Private Sectors	Agriculture	–	8.54	8.54	–	8.54	8.54
	Commerce	–	2.22	2.22	–	2.22	2.22
	Tourism	1	78.1	79.1	1	78.1	79.1
	Sub-total	1	88.86	89.86	1	88.86	89.86
Infrastructure	Housing	1.01	39.59	40.6	1.01	39.37	40.38
	Community	–	49	49	–	49	49
	Water	7.56	–	7.56	15.53	–	15.53
	Electricity	1.72	–	1.72	28.75	–	28.75
	Transport	75.26	2.85	78.11	139.73	3.7	10.71
	Communication	2.44	1.61	4.06	7.01	3.7	10.71
	Sub-total	88	93.05	181.05	192.03	93.05	288.95
Cross-sectoral	Environment	1.52	–	1.52	2.02	–	2.02
	Disaster Risk Management	4.53	–	4.53	6.03	–	6.03
	Sub-total	6.05	–	6.05	8.05	–	8.05
Total		**110.39**	**181.91**	**292.3**	**234.81**	**183.78**	**418.58**

In the case of Samoa affected people have resettled currently in traditional plantation areas, where infrastructure networks (water, electricity, roads) are non-existent, or of poor quality. To support a more permanent upland resettlement of villages that have been destroyed by the tsunami, additional investments will be needed to create the necessary infrastructure networks and facilities needed to provide services at the new locations. This is the option (ii) labeled "build back and relocate" in table 2.

Total reconstruction and recovery costs under the 'build back' option are estimated at SAT$292.3 million (US$117 million), while the increased costs of relocating health and education facilities combined with investment needs for building new infrastructure networks (water, transportation, electricity, communications) would raise the total costs to SAT$418.58 million (US$ 167.4 million). Most of the burden of increased reconstruction costs under the 'build back and relocate' option would be borne by the public sector.

Resettlement of communities is a complex matter and requires thorough consultations, both with the affected communities and the entities responsible for the provision of services, so that integrated planning can be prepared before government commits the significant resources required to support relocation efforts. It appears that the immediate post-tsunami relocation pattern of communities is considerably more dispersed than traditional villages in Samoa. However, the more dispersed the population the more expensive the capital investments for the provision of services will become. In addition, the high recurrent expenses of infrastructure networks operation and maintenance for widely dispersed communities can

make the continuous services provision financially unsustainable; this could be especially risky in the case of this tsunami because the affected area encompasses lower income people that have lost most of their assets because of the disaster. Any planning for relocation should aim to maintain the social cohesion and social networks of the relocated communities; such inter-community relationships are fundamental in helping communities gain back their strength and their resilience.

Because affected communities were living in a coastal area of natural beauty with good access roads, an important source of income and economic growth has been tourism. Should resettlement upland become permanent, it will be necessary to ensure that transportation from resettlement areas to the coast is available, so that employment and income for tourism can be realized when the sector recovers. In addition, the resettlement of coastal villages provides an opportunity for planning the economic and tourism development of the areas on a new basis, potentially increasing the land value of households. Such opportunities need to be examined in consultation with the communities to develop an appropriate recovery and reconstruction strategy for the area.

Finally, it is important that Government indicates early and clearly to the affected communities its intention to support, or not, specific resettlement plans as well as reasonable time-frames for the implementation of the recovery and reconstruction program. The efforts of the GoS to advance rapidly the reconstruction of housing need to be accompanied by the planning and commitment of medium and longer term financial resources to provide the necessary infrastructure and social services.

TIMING AND SEQUENCING OF RECOVERY AND RECONSTRUCTION NEEDS

Table 3 presents estimated needs for the first two years following the disaster, divided between the first 6 months and over the subsequent 18 months to cover the period of the first two years.

The overall recovery and reconstruction expenditure program needs to be adjusted to account for the absorptive capacity of spending of the relevant implementing agencies in each sector. Generally, the various Government entities of Samoa have good planning and executing capacities, however additional spending caused by the disaster should be within the capacity (administrative, procurement, financial management) of implementing agencies. It would be generally expected that the recovery efforts will ramp-up significantly after the first six months as more contracts for reconstruction will become effective and will enable an increase in reconstruction activities and relevant expenditures.

Table 3. Summary of Recovery and Reconstruction Needs 6 and 18 months (SAT$ Million)[2]

Sector	Sub-sector	Build Back			Build Back and Relocate		
		6 months	18 months	Total	6 months	18 months	Total
Social Sectors	Health	5.9	1.5	7.4	6.5	12	18.5
	Education	4	7.2	11.2	5	15	38.5
	Sub-total	9.9	8.7	18.6	11.5	27	38.5
Private Sectors	Agriculture	1	5	6	1	5	6
	Commerce	0.5	1.7	2.2	0.5	1.7	2.22
	Tourism	6	30	36	6	30	36
	Sub-total	7.5	36.7	44.2	7.5	36.7	44.2
Infrastructure	Housing	15	18	33	15	18	33
	Water	4	3.56	7.56	4	11	15
	Electricity	1.72	–	1.72	5	20	25
	Transport	15	30	45	17	35	52
	Communication	1	3.06	4.06	1	5	6
	Sub-total	36.72	54.62	91.34	42	89	131
Cross-sectoral	Environment	0.5	1.5	2	0.5	2	25
	Disaster Risk Management	1	2.53	3.53	1	4	5
	Sub-total	1.5	4.03	5.53	1.5	6	7.5
Total		**54.62**	**101.52**	**156.14**	**61.5**	**154.7**	**216.2**

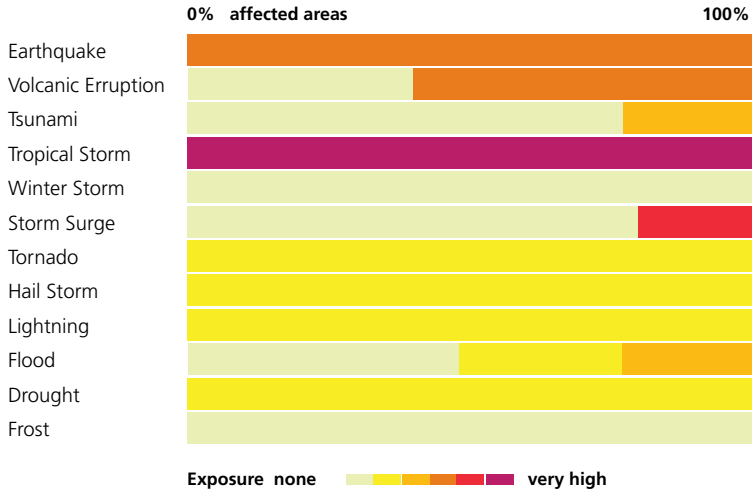
[2] Note: Estimates over period of first half year and the following period up to two years. Differences between Table 2 and Table 3 indicate that recovery needs in some sectors will extend beyond two years and are mainly related to the absorptive capacity of implementing agencies and physical constraints of executing infrastructure works. Religious, Cultural and Community infrastructure has not been considered for the above analysis.

SECTION I: LIVING WITH DISASTERS

1.1. SAMOA'S DISASTER RISK PROFILE

Samoa consists of two large volcanic Islands, Savai'i and Upolu, as well several smaller islands located in the heart of Polynesia.

The World Bank's Natural Disaster Hotspots study identifies Samoa as the 30th country in the world most exposed to three or more hazards. Seventy percent of Samoa's population lives on the coast exposing to them to coastal hazards such as cyclones, tsunamis, flooding and storm surges.



Source: Munich Re, Last update: 2/17/2009

Figure 1. Samoa Hazard Profile

Tropical storms and cyclone are the principal hazard facing the islands bringing wind, storm surge and rainfall flooding damages. Each year from 1989 to 1993 Samoa was hit by severe cyclones. With cyclones Ofa (1990) and Val (1991) especially severe affecting 195,000 and 88,000 people respectively and cost estimates approximately four times GDP. Considerable damage was also caused when Tropical Cyclone Heta struck Samoa in February 2004. Statistical review of historical events suggests that a category 3 cyclone would impact Samoa on average every 35 years. Figure 1 illustrates the intensity of natural hazards affecting the country and the area of land affected.

Table 4. Mean Return Period for Cyclones Affecting Samoa

Saffir-Simpson Cyclone Category	Average Return Period (years)
1	8
2	13
3	35
4	185
5	3,333

Source: Pacific Catastrophe Risk Financing Initiative

Anticipated Climate Changes expected to aggravate coastal hazards in particular driven by sea level rises. The Samoa Meteorological Office reports that observed long term trends in relative sea level for Apia is 5.2 cm per decade. Even more worrying is the observed increases in peak hourly sea levels. The Meteorological office expects extreme storms surge events to become much more common by 2025. Other estimates of long term, systematic changes in the average climate for Samoa indicate that by 2050 sea level is likely to have increased by 36 cm, rainfall by 1.2%, extreme wind gusts by 7% and maximum temperatures by 0.7 C.

Earthquakes and Tsunami affecting Samoa are due to a combination of local volcanism as well as earthquakes generated in the Tonga trench some 200Km to the south. The strongest recorded earthquake to affect Samoa occurred in the Tonga trench in 1917 at 8.7 magnitude. This event continues to represent the reference event for design and building codes causing ground accelerations of 0.1g – 0.2g that are greater than the accelerations potentially generated from local earthquakes. The 1917 event also caused a 3m tsunami wave with a maximum run up of 12m affecting eastern Upolu.

Table 5. Samoa Tsunami Hazard Assessment

Return Period	Average Wave Run-up*	Maximum Wave Run-up
10 years	2m	3m
50 years	7m	8m
100 years	9m	10m

** Considered appropriate for design purposes, Source: BECA consulting 2006*

Statistical analysis on historical tsunami events affecting Samoa was performed in preparation of coastal infrastructure management plans in 2006. Whilst the largest known tsunami at the time was generated near Chile and recorded a 4m wave, the Tonga trench was still identified as the main tsunamigenic threat to Samoa, affecting primarily the southern coastal areas. The National Tsunami Plan identifies a tsunami of between 7m and 9m average wave run up to occur approximately every 50 – 100 years. With the currently available analysis this remains the best design case, equivalent to a once in a life time event and resembles the September 29th 2009 tsunami.

1.2. THE TSUNAMI OF SEPTEMBER 29, 2009

At 6:48am on the 29 September, a powerful 8.0 magnitude earthquake struck south of the main Samoan Island chain with its epicenter 190 km south of the Samoan capital of Apia. This was followed only 10 - 20 minutes later by two tsunami waves that impacted American Samoa, Samoa, and the small northern island of Niuatoputapu in Tonga. The highest swell of the water was reportedly 11m in some parts and caused unprecedented fatalities, and serious damage, to the affected Pacific Island countries. In Samoa there have been 143 reported deaths and a further 5 missing and 310 injured. An estimated 5,274 people, about

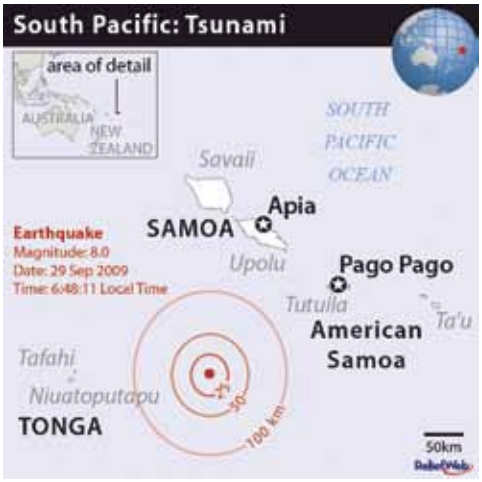
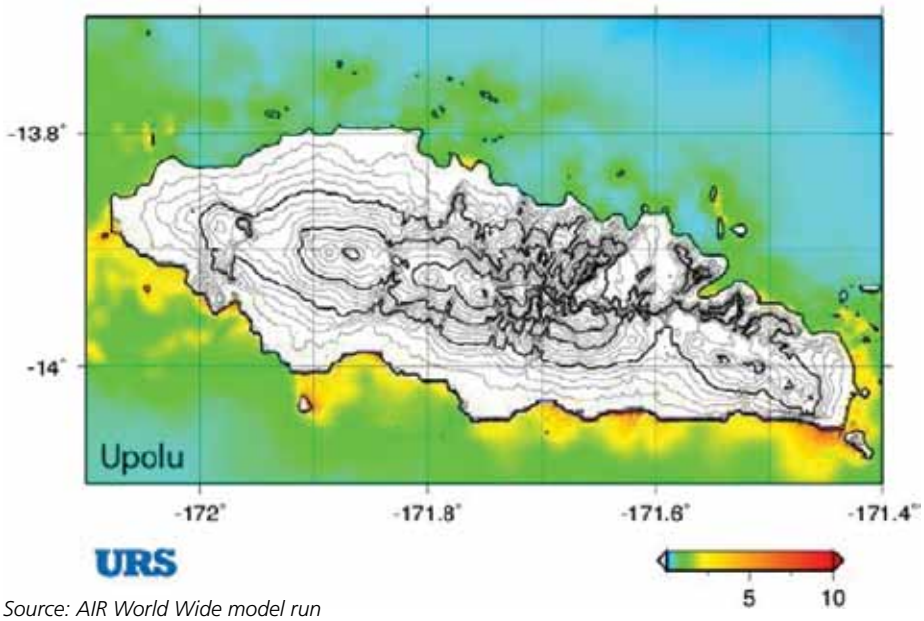


Figure 2. South Pacific Tsunami



Source: AIR World Wide model run

Figure 3. Modeled results of the 29/09/09 Tsunami wave Run Ups in meters

2.5 percent of the country's population, have been affected in an area of where a total of 11,121 people live on the southern, eastern and southwestern coast of Upolu Island. The worst affected areas included the villages of Aleipata, Saleapaga, Leap, Falealili, Siumu and the island of Monono.

Impact and National Response

On the morning of the tsunami not all affected persons knew how to read the signs or what action to take. The majority of villagers decided to evacuate and run to higher grounds, either immediately after the earthquake, which was unusually strong, or when they observed the ocean receding from the shoreline. A minority was curious to observe the waters, stayed with their homes or took protection in their cars, with varied success. Although the national tsunami warning system was activated it did not reach all the affected areas on time to provide an effective warning. The short time between the earthquake and the generation of the tsunami wave was certainly a factor, in addition to difficulties with disseminating the warning to key village representatives who had the task to alert their community.

The Samoan Government enacted emergency plans quickly and mobilized the police and emergency response units. With support from the Australian and New Zealand military and disaster relief teams, emergency medical services, tents and clean water were provided to the affected areas. Despite the devastation, strong social networks responded effectively, as many homeless people were accommodated by family and friends.

Relief efforts focused on the worst hit southern coast of Upolu. The Samoan Red Cross (SRC) early assessments indicated that 40 villages were affected along the south-eastern coast, with 20 villages completely

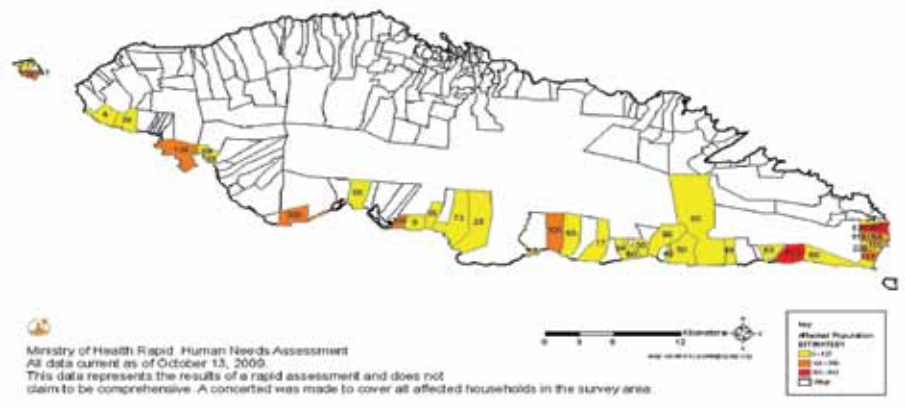


Figure 4. Number of Affected persons by Village

destroyed by the tsunami waves. Access roads to affected areas were quickly cleared by government of Samoa allowing for rapid response efforts by communities, NGOs and the national Disaster Management Office (DMO). The Government of Samoa (GoS), SRC, Caritas, and other national organizations organized to distribute relief items, including food, water, clothing, sanitation items and tarpaulins as the early priorities.

Request for assistance and Immediate International Response

The Government of Samoa Disaster Advisory Committee requested assistance from the UN for a multi-cluster needs assessment in conjunction with the Government. Advanced teams arrived in Samoa on Oct 4 and 5.

The Samoan National Disaster Council met on October 6 and appointed the deputy CEO of Finance, Noumea Simi, as the key coordination point for donors. Ms. Simi emphasized the importance of coordinated donor engagement with donors taking the lead in areas consistent with existing donor division of labor and the priority placed by the Government on flexible support for reconstruction efforts, including through budget support.

The Minister of Finance, meeting with World Bank East Asia–Pacific Vice President, requested World Bank support for a Post Disaster Needs Assessment (PDNA) to complement the early recovery assessment in order to formulate a long term recovery and reconstruction strategy.

1.3. EARLY RECOVERY FRAMEWORK

The United Nations Resident Coordinator activated the cluster approach to perform an early recovery needs assessment (ERNA) with participation of UN Agencies, Asian Development Bank (ADB) and the World Bank (WB). The document was presented to the Government in October 2009 and included preliminary estimates of the economic impacts of the tsunami.

SECTION II: ECONOMIC AND SECTOR IMPACTS AND NEEDS

2.1. ASSESSMENT METHODOLOGY

Damage and Loss Assessment

The methodology for the damage and loss assessment (DaLA), developed originally by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) in the early 1970s, was used in the damage and loss assessment[3]. This methodology has been continuously expanded and updated over the past three decades, and in recent years has been simplified and customized for application in different regions of the world. It has been applied by the World Bank and other international organizations in numerous cases of recent disasters, and provides a satisfactory framework to identify and quantify the socio-economic and environmental impact of disasters.

Under the DaLA framework, the assessment of damage provides the basis for estimating reconstruction requirements, and the estimation of losses provides an indication of the reduction or decline in economic activity and in personal and household income arising from disasters, which is used for the estimation of needs to achieve full recovery of economic activities at the macro-economic level and at the level of individual persons or household.

Conceptual Framework

The DaLA methodology is based in the utilization of the system of national accounts of the affected country as a means for valuation of the damage and the losses caused by the disaster. In the simplest terms, the DaLA methodology provides for the estimation of the destruction of assets caused by the natural event that caused the disaster, the changes in the flows of the economy caused by the temporary absence of the destroyed assets, and the modifications in the performance of the affected economy. In addition, it also provides the basis for assessing the negative impact on personal or household income and overall well-being.

- Damage is defined as the monetary value of fully or partially destroyed assets. It is initially assumed that assets will be replaced to the same condition – in quantity and quality – that they had prior to the disaster.
- Losses are defined as the changes in the flows of goods and services that will not be forthcoming in the affected area until the destroyed assets are rebuilt, over the span of time that elapses from the occurrence of the disaster and the end of the recovery and reconstruction period. Losses include

[3] Handbook for Estimating the Socio-Economic and Environmental Impact of Disasters, Economic Commission for Latin America and the Caribbean, United Nations, second version, 2003.

production of goods and services that will not be obtained; higher costs of operation and production, and the cost of the humanitarian assistance activities.

- Total disaster effects are the addition of damage and losses.

Macro-economic effects are defined as the manner in which the disaster modifies the performance of the main macro-economic aggregates in the affected country or region. These effects arise from the damage and losses caused by the disaster. Macro-economic effects represent a different view of disaster impact – as they describe the impact of the disaster on the functioning of the economy and the resulting macro-economic imbalances – and are therefore not added to the sum of damage and losses to avoid double accounting.

Main macro-economic effects include the impact on the level and growth of the gross domestic product of the country or region affected by the disaster; the modification of the normal pattern and structure of the balance of trade and payments due to increased imports and lower exports of goods and services arising from the disaster; and the corresponding impact on the fiscal sector that may occur due to lower revenues and higher expenditures of the government due to the disaster.

The post-disaster macro-economic analysis also includes an examination of the impact on gross investment to take into consideration the investments to be made during the reconstruction, the examination of possible inflation stemming from the effects of the disaster, and negative impacts on employment and income at the personal and household or family level.

As mentioned earlier, estimations were made through the application of the damage and loss assessment methodology developed in the 1970s by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) 11, that has been updated, expanded, systematically customized and simplified for application in different regions of the world.

Objectives of the Assessment

The assessment of damage and losses after disasters is essential for the estimation of financial needs for recovery and reconstruction. Priorities are defined in terms of the most affected sectors of the economy, geographical areas of the country and population groups to be attended during recovery and reconstruction.

In addition, the assessment enables an estimation of the capacity of the affected government to undertake on its own the different components of the recovery and reconstruction programs, as well as the estimation of requirements of international cooperation when the domestic capacity is insufficient to meet post-disaster needs. Furthermore, the assessment of damage and losses provides a quantitative basis to monitor progress in the execution of post-disaster programs.

Assessment Principles and Procedures

The DaLA relies on the estimation of disaster effects in each and all sectors of the affected economy. Once all sectors have been assessed in terms of damage and losses, the results are aggregated to obtain the total amount of disaster effects ensuring that no double accounting and/or gaps exist.

The above enables the analysis of the impact of damage and losses on the functioning of the affected economy, using the forecasted performance for the current year – and in some cases for several subsequent years – if the disaster had not occurred. In addition, estimates are made of the decline in personal or household income arising from the estimated losses in all sectors.

From there, estimates are derived of the financial needs for ensuring recovery and reconstruction, based on public policies designed to mitigate the negative impact of the losses on production as well as on a preliminary strategy for reconstruction that takes into consideration the possibility of "building back better" the destroyed or damaged assets, within financial constraints. Furthermore, estimates can be made of special needs to reduce the long-term exposure or impact of future disasters, as part of a disaster risk management program.

2.2. SUMMARY OF DAMAGE AND LOSSES

The total economic value of the disaster effects caused by the tsunami in Samoa is estimated at about SAT$261.11 million (US$104.44 million—See Table 6 below) equivalent to approximately 20% of Samoa's Gross Domestic Product (GDP), which illustrates the magnitude of the disaster.

Table 6. Summary of Damage and Losses due to the tsunami in Samoa (SAT$ Million)

Sector	Sub-sector	Disaster Effects				Total
		Private	Total	Public	Private	Total
Social Sectors	Health	1.30	7.37	8.67	–	8.67
	Education	9.07	2.13	11.20	–	11.20
	Sub-total	10.37	9.5	19.87		19.87
Private Sectors	Agriculture	14.45	21.01	–	35.45	35.45
	Commerce	0.9	1.32	–	2.22	2.22
	Tourism	24.1	55	1	78.1	79.1
	Sub-total	39.45	77.33	1	115.77	116.77
Infrastructure	Housing	31.46	1.01	1.01	31.46	32.47
	Water	3.49	3.63	7.56	–	7.56
	Electricity	1.43	0.29	1.72	–	1.72
	Transport	73.35	4.76	75.26	2.85	78.11
	Communication	2.96	1.1	2.44	1.61	4.06
	Sub-total	113.14	10.78	88	35.92	123.92
Cross-sectoral	Environment	–	0.55	0.55	–	0.55
	Sub-total	–	0.55	0.55	–	0.55
Total		**162.96**	**98.16**	**109.42**	**151.7**	**261.11**

Of the total disaster effects, an estimated SAT$162.96 million (US$65.18 million) corresponds to the value of the destruction or damage to physical assets existing in the affected areas, and an additional SAT$98.16 million (US$39.26 million) represents losses in the flows of the economy that are expected to occur in the country over the next 18-24 months as a result of the temporary absence of the destroyed assets (See Figure 5). In the case of agriculture—with the third largest share of damages and losses, this is explained by the fact that the seedlings for the damaged fruit trees will take 3-4 years before the trees start bearing fruits; the same also holds for the livestock and the agricultural land whose soil was eroded.

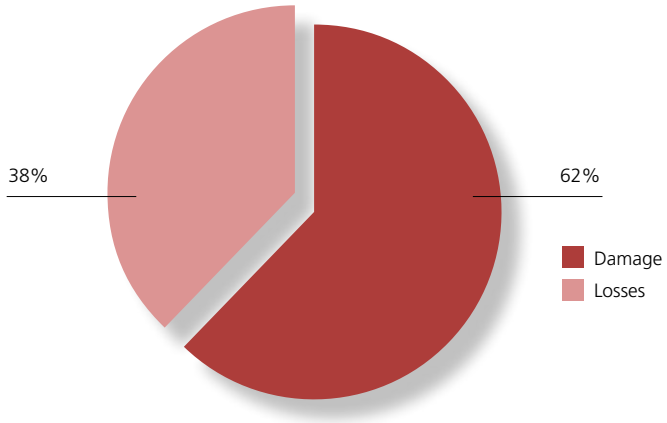


Figure 5. Distribution of Damage and Losses due to the September tsunami in Samoa

The share of the private sector of the total value of damage and losses is estimated at 58.3% (SAT$151.7 million or US$60.68 million), while the share of the public sector is estimated at 41.7% (SAT$109.42 million or US$43.77 million). This is a measure of the damages and losses to each sector and could be viewed as an initial starting point to assess the relative efforts that each sector must bear in the post-disaster recovery and reconstruction activities (See Figure 6). Nonetheless, the government would be expected to assist in the funding of several initiatives that follow on damages and losses to the private sector, including inter alia support to the livelihoods of those who lost their job or income and to reconstruction of housing for limited income groups among other activities. As such, the Government's share of the reconstruction and recovery costs is likely to significantly increase.

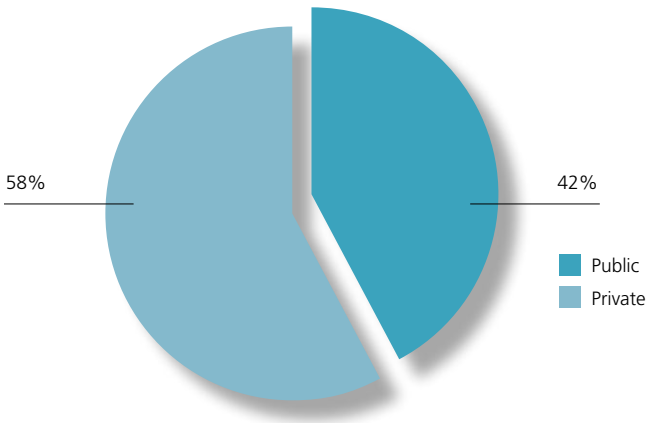


Figure 6. Share of the Public and Private Sector of Damages and Losses

The disaster affected various economic sectors in different ways. The productive sectors (agriculture, livestock, fishery, commerce and tourism) have the second largest number on damages, but their economic losses account for 78.7% of total losses with SAT$77.33 million, or US$30.93 million. Infrastructure sector (transport, power, water, telecommunications and housing) present a different story. Infrastructure suffered 69.42% of total damages (SAT$113.14 million or US$45.26), but is expected to have SAT$10.78 million economic losses, only a little higher than social sector, for which losses are estimated at SAT$9.5 million. The social sector (education and health) has similar number between damage and losses. Small damages are reported for the cross-sectoral environment category because environmental losses have been included in the separate economic sector above. The analysis is useful to help allocate corresponding resources for post-disaster efforts to the appropriate sectors.

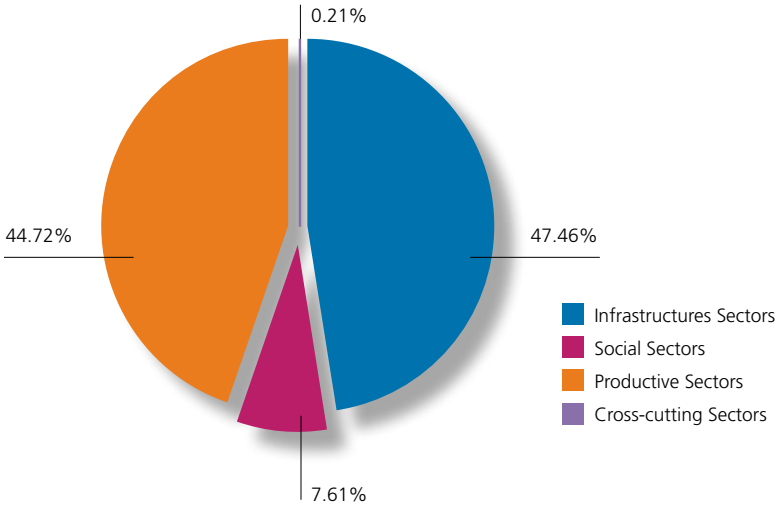


Figure 7. Distribution of Disaster Effects among the main sector of the Economy

Individual sectors that were most affected in total effects (damage and losses) were, in the order of decreasing importance: transport, tourism, agriculture, housing, education, health, water, telecom, commerce and electricity. In terms of destruction of physical assets, transport remains the most affected (45% of total damages), followed by housing (19.3%) and tourism (14.8%). In terms of losses in the economy, tourism is the most affected (56% of the total losses), followed by agriculture and health. Details of this breakdown by sector are shown in Table 6 and Figure 8.

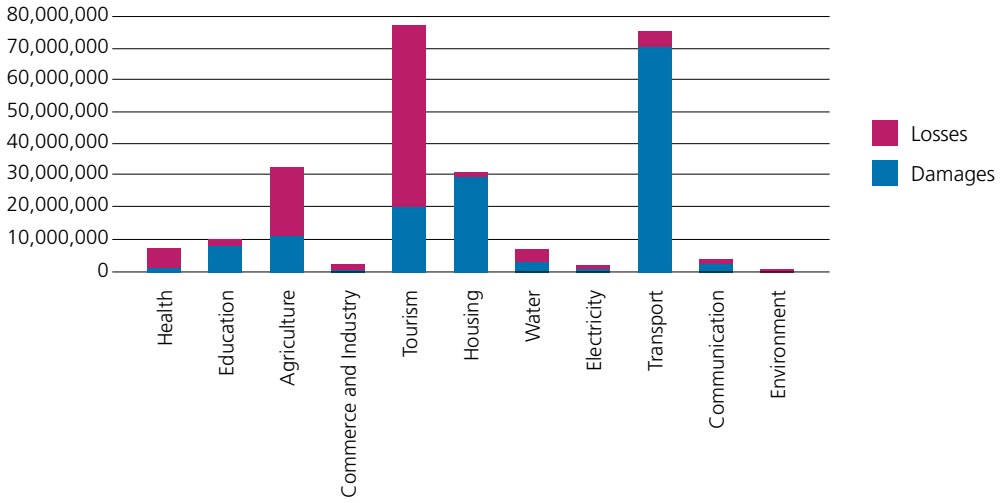


Figure 8. Distribution on Damage and Losses among sectors of economic activities

2.3. SOCIAL INFRASTRUCTURE

2.3.1. Health

Summary

The damages assessed for the health sector are estimated at SAT$1.3 million. The additional expenditures required to respond to the health needs of the population, particularly for outreach services, essential specialist care including a major psychosocial program designed to meet the needs of the tsunami affected population is estimated at SAT$7.4 million. Adding additional needs for increase disaster preparedness and relocating health facilities as recommended in this report would cost SAT$11.250 million resulting in total needs of SAT$18.6 million.

Pre-Disaster Situation

The Ministry of Health (MOH) is responsible for regulatory oversight of the health sector and provides guidance on the policy framework and health priorities for Samoa. It also responsible for: (a) monitoring overall health system performance; (b) disease surveillance; (c) primordial health promotion and prevention services including sanitation regulation and services. Major policies and priorities are reflected in the National Health Sector Plan 2008 – 2018. The National Health Services (NHS) is the main provider of health services to the population and runs the major referral hospital in Apia, several district hospitals throughout the country. Outreach services from District Hospitals are provided in Health Centers which are owned by communities or villages and in village communities. District Hospitals are essentially staffed by nurses with very limited back-up by doctors and provide a 24 hour service. Outreach services are also provided by nursing staff. Other important service providers under the regulatory oversight of the MOH include the National Kidney Foundation (a government funded service provider) and a range of health related NGOs including the Red Cross some of whom receive partial government subsidies to finance part of their operations. Private practitioners (doctors) and the private Medcen hospital are also recognized as important service providers within the health sector.

Health services were provided to the population of the affected area through a network of 2 District Hospitals owned by the NHS located at Lalomanu and Potasi respectively. One Health Center, owned by the community, is located in Fusi. This facility was visited five days per week by staff located at Poutasi District hospital. Staff undertaking outreach services at Fusi health center also delivered some village based services – typically in the afternoon to nearby villages.

Service delivery staff in the affected areas are located at the district hospitals at Lalomanu (5 registered nurses and 4 enrolled nurses: total 9) and at Poutasi (7 registered nurses and 5 enrolled nurses: total 9). District hospitals basically comprise building areas for outpatient visit care, primary health care services and have 4 beds for deliveries and stabilization of emergency cases before they are transferred to the central hospital. Staff quarters are also provided. Key services provided included: immunization, child health, reproductive health as well as ambulatory care (outpatient services) and other primary health care services.

Ambulatory care services for the first 2 weeks of October in 2008 and 2009 at the three health facilities in the tsunami affected area totaled 59 per day and 66 per day respectively.[4]

Mobile clinics say an additional 56 out patients in the same period in 2008 – numbers for 2009 are not available. Thus outpatient visits per day of around 120 per day is a reasonable benchmark for service demand prior to the tsunami in the affected area.

Damage and Losses

All health facilities in the affected area are government owned so there are no private damages (or losses) in the health sector.

The District Hospital at Lalomanu was not damaged, is located on a good site. It was build under a World Bank project and took into account the recommendations of the Coastal Risk Reduction Plan which suggested health facilities in the area be amalgamated and relocated to a safe location.

The District Hospital of Poutasi was damaged – the main building was flooded and some water damage to structure and contents (including medical equipment) was sustained. This building was financed through a World Bank project. New Zealand Army Engineers have indicated the main building was structurally sound – notwithstanding the damage sustained. Staff nurse and doctor quarters were destroyed and compound fencing was damaged. The main power supply was destroyed (electricity authority responsibility). The estimated cost (damage) of rebuilding in situ is SAT$1.3 million. However this would not accord any protection (disaster risk reduction) in the future.

It is not feasible to provide protection to the facility in situ. The preferred option is to relocate the facility to higher ground. This will require land. It is noted that the primary school next door to the hospital was destroyed and will be relocated. It may make sense to relocate the two facilities jointly. The cost for new relocated District Hospital is SAT$5.05million (see below under needs).

[4] Service provision in 2008 was exclusively provided by nurses while in 2009 doctors were also in attendance for a few of the days in the reporting period.

The Health Center at Fusi, which is located between the sea and the main road, was largely protected this time by a combination of a land spit and mangrove swamps. If the wave(s) had come from the West it would have been directly hit. There was significant damage to surrounding housing and infrastructure. It should be relocated to higher ground on risk reduction grounds. The buildings are reported to be in a severely dilapidated state. Recent facilities planning work (financed under the health SWAP) had recommended that this facility should be relocated and up-graded to a district hospital. Further there is no capacity to expand the facility on the current site. Thus on service delivery grounds and risk reduction grounds this facility should be relocated.

The preferred option of NHS is to move the Fusi facility (Health Clinic) to higher ground on risk reduction grounds and to relocate the facility further west and upgrade to a district hospital on service delivery grounds. The cost of relocation of a health clinic would be SAT$3.78 million. The cost to upgrade it to a District hospital on service delivery grounds is SAT$5.45 million.

Losses

In the Health Sector the losses reflect additional public expenditure on health needed as a direct consequence of the tsunami.

There is significant *additional* expenditure required to be made by the health sector to address the considerable health needs of the affected population arising as a consequence of the tsunami. These additional health expenditures cover the period from the time of this report and over the next 2 years. Table 7 Health Sector Damage and Losses below provides a summary of the total losses in the health sector by service delivery component. This shows total losses as SAT$7.4 million. As noted above all these expenditure needs are public. About SAT$5.9 million will be required over the next 6 months and SAT$1.5 will be required over the subsequent 18 months.

It is important to note that these numbers do not take account of the resources already expended in the humanitarian response period – i.e. from the date of the tsunami through to the date of this report. This will be a very considerable amount which is not yet fully accounted for. It would include: (i) the amount spent by government (largely by the MOH and NHS); (ii) the amounts spent by Australia and New Zealand in its emergency response program; and (iii) amounts spent by humanitarian organizations and NGOs and communities etc. A full accounting of this will indicate just how expensive the total costs of meeting the immediate needs of the affected population really were.[5]

On the other hand it is clear that the quality of the first response by government and its supporting partners met a very large proportion of the immediate needs and effectively reduced the subsequent health needs that would have been required without this response. The quick response by medical staff, public health staff (particularly for sanitation and water testing services) and the supply of generally safe water by the water authority is very notable in this respect. It should also be noted that the quick decision by the MOH public health staff to GIS map the relocated populations was critical to the planning of this immediate response and provided invaluable information for overall service delivery planning by each sector incorporated in this report.

[5] This should be done as soon as possible. Quite understandably this information was simply not available at the time of writing this report.

Strategy for Health Service Delivery for Affected Population

The service delivery strategy for the tsunami affected population has taken into account the nature and the anticipated health conditions that the population is expected to face during the forthcoming 2 year period – most of which will need to be delivered over the coming six months. The strategy also takes into account important socio-economic characteristics of the population discussed elsewhere in the report. This includes that the population affected by the tsunami is according to the recent house hold income and expenditure survey one of the poorest areas in the country with less disposable income than other areas. Further the population income earning opportunities have been devastated – including commercial fisheries and tourism operations. Further key aspects of subsistence food production in the form of fisheries, poultry, house gardens (mainly green vegetables) have also been destroyed or significantly reduced. This means affected households which were often among the poorest in the country have lost their houses, material possessions, access to discretionary cash incomes and to significant parts of their subsistence food production. Thus they are particularly vulnerable and have limited capacity to ensure they can finance a basic package of needs through their own private efforts – notwithstanding considerable overseas remittances.

Table 7. Health Sector Damage and Losses (in SAT$)

Sub-sector Component	Disaster Effects			Ownership by Sector		Effects on	
	Damage	Losses	Total	Public	Private	BOP*	Fiscal Sector**
Public Health		2,353,000	2,353,000	2,353,000	0	540,000	2,353,000
Surgical/medical/Dental		525,000	525,000	525,000	0	200,000	525,000
Primary Health Services	1,300,000	1,513,000	2,813,000	2,813,000	0	1,500,000	2,813,000
Psychosocial Services		420,000	420,000	420,000	0	100,000	420,000
Disability Services		80,000	80,000	80,000	0	65,000	80,000
NCD Services		40,000	40,000	40,000	0	25,000	40,000
Laboratory		240,000	240,000	240,000	0	240,000	240,000
Pharmaceuticals		1,200,000	1,200,000	1,200,000	0	1,200,000	1,200,000
X-ray services		520,000	520,000	520,000	0	520,000	520,000
Clean up & Temp services		430,000	430,000	430,000	0	100,000	430,000
Monitoring program		50,000	50,000	50,000	0	10,000	50,000
Total	**1,300,000**	**7,371,000**	**8,671,000**	**8,671,000**	**0**	**4,500,000**	**8,671,000**

** Lower exports; higher imports*
*** Lower tax revenues; unexpected expenditures*

The tsunami, fortunately, did not result in major loss of limbs and other major long term physical disabilities as typically happens in other tsunamis. Nevertheless the surviving victims of the tsunami did get a range of major injuries including major and relatively minor lacerations, broken bones and many swallowed considerable dirty sea water and now face respiratory and "tsunami cough" which if not treated can result in serious pneumonia particularly in the elderly and the young. In the two weeks post tsunami approximately 1,500 patients have been seen by medical teams (doctors and nurses) in the affected areas – about double the number compared to a similar period pre tsunami. There has been a major jump in the number of injuries and wounds (over 100%) but the disease numbers disguise the major change in the severity of the conditions seen. There has also been a major jump in the number and proportion of skin diseases including a sudden increase in reported scabies in families. Diarrhea and gastroenteritis conditions have increased dramatically (almost 300 percent) in the immediate aftermath – it is critical to monitor

these trends and more particularly the severity of the disease. An area of concern is that the numbers of pregnant mothers accessing maternal care has dropped by almost two thirds in the immediate aftermath of the tsunami. Hospital numbers jumped significantly. Consultations for injuries and wounds were three times higher than in the period prior to the disaster.

There were 93 admissions at the TTM hospital and over 130 surgical procedures for tsunami related injuries. As is to be expected, injuries post-tsunami are significantly more complicated and serious, requiring expert wound and nursing care, management, clinical oversight and post discharge management. In addition, however, the hospital is now dealing with quite serious infection issues (including so called "super bugs") requiring fourth generation antibiotics. This has put serious demands on the laboratory including the need for overseas laboratory testing and related services and need for overseas specialist support for the laboratory and infectious disease control in the hospital more generally. In the field serious infections of injuries and pneumonia are emerging and need very active outreach services by both doctors and nurses. A failure to do active case detection among the affected population would likely result in considerable future hospital admissions (with all the dangers of cross infections evident at present) and far more expensive care to save lives still in danger and to reduce future disabilities.

Another major risk in a disaster such as this results from environmental health needs (including water supplies) of relocated populations. As discussed, the government (water supply authorities) moved swiftly to ensure temporary safe water supplies and MOH staff have ensured strategic provision of sanitation services – which of course need to be extended. So far there have been no major infectious disease outbreaks – with the possible exception of increased diarrhea cases and a possible measles outbreak which is thought to have resulted from infected overseas contacts responding to the tsunami in a situation where vaccination rates are too low for herd immunity. A special effort is being made to deal swiftly with the dithers cases and a measles campaign (which health authorities have determined needs to be national rather than just focused on the affected population which is not really isolated from the general population) is now in advanced stages of planning.

Other risks which need to be managed include potential nutritional issues arising from reduced livelihoods as discussed above; particularly the potential reduction in access to green vegetables poultry, pork and fisheries. The disaster management office plans to stop food distribution in two weeks. The MOH will carefully monitor nutritional issues that may arise and consider options for strategic food distribution to vulnerable households, pregnant women and children. These programs should follow "best practice" in emergency situations and not use foods which encourage thirst (e.g. salty noodles and fortified milk biscuits) in situations where water supplies are at risk of being unsafe. Likewise liquid ORS salts are to be used for dithers rather than powders that need to be mixed with water. Special nutrition needs may also emerge for those with serious and advanced non-communicable diseases – particularly those with diabetes and heart related diseases.

While physical disability needs are not expected to be great, as discussed, they are nevertheless not zero. Furthermore, a number of the population (not yet fully documented), are known to have disabilities including many who have lost limbs due to advanced conditions associated with diabetes. This includes crutches, commodes and other special sanitation needs, various mobility devices and some artificial limbs – the vast majority of which will have been lost together with other household chattels.

A very serious and major need is for psychosocial services for three distinct groups: (a) the affected population; (b) volunteers and others in the community who have been directly involved in the tsunami response efforts; and (c) public servants – particularly the first responders (medical police, emergency services) and others working on a daily basis with the response (including those caring for the injured and sick in hospitals and dealing with the dead and their relatives). Evidence to date indicates that the overall need for psychosocial services is both large and varied. There is absolutely no doubt that the affected population is severely traumatized – the MOH survey indicated at least 90 percent of the population wanted to relocate because of this trauma. It is clear a number of the affected population require specialist psychosocial services. At present there a quite a number of hospital inpatients who could be discharged on the basis that their physical injuries could be managed through outreach services but who are simply not in a mental state to be able to cope. Counseling services are required for many in the general affected population and among public servants and other first responders.

The primary health care, medical services (particularly the post hospital discharge services) and the psychosocial services, as noted require active case detection and follow-up. The relocated families are also significantly more dispersed than previously – an issue that affects the costs of both the delivery of a basic package of services (water, health, education, power, roads etc.) in the medium term and in the short term delivery of health services to the affected population. To this end the extra expenditures includes increased nurse and doctor outreach services for the next six months and it includes resources to pay for transfer of the population for specialist services (e.g. X-rays for "tsunami cough", laboratory and other specialist services – including psychosocial services. This is critical as patients may avoid accessing services early because of the costs of accessing the services. Further, this is concern that individuals (and their dependants) suffering mental stress may also not seek services when really needed.

Other losses (increase in expenditures) include the net run down[6] in stocks of health system support services including (laboratory services, radiography services and pharmaceuticals and medicals supplies) and the expected demand for additional supplies and services over the next 2 years to deliver the services expected to be needed as a result of the tsunami. This is expected to be almost SAT$2 million (see Table 7 above). Finally, provision should be made for additional resources to manage and monitor the implementation of the tsunami response over the next 2 years.

Risk Management Issues

There are two major risk management strategies incorporated in the health sector section of this report. The first is, as discussed in the damages section above, the proposals to relocate two health facilities in the affected area on risk reduction grounds. Thus it is proposed not to rebuild the damaged Poutasi District Hospital in situ. It is proposed to move it on largely risk reduction grounds to higher elevations – although part of the case for relocation could also be justified by the fact that some of the population has relocated further from the facility. The cost for this is SAT$5.05 million. The cost to build in situ would be SAT$1.3 million. While the Fusi Health Center was not damaged, as discussed above, it is right on the sea front and in serious danger from a repeat similar event. As discussed, it is proposed to relocate the facility to higher ground and on service delivery grounds shift it further west and to upgrade it to a District Hospital. This

[6] Net run down in stocks includes the use of government owned and financed materials and supplies to respond to the tsunami less the addition to stocks supplied during the humanitarian relive period and not yet used.

would cost SAT$5.45 million. The cost to relocate Fusi and not upgrade the facility to a district hospital would cost SAT$3.78.

The second risk reduction strategy in the health sector essentially entails developing increased capacity to adequately respond to future disasters. This includes reviewing the existing disaster preparedness plan for the health sector (in the light of the tsunami experience and the recent swine flu epidemic) and draw out lessons learned including those related to guidelines for disaster response and command and control/coordination issues. For increased response capacity immediate lessons learned include the need for emergency response kits for responding doctors and nursing staff, stocking and storage location of pharmaceuticals and medicals supplies likely to be needed for an emergency response in easily accessible and known locations, increased medical support equipment and supplies including portable oxygen cylinders and heads and back up/makeshift ambulance services.

Recovery and Reconstruction Requirements

The health sector recovery and reconstruction needs incorporating the risk reduction strategies discussed above are presented in Table 8 below. These include the facility relocation needs as discussed (relocation of Poutasi District Hospital) and the relocation and upgrading of Fusi Health Center from a Health Center to a District Hospital. The needs estimate also provides for essential disaster preparedness within the MOH and NHS. The losses (increased expenditures) set out in Table 8 are otherwise the same as those incorporated in the earlier Table 7.

Thus needs are as follows: infrastructure SAT$10.5 million and losses (increased expenditure for the health sector and modest disaster preparedness) add to SAT$8.1 million. Thus total needs for the health sector are estimated at SAT$18.6 million.

It is anticipated that the foreign exchange (balance of payments impact or BOP) content of the projected expenditure will be about SAT$10 million or about 54 percent of the total expenditure program. Obviously, the import content of the subcomponents varies significantly because some require considerable equipment and overseas expertise.

This is a significant additional expenditure program to be managed by the health sector. It will obviously stretch implementation capacity of the various health sector partners. There are however three very important factors which make program implementation feasible. The first is the clear commitment of the health sector staff to respond adequately to this disaster. While this is an intangible factor it is an important one. Secondly, the MOH and the health sector have been gearing up for a major health sector program financed by the World Bank, AusAID and NZAID. This means there is important implementation capacity not previously in place – including the capacity to undertake quite complex procurement actions. Third, there are a number of health sector development partners that have a capacity to assist with the program. While some, such as the UN technical agencies and WHO, may not have significant financial resources to assist the sector, it is always feasible to organize additional financing from the funds available to meet the needs for these agencies to assist where comparative advantage exists and they are willing to take on additional responsibilities.

Table 8. Health Sector Needs (in SAT$)

	Disaster Effects			Ownership by Sector		Effects on	
Subsector, Component	**Facility Needs ***	**Losses**	**Total**	**Public**	**Private**	**BOP****	**Fiscal Sector*****
Public Health		2,353,000	2,353,000	2,353,000	0	540,000	2,353,000
Surgical/Medical/Dental		525,000	525,000	525,000	0	200,000	525,000
Primary H'lth Services	10,520,000	1,513,000	12,033,000	12,033,000	0	7,000,000	12,033,000
Psychosocial Services		420,000	420,000	420,000	0	100,000	420,000
Disability Services		80,000	80,000	80,000	0	65,000	80,000
NCD services		40,000	40,000	40,000	0	25,000	40,000
Laboratory		240,000	240,000	240,000	0	240,000	240,000
Pharmaceuticals		1,200,000	1,200,000	1,200,000	0	1,200,000	1,200,000
X-ray services		520,000	520,000	520,000	0	520,000	520,000
Clean up & Temp Serv		430,000	430,000	430,000	0	100,000	430,000
Monitoring program		50,000	50,000	50,000	0	10,000	50,000
Disaster Preparedness****		730,000	730,000	730,000		600,000	730,000
TOTAL	**10,520,000**	**8,101,000**	**18,621,000**	**18,621,000**	**0**	**10,000,000**	**18,621,000**

* *Costs of facility relocation to reduce risks*
** *Lower exports; higher imports*
*** *Lower tax revenues; unexpected expenditures*
**** *Disaster preparedness for the MOH and NHS (increased capacity to respond to disasters)*

The construction activities are not particularly large for the health sector and should not pose significant problems to the construction sector. The risk however is that the total construction program for all sector may stretch the capacity of the construction sector to undertake all the work envisioned. The health sector program is planned over the next 2 years. Once agreement is reached within government on the scope of the proposed program and financing is in place the sector can move quite quickly. A key issue will be to sort out the land issues and finalize locations for new facilities.

Currently there are only relatively minor funds (compared to the total required) identified to support the proposed expenditure program. Funding has been identified for the some of the vaccination program (UNICEF), some technical support from WHO and from the winding down of the New Zealand Government humanitarian response program.

It is possible, given government review of the program and with the agreement of the financing partners of the health SWAP (NZAID, AusAID and the World Bank) that the SWAP could fund significant parts of the program – although to fund the whole program would probably require a top-up of existing resources from the joint partners and may require some redefinition of the program. All parties to the health SWAP have agreed that they are willing to discuss options with Government within the context of a whole of Government discussion of financing options for the recovery program.

Table 9. Recovery Needs, Financing and Financing Gaps on Health (in SAT$)

	Recovery and Reconstruction		
Subsector, Component Needs	**Recovery and Reconstruction Needs**	**Committed Recovery and Reconstruction Financing**	**Recovery and Reconstruction Requirements**
Public Health	2,353,000	20,000	2,333,000
Surgical/Medical/Dental	525,000	100,000	425,000
Primary H'lth Services	12,033,000	300,000	11.733,000
Psychosocial Services	420,000		420,000
Disability Services	80,000		80,000
NCD services	40,000		40,000
Laboratory	240,000		240,000
Pharmaceuticals	1,200,000		1,200,000
X-ray services	520,000		520,000
Clean up & Temp Services	430,000		430,000
Monitoring program	50,000		50,000
Disaster Preparedness	730,000		730,000
TOTAL	**18,621,000**	**450,000**	**18,171,000**

2.3.2. Education

Summary

The damages to schools assessed for the education sector are estimated at just over SAT$9.0 million. The additional expenditures required to get children back in temporary schools pending school reconstruction is estimated at SAT$2.1 million. Adding additional needs for increase disaster preparedness and relocating school as recommended in this report would cost SAT$19.0 million making a total needs of SAT$21.1 million.

Pre-Disaster Situation

The Ministry of Education Science and Culture (MESC) is responsible for running the education system in Samoa. The primary school system encompasses grades 1 – 8. The secondary school years cover grades 9-12. Primary schools are owned by the community/village while secondary schools are formally owned by MESC on behalf of the government.

Key exams are held at the end of years 6, 8 and 12. The grade 8 student exams are scheduled for November 9, 2009. This is a key exam determining access to secondary schooling. The tsunami has seriously affected 7 schools 2 secondary schools and 5 primary schools – including 2 primary schools being conducted in temporary facilities while schools were being constructed. It is estimated that 592 primary school students were enrolled in these schools and 495 secondary school students – a total of 1,087. These students were taught by 42 teachers – including 18 secondary teachers and 24 primary school teachers.

Damage and Losses

Table 10 below documents the damages to schools (SAT$3.4 million for primary schools and SAT$4.6 million for secondary schools; see Annex for details by school).

The losses (increased expenditure by Government) are estimated at SAT$2.1 million. These expenditures are for the reopening of schooling for affected students. Post disaster experience globally has demon-

strated that one of the important lessons learned for schools and school children is to try and restore some semblance of normality and routine to their lives. Further with national exams looming for grade 8 students it was also important to get schools back in operation. The increase expenditures for emergency schooling is designed to ensure all students can return to school and stay in temporary facilities while new schools are rebuilt.

It is important to note that these numbers do not take account of the resources already expended in the humanitarian response period – i.e. from the date of the tsunami through to the date of this report. The numbers are for the next two years. This will be considerable but is not fully accounted for yet.

All the expenditures and damages are for the public sector.

It is anticipated that the damages and losses would require about SAT$7 million of direct imports to replace damaged facilities and sustain the increased government expenditures arising from the direct result of the tsunami.

Table 10. Education Damage and Losses (in SAT$)

Subsector, Component	Disaster Effects			Ownership by Sector		Effects on:	
	Damage	Losses	Total	Public	Private	BOP*	Fiscal Sector**
Primary Schools	4,430,000	—	4,430,000	4,430,000	—	2,600,000	4,430,000
Secondary Schools	4,635,000	—	4,635,000	4,635,000	—	3,000,000	4,635,000
Emergency Schooling	—	—	—	—	—	—	—
School transport	—	270,000	270,000	270,000	—	60,000	270,000
Temp Learning space	—	350,000	350,000	350,000	—	250,000	350,000
Temp water and sanitation	—	720,000	720,000	720,000	—	200,000	720,000
School furniture	—	45,000	45,000	45,000	—	320,000	45,000
School materials	—	700,000	700,000	700,000	—	550,000	700,000
Psychosocial support	—	30,000	30,000	30,000	—	10,000	30,000
School supplies & monitoring	—	15,000	15,000	15,000	—	10,000	15,000
Total Emergency Schooling	—	2,130,000	2,130,000	2,130,000	—		2,130,000
TOTAL	**9,065,000**	**2,130,000**	**11,195,000**	**11,195,000**	**—**	**7,000,000**	**11,195,000**

** Lower exports; higher imports*
*** Lower tax revenues; unexpected expenditure*

Socio-economic Impact

The provision of transport services to students are an important part of the service delivery strategy and takes into account important socio-economic characteristics of the population discussed elsewhere in the report. This includes that the population affected by the tsunami is, according to the recent house hold income and expenditure survey, one of the poorest areas in the country with less disposable income than other areas. Further the population income earning opportunities have been devastated – including commercial fisheries and tourism operations. Further key aspects of subsistence food production in the form of fisheries, poultry, house gardens (mainly green vegetables) have also been destroyed or significantly reduced. This means affected households will not have the ability to fund school uniforms and pay for transport to school as typically happened prior to the tsunami.

Risk Management Issues

There are two major risk reduction measures suggested for the education sector. The first is that appropriate lessons be added the school curriculum. This is suggested in the risk mitigation section of the report and associated costs, which are not high, are included in that section.

The second measure is to relocate the two secondary schools (which were both partially damaged) at a cost of SAT$10.9 million and rebuild 3 relocated primary schools at a cost of SAT$8.2 million. This compares to a cost of SAT$4.4 million to rebuild damaged and destroyed primary schools in situ and SAT$4.6 to rebuild secondary school in situ. This would imply an expenditure of SAT$10 million to prevent a repeat of the damage done by the tsunami (see Table 11 and Annex).

Table 11. Education Reconstruction Needs (in SAT$)

Subsector, Component	Disaster Effects			Ownership by Sector		Effects on:	
	Infrastructure Needs	Losses	Total	Public	Private	BOP*	Fiscal Sector**
Primary Schools	8,150,000		8,150,000	8,150,000		5,000,000	8,150,000
Secondary Schools	10,850,000		10,850,000	10,850,000		5,000,000	10,850,000
Emergency Schooling							
School transport		270,000	270,000	270,000		60,000	270,000
Temp Learning space		350,000	350,000	350,000		250,000	350,000
Temp water and san		720,000	720,000	720,000		200,000	720,000
School furniture		45,000	45,000	45,000		320,000	45,000
School materials		700,000	700,000	700,000		550,000	700,000
Psychosocial support		30,000	30,000	30,000		10,000	30,000
Schools support & monitoring		15,000	15,000	15,000		10,000	15,000
Total Emergency Schooling		2,130,000	2,130,000	2,130,000			2,130,000
TOTAL	**19,000,000**	**2,130,000**	**21,130,000**	**21,130,000**	**0**	**11,400,000**	**21,130,000**

** Lower exports; higher imports*

*** Lower tax revenues; unexpected expenditure*

Recovery and Reconstruction Requirements

The cost of the rebuilding of schools in the affected area in safe locations (needs) is estimated at SAT$19 million (Table 6). Additionally SAT$2.1 million is required for maintaining children in temporary schools as discussed. Thus total needs are estimated at SAT$21.1 million.

The MESC has the capacity to implement the emergency school program and has already made substantial efforts to get all students back in temporary classrooms. MESC has the capacity to commission construction of new schools. The only risk to the quick implementation of the construction program could be macro constraints on the construction industry trying to complete all the work needed to be done to rebuild the affected area.

Table 7 presents the recovery and reconstruction needs for the education sector and the expected financing that may be available for the sector and thus the anticipated financing gaps. It is anticipated that JICA may be in position to finance the primary school construction program estimated at about SAT$6 million. If this is confirmed this would result in a financing gap to be filled of SAT$15.1 million.

Table 12. Recovery Needs, Financing and Financing Gaps on Education

Subsector Needs	Recovery and Reconstruction (US$ Million)		
	Recovery and Reconstruction Needs (Tala Million)	Committed Recovery and Reconstruction Financing (Tala Million)	Recovery and Reconstruction Requirements (Tala Million)
Primary Schools	8,150,000	6,000,000	2,150,000
Secondary Schools	10,850,000		10,850,000
Emergency Schooling			
School transport	270,000		270,000
Temp Learning space	350,000		350,000
Temp water and san	720,000		720,000
School furniture	45,000		45,000
School materials	700,000		700,000
Psychosocial support	30,000		30,000
Schools support & monitoring	15,000		15,000
Total Emergency Schooling	2,130,000		2,130,000
TOTAL	**21,130,000**		**15,130,000**

2.3.3. Community Infrastructure Religious and Cultural Heritage

Pre-Disaster Situation

In Samoa, stakeholder and grass roots participation has a long and successful history. Social cohesion through formal community and participatory governance practices were very much evident in the villages that were affected by the tsunami of September 2009. The extended families have regular meetings of the family under the leadership of the High Chief of the family *'Matai.* The Chiefs in turn meet as the Village Council under a Highest Chief appointed from amongst them. There are also women's committees, youth groups and 'Untitled' men's group that schedule their meetings around the meeting of the Village Council for coordination of their special interests. These traditional governance structures in turn work in

close coordination with other institutions at the village level such as the Mayor and the Church. Further, critical community services such as health and education services at the village level are tightly woven into the participatory practices of Samoan way through the village committees.

The traditional culture of Samoa that provides the foundation for the social and political life of the nation further reinforces these participatory practices. The traditional chieftaincy or the 'Matai' system, a key element in this traditional culture, still plays a dominant role both at the village level and the national politics and is widely considered to contribute towards the national stability.[7] The 'Matai' is the elected leader of a defined socio cultural group or an extended family called an 'aiga' and represents its interests in the Village Council and other community gatherings. Each Samoan family has a hierarchical 'Matai ' title which gives them their identity in the village .The Population and Housing Census of 2006 has enumerated about 16,000 'Matai' title holders of whom over 96 percent continue to actively engage in village activities using their 'Matai' titles. More than 80 percent of the land is under the traditional 'Matai' control and enjoyed by the owners of hierarchical 'Matai' titles. The cultural obligation of emigrants with 'Matai' titles is also a major factor explaining the high level of foreign remittances (SAT$365.0 representing 20 percent of GDP) which is an important source of revenue to the national economy, and the single most important source of monetary income at the village level.

The importance of community structures in the Samoan society has to be viewed in this context. Disruption of the working of these structures, as in the case of the recent tsunami disturbs not only the important self governing mechanisms at the local level but also the social and spiritual environment that prevails within a community.[8]

In Samoa, these traditional strengths can be built upon to form the foundation for the early recovery for effectively meeting the needs of the populations affected. They could be used to promote participation in the recovery efforts and to promote community ownership of the investments made. Such an approach is also important for reducing future vulnerabilities. Being a part of the Pacific Island community, Samoa is particularly vulnerable to natural disasters. With increased climate variability in the future, disasters in the region are likely to become more intense and more frequent[9].The experience of the earthquake and the tsunami of September 2009, which belonged to the category of 'local tsunamis', has strongly raised the need for greater vigilance in disaster prevention and preparedness. The threat from local tsunamis that impact the coastline within a few minutes of an earthquake close to the land, as experienced and witnessed in September, does not give sufficient time from the tsunami warning, to prepare the communities for evacuation. Strengthening the existing effective community structures, will help to build the resilience of communities against such disasters, and strengthen collaborative action, pro active response, including sharing of knowledge and information, and raising public awareness among communities to reduce their vulnerability to the effects of natural hazards.

7 Pacific Studies Series – Samoa 2000: Asian Development Bank
8 Ministry of Women, Community and Cultural Development
9 Adapting to Natural Disasters in the Pacific Region – A Policy Note 2006: The World Bank

Damage and Losses

Table 13 summarizes the damages to community infrastructure and churches from the Tsunami. A total damage of about SAT$49 million has been estimated for community structures. These damages are considered private as ownership of these facilities is with the respective communities (the GoS does not own such infrastructure).

Table 13. Table of Estimated Damages and Losses in Community and Religious Infrastructure (in SAT$)

Sector	Sub-Sector	Disaster Effects (Millions)				Total
		Damage	Losses*	Public	Private	
Community Infrastructure	Community Centres	9.0[1]			9.0	9.0
	Village Churches	40.0[2]			40,0	40.0
Total		**49.0**				**49.0**

[1] SAT$500000* 45 (Centres)/2.5

[2] SAT$2,5 M*40 Churches/2.5

** There is a real social cost resulting from the loss of these facilities. But imputing a value will be subject to lot of assumptions.eg. Value of community support lost to trauma victims*

Recovery and Reconstruction Requirements

Strategy: The strategy proposed here underscores the need to assist the communities to resume their traditional strength along with the early recovery of lost physical and economic assets. It focuses on community infrastructure damaged by the tsunami such as community buildings, community access roads, community managed water supply schemes, and socially significant cultural infrastructure such as the village churches, which are valuable assets of a well functioning community. For this purpose the strategy covers the affected villages as well as new dispersed settlements in the inland plantations created by the members who are hesitant to return to their former villages. The emphasis on user participation should strengthen them further to assume even a greater role at the community level, in the reduction of impact of possible future extreme events of nature.

Community Centres: The community buildings were assets created by individual communities, sometimes with the assistance from the village church for their common use. Every village had its own gathering place or the community building, which facilitated the different village level committees to meet, discuss and share ideas as a community. The village health clinic is operated from the village community building and the Village Health Care Worker, who is a member of the community, trained by the Department of Health managed the Village Health Clinic. Some community buildings were designed as multi-purpose halls for promoting village cultural activities.

Community facilities that encourage broad based consultation amongst its members will be important to a user driven development approach. The rehabilitation or reconstruction of the community centres to sustain community initiative is important for the success of the recovery at this critical stage when ground level decisions are being made and plans are finalized. However, meeting the cost of such repairs will be beyond the capacities of the most communities in their impoverished circumstances, when the disruption of their personal lives and families dominate their immediate concerns.

The strategy therefore proposes the inclusion of the cost of a basic community centre within the cost of the Early Recovery Framework. The limited assistance proposed here will help the community to build an open *fale* type meeting hall in every affected village estimated to cost 2 times the cost of a *fale* type house ie. SAT$120,000. The construction will be undertaken with the active participation of the user community. Since the actual meeting halls destroyed in the village are considered to be sometimes several times larger than the proposed building, design will allow for the expansion of the building by the community using their own resources at a later stage. In addition to these 31 community centres, financial provision is proposed for 8 additional centres of a smaller size (1.5 times the *fale* house) costing SAT$90,000 to serve the new communities settled inland, where they are no longer able to attend the community meetings because of the distance from their original village. Since the population movements are still not well established on the ground, their actual location will be determined later in the recovery process.

Community Managed Water Supply Schemes: All villages affected by the tsunami except two had piped borne water services provided by the Samoa Water Authority (SWA). These services were successfully reinstated by the SWA during the early days of the emergency phase. The three community managed water supply schemes that were damaged in Vavau, and Aufaga including Saaga that served a population of about 1000 are being reinstated by SWA with assistance from New Zealand. The communities settled inland are being provided water with tanker trucks. UNICEF will provide two Water Engineers for site investigations for gravity supplies and bore holes and water quality testing to provide more permanent supplies to these communities.

Table 14. Summary of Recovery Needs for Community Infrastructure

Sector	Sub-Sector	Build Back			Build Back + Relocate		
		Public	Private	Total	Public	Private	Total
Community Infrastructure	Community Centres	1.5[1]		1.5	1.78[2]		1.78
	Village Churches		40.0	40.0		40.0	40.0
	Flights of steps up the cliffs	0.8		0.8	0.8		0.8
Total		**2.3**	**40.0**	**42.3**	**2.58**	**40.0**	**42.58**

[1] SAT$120000*31Centres/2,5
[2] Sum 4 above + 90000*8

Community Access Roads: The network of roads in a village includes the access roads to the hinterland. The access roads to inland settlements are unsealed and were under community maintenance. Their maintenance had been poor and the wear and tear of tracks has increased with increased traffic such as water tanker trucks and relief deliveries. During the recovery phase these roads are expected to get worse, with the trucks carrying heavy building components and additional transport of water for construction purposes. The Government proposes to improve and seal these roads estimated to be around 26 km in length and costing about SAT$2.0 M per kilometer. Financing needs for these access routes are addressed in the transport sector.

Emergency Escape Routes on the Cliffs: With the clear signs of some of the affected families wanting to return to their original land for economic and cultural reasons, special attention needs to be paid to the safety and protection of those who return. In this context, the communities who feel the need to return, have proposed the provision of flights of steps in a few selected places on the near-by cliffs, so that people are able to escape in time to the highland in the event of an early warning of an earthquake or a high wave. Since the proposal is in very early stages and needs further investigation, resources are proposed for 10 flights of steps to a safe height at a cost of SAT$2.0 M per flight of steps.

Cultural Infrastructure: The area affected by the tsunami did not include any historical sites, such as museums and libraries etc. The most valuable cultural infrastructures damaged are the village churches, which had been big investments and the ancestral graves that Samoans have in the proximity to their houses.

Churches: Given the number of denominations present in a village, most villages had more than one church. The village church is an important institution that enjoys community ownership and shared pride. The Pastor or the Minister in return is able to exert significant influence on the decisions of its followers. The respect the church earns from the community is so high that in the aftermath of the cyclones Ofa in 1990 and Val in 1991, the communities affected were reported to have volunteered to rebuild the Pastor's house and the church before rebuilding their own homes. The churches affected have not been enumerated in the damage assessments of the Government but are expected to be available with respective denominations. However, if diversion of community energies to rebuild these institutions as had been the tradition is to recur, it will result in major delays in the recovery of housing and its social costs could be significant. On the other hand, the positive influence the church and the Pastor have on the community will be a great resource that can be used effectively in a people centred approach to post disaster recovery.

Samoa does not have a tradition of state assistance to build churches. However, the respective denominations are believed to be able raise a large share of the funds needed for rebuilding of the damaged and destroyed churches which are estimated to number around 40. It is also believed that some of the larger well resourced NGOs active in the country, operating charities promoting Christian values will also be able to contribute towards this effort.

Recovery costs of churches vary significantly. An average value of SAT$2.5 M is applied to value the cost of damage assuming that some churches being solid structures have suffered only partial damage.

Family Grave Sites: Samoans have a tradition of burying the dead in their family compound and almost every affected family has an ancestral grave site in the compound they live. This sense of belonging is also believed to be a strong factor that influences their return to their places of origin despite the risks inherent in a decision to return to an unsafe environment. Many of these graves were severely damaged by the September tsunami. The respective families are expected to attend to their rehabilitation as a matter of priority with the assistance received from emigrant members of their families.

2.4. PRODUCTIVE SECTORS

2.4.1. Agriculture, Livestock and Fisheries

Overview and Pre-Disaster Situation

Samoa a Polynesian country has the land area of 2,934 sq km and a population of around 183,000 people. Almost 80 percent of the population lives in rural areas with about 66 percent contributing to some form of agriculture activity. The national economy is dominated by agriculture which is characterized by smallholder subsistence farmers who contribute to 19 percent of the agriculture GDP. The production base is narrow being confined to small scale root crops, vegetables and fruits production. The plantation crops include mainly coconuts, cocoa, breadfruit and bananas. Floriculture for beautification, traditional and medicinal plants are also of significant economic and cultural value in the Polynesian society.

The monogastric animals include pigs and chicken and ruminants cattle, goats and recently introduced 'Fiji Fantastic Sheep' from Fiji. Nearly 85 percent of the pigs are unimproved or indigenous breeds. They come in all sizes, shapes and colour and largely free ranging and well adapted to local conditions and subsist mainly in poor nutrition.

The main concentration of Samoan population is on the two volcanic islands of Upolu and Savai'i where about 330 villages are located. And this is where the main agricultural activities are carried out.

The main focus of agricultural development in Samoa is to enhance food security through intensification, diversification and value-adding in both crops and livestock sectors quite apart from other economic growth sectors.

The central ridge of both islands is rocky with steep slopes. Only limited area is amenable to mechanization as most arable lands are still covered with volcanic rocks and boulders.

Samoa is highly vulnerable to destructive cyclones and droughts that can severely affect food security and endanger human life and property damage. Much of agriculture and the population concentration are on the coastal areas of the country.

The damage assessed for the crops, livestock, fisheries and other income generating activities reflects the situation prior to the tsunami disaster. These have been quantified under sub-sectors of crops, livestock, and fisheries assets.

Damages

The damages to crops and livestock quite apart from the destruction to farm inputs, tools, fishing boats and gears; and agricultural amenities in the coastal land area affected by tsunami (waves and salty water) was complete. The damage assessed for crops is SAT$1,531,750 and for livestock SAT$324,000.

The damage to the marine resources and environment as visually observed from land and inference made based on coastal destruction is also estimated at SAT$12.6 million (See Table 15 for details). It should be noted however, that this figure however is highly uncertain since no detailed inspection of the marine

damages has been done. The experience in American Samoa showed that coral reef damage, whilst varying greatly was not as extensive as land surface damage nor did marine damage sites correlate particularly with terrestrial damage sites.

Losses

An estimation of losses has not been a part of damage assessment in most Pacific Island nations when assessing damages following natural disasters. Damage was interpreted as being inclusive of the losses as well which not the case. However, for the tsunami that affected Samoa, losses have been assessed and estimated for all commodities and income generating activities that were impacted. The important distinction between damages and losses is that the loss in production and or income in subsequent months and years following a natural disaster have to be calculated and added to the estimates of damages. This has to be calculated based on the time it would take to re-establish the lost crops, livestock and income generating activities like fisheries to reach the production level as prior to the disaster. Sometimes estimating this may be difficult but not impossible. The estimated losses to agriculture is SAT$8 million livestock SAT$1.4 million and fisheries SAT$11.5 million. The total losses have been calculated and shown in detail in Table 15.

Virtually all damages and losses that resulted from the tsunami have exclusively impacted the private ownership (see Table 15).

Table 15. Agriculture, Livestock and Fisheries Damage and Losses (in SAT$)

Subsector Component	Disaster Effects			Ownership by Sector	
	Damage	Losses	Total	Public	Private
Agriculture	1,531,750	8,090,325	9,622,075	-	9,622,075
Livestock	324,000	1,358,100	1,682,100	-	1,682,100
Fisheries	12,592,400	11,557,800	24,150.200	-	24,150,200
Total	**14,448,150**	**21,006,225**		**-**	**35,454,375**

Socio Economic Impact

Apart from several fatalities and injuries to human life considerable loss has also been recorded to livestock, crops and fisheries subsectors. This has impacted greatly on the health, education, economic, cultural and normal daily lives of the affected population in 21 villages who were affected.

The above impacts represent the main parameters with significant contribution to food insecurity to the families and to the tourism sector. On the latter, local tourism in the Aleipata area was the main market outlet for the farm families and a source of cash income and it warrants special consideration for alternative options.

Risk Management Issues

Serious consideration needs to be given to relocating the existing population to safe and higher ground. The short term crops could continue to be grown in the affected areas together with the rehabilitation of the damaged and new plantings of perennial crops. The main livestock pigs and poultry will have to be relocated on higher grounds. The reason being it would be difficult for the farmers to keep their livestock away from where they actually reside.

For fisheries, fishing boats and fishing gear need to be protected from future disasters. It is considered prudent to make special provisions for the safe keeping of these assets by the fisherman.

Apart from the damages and losses, there has been considerable pollution of the sea water inundated land and sea area. The consumption of fish and other marine products from these polluted areas may not be safe, therefore it is advisable that people should be discouraged from fishing in these areas until such time that an assessment is made of the fishing areas and declared safe.

The other risk to the human health is the consumption of water from within the affected areas and the likelihood of injuries particularly to children with debris left from the damaged buildings, vehicles and other objects which maybe partially buried in the sand. Even though the local people are aware of these dangers it would be desirable to reinforce the message through the media.

Recovery and Reconstruction Requirements

The estimated value to restore agriculture and fisheries sectors to pre-tsunami level as assessed by MAFF is SAT8,538,400.00 (See Table 16). The number of people considered in this assessment for rehabilitation is estimated between 350-500 households. For short term crops such as vegetables, root crops and small livestock, the rehabilitation effort should begin as soon as possible. For the long term crops effort has to be made to source and secure healthy planting materials as well as to rehabilitate damaged trees where possible and establish new plantings. These efforts will compliment the immediate food security needs of the local population, restore the affected farms and open local market for produce especially with the tourist resorts. The food aid will only last for so long and there after the people will be left to look after themselves. So it is important to get our people involved in the planting of short term crops and raising livestock that will mature within a few weeks to a few months.

The activities are prioritized in respect to food security and the immediate need to establish the staple food supply system. The longer term objectives are achieved with proper settlement of family members.

Agriculture, Livestock, and Subsistence Fisheries

- Rehabilitation/reestablishment of damaged and lost home gardens and plantations to increase local food supply and reduce dependency on food assistance.
- Restocking of lost small backyard livestock (poultry and pig) to increase availability of protein.
- Provision of suitable fishing alternatives to subsistence fishers who cannot fish within the reef anymore due to tsunami damages.
- Agriculture inputs such as farming tools, seed and planting materials and some agrochemicals should be provided to facilitate rehabilitation. Inputs should be sourced as much as possible from the local market. A system to ensure adequate quality control needs to be established. Supporting services such as tractor and rotor-tiller plough is essential to speed up production.

Table 16. Estimation of Inputs for Emergency Response and Recovery on Agriculture

Priority of Response Action	
PRIORITY I	
Support Services	**388,000**
2 Tractors for clearing rocks and boulders @ SAT$110,000.00 4 Rotor-tiller for tilling the soil @SAT$20,000.00 1 Vehicle for monitoring & managing @ SAT$88,000.00	
Agricultural Inputs	**1,200,000**
Seeds for 350 households @ SAT$300.00 per household per 3 month period Planting material for 400 households @ SAT$200.00 per household Tools & equipment: Bush knives for 500 households @ SAT$50/b/knife, 4 per household Axe for 500 households @ SAT$200/axe/household File for 500 households @SAT$50/file/household Knapsack sprayer for 400 households @SAT$500 Spades for 500 households @SAT$150 Picks for 400 households @SAT$200 Oso for 400 households @SAT$50, 2 per household Mata-tuai for 500 households @SAT$50 Hammer for 500 households @SAT$150 Pliers for 500 households @SAT$150 Chainsaw 10 (MAF) @SAT$30,000 Chemicals & fertilizers Sting (Systemic) herbicide for 500 households @SAT$180/5l, 1 per household per month (monitored carefully) Other Insecticide & fungicide for 500 households @SAT$200/month worth	
Fisheries	**1,810,400**
Coral rehabilitation (MAF) Projects 21 villages@SAT$30,000 ea Paopao (Canoe) 227 households @SAT$5000/canoe Fishing gear for 227 households @$200/household	
Miscellaneous Costs	**29,000**
Fuel for Tractors SAT$6,000/6month Fuel for Support Transportation SAT$12,000/6month Stationery & materials for training SAT$3,000/6month Chainsaw fuel SAT$5,000 Other Costs SAT$3,000/6 month	
Sub-total Priority I	**3,427,400**
PRIORITY II	
Agricultural Inputs	**2,295,000**
Poultry for 500 households @SAT$30/chicken, 4 hens, 1 rooster per household Chicken fencing for 500 households @SAT$800/50m x 4 per household Chicken feed for 500 households @SAT$80/40 kg x 4 per month per household Chemicals & fertilizer Protective clothing for 500 households @SAT$300	
Fisheries	**912,000**
Alia @$40,000 ea for 12 households Fishing gear and safety equipment for 12 household@$15,000/alia Alia outboard motor for 12 household @$15,000/alia Radio, GPS etc. for 12 alia@$6,000/alia	
Sub total of Priority II	**3,207,000**
PRIORITY III	
Agricultural Inputs	**1,904,000**
Pigs for 350 households @SAT$400/pig, 3 sows, 1 boar per household Pig fencing for 350 households @SAT$500/50m x 4 per household Pig feed for 350 households @SAT$80/40kg x 4 per month per household Chemicals & fertilizer Fertilizer for 350 households @SAT$200/40kg sack, 6 per household per 4 months	
Sub total of Priority III	**1,904,000**
Grand Total	**SAT$8,538,400**

- Provision of small livestock such as chickens and pigs, accompanied by startup kits including supplies for pig and poultry pens, feed for the initial period, training and animal health support. It is essential that both crops and livestock production receive ample water supply, especially with the destruction of water tanks in the tsunami. The provision of water tanks is recommended[10].
- Inshore Fish Aggregation Devices (FADs) should be deployed for village communities in support of subsistence fishing.

Small-scale Commercial Fisheries

The small-scale commercial fisheries sector in Samoa is based on longline tuna fishing, trolling and bottom fishing. The repair/replacement of lost vessels is an option to restore income generating activities and source of protein.

- Rehabilitation of damaged Alia fishing vessel fleet, repair/replacement of lost/damaged engines, fishing gear and other equipment to allow for early resumption of fisheries activities to ensure adequate supply to the local market and minimize risk of price increase.
- Training of mechanics to build capacity of repair and maintenance of out-board engines.
- Rehabilitation of damaged giant clam nurseries.
- Private sector grant / credit mechanisms could be activated (via bilateral channels) to support the rehabilitation / replacement of Alia fishing vessels and provision of lost equipment and fishing gear.
- Inputs and technical assistance for the rehabilitation of mariculture activities.

Fisheries Management Strategy

The Village Community Fisheries Management (VCFM) has been very active to sustainably manage the resource. A project costing is included on this community-based model for coral gardening to rehabilitate the inshore fisheries. This is a major source of protein at the villages.

Table 17. Strategies for Early Recovery on Fisheries

Category	Farming type	Process	Priority (1=high)
Food security	Annual crops – Vegetables, root crops (taro, cassava, taamu, yam- ufi tau etc.)	Land clearing and planting	1
	Biennial crops – banana etc	Land clearing and planting	1
	Biennial crops – yam palai maoi etc.	Land clearing and planting	2
	Perennial crops – breadfruit etc.	Land clearing and planting	1
	Perennial crops – Fruit trees etc	Land clearing and planting	2
	Fishery – inshore rehabilitation	Coral gardening	1
	Livestock – small animals	Restocking chicken and pigs	2
Farming as a business	All of the above with time.		3
Supporting services	Infrastructural and technology support (MAF)	Equipment (tractor) and seeds	1

[10] Cost of Water Tanks is not included in this report.

In parallel with Early Recovery activities and interventions, an in depth sector assessment needs to be carried out to evaluate progress of implementation and improve on medium and long term rehabilitation strategies.

Summary of Available Capacity

- Existing network and channel for aid to vulnerable households.
- Redirecting of resources to address the most immediate early recovery needs.
- Technology source from MAF and relevant agencies.

FAO was immediately available to provide the necessary technical support in the early recovery and medium to long term rehabilitation process. Resources have been allocated to meet immediate needs. SPC, USP and others have also expressed offer of assistance.

2.4.2. Industry and Commerce

Pre-Disaster Situation

The Commerce sector in Samoa accounts for 20 percent of GDP and comprises wholesale and retail trade outlets. The sector is estimated to have declined by 1.6 percent in 2008/09 driven by falls in construction sector activity as well as falling consumption as price rises, particularly in food and fuel, reduced real personal incomes.

Most commerce sector enterprises are located around the main urban centres particularly Apia. In the disaster affected districts of south Upolu most commerce enterprises and small or micro enterprises operate with a small number of employees or family workers. According to data supplied by the Ministry of Revenue the number of wholesale and retail businesses in the tsunami affected areas/districts numbered 155. Many of these small retail businesses close to the sea benefited to some degree from purchases by tourists.

Damage and Loss Assessment

Figure 9. Retail store damage in Malaela and Petrol station in Vailoa

Of the 155 commercial enterprises, and following consultations with the Small Business Enterprise Centre which conducted a survey of the worst affected areas, it is estimated that 52 small and micro retail businesses employing an average of 2 persons (employees or family workers) were severely or partially damaged. All were in the private sector. Damage included complete destruction of retail shop premises, partial destruction of premises and loss of stock and furniture and fittings.

These damages will cause interruptions of business for several weeks and longer for those which were completed destroyed. Physical damage to the premises, fittings and loss of stock is estimated at SAT$900,000. This does not include damage to the business owners houses which in most cases were adjacent to shop premises. These losses are accounted for in the housing sector analysis.

The estimated average recovery period for the 52 commercial enterprises is just over 9 weeks. This is the period needed, on average, to repair/rebuild premises, restock inventory and repair damaged equipment. Some businesses will also need to refinance their operations.

However, some retail stores had already re-opened within around 3 weeks of the disaster, although repairs were needed to fully restore their premises. Electricity and water supply was restored within a few days of the tsunami and has not been a constraint on most businesses. Other businesses may not reopen at all and some may not be in a position to re-open for several months.

Normal sales volume for the 52 retail businesses totaled around SAT$334,000 per month. Losses in sales are estimated at SAT$804,500 during the average 9 weeks that these businesses will not be in operation. Whilst these businesses are not in operation, residents of the affected areas are using other retail outlets. In addition food rations and other household supplies have been supplied by government and relief agencies for at least 4 to 6 weeks following the disaster. The only petrol station in the area was badly damaged. Additional costs to vehicle owners for re-fueling are accounted for in the transport sector.

Household incomes in the worst affected areas have been reduced due to loss of income from agriculture and fishing and from the loss of jobs in the many tourism establishments in the area. This is likely to result in reduced sales income, at least until tourism operators have rebuilt and re-opened which may be until September 2010. It is estimated that this will reduce normal sales income for the affected businesses by around SAT$515,400.

The loss of sales income is likely to result in lower VAGST collections of around SAT$216,000.

Table 18. Losses on Commerce Sector (in SAT$)

Commerce sector	Disaster Effects		
	Damage	Losses	Total
Values	900,063	1,319,922	2,219,984
Loss of employment		990 weeks	

Risk Management Issues

Whilst the damage to some business will have created new hazards such as chemicals, spills and debris clean, risk management issues arising from this are discussed in the environment section. Many risk reduction measures to build back better are also discussed in sections on housing and transport.

The principal risk management strategy for small business of the type covered in this sector lies in insurance cover. Samoa has three national insurance companies offering cover for natural perils including tsunami. According to a review in 2006 only 25% of residential houses had some form of cover, and no data are available on the proportion of small scale business covered. Insurance premiums for disaster cover in small markets can often varying greatly and are hard to price in the absence of good information of probable losses. Improvement of both the quality of risk information and access of people to that information has been shown to support the development of competitive national insurance markets and increased coverage of private sector assets. In many cases, mortgagors require properties to be insured against natural perils to at least the value of the mortgage.

Recovery and Reconstruction Requirements

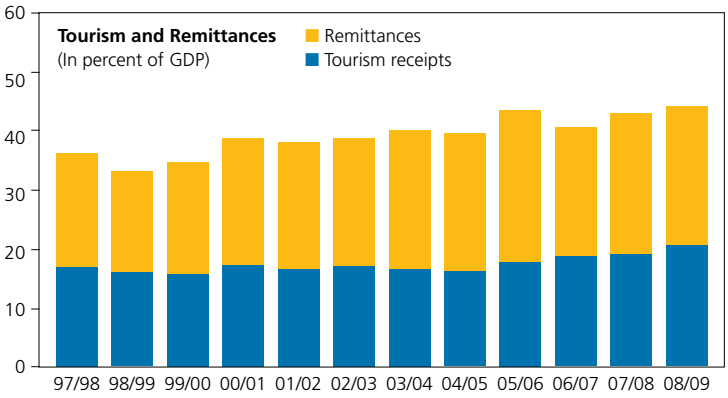
The speed with which many of these retail businesses will be able to refinance their businesses to repair damage and restock their inventory may affect the average time in which the businesses are out of operation. It is estimated that some SAT$900,000 may be needed for this refinancing. Some of this may come from increased remittances from relatives working overseas and some will come from refinancing existing loans, for example through assistance from the Small Business Enterprise Centre.

In addition many of the businesses will need to rebuild their houses which were adjacent to business premises. These needs are accounted for in the housing sector.

2.4.3. Tourism

Pre-Disaster Situation

Tourism is one of the most important economic sectors in Samoa with expanding momentum. Before the tsunami, tourism revenue accounted around 20% of the total GDP with more than 130,000 arrivals annually. Assuming that the expenditure of each tourist is an average of US$ 950 during the stay, the annual revenue from tourism is around US$ 123 million, and tourism is by far the single largest commercial earner of foreign exchange. Tourism receipts in FY 2008/09 accounted for 65 percent of all export earnings and the sector is estimated to contribute directly and indirectly (through domestic suppliers) to about 14 percent of GDP. Estimated direct tourism employment is 5,400 persons, which accounted 10% of total employment as per the 2006 consensus.



Sources: Samoan authorities and IMF estimates

Figure 10. Tourism and Remittances account for almost half of Samoa's GDP

Before the tsunami hit, a total of 1473 rooms (or 3512 beds) were available for tourists accommodation (see Table 19 for a breakdown of available facilities).

Table 19. Tourism accommodation facilities stock prior to tsunami

	Property	Total Rooms	Total Beds
Deluxe	5	326	854
Superior Standard	5	135	314
Standard	21	315	759
Budget	27	406	864
Beach Fale (overnight)	9	153	358
Beach Fale (day visit)	18	138	363
Grand total	**85**	**1473**	**3512**

Source: Samoa Tourism Authority

Damages and Losses

The southern and south-eastern coast of Upolu island is one of the most popular tourism destinations with well-developed tourism facilities. The damages caused by the tsunami are mainly concentrated on physical infrastructure such as buildings, furniture and other equipment. The total estimated damage is around SAT$24.1 million (or US$9.6 million)—the third largest sector damage after transport and housing.

In terms of capacity, 20% of total accommodation rooms (or 23% beds) were totally destroyed or partially destroyed. The biggest impact is on the beach fale accommodation category, where 77% rooms or 79% beds are not available anymore. For the other categories (superior, standard and budget), the rate is limited to 7%-8%.

Table 20. Affected Tourism Accommodation Facilities

Category	Rooms	Beds	Damages (in SAT$ M)
Deluxe	47	106	14.1
Superior Standard	9	26	1.8
Standard	9	39	0.9
Budget	31	88	1.6
Beach Fales (overnight)	100	262	2.4
Beach Fales (daytime visit)	110	273	

Source: Samoa Tourism Authority

All the tourism properties along the Lalomanu, Saleapaga, Aufaga and Vava'u have been completely destroyed including restaurants and bar facilities. Almost all of the tourism facilities in the affected area were located quite close to the beach and were therefore greatly affected.

The medium and long-term economic losses caused by the tsunami could be serious and complicated. The estimation on revenue losses is not only about rebuilding the accommodation facilities, but also about how soon tourists' confidence can be fully restored. Base on the international experience, it may take four to eight quarters before tourism revenue regain their pre-disaster levels, as was observed in Thailand, Maldives and Indonesia.

Even if the affected areas only account for 20% of the total facilities stock, it is possible that the revenue losses will be higher than 20% of the total. Depending on how quickly Samoa will be considered as a safe and attractive destination among tour operators and the general public, the number of incoming tourists could decline because of the tsunami. Some early anecdotal evidence shows that some tourists may be diverted to the many other alternative destinations in the region.

It is difficult to predict how soon revenues from tourism can regain their pre-disaster level, as the number of arrivals would also depend on other factors –beyond the tsunami itself—related with the economic situation in the countries were tourists originate from. Some experts believe that tourist activity can be fully restored within next year. Even under this case, it is likely that 25%-30% of the revenue will be lost, translating to SAT$76.8 million (or US$30.75 million) - SAT$92.25 million (or US$ 36.9 million). If the rehabilitation takes longer, 6 to 8 quarters, the losses can reach SAT$114.4 million (or US$ 45.75 million) to SAT$153.7 million (or US$61.5 million). Under this scenario tourism will be the sector with the largest losses.

As mentioned earlier, past experience shows that return of the tourist confidence may take a longer time than the reconstruction of the facilities. Without tourist arrivals, additional losses may be incurred even after two years following the tsunami. It is therefore necessary to adopt marketing and promotion measures to facilitate the rehabilitation of the market. Monitoring the perception of Samoa as a tourist destination would be important through appropriate surveys.

Inputs for Macro-Economic impact Analysis

Tourism is the largest commercial earner of foreign exchange in Samoa. But tourism is also a fragile sector which heavily depends on the natural beauty of Samoa and overseas demand. The tsunami affected negatively both of these factors directly and indirectly. Lower revenues from tourism will put pressure both on

the fiscal side because of reduced tax receipts, and on the balance of payments because of lower foreign exchange inflows.

The foreign content of the damaged facilities is estimated at 60 percent of the total, which translates to about SAT$14 million. Most of the economic losses of reduced tourism would also affect the balance of payments for an estimated SAT$55 million. Reduced tax revenues from tourism are uncertain because of the informality of a significant number of facilities. Nevertheless, it is estimated that reduced revenues from tourism could reach SAT$10-15 million.

Socioeconomic Impact

Tourism is one of the largest non-agriculture sectors for employment in Samoa. It is estimated that the affected tourism facilities has employed approximately 500 persons before the tsunami, of which about 60 percent were formally registered. Unless these persons can be reemployed in other unaffected areas or sectors in the short term, a large number of unemployed personnel appear. Assuming that each tourist employee supports two to three persons, the number of adversely affected people could be doubled or even tripled.

Risk Management Issues

Risk management in the tourism sector should count with contingency plans and response aimed at informing foreign tourists of the hazards and risk management options. This implies ensuring that hotels contain clear instructions in various languages on what a tsunami or cyclone event is, what to do and not to do, and signage for evacuation or shelter instructions. Staff should be trained in guiding tourists and ensuring that they comply with the response plans.

The rebuilding of tourism infrastructure in affected areas should incorporate the most detailed hazard mapping information available and consider not only the building locations – higher above sea level and further from the shore – but also the beach front debris field. Resort should ensure that they regulate the type of structures and materials left close to the water's edge as even ornamental posts, board walks, large stone pots can become hazardous debris caught in the wave run up.

The reconstruction plans and progress on tourism accommodation facilities will be highly affected by the design and timeframe of other basic infrastructure rehabilitation, such as roads, seawalls, power and water. The environment rehabilitation is also an essential part of the whole plan. An integrated plan and efficient coordination are being recommended.

Since most of the reconstruction requirements are expected to be funded by the private sector, an innovative risk management mechanism and efficient insurance system should seek to incentivize risk reduction in private investment.

Recovery and Reconstruction requirements

The estimated total recovery and reconstruction needs for tourism are SAT$36 million, the second largest after transport. About SAT$6 million are needed for clean-up and other immediate recoveries within next 6 months, while the remaining SAT$30 million would be required for facilities reconstruction after that.

The reconstruction plans and progress on tourism accommodation facilities will be highly affected by the design and timeframe of other basic infrastructure rehabilitation, such as roads, seawalls, power and

water. The environment rehabilitation is also an essential part of the whole plan. An integrated plan and efficient coordination for reconstruction of tourist facilities are recommended.

A series of policies has been proposed to the government to facilitate the recovery and reconstruction. The government is considering SAT$500,000 funding for marketing and promotion while import duty concessions may be granted to the affected 32 tourism accommodation businesses.

Most of the reconstruction requirements are expected to be funded by the private sector, however financing by banks might require additional risk management mechanisms and insurance arrangements that take into account the risks of the tsunami.

Further to the reconstruction of physical infrastructure, it would be important to maintain well-trained and key employees during the reconstruction period.

2.5. ECONOMIC INFRASTRUCTURE

2.5.1. Housing

Pre-Disaster Situation

Prior to the disaster, housing in the affected areas was available and generally adequate including provision of utility services (water, electricity). No complete detailed registry of housing units and owners is available, although the EPC holds a database of customers and their geo-referenced positions. However, the number of electricity connections does not appear to correspond to data collected after the tsunami, indicating that probably multiple households would on some occasions be metered at a single point. A number of beach fales in the coast appear to have been used both to house local families and to provide lodging for tourism (however, such economic impacts are considered at the tourism section of this report). Most importantly, however, it appears that housing insurance has been totally absent. Because damages in the housing sector are overwhelmingly incurred by private people, the financing of reconstruction costs may be difficult in the absence of some public support.

Damages and Losses

Damages to the housing sector were estimated as the cost to repair and rebuild the number of housing units that have been partially or totally destroyed plus the value of replacing the household goods that were similarly destroyed. The number of units in each type of housing unit identified were combined with the estimated repair and reconstruction costs that will enable building back housing units to the same level of quality and extent they had prior to the disaster.

Data for the number and typology of houses destroyed were provided by DMO on the basis of reports from the heads of villages collected by the DMO. According to the above data a total of 742 units were fully destroyed and 64 were partially destroyed, which represents about 13 percent of the country's housing stock[11].

[11] It is noted that the figures of electricity connections affected by the tsunami reported by EPC were less than 400, while water connections affected reported by the SWA were about 680. Discrepancies between these figures and the data provided by heads of villages could be explained in the case of electricity because of possible multiple connections to houses that are metered at a single point, while in the case of water there may be units that were not supplied at the time of the tsunami. Nevertheless, a separate detailed verification of the actual units affected should be undertaken as part of the recovery efforts.

The initial rapid assessment of the damage and loss made immediately after the tsunami, had estimated that the damage to housing as 685 in 31 affected villages in the Southern and South-Eastern Coast of Upolu Island and Manono tai of Samoa. These estimates were based on the early reports of the village Mayors. The Disaster Management Office of the Ministry of Natural Resources and Environment has more recently undertaken a field verification survey of these initial reports. The survey has established the extent of damages to houses from the list initially presented. The new numbers include a few houses missed out in the early reports but picked up during the verification survey. While a total of 406 families had claimed that 908 structures were damaged, the survey has ascertained the number at 566 housing units. Of this number 405 are fully destroyed and 80are structurally damaged. An additional 81 units have suffered partial damage. Of the 50 villages reported to have been affected three villages, namely, Satitoa, Mutiatele, Saleapaga, have suffered worst with over 70 houses destroyed in each village. Further 8 villages have been affected seriously with damage assessments of over 20 houses per village. Eight villages have lost between to 10-20 houses. Other villages covered by the survey have been affected but the damage caused to housing is relatively small. See Table 21 for the District and Village breakdown of the total damage.

Table 21. Assessment of housing damages

			No of Families and Houses Affected		Houses Affected (Verified)			
District	#	Village	Families	Houses	Destroyed	Structurally Damaged	Damaged	Total
Anoamaa	1	Eva	0	0	0	1	0	1
	2	Salelesi	0	0	0	1	0	1
District Sub Component: Anoamaa			0	0	0	2	0	2
Lotofaga	1	Lotofaga	9	22	2	0	2	4
	2	Matatufu	6	6	0	0	3	3
	3	Vavau	8	13	8	0	0	8
District Sub Component: Lotofaga			23	41	10	0	5	15
Falealili	1	Sapoe	1	1	0	0	1	1
	2	Utulaelae	11	13	3	3	2	8
	3	Salani	14	22	5	6	2	13
	4	Salesatele	5	6	2	3	0	5
	5	Poutasi	24	45	22	1	0	23
	6	Saleilua	2	2	0	1	0	1
	7	Iliili	2	2	1	0	1	2
	8	Vaovai	8	13	4	3	1	8
	9	Sapunaoa	7	7	2	2	2	6
	10	Satalo	5	6	2	2	4	8
	11	Tafatafa	4	4	0	0	0	0
District Sub Component: Falealili			83	121	41	21	13	75
Siumu	1	Siumu Sasae	7	9	1	2	1	4
	2	Saaga	4	7	2	0	2	4
	3	Maninoa	6	6	2	2	2	6
	4	Siumu Sisifo	3	3	0	1	1	2
District Sub Component: Siumu			20	25	5	5	6	16
Safata	1	Saanapu	0	0	2	0	3	5
	2	Tafitoala	3	3	5	4	10	19
	3	Sataoa	0	0	0	0	3	3
District Sub Component: Safata			3	3	7	4	16	27

			No of Families and Houses Affected		Houses Affected (Verified)			
District	#	Village	Families	Houses	Destroyed	Structurally Damaged	Damaged	Total
Lefaga & Faleaseela	1	Matautu	2	2	0	0	0	0
	2	Matafaa	0	0	0	0	10	10
District Sub Component: Lefaga & Faleaseela			2	2	0	0	10	10
Falelatai & Samatau	1	Siufaga	6	9	1	2	1	4
	2	Samatau	0	0	0	2	4	6
District Sub Component: Falelatai & Samatau			6	9	1	4	5	10
Aiga I le tai	1	S alua uta	5	5	0	3	2	5
	2	Faleu-uta	4	5	0	3	4	7
	3	Lepuiai-uta	2	2	2	2	2	6
	4	Lepuiai-tai	11	11	2	2	5	9
	5	Faleu-tai	13	17	4	4	5	13
	6	Apai tai	8	17	2	6	4	12
District Sub Component: Aiga I le tai			43	57	10	20	22	52
Aleipata Itupa I Lalo	1	Lotopue	2	3	2	0	0	2
	2	Satitoa	44	94	72	0	0	72
	3	Tiavea-tai	11	12	9	0	2	11
	4	Utufaalalafa	4	4	1	3	0	4
	5	Saleaumua	34	58	32	2	0	34
	6	Malaela	25	57	25	0	0	25
	7	Mutiatele	13	17	13	0	0	13
District Sub Component Aleipata Itupa I Lalo:			133	245	154	5	2	161
Aleipata Itupa I Luga	1	Ulutogia	21	45	21	0	0	21
	2	Vailoa	16	22	16	0	0	16
	3	Lalomanu	41	122	43	0	0	43
	4	Tapaga	2	3	2	0	0	2
District Sub Component: Aleipata Itupa I Luga			80	192	82	0	0	82
Lepa	1	Saleapaga	61	136	49	15	2	66
	2	Lepa	37	64	34	4	0	38
District Sub Component: Lepa			98	200	83	19	2	104
Satupaitea	1	Pitonuu	9	10	9	0	0	9
District Sub Component: Satupaitea			6	10	9	0	0	9
Palauli Sasae	1	Vaitoomuli	3	3	3	0	0	3
District Sub Component:			3	3	3			
TOTAL			**460**	**908**	**405**	**76**	**85**	**566**

Source: Disaster Management Office, Samoa: Field Verification Data – November 2009

The above survey has established that not all the 460 households reported by the Mayors of villages are seriously affected. Similarly, of nearly 900 houses reported to have been damaged, nearly half were not residential units but structures such as kitchens and other auxiliary buildings found in rural compounds. The quality, size and material used in the construction of Samoan houses known as *fale* vary widely. Accordingly, the houses affected cover the full range of housing types found in Samoa reflecting different *fale* types of varying quality. These include; *Fale Palagi* (European Style House), *Fale* (an open house), *Fale Samoa* (proper traditional Samoan house), *Fale Apa* (tin roofed house), *Faleo'o* (thatched simple version of the Samoan *fale*), *Fallee'o fale* (a central fale house), *faasee faleo'o* (a very small house), *faasee fale apa*

(a small tin roofed *fale*) etc. The large majority of the houses affected were open type houses (*fale*), the traditional house seen in most villages. However, the wave strength had been such the damage is widely distributed to all types and quality of housing. The fact that almost 70 percent of the housing stock affected had been fully destroyed also support the fact that the built quality of housing was not able to resist the wave strength although on the ground some houses seem to have withstood the wave either due to their built strength or the quality of the foundation – a point worth investigating.

The government has decided the financial grant it will provide to each affected family to replace their fully damaged house. The entitlement of 160 families whose houses have suffered structural and partial damage has not been clarified yet. Following the Asian tsunami, the early classification of partially damaged and structurally damaged houses led to much confusion in the recovery phase. First the determination was beyond the capacity of non technical staff responsible for field enumeration and the margin of error of their decisions was significantly high. If the entitlement of a family is to be based on the extent of damage suffered by a house, a competent technical team has to determine this in the field.

In the case of the group of structurally damaged houses a safety assessment must also be made by a similar team on the nature of structural damage and structural safety of fixing the damage. On assessing these, the owners of structurally unsafe houses may be made entitled to a replacement house. The houses that could be repaired may be made the responsibility of the owner families, where they will have the option to improve the house the way they wish supplementing with their own family resources, the grant assistance given to them. These families however may need technical advisory assistance to ensure that the structural damages are properly fixed, funds are properly used, and the houses are completed meeting the recommended quality and minimum safety standards.

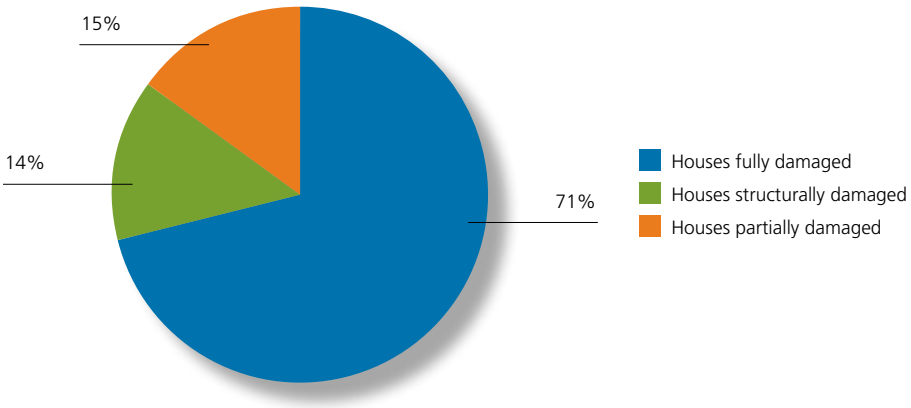


Figure 11. Distribution of Housing Damage by Extent of Damage

A closer analysis shows a wide difference in the severity of the impact of the tsunami between the different districts. Aleipata Itupa I Lao has suffered most and accounts for over 28 percent of the total damage to housing. The Population Census of 2006 of Samoa gives a total population of 3604 persons in Aleipata Itupa I Lao District. On an average family size of 7.7 [12] the number of persons affected in the 160 houses

[12] 29 September Earthquake and Tsunami: Early Recovery Framework – October 2009

damaged is over 34 per cent of the total population in the district. The analysis given in table 2 below shows that almost 80 percent of the total damage to housing was concentrated in just five Districts of the thirteen affected, A risk analysis of these districts could be valuable as it could provide key pointers to focus a future hazard reduction strategy for the human settlements sector discussed in section 5 above. It would also be helpful to get a sense of the degree of enforcement and compliance at the ground level of the risk management instruments already in place such as the National Building Code, introduced after Cyclone Ofa (1990) and the Hazard Mapping undertaken to ascertain environmentally unsafe settlements. The study should throw light not just on the on the institutional and policy gaps, but also on weaknesses in the enforcement and implementations of provisions at the disposal of the Government. They would help the authorities to reinforce the recovery programme now taking off with well coordinated risk management measures and preventive action to avoid a repetition of these weaknesses.

Four main types of housing units were used for the assessment: (i) Faleoo; (ii) Falesamoa; (iii) Faleapa; (iv) Falepalagi. The replacement value for each unit was estimated on the basis of average unit costs (per square meter) used by the office of tax registration as of August 2009, reduced by 30 percent to adjust for aging of the housing units and an average typical house size was assumed per housing unit typology.

Table 22. District Analysis of the housing impacts

District	Houses Fully Damaged		Houses Structurally Damaged		Houses Partially Damaged		Total Number of Houses Damaged	
	Number	%	Number	%	Number	%	Number	%
Aleipata Itupa I Lalo	154	0.27	5	0.008	2	0.003	161	0.28
Lepa	83	0.15	19	0.03	2	0.006	104	0.18
Aleipata Itupa I Luga	82	0.14	0	0	0	0	82	0.14
Fale al ili	41	0.072	21	0.04	13	0.023	75	0.13
Aiga le tai	10	0.017	20	0.03	22	0.04	52	0.091
Safata	7	0.012	4	0.007	16	0.03	27	0.048
Siumu	5	0.008	5	0.009	6	0.010	16	0.028
Lotofaga	10	0.017	0	0	5	0.008	15	0.026
Lefaga & Faleaseela	10	0.0177	0	0	0	0	10	0.018
Fale latai & Samatau	0	0	0	0	10	0.02	10	0.018
Satupaitea	0	0	0	0	9	0.015	9	0.016
Palauli Sasae	3	0.005	0	0	0	0	3	0.005
Anoamaa	3	0.005	0	0	0	0	3	0.005
	405	**0.715**	**80**	**0.14**	**81**	**0.150**	**566**	**1**

Data for household goods (washer, cooker, television, refrigerator, utensils, etc) were estimated on the basis of the household survey of 2008 [ref] and adjusted according to the typology of dwellings.

A summary of estimated damages and losses in the housing sector is provided in Table 23.

Table 23. Damage and Losses on Housing Sector (in SAT$)

	Type of Housing Unit				Damage /SAT$ Million	Losses /SAT$ Million
	Faleoo	**Falesamoa**	**Faleapa**	**Falepalagi**	**Damage**	**Losses**
Estimation of Damage						
a) Houses fully destroyed			131	151		
Number of units	514	11	111	106		
Average replacement cost, Tala	$12,000	$28,980	$42,000	$100,000		
Damage, million Tala $	$6,168,000	$318,780	$5,502,000	$15,100,000	$27,088,780	
b) House partially destroyed						
Number of units	0	0	20	45		
Average repair cost, US$	$6,000	$14,490	$21,000	$50,000		
Damage, million US$	$0	$0	$412,650	&2,265,000	$2,677,650	
c) Household goods	$1,079,400	$23,100	$275,100	$317,100	$1,694,700	
d) other assets						
e) Total damage, million US$	$7,247,000	$341,880	$6,189,750	$17,682,100	$31,461,130	
Estimation of Losses						
Duration of repair/ reconstruction						
Cost of temporary shelter scheme						$1,008,750
Total losses, million Tala $						**$1,008,750**

As seen around the world every disaster is a development opportunity. Disasters have a way of bringing together the Governments, donors, private sector, non-government agencies and the affected communities to overcome the daunting challenges thrown ahead which are beyond the capacity of any one actor. This meeting of minds that follows the shock and the devastation of a disaster can also be an excellent opportunity to think creatively and for authorities take measures that were known to be needed but were slow to decide under normal times. The preventive actions that failed to inspire interest in higher seats of decision making and failed to attract resources because of higher priorities assigned to investments that promise greater political visibility have a better chance of success in competing for public resources.

In Samoa, the two devastating cyclones in 1990's provided an impetus for the Government to introduce a series of Risk Management of Natural Hazards (RMNH) measures that included the comprehensive coastal protection measures, the formulation of the national building code and participatory hazard mapping that identified areas subject to erosion, flooding and land slide hazard risks. Based on this experience, opportunities can be created to manage post tsunami recovery assistance to Samoa as an integral part

of a national risk management strategy. It would help to correct some of the structural weaknesses that prevail in the human settlements sector and provide better safeguards and resilience in the event of a future hazard of nature.

The Early Recovery Framework has identified three broad strategic options that have different levels of risk reduction and protection, for settling the affected families. The Option I which offers the highest level of safety, recommends the permanent relocation of the people in the lands they have spontaneously relocated inland. This proposal has strong support from the environmental actors, those responsible for disaster management, and settlement planners both inside and outside the government. Despite the negative experience in countries in Asia affected by the Indian Ocean tsunami that attempted to impose a build free zone along the coast, where people refused to relocate themselves or consented under pressure but returned later to their lands of origin, the proposal can be supported in Samoa for several reasons.

- The topography and lay of the land is such that the cliffs are physically close to their former sea side settlements, which make it unnecessary for most of them to move into a distant land.
- The proximity of their new settlements will enable them to continue their family, community and church affiliations which are strong in Samoa. They could therefore continue to benefit from the traditional family support systems and mutual help which under normal circumstances is a strong disincentive to voluntary relocation.
- Large majority of the persons affected had their livelihoods in the rural subsistence economy primarily in agriculture and fisheries. Even the fishermen will not be seriously inconvenienced from continuing their trade with the relocation.
- Even for those who were informally employed in the tourist sector, the relocation will not be an impediment for finding work in the industry.
- Initial surveys have indicated that 95% of the affected persons have indicated a preference to stay in the safety of their farmlands. If the decision is voluntary, their decision needs to be supported.

On the positive side, it is reported that the residents of Saleapaga in the District of Lepa have met in a broad based community consultation and have decided as a community to settle on the higher lands. This points to an opportunity available as recommended in the Early Recovery Framework, to educate the people of the risks involved and the positive measures the government will take to provide them access to basic services and improve their living conditions in their new settlements. Since climate change and the risks associated are difficult concepts for people to assimilate, such consultations could guide people to take informed decisions weighing in the relative risks associated with their decisions.

People should have the freedom to decide. Population movement to safer ground inland in the immediate aftermath of a disaster is not a new experience in Samoa, as they did the same immediately after the cyclones of early 1990s. Most of them however, have returned after a while to their places of origin. The pull factors of the coastal areas are well known. More than 80 percent of the national population of Samoa lives in coastal settlements. This naturally adds complexity to risk reduction from climate related disasters. The population density in coastal regions of Samoa is about 8 times the density in other areas[13] indicating

[13] Report of the Housing and Population Census -2006

the high preference of the Samoans to live along the coast. These factors place a premium on the lands they occupy along the coastline making it a harder decision to move.

Moreover, the traditional social values and ethos influenced by the Matai family structures, family titles of honour, social organisation, extended family ties, strong community structures, customary land ownership where occupation is the basis for right to tenure, powerful links to the village church, emotional ties with ancestral grave sites on traditional land, all contribute to make voluntary relocation a difficult one for the individual living on coastal lands. Even without the strong economic and livelihood reasons that made the forced relocation from a coastal no built zone imposed after the Indian Ocean tsunami - a total failure in the Asian countries - the above factors are likely to make the people resist the evacuation from their traditional settlements. The limited institutional capacities available with the government to manage the vast land resources so released and prevent future unauthorised and unplanned settlements was also a critical factor in several Asian countries.

The reality on the ground already substantiates that the people will invariably have the final decision. In many affected villages people are moving back to their places of origin and some have even started rebuilding or repairing their damaged houses. Their decisions are believed to be influenced largely by the above factors. However, even where the people have opted to remain in safer areas because of the trauma of events in September, the delay on the part of authorities to give them access to basic services in their new places of temporary residence will naturally make them to follow the rest. The cost of providing access roads to dispersed populations, and the possible delays in securing land from customary owners for improving access are also issues that need to be resolved without delay.

People have to stay to invest on the services and the services must be available for people to stay. The question of who should act first has implications either way on the medium to long term risk reduction and mitigation. It is relevant to note, that lack of proactive intervention to address the concerns of families that were relocated after the Indian Ocean tsunami including the timely provision of basic services, made the majority of affected families to return.

The Early Recovery Framework underscores the need to ensure tenure rights of the affected during the recovery process. Most of the areas affected by the tsunami are rural in nature where customary land ownership is widely practiced. As there is no land market operation, tenancies or widespread unauthorised occupation of land, the authorities do not anticipate land issues of a serious nature to hinder the reconstruction by those families that opt to return. Even in instances where a particular housing site is found unsuitable because of heavy erosion or exposure to disaster risk, the family concerned has recourse within the extended family structure to exchange their housing plot for a safer one. This is an experience very different to situations in other countries where recovery of fixed assets after a disaster is mired in ownership disputes, shared ownership, inheritance rights, loss of legal documents, gender discriminations and encroachments,

While the explanation above clarifies the position of those who return, the tenure rights of those who remain on safe ground need closer examination. In reality most families who live on the coast also own farm land inland. The initial observation is that the majority of the affected families who remain on inland are occupying their own lands. There is however a smaller percentage of persons who remain in host family

properties on which they are not able to place a long term claim. They are also not able to buy rights for such land or an alternative land as customary land cannot be sold. The authorities however feel that such problems can also be resolved without the involvement of the higher government through interventions of self governance mechanisms at the local level and the customary land tribunal, where the affected party can be helped to negotiate an exchange of land rights.

The authorities have demonstrated remarkable efficiency in reconnecting the services damaged by the tsunami. Initial repairs or relocations of education, health, water supply and sanitation power and roads are all being attended to with generous assistance from the donors and the Australian and New Zealand armed forces.

As experienced the world over housing is the most valuable family asset lost in the tsunami. The estimated damage and loss based on early reports of damage was US$32.0 M and the build back cost of 685 units was US$40.0 M[14]. Findings of the field verification survey which revised the number of houses needing replacement to 480 units (fully + structurally damaged) will bring this down to about 70 percent of the estimated cost, still a major item of cost in the total recovery budget. Some families who can afford the cost, have already taken the initiative to repair or rebuild their houses. A further 41 families who had built their houses with mortgage loans from the Housing Corporation of Samoa have requested the Corporation for refinancing facilities to pay for the cost of rebuilding. The Corporation has decided to refinance them up to a total value of SAT$400,000. Further an unknown number have rebuilt their houses with either scavenged or local material.

In the absence of a specialised agency on housing no cohesive policy that covers the needs of the sector is available for review. However, as discussed in the following sections, implied in the decisions the Government has made during the last three weeks are important policy directions. It is believed that other implementation decisions will evolve around these key decisions.

The government has decided to assist the people to build an open fale house with permanent materials measuring 34.6m^2. A standard type plan has also been approved. The design incorporates some disaster safety elements. The material cost of the house is estimated at SAT$18,240 which will form the basis of the government grant to affected families. Two important decisions that may have implications with the beneficiary families at a later stage of the process are the decisions made to provide every affected family a house of the same design and size, and to provide the Government grant of SAT$18,000 in the form of building components and materials supplied through the private sector. All donors contributing to housing are expected to comply with these decisions, meaning that everyone must provide the same design and size of a house adopting the approved type plan and the standard materials package. The grant does not include the cost of labour, site preparation, water for construction and project management costs. Implied in this decision is also the need for individual families to take responsibility for constructing their individual houses using their family labour or for the donors who participate in the programme to associate the families and their labour in the construction of their share of houses.

[14] 29 September Earthquake and Tsunami: Early Recovery Framework – October 2009

Habitat for Humanity, New Zealand, (H&H) has offered its assistance to the Government to build the houses. Habitat for Humanity will use its volunteer led construction approach to build houses for individual families using the Government provided materials package. They will bear the additional costs associated with the project and proposes to raise funds to meet this cost which is estimated at $500,000.

H&H have lined up a group of 500 volunteers who will pay for their own travel and insurance and work for 2 weeks to a month in building houses. They will work as teams of 2 New Zealanders and 6-8 nationals and propose to complete the programme in 6-8 months. While they request the community to provide the food for the builders, H&H is reluctant to engage the untrained family members on their worksites because of insurance liabilities in the event of an accident. They have already commenced the work on the ground.

In the meantime, the following agencies have also offered to share the cost of rebuilding the houses:

Table 24. Cost sharing of Housing Recovery

Agency	Number of Houses
CARITAS	50
Latter Day Saints	40
DIGICEL	20
Others	12
Total	**122**

While the above three NGO's and philanthropists will bear the full cost of the houses they have offered to provide, H&H will help the families to build the balance houses with the package of building materials supplied by the government. Some of the donors listed above may also decide to pay H&H to build their quota of houses using the H&H volunteers as they will have better capacities established in the districts. The total number of houses Habitat for Humanity has committed to build will be reduced by the number of families who will rebuild with their own resources. Since their house designs will not comply with the approved type plan and they will not be eligible for the Government grant. This may also include at least a section of the affected families who had repaired or rebuilt their damaged houses using locally sourced materials.

As regards the three settlement options recommended in the Early Recovery Framework, although no firm decision appears to have been made, the government may leave the choice with the affected families. As a result the likely option that will be implemented by default will be the option two proposed in the early recovery framework, which will be a combination of voluntary relocation and rebuilding in their places of original residence. This decision will have budgetary implications in improving the access and basic services in the new settlements and introduction of risk mitigation measures in the coastal settlements.

The extent to which the user participation will be encouraged by the above decisions has to be seen. Empowering people, to take the lead in their recovery has proved to be the most effective path to early recovery. In many situations the community leadership has helped the affected families to elevate their quality of life to a level higher than their pre disaster existence, This has been witnessed in Gujarat in

India after the earthquake of January 2001, one of two most powerful earthquakes ever to hit India, in Afghanistan where millions were displaced from the decades long war, in Aceh, Indonesia, and Sri Lanka where the Indian Ocean tsunami of 2004 killed hundreds of thousand people and displaced millions. The key to the success of the approach however is in not just making them responsible but also mobilising them to act collectively and to bring forth the creativity and ingenuity inherent in poor communities to survive when challenged.

Owner driven housing allows people, to bring two streams of forces to work, both of which combine to produce a better quality house. To the extent the recovery process allows beneficiaries the freedom to optimise the play of these forces the beneficiary ownership and the quality of the house could improve.

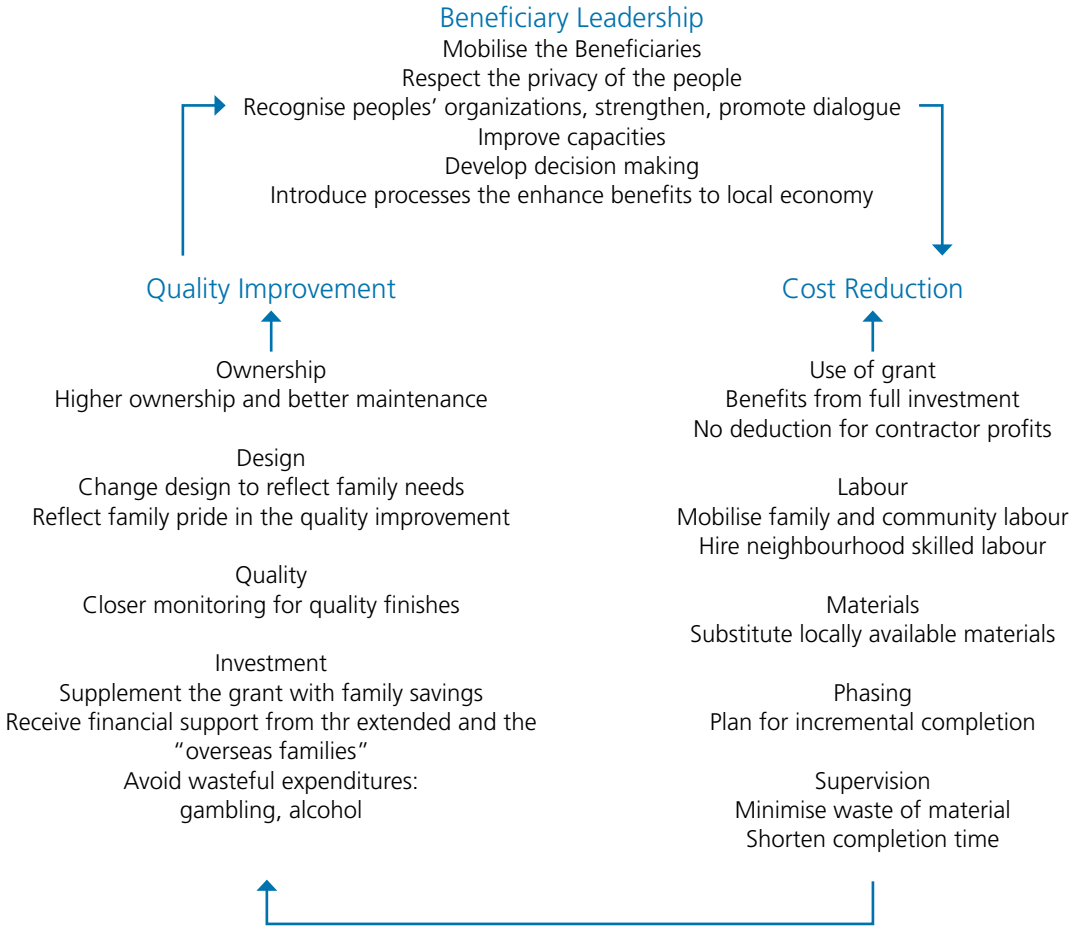


Figure 12. Owner driven housing positive outcomes of beneficiary leadership

The downward stream of flows in Figure 12 helps the user to reduce the cost of construction. Government and donors can help to improve their impact on cost reduction with mobilisation, capacity building, provision of skills training etc. These interventions should be supportive and respect the primacy of the family concerned. The upward stream on the left contributes to improve the quality and the standard of the house. This is rooted in the ability of the poor to draw strength from the family and community

support in the face of adversity. They may be strong or weak depending on the social organisastion, but tend to come together with fortitude at times like this when they are faced with a challenge beyond their strength. Together, the two streams help in producing a house in many ways better than what an outside party is able to produce. The objective of a good housing policy for the poor is to encourage their positive interaction to help the poor to reach beyond what markets are able to provide for them.

Under the present approach, even though individual families are expected to contribute their labour, the enforcement of the type plan and the provision of the building material package for the type plan can limit the choices open to the beneficiary family. The type plan and the process of building the houses for the people will also not allow the family to bring in their resources to improve or add to the quality of the house. In fact it is not encouraged at the construction stage, as the objective is to provide all families affected a similar house. This will be unfortunate since most Samoan families affected are able to get assistance from their "overseas families" to top up the Government grant. There is a risk that the non engagement of the family in the building of their house could lead to beneficiary unhappiness with the houses produced.

Therefore all parties associated with the process need to take special measures in the early stages of the programme to create opportunities for the family and community engagement in the construction process, and improve family ownership.

While there is no doubt the task of building the number of houses needed is well within the capacity of H&H and they are sufficiently resourced and committed to the task, it could well be that they may not be able meet the housing needs of some, for reasons beyond their control. The settlements that families have created in the hills are dispersed and not all are accessible. Unless the provision of access roads and basic services including water progresses in parallel some houses may not get built. A further factor will be the smaller number of families who have found residence in host properties on which they have no customary right to stay. Since sites cannot be handed over for construction without the resolution of the tenure issues such families may not be able to fit into the proposed 8 months construction programme of H&H. The Government may have to step in to coordinate the speedy resolution of these issues.

A case must also be made for the people who have rebuilt on their own, using temporary and scavenged materials. Since their economic circumstances are no different to others who were affected, there must be flexibility in the approach to accommodate them for the entitlement of the subsidy. A policy decision is also necessary on the extent of support the government is able to provide to those whose houses were partially damaged. They will also need technical advisory assistance to incorporate disaster safe construction in the repairs.

There are reports on the quality of material delivered by the private sector suppliers. Where houses are built by H&H, they are likely to ensure that only the materials meeting the stipulated standards are accepted. For the families who may have to build their own houses as in the above cases, a facility must be in place to ensure the quality of materials supplied by third parties, as the beneficiary families on their own may be ill equipped to ensure this.

Risk Management Issues

Relocation of houses is typically seen as the ultimate risk reduction measure. Resettlement of communi-

ties is a complex matter and requires thorough consultations both with the affected communities and the entities responsible for the provision of services, so that integrated planning can be prepared before government commits the significant resources required to support relocation efforts.

The rebuilding of houses in affected areas exposed to future tsunamis should incorporate the most detailed hazard mapping information available and consider not only the building locations – higher above sea level and further from the shore – but also the beach front debris field. Communities should ensure that they regulate the type of structures and materials left close to the water's edge as and loose though heavy objects can become hazardous debris caught in the wave run up or in cyclone generated storm surges.

Construction standards should also be reviewed and for buildings remaining within the hazard zones should incorporate measures such as better construction materials, reinforced foundation and elevated structures.

If the Government, does not wish to interfere with the right of a family to choose where they wish to live, the recovery assistance should also take measures to reduce the risks of the people who decide to return to their places of origin from future disasters. In addition to technical solutions such as building back better, promoting disaster resistant reconstruction, avoid re-establishing the risks that prevailed on the ground, high sea walls and the like, measures must also be taken to improve information and communication with and within communities, improve traditional self governing mechanisms for local disaster mitigation planning and decision making, the replacement of radios which were for most the main source of receiving warnings and public information, safe escape routes such as community request for flights of steps cut into nearby cliff faces, and physical facilities for evacuation. The churches present within settlements are able to provide safety in the event of strong winds but for a tsunami it could be platforms cut into the cliff face at a safe height.

Recovery and Reconstruction needs

The total estimated reconstruction needs to rebuild fully destroyed shelter and repair partially damaged houses in the affected areas amounts to about SAT$40.3 million. This figure is based on the assumption of building fully damaged houses either on the same site, or at resettlement areas, but takes into account better construction standards to improve resilience (for instance, better construction materials and reinforced foundation). Reconstruction needs are derived from the damages based on new housing construction costs for units that are proportional with the existing destroyed stock. In addition, the value of land has been ignored for both the on-site and the relocation cases, assuming that any resettlement will take place in communal land, where land will be provided at no cost. An incremental additional cost for the provision of temporary shelters during the reconstruction period has been assumed.

The reconstruction of houses is one of the most important activities of recovery efforts after a disaster. Following the tsunami in Samoa a significant part of the affected population has moved away from the coastal areas and indicated a wish to settle permanently in new locations, away from the coast. Such population movements and attempts to rebuild communities away from natural hazard areas are common after tsunami disasters. However, the success --or failure-- of communities' and governments' efforts to reduce vulnerability to natural risks by establishing resettlement areas, is highly dependent on whether basic services can be provided quickly and sustainably to relocated people.

In the case of Samoa affected people have resettled currently in traditional plantation areas, where infrastructure networks (water, electricity, roads) are non-existent, or of poor quality. To support a more permanent upland resettlement of villages that have been destroyed by the tsunami, additional investments will be needed to create the necessary infrastructure networks and facilities needed to provide services at the new locations. Resettlement of communities is a complex matter and requires thorough consultations both with the affected communities and the entities responsible for the provision of services, so that integrated planning can be prepared before government commits the significant resources required to support relocation efforts. It appears that the current post-tsunami relocation pattern of communities is considerably more dispersed than traditional villages in Samoa. However, the more dispersed the population the more expensive the capital investments for the provision of services will become. In addition, the high recurrent expenses of infrastructure networks operation and maintenance for widely dispersed communities can make the continuous services provision financially unsustainable; this could be especially risky in the case of this tsunami, since the affected area encompasses lower income people that have lost their assets because of the tsunami. Any planning for relocation should aim to maintain the social cohesion and social networks of the relocated communities; such inter-community relationships are fundamental in helping communities gain back their strength and their resilience.

Because affected communities were living in a coastal area of natural beauty with good access roads, an important source of income and economic growth has been tourism. Should resettlement upland become permanent, it will be necessary to ensure that transportation from resettlement areas to the coast is available, so that employment and income for tourism can be realized when the sector recovers. In addition, the resettlement of coastal villages provides an opportunity for planning the economic and touristic development of the areas on a new basis, potentially increasing the land value of households. Such opportunities need to be examined in consultation with the communities to develop an appropriate recovery and reconstruction strategy on tourism for the area.

Finally, it is important that Government indicates early and clearly to the affected communities its intention to support, or not, specific resettlement plans as well as reasonable time-frames for the implementation of the recovery and reconstruction program. The efforts of the GoS to advance rapidly the reconstruction of housing need to be accompanied by the planning and commitment of medium and longer term financial resources to provide the necessary infrastructure and social services.

Inputs for Macro-Economic impact Analysis

The imported component of housing reconstruction costs (comprising the items that are not produced locally and must be imported from abroad) is expected to be about 50 percent of the total cost of reconstruction housing needs, while most of the valuable household goods to be purchased are expected to have a major imported content as well estimated at SAT$15.9 million.

The reported lack of insurance coverage for the overwhelming majority of affected houses indicates that there is a significant need to raise financing for the reconstruction of housing. The government has indicated that will provide SAT$18,000 per family to support the housing reconstruction efforts, however the actual mechanism and number of households that will benefit from such support is yet to be determined. If an estimate of 500 housing units is to be supported by the GOS, the costs to the state would reach SAT$9 million.

The estimated share of the central government in the costs of the temporary shelter scheme has been minimal, as most of the temporary shelters have been provided through the humanitarian response efforts and have been donated to the affected. For the purposes of this analysis it is assumed that such temporary housing has been provided to about 50 percent of the affected households, mostly from abroad at an estimated SAT$1 million.

The public cost of demolition and removal of rubble is about SAT$0.3 million (this cost is presented under the environmental costs of the tsunami).

Private sector rental revenues in the affected areas during the pre-tsunami period were mainly related to tourism rather than individual households. The estimated loss of rental revenues for the estimation of GDP impact from the housing sector is therefore minimal.

2.5.2. Water Supply and Sanitation

Summary

Prior to the tsunami, almost all people in the affected areas had access to piped water supplies provided by the Samoa Water Authority (SWA) and independent community schemes. Approximately 36.9km of water mains and 527 service connections were destroyed by the tsunami. A large number of households have relocated from affected areas to higher elevations away from the coast and do not have access to permanent water supplies. SWA is carting water as an interim measure until permanent and secure water supplies can be provided to people in resettlement areas. SWA is likely to continue carting water to resettlement areas until a permanent water supply to the resettlement areas is commissioned which may require 24 months to construct. Estimates of the damage to the water supplies affected by the tsunami and resultant losses are estimated at SAT$3.94 million and SAT$4.62 million respectively.

Pre-Disaster Situation

Water supplies to tsunami-affected communities located on the south-east and south coast areas of Upolu are provided by the SWA with the exception of 3 community (or "independent") schemes which service the villages of Saleaumua which is also serviced by SWA, Mutiatele, and Vavau. The SWA water supplies comprise a mix of treated and untreated water from both surface water and groundwater sources. Consumer connections to the treated water supplies are usually metered. Consumers serviced from SWA untreated water supplies are not metered. Independent schemes are not metered.

Coverage of water supplies is extensive with more than 90% of Samoa's population, including the tsunami-affected areas, having access to piped water.[15] Unaccounted for water (UFW) is estimated to exceed 40% in rural areas.[16] Estimates of the production per capita to meet demand in non-metered water supply schemes is estimated in North-west Upolu at 800 liters per person per day due to system losses (UFW) and the absence of financial incentives to conserve water at the consumer level. A similar level of production per capita is likely to apply for the un-metered water supplies in the tsunami-affected areas. In metered

[15] Data collected during the 2006 Census indicates that more than 90% of Samoa's population has access to a piped water supply. The coverage of piped water supplies to rural Upolu, including the tsunami-affected area, is estimated at 91%. Approximately 58% of Samoa's population obtains water from metered supplies and 38% from un-metered supplies.

[16] Government of Samoa. 2008. Water for Life. Water Sector Plan and Framework for Action. Apia.

areas, the required production per capita is estimated at 350 liters per person, however higher production per capita may be required in some schemes where system losses are high.

SWA applies to block tariff structure to its metered domestic customers with the first 15m^3 per month priced at SAT$0.50 per m^3, 16m^3 to 40m^3 at SAT$1.40 per m^3, and SAT$1.90 per m^3 for consumption in excess of 40m^3. SWA commercial customers are at the rate of SAT$1.50 for the first 40m^3 consumed and SAT$2.00 per m^3 thereafter on the basis of a monthly billing cycle. The majority of SWA's water supply customers in the affected areas are domestic consumers (approximately 96%). SWA applies a flat rate charge of SAT$20 per month to its un-metered customers. Charges applied by the independent scheme operators vary; however a charge of SAT$5.00 per water supply outlet (faucet) per year is typical.

The 2007/2008 SWA Annual Report states a total water supply customer base of approximately 22,000 and an income during fiscal year (FY) 2007/2008 of SAT$14.13 million including revenues from water sale of SAT$7.55 million. SWA expenditure for FY 2007/2008 is reported at SAT$16.06 million including SAT$4.8 million for the operation of SWA's water supplies.

Damage and Losses

Damage to the water supply systems has been fully attributed to the impacts of the tsunami. No damage is attributed to the earthquake which preceded the tsunami by approximate 10 to 20 minutes. Damage to the water supply systems operated by SWA included destruction of 10.8km of the 80mm to 100mm diameter water mains, 4.3km of 25 to 50mm diameter water mains, 21.8km of 15 to 20mm diameter water mains, and 527 service connections (in 22 villages). The worst affected villages, in terms of damage to water services, were Saleapaga (81 connections destroyed), Satitoa (61 service connections destroyed) and Saleaumua (48 service connections destroyed). Damage to the independent water supplies included the destruction of about 1.2km of 100mm diameter water main in the Vavau water supply network and 71 service connections. The majority of the damage to service connections was to domestic consumers. The number of commercial customers who suffered damage to their water services is estimated at 20. Further details of the extent of the water supply networks destroyed by the tsunami are presented in Table 25.

Table 25. Water Supply Mains Destroyed

Affected Villages	Lengths of Water Mains Destroyed			
	Zone	80mm-100mm dia. (m)	25mm - 50mm dia. (m)	15mm-20mm dia. (m)
Saleaumua - Lalomanu	1	4,063	1,797	8830
Saleapaga - Lepa	2	3,730	161	6475
Sapoe	3	—	0	390
Utulaelae	3	—	280	404
Salani	3	—	256	460
Salesatele	3	—	255	300
Sapunaoa	3	—	477	435
Satalo	3	—	516	270
Tafatafa	3	-	586	190
Vaovai	3	-	0	270

Affected Villages		Lengths of Water Mains Destroyed		
Matautu	3	-	0	210
	Zone	**80mm-100mm dia. (m)**	**25mm - 50mm dia. (m)**	**15mm-20mm dia. (m)**
Siumu	3	-	1,392	500
Tafitoala	3	-	1,165	560
Sataoa	3	-	1,212	208
Saanapu Tai	3	-	1,438	480
Lefaga	3	-	2,308	520
Manono Island	4	3,000	0	518
Vavau	3	1,156	0	
TOTAL		**10,793**	**13,155**	**21,770**

Source: SWA and Pacific Water and Waste Association

Zone 1 = South-east coast including villages of Saleaumua, Mutiatele, Malaela, Satitoa, Ulutogia, Vailoa, Tiavea-Tai, and Lotope.
Zone 2 = South coast villages comprising Lalomanu, Aufaga, Vaigalu, Siupapa, Saleapaga, Leatele, and Lepa.
Zone 3 = South coast villages comprising Matatufu, Lotofaga, Vavau, Salani, Salesatele, Sapunaoa, Malaemalu, Tafatafa, Mata-utu, Vaovai, Poutasi, Ili-ili, Siumu, Maninoa, and Utaluelue.
Zone 4 = Manono-tai

Table 26. Service Connection Destroyed

Villages	Water Supply Provider	Zone	Number of Affected Connections
Saleaumua	50% Independent, 50% SWA	1	48
Mutiatele	Independent	1	16
Lotopue/Malaela	SWA	1	35
Satitoa	SWA	1	61
Ulutogia	SWA	1	35
Vailoa	SWA	1	5
Lalomanu	SWA	2	61
Saleapaga	SWA	2	81
Lepa	SWA	2	41
Utulaelae	SWA	3	9
Salani	SWA	3	7
Salesatele	SWA	3	6
Sapunaoa	SWA	3	9
Satalo	SWA	3	5
Vaovai	SWA	3	10
Matautu	SWA	3	7
Poutasi	SWA	3	25
Siumu	SWA	3	5
Tafitoala	SWA	3	13
Sataoa	SWA	3	5
Saanapu tai	SWA	3	12
Lefaga	SWA	3	24
Manono Is.	SWA	4	23
Vavau	Independent	3	7
Total			**550**

Source: SWA and Pacific Water and Waste Association

Losses that will be incurred in the provision of water to communities affected by the tsunami include loss of revenue, costs of water carting, costs for additional pumping water from groundwater sources for water carting operations, and cost for providing temporary rainwater harvesting systems to dwellings until full piped water services are restored to affected areas and extended to resettlement areas. The losses will continue until a new water source, pipelines, and distribution networks are commissioned to service communities which have resettled from affected areas on the coast to higher elevations. The new water supply systems to resettled communities may require up to 24 months to develop and commission. Water carting to resettled communities from Lepa to Saleaumua is therefore likely to be required for a period of 24 months. Estimates of the losses are presented in Table 27.

Table 27. Estimation of Losses on Water and Sanitation (in SAT$)

Loss/Location	Zone 1	Zone 2	Zone 3	Zone 4	All Zones
Lost and lower revenues and write-off of arrears - SWA	52,998	74,616	89,444	0	217,057
Lost and lower revenues and write-off of arrears - Community Schemes	400	0	70	0	470
Higher expenditures					
Water carting	1634254	763904	250460	0	2,648,619
Temporary rainwater harvesting	469800	219600	246600	41400	977,400
Additional pumping costs	344794	344794	86198	0	775,786
TOTAL	**2104054**	**983504**	**497060**	**41400**	**461,9332**

The total cost of water supply damage and losses as a consequence of the tsunami is estimated at SAT$8.56 million ((US$3.42 million equivalent) and is summarized in Table 28.

Table 28. Estimation of Total Damage and Losses on Water

Components	Damage (SAT$ millions)	Losses (SAT$ millions)	Total (SAT$ millions)	Total (US$ millions)
Samoa Water Authority Schemes	3.90	3.64	7.54	3.01
Community Water Supply Schemes	0.04	0.98	1.02	0.41
Total	**3.94**	**4.62**	**8.56**	**3.42**

Recovery and Reconstruction Requirements

Water supply mains destroyed by the tsunami have been replaced and water supply restored. However, a substantial number of people who lost their homes (estimated at 659 households or 5,300 people) have relocated to temporary shelters located in higher areas away from the coast, particularly in the coastal strip from Lepa to Lalomanu. Many of the affected people have stated that that they do not wish to return to the coastal areas and are likely to establish homes in the resettlement areas. Provision of water supplies to resettlement areas will require the development of new water sources, water supply mains and distribution systems. SWA has identified a new water source, a crater lake, which could provide water by gravity to all communities in both the coastal and resettlement areas and have prepared concept designs and preliminary cost estimates of the proposed scheme. Components of the proposed scheme include

the construction of headworks at the crater lake, water treatment which could consist of consisting of chemical dosing, filtration, and disinfection facilities, 25.8km of water supply mains with diameters ranging from 250mm to 100mm, and 6 storage / break pressure reservoirs. SWA has also identified the need to install standby generators to water supply bores which are currently being utilized as a source of water for water carting operations as well as servicing several unaffected communities. The estimated cost to implement the proposed water supply scheme and for the provision of generators to the water supply bores are SAT$14.93 million and SAT$0.6 million respectively.

2.5.3. Energy

Summary

Prior to the tsunami, most all people in the affected areas had access to electricity provided by the Electrical Power Corporation (EPC). Approximately 11km of power lines and 303 service connections were destroyed by the tsunami. The earthquake that preceded the tsunami also caused damage to parts of the electricity network in the tsunami affected areas and elsewhere in Upolu and Savaii. The electricity supply has been restored to affected areas and temporary electricity power supplies have been provided to some of the resettlement areas. Losses due to reduced sales of electricity during the reconstruction period are small in comparison to other sector, such as water supplies. Estimates of the damage to the water supplies affected by the tsunami and resultant losses are estimated at SAT$0.84 million and SAT$0.75 million respectively.

Pre-Disaster Situation

The Electric Power Corporation (EPC) is vested with all operating responsibilities for the power sector. EPC is a wholly owned government corporation established in 1972. The utility operates as a separate entity and is defined as a public trading body under the Public Bodies Act (2001) with the principal objective of operating as a commercial business. EPC services about 29,800 consumers throughout Samoa and approximately 95% of the population has access to electricity. The average household consumption is 76 kilowatt-hours (kWh) per month.

The generation on Upolu, which accounts for 90% of EPC's total generation, is a mix of diesel and hydro power stations. The main power station on Upolu is located at Tanugamanono and has five diesel generation units with a combined available generation capacity of 17.9 MW. Of the 12.5 MW of hydropower generation capacity, 6.7 MW is firm, of which the Afulilo storage hydropower scheme on Upolu accounts for 4.0 MW. The remaining hydropower capacity comes from four run-of-the-river schemes. The run-of-the-river hydro schemes exhibit large reductions in output during the dry season so that their available energy is significantly reduced.

During the 12-month period from 1 September 2008 to 31 August 2009, EPC produced 96GWh of energy in Upolu of which 39.3GWh (40.9%) was generated by hydropower schemes. Losses (both technical and non-technical) are currently estimated at 16.4%. In the same period, EPC sales sold 54.4 GWh of electricity to customers in Upolu generating revenue of approximately SAT$69.7million. The average cost to supply electricity to EPC's customers is currently SAT$0.731

EPC applies to block tariff structure to its domestic customers. Domestic customers are currently charged SAT$0.69 for the first 50 kWh and SAT$0.82 for each kWh in excess of 50 kWh based on a monthly billing cycle. All other EPC customers (commercial, government, and institutional) are charge at a flat rate of SAT$0.82 per kWh of electricity consumed.

Damage and Losses

Damage to the electricity system resulted from both the tsunami and the earthquake which preceded the tsunami by approximate 10 to 20 minutes however the impacts of the tsunami of the electricity system were considerable greater than the earthquake. While damage to the electricity occurred both in Upolu and Savaii, the majority of the damage was in located in tsunami affected areas on the south and south-east coasts of Upolu and to the island of Manono. Damage to the electricity system included 18 power poles, 26 street lights and approximately 11km of overhead cables lost, 25 poles felled, damage to generation system at Manono, damage to transformers, and the destruction of 303 connections to 280 domestic customers and 23 commercial customers.

Table 29. Damage and Losses on Energy (in SAT$)

Component	Location					
	Zone 1	Zone 2	Zone 3	Zone 4	Other Upolu	Total
A. Earthquake						
a) Power plants						
Hydropower plants	—	—	—	—	80,860	80,860
Thermal power plants	—	—	—	2,871	121,290	124,161
b) Distribution grids	—	—	—	16,021	302,952	318,973
c) Service Connections	—	—	—	7,745		7,745
d) Administrative overheads	—	—	—	909	58,087	58,996
TOTAL	**—**	**—**	**—**	**27,546**	**563,189**	**590,735**
B. Tsunami						
a) Power plants						
Hydropower plants	—	—	—	—	—	—
Thermal power plants	—	—	—	11,485	—	11,485
b) Distribution grids	507,919	411,934	291,953	64,084	—	572,003
c) Service Connections	152,795	123,920	87,827	30,978	—	183,773
d) Administrative overheads	75,982	61,623	43,675	727	—	76,709
TOTAL	**736,696**	**597,478**	**423,455**	**107,274**	**—**	**843,970**

Lost revenue represents the largest source of loss to EPC as a result of reduced demand, assumed at 25% of pre-tsunami demand levels, from customers whose connections were destroyed by the tsunami. The reduced demand is expected to continue for up to 24 months until construction of houses in the resettlement areas and reconstruction of commercial businesses and homes in the affected areas is complete. Estimates of the losses are presented in Table 29, Table 30 and Table 31.

Table 30. Estimates of Losses on Energy -Domestic Consumers (in SAT$)

	Location			
	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**
No. of Affected Customers	125	102	72	5
Duration and staged recovery of demand per user sector, months	24	24	24	24
Estimation of lower revenue for electricity sales per secor				
Forecasted electricity demand, KWh	234,000	154,224	138,240	9,600
Post-disaster electricity demand, KWh	58,500	38,556	34,560	2,400
Decline in demand, KWh	175,500	115,668	103,680	7,200
Average Sales rate in sector, SAT$/KWh	0.726	0.704	0.729	0.729
Estimated losses of revenue, SAT$	127,440	81,408	75,531	5,245

Table 31. Estimates of Losses on Energy - Commercial Consumers (in SAT$)

	Location			
	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**
No. of Affected Customers	10	4	9	—
Duration and staged recovery of demand per user sector	24	24	24	24
Estimation of lower revenue for electricity sales per secor				
Forecasted electricity demand, KWh	79,584	32,957	629,338	—
Post-disaster electricity demand, KWh	19,896	8,239	157,334	—
Decline in demand, KWh	59,688	24,718	472,003	—
Average Sales rate in sector, SAT$/KWh	0.820	0.820	0.820	0.820
Estimated losses of revenue, SAT$	48,944	20,268	387,043	—

Recovery and Reconstruction Requirements

The electricity supply to areas affected by the earthquake and the tsunami has been restored. However, a substantial number of people who lost their homes (estimated at 659 households or 5,300 people) have relocated to temporary shelters located in higher areas away from the coast, particularly in the coastal strip from Lepa to Lalomanu. Many of the affected people have stated that that they do not wish to return to the coastal areas and are likely to establish homes in the resettlement areas. Provision of a permanent electricity supply to resettlement areas will require the development of transmission and distribution system. EPC has prepared a preliminary cost estimate for the construction of a new transmission and distribution network to the resettlement areas including the provision of underground transmission lines to reduce the risk of system failure as a consequence of cyclones. The preliminary cost estimate to construct the permanent electricity supply to the resettlement areas is SAT$28.75 million as shown in Table 32.

Table 32. Recovery and Reconstruction needs on Energy

	Recovery and Reconstruction		
Component	Recovery and Reconstruction Needs (Tala million)	Committed Recovery and Reconstruction Financing (Tala million)	Committed Recovery and Reconstruction Requirements (Tala million)
Transmission and distribution	28.10		
Service connections	0.63		
Administrative costs	0.12		

2.5.4. Transport

Summary

The tsunami effects on transport sector were largely confined to the roads, especially the coastal roads running through the south and southeast part of the Upolu Island. The total damages to the transport sector are estimated at SAT$73.35 million, which comprise road (including roads, seawall and bridge), vehicles and wharf. The damage to the road is with estimation up to SAT$61.55 million. The damages to the vehicles and wharf are estimated at SAT$1.69 million[17] and SAT$10.11 million respectively.

Based on the road maintenance system developed by Land Transport Authority (LAT) of Samoa, the road network is divided into 10 zones for maintenance purpose, and the roads affected by Tsunami are concentrated in Zone 7 and 8 with total length 30.651km. Seawall along the coast roads can be deemed as unalienable part of the road for protection, with totally 6.4 kilometer partially destroyed. Only one bridge called Sanani Bailey (East Abutment) partially ruined on foundation.

For sea transport, the newly-built Aleipata wharf which owned and managed by Samoa Ports Authority (SPA) reported the heavily damages on embankment, terminal buildings and equipments with total amount up to SAT$10.11 million. No significant damages were reported on the country's two airports. All in all, the damages reported to the transport sector amount to SAT$73.35 million.

Table 33. Breakdown of the damages on Transport

Number	Sub-sectors	SAT$ million
1	Roads	48.50
2	Vehicles	1.69
3	Seawall	12.8
4	Bridge	0.25
5	Wharf	10.11
Total		**73.35**

The losses in the transport sector are largely caused by increasing driving cost on affected roads (operation losses) and delay costs (time losses) for the road user during the rehabilitation period, which believed at least 6 months are needed. The total economic losses on the roads were estimated at SAT$$1.16 million. The LTA has already completed works of over SAT$2 million on urgent clean-up and recovery activating its on-going road maintenance contracts. Such measures were a rapid and effective response to the disaster, restored access and affected roads to workable status and could be used for search and rescue activities and to facilitate the provision of humanitarian relief. LTA's response has likely kept the economic losses due to roads substantially low.

[17] No exact data is available on the vehicle loss so far. Base on the village survey conducted by JICA and statistic assumption, the loss number on light vehicles is about 50, 5 for buses/trucks and 3 for heavy vehicles. The unit cost assumption on each type of vehicle is $25,000 for light one, $40,000 for buses/trucks and 80,000 for heavy ones.

On maritime transportation, according to the STA, the potential economic losses from the considerable destruction of the Satitoa wharf is expected to be around SAT$3.6 million for the next five years. The majority of such losses are allocated to foregone revenue from maintenance works that would be carried out at the wharf's slipway.

In response to the disaster, LTA has proposed a detailed upgrade and reconstruction plan on existing roads. Two inland routes and ten access roads to inland are planned for upgrading. The upgrade and reconstruction are really critical to provide good transportation access to the resettlement areas year around and would be critical to support any resettlement efforts. The identified upgrade and reconstruction needs for above roads are estimated at SAT$81 million.

Table 34. Breakdown on early and medium to long-term recovery needs on Transport

	Early recovery needs	Medium to long-term reconstruction needs	Total	Total
Sub-sector		Amount (SAT$ in M)		Amount (US$M)
Road	48.5	81	129.5	51.8
Seawall	12.8		12.8	5.12
Bridge	0.25		0.25	0.1
Wharf	6.84	3.27	10.11	4.04
Total	**68.39**	**84.27**	**152.66**	**61.06**

Pre-Disaster Situation

The Government of Samoa has a well-defined strategy on Transport sector which served as an essential part of *Samoa Government Strategy of Development 2008-2012*. The objective of the sector is trying to develop an efficient sector service rather than simply expanding the sector. In order to realize this objective, prioritized and coordinated investment is required. The private sector will be encouraged and promoted to provide more transport service.

To fulfill the strategy, Land Transport Authority (LTA) was established in 2008 to ensure a coordinated planning and regulation of land transport. Planning and regulation of other transport modes is undertaken by Ministry of Work, Transport and Infrastructure (MWTI).

Samoa Infrastructure Asset Management Project (SIAM): This is a two-phased, eight-year project initialed in February 2000 in partnership with World Bank and Ausaid. The project incorporates four components including: air transport infrastructure; road system infrastructure; coastal infrastructure and management and institutional development.

Air Transport facilities in Samoa are relatively good given the size and volume of the air traffic. Two airports are operated and managed by state-owned Samoa Airports Authority (SAA). Faleoto International Airport in Upolu was upgraded to international standards with 10 years horizon and the other one in Savai'I was also upgraded to reach international status for regional trip.

There are two international ports in Samoa operated by Samoa Port Authority (SPA) which accommodate all international freight traffic. SPA also operate two domestic ports used for ferry travel between Upolu (Mulifanua port) and Savai'i (Salelologa port). The new wharf in Aleipata was almost completed before the

tsunami which supposed to provide the ferry service to American Samoa. The new wharf can also provide the slippage service to the local fishing boats and mooring location for cruiser.

The Government's focus in road transport is maintaining and improving the existing road stock through investment and better management system. The road network managed by LTA is classified into three categories according to the traffic volume. Only the roads covered by the system are maintained regularly byLTA.

Table 35. Roads stock under the maintenance by LTA in Upolu (in meter)

ZONE	Description of Area	CLASS 1	CLASS 2	CLASS 3	Total
1	N1008 (Tamaligi-Falealili St)- N0162(Lepea)	34,349	21,219	22,998	78,566
2	N0162(Lepea) - N0420(Vaitele)	18,813	27,682	19,463	65,958
3	N0420(Vaitele) - N0447(Afega)	9,681	25,191	32,622	67,494
4	N0447(Afega) - N0464(Leulumoega Tuai)	24,889	29,971	16,807	71,667
5	N0463 (Leulumoega Tuai) – N0570 (Lefaga)	46,997	0	16,278	63,275
6	N0570(Lefaga) - N0350(Siumu)	23,022	8,503	30,112	61,637
7	N0820(Siumu) - N0544(Aleipata)	35,743	8,995	14,745	59,483
8	N0526(Salani) - N0537(Fagaloa)	49,726	4,464	11,176	65,366
9	N0537(Fagaloa) - N0522(Solosolo)	20,382	17,806	24,494	62,682
10	N0522(Solosolo) - N1008(Apia)	26,672	23,951	24,530	75,153
Total		**290,274**	**167,782**	**213,225**	**671,281**

Source: LTA

Damage and Loss Assessment

No damages reported on the facilities of the two airports. The well functioning of the airports is critical for aid and rescue traffic.

Substantial damages reported on the newly constructed Aleipata. The wharf was almost ready for operation after 17-month construction, but now a reconstruction is needed. The total damages estimated at SAT$10.11 million with breakdown listed as follows:

Table 36. Breakdown of damage on Aleipata Wharf (in SAT$)

Terminal buildings	$500,000
wharf and other structures	$4,390,600
Equipments	$2,238,658
Boats and ships[1]	$742,870
Slipway	$1,120,687
General Demolition and Clearing	$1,119,680
Total	**$10,112,495**

[1] Three barges named Mulifanua, Salelologa and Toloa were destroyed.
Source: SPA

The affected roads are concentrated in Zone 7 and Zone 8 in Upolu Island with 30.65 kilometers partially destroyed by the tsunami, which accounted about 24.5% of total road stock in the two zones and 4.6% of total public roads in Upolu. The affected roads distribute evenly among the different classes with 9.8 km for class-1, 10.01km for class-2 and 10.8km for class-3. LTA indicates that the average recovery rate for each kilometer on Class-1 is SAT$2 million, for Class-2 is SAT& 1.8 million and for Class-3 is SAT$1 million. Yellow-marked roads are believed partially destroyed by the tsunami.

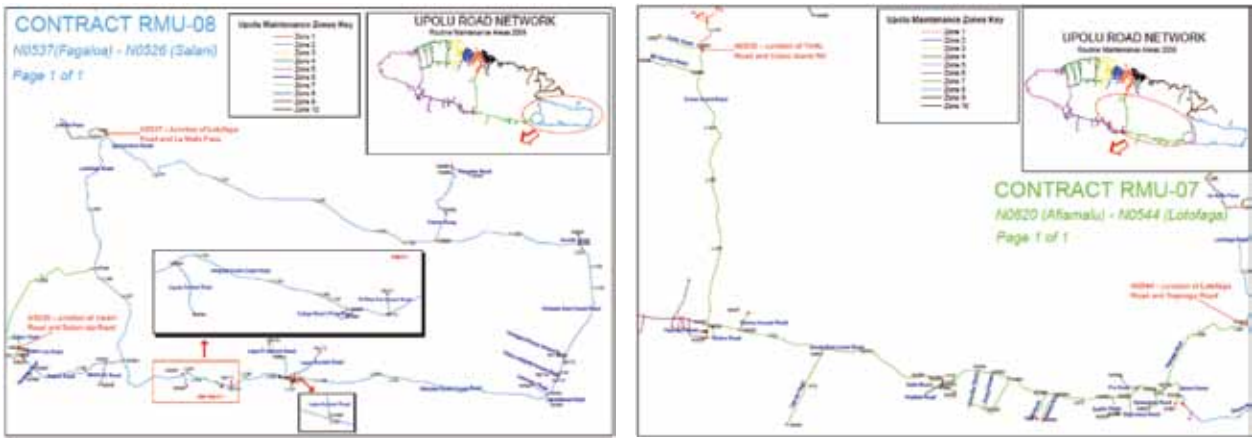


Figure 13. Map for Roads affected in Zone 7 and Zone 8

Seawalls are an essential part of the coast road which mostly rated as the class-1 road. For Zone 7 and 8, there are totally 6.4km seawalls constructed for vulnerable parts of the coast road (Southeast coast road in zone 7 and Aleipata East/South coast roads in Zone 8). All the seawalls in two zones are partially destroyed by tsunami and need to be rehabilitated to prevent the water tide erosion. Based on the current price of seawall construction, the unit cost of seawall is around SAT$2 million/km, with an estimated total of SAT$12.8 million for full recovery.

Losses

No economic losses are expected for air transport. The incoming aid and rescue traffic can largely compensate the declined tourists flow. The Aleipata wharf was nearly finished but not open for operation yet before tsunami. The projected operation incomes are coming from two sources: the ferry service between Upolu and American Samoa and slipway service for local fishing and/or other boats. Based on the financial projection made by SPA, the first year revenue from both operation is around SAT$870,000.[18] The annual revenue growth rate is about 5%. Assuming a discount rate of 12% and calculating the revenue losses for the next 5 years, the expected losses on the wharf are around SAT$3.6 million.

Economic losses on road transport are composed by the increased marginal operating costs and additional time cost caused by travel delays. For the marginal costs, we assume that daily traffic through the affected roads is around 130 (with 100 light vehicles, 20 buses/truckes and 10 heavy vehicles), while the marginal operating cost on different classes of roads would be increased during the rehabilitation period. Based on

[18] Projected revenue from slippage is $750,000/yr and $120,000/yr generated from ferry service

the current gas price and labor cost, if the affected road can be recovered within 6 month, total economic losses is around SAT$1.15 million.[19]

Socio-economic Impact

Recovery and reconstruction impact on the macro economy is limited unless the large scale upgrade and reconstruction of the roads can start in the short term. Upgrade and reconstruction activities will generate employment, which can also increase the cash income of the local residents.

With upgrading of the access roads to inland, the livelihoods of the residents that have relocated can be substantial improved. Better roads to areas of relocation away from the coastal areas are necessary to firmly establish local communities, as access to the coastal areas where employment from tourism can be facilitated and transportation of equipment and agricultural products will be easier.

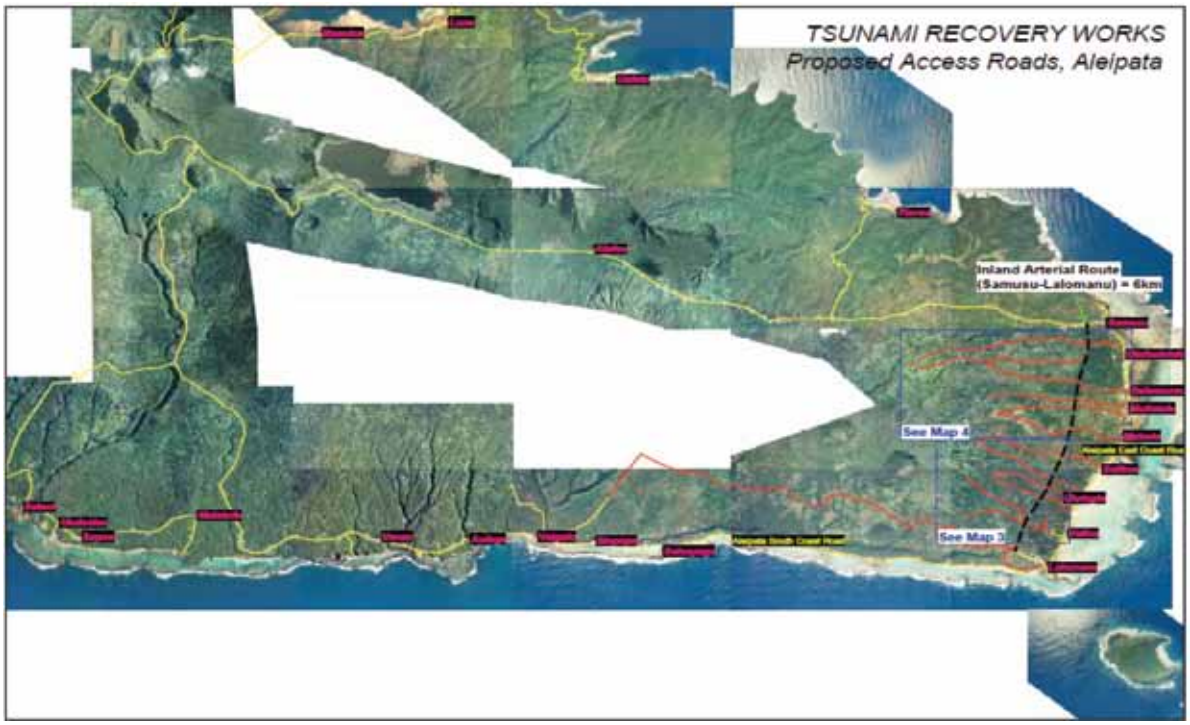


Figure 14. Recovery Plan on Roads

Recovery and Reconstruction Requirements

Recovery and reconstruction requirements for the transport sector are mainly focused on the road network. The government has disbursed more than SAT$1 million for urgent clean-up and recovery of affected roads. For full recovery, totally SAT$61.55 million are needed in the following months.

[19] Unit marginal cost for light vehicles travel on Class-1 is $0.47, $0.61 for Class-2 and $0.71 for Class-3. Unit marginal cost for buses/truckes travel on Class-1 is $0.94, $1.22 for Class-2 and $1.41 for Class-3. Unit marginal cost for heavy vehicle travel on Class-1 is $1.65, $2.14 for Class-2 and $2.47 for Class-3

To provide the full services to the resettled residents in the inland of the Upolu Island, LTA has proposed two inland routes to be upgraded and reconstructed. The Escarpment Route from Lepa to Lalomanu will link the densely populated resettlement areas with a total length 11.5 km, while the other inland arterial route from Samusu to Lalomanu runs around 8 km. The unit construction cost for each kilometer of the two routes is around SAT$2.5 million, with a total cost of SAT$48.75 million.

Ten access roads in eastern inland are scheduled for upgrades to link the resettlement area and coastline. All the access roads are critical for permanent new house construction and the unit cost is relatively low with SAT$1 million for one kilometer.

Table 37. Recovery and Reconstruction needs on access roads

No.	Name of access road	Activities	Length(km)	Cost in SAT$
1.0	Utufaalalafa Access Road	Upgrade	6.44	$6,440,000
2.0	Saleaaumua Access Road	Upgrade	4.1	$4,100,000
3.0	Mutiatele Access Road	Upgrade	2.7	$2,700,000
4.0	Malaela Access Road	Upgrade	5.5	$5,500,000
5.0	Satitioa Access Road	Upgrade	4.785	$4,785,000
6.0	Ulutogia Access Road	Upgrade	3.54	$3,540,000
7.0	Ulutogia Primary School Road	Upgrade	0.216	$216,000
8.0	Vailoa Aleipata Access Road	Upgrade	3.8	$3,800,000
9.0	Relocation of Taua Kitiona's Access Road	New	1.2	$1,200,000
		Total	**32.281**	**$32,281,000**

Source: LTA

LTA estimated that to access the new resettlement areas with sealed roads, SAT$82.5 million needs to be invested. The works include clearing and grubbing, reshaping, drainage and gravelling. The two routes would have a width of 6-7 meters for sealed carriageways and 4-5 meters for access roads.

2.5.5. Communication

Summary

The damages to the communications sector were mostly on telecommunications infrastructure. GSM and fixed line sites at Lepa and an estimated 17 km length of cables were damaged. Substantial damages were made to the television broadcasting sector. Two telecentres were destroyed. The losses were caused by the loss of revenue due to the disruption of the telephony services and the extra expenditures for emergency response, repair of damaged sites and reconnection of the services. The damages and losses were estimated at respectively SAT$2.96 and 1.1 million. 72% of the total damages were to the public sector, whereas the private sector had about 72% of the total losses. The recovery and reconstruction needs for both public and private were estimated at SAT$4.06 million. The relocation of the telecommunication infrastructure and the broadcasting receivers/transmitters to cover the new resettlements of the affected communities would entail substantive additional costs estimated at SAT$5.85 million.

Pre-Disaster Situation

In 2007, the number of customers of fixed line was estimated to exceed 21,000 users; and of mobile 85,000 users. The total tele-density has reached 56 phones per 100 people.[20] The fixed and wireless telephone services cover about 98% of the population coverage of Samoa. SamaoTel is the only fixed line operator, which fixed telephone line license will expire in 2009 and the market will be opened to other operators. Mobile telephone services were launched by Digicel (Samoa) Ltd on 31 October 2006. Digicel operates via its satellite telecommunications. The second GSM cellular operator, SamoaTel, was launched on 6 January 2007. The analogue cellular (TDMA) system was terminated in April 2007. [21]

Samoa is connected to the Pacific Rim (PacRim) East cable, which connects American Samoa, Samoa and Hawaii to the global telecommunications infrastructure networks. The ASH Submarine Cable was launched on 28 May 2009. The *high speed fibre optic cable* will provide more than 40 times the current capacity in use, more bandwidth at lower cost for improved international communications and services in e-government, e-tourism, e-business, and others. Fibre cable of about 300 km length surrounds the main island of Upolu. Wireless broadband and ADSL technologies are now widely used in Apia and business areas. Access to affordable telecommunications services has increased in recent years. The cellular mobile telephone service price has decreased. International telephone costs have dropped by more than 50% since the launching of Digicel (Samoa) Ltd. However, the standard local rates have increased to reflect the actual cost of the domestic service.

The Ministry of Communications and Information Technology (MCIT) is providing public radio services through the National Radio 2AP medium wave radio broadcasting. The objectives of Radio 2AP include informing all people residing in Samoa of natural disasters, raising awareness of the National Disaster Management Plan (NDMP) that includes programmes on awareness, training workshops, drills and actions when natural disasters strike the country.[22] Television broadcasting is provided by Apia Quality Broadcasting (TV1), TV2 Network, Apia Broadcasting TV3. The television broadcasting coverage is about 95%.

Rural connectivity began in September 2006 with the "Fesootai Centres". Eleven telecentres were established at Ulutogia, Saoluafata, Salepouae, Lotofaga, Fuailolou in the main island of Upolu; Vailoa, Sagone, Auala, Safune, Gataivai in the main island of Savaii; and Faleu on Manono Island.

Damage and Losses

In communications, the telecommunications infrastructure, in particular in the southeastern coastal area of Upolu was most severely impacted by the earthquake and tsunami.

The major damages were on the backbone transmission cables along the southeastern coastal fringes of Upolu. SamoaTel reported that 8 cuts occurred on an estimated 17 km length of cable, and that the joints have been temporarily repaired. Fortunately, the submarine cable has not been damaged. The GSM and fixed line sites at Lepa were destroyed. Until the date of this reporting, the GSM and fixed line sites of SamoaTel at Lepa are out of function. There were also substantive damages to television broadcasting.

[20] Ministry of Finance, Strategy for the Development of Samoa 2008-2012, May 2008
[21] Ministry of Communications and Information Technology, Annual report 2006-2007
[22] Ministry of Communications and Information Technology, Corporate plan 2008-2011, December 2008

The receiver/transmitter site at Lepa of Samoa Broadcasting TV3 was destroyed. The transmitters of Samoa Quality Broadcasting Co Ltd were destroyed at 2 sites, Lepa and Lelamanu.

Figure 15. Damaged telecommunications sites

Two rural telecentres, namely at Ulutogia on the main island of Upolu (connected via telephone line), and at Faleu on Manono island (connected through GPRS), with all ICT equipment and solar panels, were destroyed. The telecentres have been in operation for 2.5 years.

Figure 16. Destroyed telecentre

The losses were accounted for the loss of revenue due to the disruption of the telephony services caused by the tsunami, and the extra expenditures for emergency repair of damaged sites and reconnection of the services. The transmission of SamoaTel in the southeastern area of Upolu was disrupted for 3 days. The losses include the extra services (free phone calls, local and international) provided by the telecommunications service providers to all subscribers on the first day of the disaster, and to the affected villages during

the next two days until the telephony connection was restored. The affected area, covering at least 3 villages, is marginally connected through the neighboring GSM sites. Digicel wireless phone services were also disrupted due to power outage and breaking down of generators on various sites for 1 to 3 days. It was reported that Digicel services were jammed on the first day due to the very large amount of incoming international calls. Television broadcasting coverage was reduced by 15% after the tsunami with indirect losses to broadcasters estimated at 3% of the annual revenue. 72% of the damages were to the public SamoaTel, which operates fixed line, wireless, and the inland fibre and copper cables. The private sector (Digicel Samoa, TV broadcasters, community-owned telecentres) had about 72% of the total losses.

Table 38. Communications sector damage and losses (SAT$ Million)

	Disaster Effects			Ownership by Sector	
Subsector, Component	**Damage**	**Losses**	**Total effects**	**Public**	**Private**
SamoaTel:					
Wireless	0.29	0.26	0.55	0.55	
Fixed line	0.69	0.02	0.71	0.70	—
Cables	1.16	0.03	1.19	1.19	—
Digicel wireless	0.14	0.75	0.89		0.89
TV broadcasting	0.56	0.04	0.59	—	0.59
Telecentres	0.12	0.001	0.13	—	0.13
Total (SAT$ million)	**2.96**	**1.10**	**4.06**	**2.44**	**1.61**

In terms of macro-economic impact: it is estimated that about 80% of expenses for building back will be on importing communications and ICT equipment and accessories to replace the destroyed or damaged equipment. An estimated 20% of the expenditures will include local contractors for civil works and trenching, for labour for pulling cables and jointing of the cables, installing new sites and retrofitting current masts. In addition, there will be lower tax revenues due to services and sales decline.

Risk Management Issues

Communications infrastructure and services needs to be designed taking into consideration the need for multi-hazard risks.

Communications must also be regarded as critical facilities that support essential services in the event of disasters. Besides providing critical channels for early warning messages, communications must remain operational during disasters when contact with the communities will be critical for liaising and coordination of help and support resources.

There is need for a detailed hazard risk assessment and detailed risk maps along the coastal areas. Risk assessment maps will play a critical role in determining less hazardous areas and appropriately planning communications infrastructure.

The national Radio 2AP, which is one of the channels for broadcasting early warning to the people of Samoa, needs to continue its services in this field. The mast next to the radio station in Apia might have been affected by the earthquake. A structural assessment or retrofitting of the mast to ensure that it can withstand strong earthquakes and cyclones, and fencing of the mast, should be considered.

Recovery and Reconstruction Requirements

The recovery and reconstruction needs for the communications sector are estimated at SAT$6.24 million.

Table 39. Communication recovery and reconstruction needs (SAT$ Million)

	Recovery and Reconstruction Needs				
	Total	**Early recovery**	**Medium-longer term**	**Public**	**Private**
Subsector Needs					
Wireless	1.10	0.48	0.62	0.48	0.62
Cables, fixed line	4.08	0.30	3.77	4.08	
Broadcasting	0.86		0.86	0.19	0.67
Telecentres	0.20		0.20		0.20
Total	**6.24**	**0.78**	**5.45**	**4.76**	**1.49**

The reconstruction priorities in the immediate and medium-term will be to restore as soon as possible the telephony connection and services in the tsunami-affected areas. This would include at least the restoration of the destroyed GSM and fixed line sites at Lepa. The costs associated with the replacement of these GSM and fixed sites is estimated at SAT$0.78 million.

The costs associated with the reconstruction and replacement of the damaged and destroyed telecommunications infrastructure, broadcasting equipment and the restoration of the rural telecentres to reconnect rural communities and help enhance their livelihood In the medium to longer term is estimated at SAT$5.45 million.

The relocation of the telecommunications infrastructure as well as the radio and TV broadcasting receiver/transmitter sites to higher and safer grounds along the affected coastal fringes of Upolu should be considered within the overall framework of the Government to relocate and install new settlements for the affected communities.

Table 40. Additional relocation estimates (SAT$ Million) on communication

	Total	**Public**	**Private**
Subsector,Component			
Fixed and wireless equipment: GSM units, fixed RSS, copper cables, fibre cables, transmission links, monopoles, generators, etc.	4.08	3.46	0.62
Broadcasting equipment	0.77	—	0.77
Civil works, trenching, ducting, labour	1.10	1.10	—
Total	**5.85**	**4.56**	**1.39**

The additional costs associated with the installation of telecommunications infrastructure equipment (fibre optic cables, copper cables, fixed line and GSM sites, etc.) is estimated at SAT$4.08 million, whereas the costs for trenching, ducting and pulling cables and jointing is estimated at SAT$1.1 million. The costs for trenching for the communications sector could be substantially reduced to about SAT$0.4 million should

there be a common trench for water supply and other infrastructure services. The costs for relocating the television broadcasting equipment to service the new settlements is estimated at SAT$0.77 million.

2.6. CROSS-SECTOR ISSUES

2.6.1. Environment

Summary

The environment is intricately linked to the livelihoods of the tsunami affected communities because of their dependence on natural resources. In Samoa, a number of sectors, including agriculture, fisheries, tourism and energy, rely on the sustainable management of the natural resources. The reefs and the vegetation in the affected areas sustained considerable damage, causing a long term loss of economic opportunities and environmental services.

Concrete environmental impacts from the tsunami include a) large amounts of debris and pollution on land and in the sea, b) dieback and browning of terrestrial vegetation c) damage of the marine habitats, such coral reefs, and d) coastal erosion. The damaged environmental assets are associated with non-tradable environmental services which are often impossible to readily monetarize. Monetary damages to the environment are presented in other sectors. Since many economic sectors rely on the environment, most damages and losses related to environmental assets are captured in the assessments of other productive sectors, especially agriculture, fisheries, transport, and tourism. For example damages to the reef, house gardens, and trees are accounted for in the agriculture and fisheries assessment. The estimated losses in the environment sector amount to SAT$550,000 and are related to clean-up activities.

Short, medium and long term needs are environmental assessments, community-based ecosystem recovery on the coastal strip, and environmentally sustainable development in the resettlement areas. Short-term needs amount to SAT$1 million, medium-term are SAT$540,000, and long-term needs were estimated at SAT$480,000.

Pre-disaster Situation

Samoa relies on the environment for its productive sectors and its sustainable use is directly linked to public health, food security, social and economic benefits, including cultural values and traditional livelihoods. Traditionally, environmental policies and management were by and large left to individual ministries, due in part to the environmental policy vacuum in the last Strategy for the Development of Samoa (SDS). In the recent past, however, progress has been made with integrating environmental considerations into development policies and planning. The SDS 2008-12, for example, recognizes "Public Sector Management and Environmental Sustainability" as one of its three priority areas.

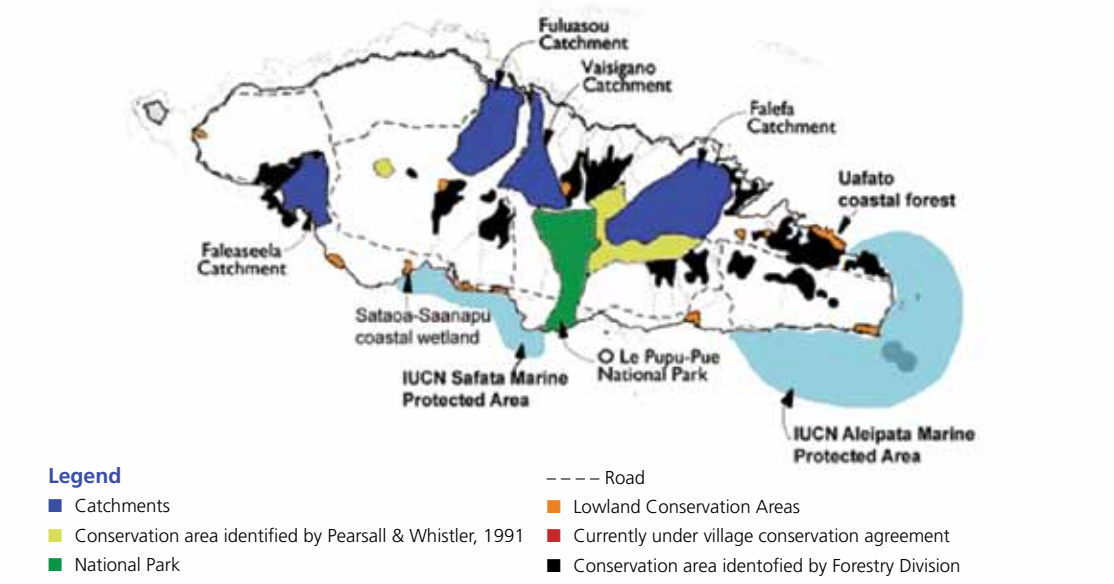
The predominant land use apart from indigenous forests (36%) is agriculture (35%). Agriculture plays an important role in the Samoan economy with at least two-thirds of households reliant on a mixture of subsistence and cash income. About 37% is covered by remaining forest (36 % indigenous, 1% plantation). A common land use pattern in the villages consists of a residential area with a village common ground on strip of land along the coastline. Next, further inland is a mixed cropping zone of fruit trees, bananas and coconuts, and further inland is a zone of primary food crops of taro, taamu and yams.

Table 41. Estimates of Land Uses in Samoa in 1993

Land Use Type	Area (ha)	(%)
Merchantable Forest	13,574	4.6
Forest Protected/Village Conservation Areas	3,089	1.1
Watershed Areas	31,992	11.3
National Parks/Reserves	2,880	1.0
Land Available for Reforestation	10,000	3.6
Agriculture / Cropland	98,000	34.7
Recent Lava Fields	11,433	4.1
Unproductive Forest Areas	111,112	39.4
TOTALS	**282,000**	**100**

Source: National Report of the Government of Samoa's Forestry Division, Department of Agriculture, Forests, Fisheries & Meteorology to the FAO/SPRIG/AUSAID/SPREP & SPC/PIFTSP Pacific Sub-Regional Workshop on Forest and Tree Genetic Resources, April 1999, Apia, Samoa.

Figure 17. Conservation areas of the Island of Upolu in Samoa



While coral communities are impacted by anthropogenic factors and by recent cyclones, a survey conducted by Green (1996) reported that despite the cyclones and other impacts on the coral reefs, the reef fronts were in reasonably good condition. Many community-owned marine protected areas have been established and initial assessments indicate substantial coral recovery and growth in these areas. However, coastal fisheries have often been severely depleted and are believed to be fished beyond their maximum sustainable level. Away from the coast, land-use practices, such as deforestation, cattle farming and agriculture are increasing both the rate of erosion and the supply of silt to the coast. These practices can affect the amount of flooding in coastal areas, and the amount of silt deposited on nearby reefs. Forest clearance threatens catchment areas and the quality of water supplies. Deforestation on marginal land areas leads to coastal erosion which is evident in various places along the coast.

Mangrove swamps or seasonal wetlands are interspersed in Samoa. The total area of mangroves and swampy forests in Samoa is estimated to be less than 10%, with a big area near Apia. Mangroves continue to suffer from coastal development, despite the institution of conservation and mitigation strategies. Protection of mangrove ecosystems is controlled under the Lands and Environment Act 1989 but to date there are no regulations governing the protection of mangroves. Presently only about 27% of communities with community-based management plans have opted to impose appropriate actions to manage activities adversely impacting on mangroves.

The affected areas are located on the southern and eastern side of the Island of Upolu, with the south-eastern end being most impacted. The geographical terrain of the area varies from low-lying sandy beaches to steep hills with small sandy bays. The south-eastern side is characterized by steep south facing hills, sloping down to a narrow strip of fine coral sand next to the sea. In the western part, where the coastline flattens out, the coastal strip is more elevated and rolling and pockets of sand are interspersed with outcrops of volcanic rock. The coast is dissected by many rivers that are often dry, but can have a large volume of water in them after heavy rain. Where there are adjacent reefs, they lay 100-500 meters off shore and are often interrupted by steep volcanic headlands between the bays. An extensive reef system lies 500 to 2000 meters offshore. Two Marine Protected Areas (MPAs), Aleipata and Safata, are located in the affected area as well as a number of other 'No take' zones.

Damage and Losses

The tsunami had large impacts on the coastal and marine environment causing damage and loss of animals, plants and habitats, and important ecosystem functions. Within the first three weeks after the disaster, three studies gave a first overview of the environmental impacts: a) a Tsunami Rapid Environmental Impact Assessment had been undertaken immediately following the disaster by the Ministry of Natural Resources and Environment (MNRE), Conservation International Pacific Islands Programme, the Secretariat of the Pacific Regional Environment Programme, UNESCO, and UNEP, b) JICA undertook a preliminary Survey Report on Bulky Wastes and Sewage Conditions in 10 of the affected villages and c) UNESCO-IOC International Tsunami Survey Team concluded a qualitative field assessment.

Damage to environmental or waste management equipment and infrastructure of the Ministry of Natural Resources and Environment has not been reported.

Debris, waste, and pollution: The tsunami generated a considerable amount of rubble and debris from destroyed buildings, washed away rocks, uprooted vegetation, but waste also includes car bodies, fishing boats, and household items. The Aleipata Wharf and a gas station sustained significant damage and fuel drums were lost in the event, releasing toxic substances. The tsunami also damaged significant number septic tanks, dispersing sewage on land and sea.

A rubble and debris management plan that encourages reuse and recycling of rubble and identifies suitable disposal sites is urgently needed. Insurance claims for insured items, such as cars, should be filed before their removal. In environmentally sensitive habitats, the clean up should not further damage the sites. The removal of debris needs to be viewed as an opportunity for employment generation for the affected communities. It is estimated that 2500 m^3 of solid waste (excluding tree logs) were occurred. Costs of removing the debris were estimated at SAT$300,000.

Waste also needs to be removed in the marine areas in close partnership with the nearby communities. Estimated costs: SAT$200,000.

An assessment of sources of hazardous pollution, such as the affected wharf, gas station, asbestos, polychlorinated biphenyls (PCBs), anti-fouling paints (used on fishing boats), batteries, pharmaceuticals, and pesticides. Recommendations on the containment of toxins are necessary. Cost: SAT$50,000.

The tsunami resulted in saltwater intrusion into fresh water lenses, resulting in vegetation browning and dieback. Vegetation has been severely damaged. Food crops, trees and house gardens have been destroyed. Only very few indigenous forests occur in the affected area and most trees in the tsunami area are used for agricultural production and their damage is therefore accounted for in the agricultural assessment. Some tree species proofed to be highly resilient and provided immediate places for safety during the tsunami and resources in the post-tsunami phase. Trees have reduced the impact of the tsunami on coastal infrastructure and are reported to have saved lives.

Figure 18. Vegetation dieback due to salinization

Figure 19. Coastal Erosion

Contamination from mud, silt, debris, and saltwater of some rural drinking water resources, such as shallow wells, occurred. Freshwater swamps were also affected from wave action, salinization, and debris. It is expected that freshwater resources in rivers will recover quickly. River banks sustained damage and significant erosion.

It is expected that the coral reefs experienced physical breakage and that they have been damaged by excessive amounts of debris and pollutants. Sediments were transported into the lagoon and reef areas, leading to smothering of corals and benthos. The two Marine Protected Areas and other 'No Take' zones are expected to have sustained significant damage and their function to support substance fishing will

be reduced for an extended period of time. Many 'No Take' zones have lost their marker buoys. Seagrass beds are limited in the affected area and had already been severely impacted by the construction of the Aleipata wharf before the tsunami. Further damage to seagrass areas, which are vital green turtle feeding areas, is likely. Mangroves are interspersed in the affected areas and their importance as effective barriers to tsunamis is obvious in some areas. Mangroves and swamps have been slightly damaged but are likely to recover in the medium term. Damage also occurred to marsh areas from wave action, sedimentation, debris, salinization, and contamination. The decrease in marshland, reefs, seagrass, and mangroves does not only lead to a loss in habitat for plants and animals but also to an increase in the exposure of communities to natural hazards. A detailed marine impact assessment is required.

The tsunami resulted in erosion of beaches. Beach profiles have dropped up to 1.5 meters in some areas, especially in the south-eastern end. In some instances, former tourist resorts have lost their small strip of beach. The associated sand and sediment wash-off into the lagoon caused further impacts in the marine environment. The erosion poses further risk to development, including houses, roads, and cultural sites.

Table 42. Damages and Losses to the Environment (in SAT$)

Component	Disaster Effects			Ownership by Sector	
	Damage	Losses	Total	Public	Private
Debris removal		300,000	300,000	300,000	
Marine clean up		200,000	200,000	200,000	
Hazardous waste		50,000	50,000	50,000	
Total		**550,000**	**550,000**	**550,000**	

*Other damages and losses in the environment, including agricultural land, reefs, trees, fisheries, seawalls and impacts on tourism due to environmental damage are accounted for in the respective sector assessments.

Risk Management Issues

Ecosystem-based interventions provide important opportunities to empower communities to take control of their immediate surroundings and to develop disaster risk and climate adaptation responses which are sustainable in financial, social and cultural terms. Healthy ecosystems not only benefit peoples' livelihoods and well-being but also offer a buffer against natural hazards and sea level rise. Coastal development in the affected area is exposed to tsunamis, storm surges from cyclones, floods, earthquakes, sea-level rise, and wind damage. The full suite of environmental approaches should be investigated and used to reduce the associated risks. A study by the UNESCO-IOC International Tsunami Survey Team, for example, investigated which trees was highly resistant to the tsunami event in Samoa and concluded that native littoral coastal trees provided considerable protection for coastal infrastructure from the waves and debris, for example, fetau (*Calophyllum inophyllum*), talie (*Terminalia catappa*), pu'a (*Hernandia nymphaeifolia*), niu (coconut palm, *Cocos nucifera)* and fasa (*Pandanus tectorius*). The same study noted that the flow depth and consequently the degree of damage were influenced by the size of the coral reef. The areas with extensive reefs had lower flow depths and thus sustained less damage.

Creating the potential for innovative ecosystem-based interventions that link climate adaptation, hazard risk reduction, and vulnerability reduction in national and sectoral policies should be of paramount importance. With lands, forestry, environment, disaster risk reduction, and climate change adaptation now

under one ministry, the Ministry of Natural Resources and Environment (MNRE), there is an excellent opportunity to link conservation and regeneration of the environment with integrated land use planning and disaster risk reduction. This can facilitate multiple and integrated uses of land resources while minimizing adverse environmental and disaster impacts.

RECOVERY AND RECONSTRUCTION REQUIREMENTS

Immediate priority

Restoring the natural resilience of about 1.0 km of the most affected shorelines to withstand prevailing natural hazard risks through non-structural measures, including beach nourishment, dune construction, planting, and stabilization efforts. Cost: SAT$300,000.

While initial assessments have provided a rough sketch of environmental damages and associated losses, recovery and reconstruction work must be guided by a more in-depth analysis, focusing on the following three areas:

- Direct environmental damage of the tsunami: This component would expand the preliminary findings with a marine and terrestrial impact and restoration assessments, which will give detailed reviews of pollution, salinization, sedimentation, and impacts on flora and fauna. For example, an assessment on potential contamination of marine key food species is needed. Cost: SAT$120,000
- Environmental footprint of the recovery: Relief and recovery activities should be conducted in an environmental friendly manner and any additional damage to natural assets need to be identified and, where possible, mitigated. Next to environmental impact assessments of new investments, a thorough assessment for the Aleipata wharf is necessary. Since a large number of communities have moved further inland, there is also a need for the Government to be proactive with respect to ensuring environmental sustainability and protection of critical watershed lands in these areas. Cost: SAT$100.000
- Institutional assessment: Policy constraints and capacity gaps to manage environmental rehabilitation in the short and medium term need to be identified, in particular gaps in mainstreaming environmental considerations. As a crosscutting issue, environmental management needs to be addressed in the key economic sectors such as agriculture, fisheries, tourism and energy. Cost: SAT$30.000

Medium-term

Based on the environmental damage assessments, a monitoring program needs to be introduced to follow and learn from the recovery in the marine and terrestrial habitats. Fishing capacity, for example, should be carefully monitored. Environmental stressors, including sand mining and commercial fishing, should be banned to allow for recovery. Cost: SAT$70,000.

Long-term Priority

Experience shows that eco-system restoration through small scale coastal afforestation protects infrastructure against tsunamis and other hazards. Larger coastal trees have been removed over the past decades in the affected area due to construction of infrastructure, including houses or seawalls. This removal has left communities more vulnerable to disasters. Programs to green the coastal strip are needed for protection against future disasters and to provide income opportunities for the communities for co-management of the programs. Recovery programs for the affected communities need to be prepared, using participatory planning methodologies. The programs should include education campaigns and advisory support. Identified activities could include:

- coastal garden restoration works,
- planting of native, salt resistant trees to reduce erosion and protect infrastructure
- establishing plant nurseries,
- protection of communal fresh water pools,
- reforestation of mangroves and swamps for fish and crab breeding and hazard protection,
- establishing and monitoring "no-catch" marine protection areas
- banning of destructive fishing methods,
- controlling activities that affect coastal habitats such as sand mining and illegal waste deposits
- small works, such as culvert crossings or upgrade of drainages from the mangroves to the sea.

MNRE will require support to implement the program at an estimated cost of SAT$900,000.

An environmental sustainability program should be undertaken in the new resettlement areas. A particular emphasis should be given to drainage, watershed protection, soil stabilization through improved agricultural techniques, and upscaling of the successful program on certified organic farming. The integrated development of these areas will ensure a favorable environment for flora and fauna. Plans for the resettlement areas need to be developed in a participatory manner. An indicative cost of such a program is SAT$500,000.

Table 43. Needs in the Environment Sector (in SAT$)

Program		Short	Medium	Long	Total
Beach nourishment		300,000			300,000
Environmental	Direct Damage	120,000			120,000
Assessments	Recovery Footprint	100,000			100,000
	Institutional Capacity	30,000			30,000
Recovery monitoring			40,000	30,000	70,000
Small-Scale Coastal Eco-system Restoration		300,000	300,000	300,000	900,000
Resettlement Areas		150,000	200,000	150,000	500,000
Total		**1,000,000**	**540,000**	**480,000**	**2,020,000**

SECTION III: THE ECONOMIC AND SOCIAL OUTLOOK

3.1. MACRO-ECONOMIC AND POVERTY IMPACT

Recent Performance

The September tsunami has compounded the economic problems that Samoa is facing as a result of the global economic crisis and rising food and fuel prices. Many jobs have been lost in the domestic economy, primarily in the export manufacturing sector, and other jobs and associated remittances have been lost through the closure of a large tuna canning plant in neighboring American Samoa. The result has been an estimated fall in GDP during FY 2008/09 of -5.5% following strong growth of 5% in 2007/08.

Table 44. Recent GDP Performance of Samoa

	Nominal	Real GDP: % change over previous FY			
	2008/09	05/06	06/07	07/08	08/09
Agriculture	88.8	0.7	-4.4	5.9	-10.0
Fishing	78.9	-7.5	6.5	2.7	-7.2
Food & Beverages manufacturing	21.7	0.2	-13.3	-11.9	-30.8
Other manufacturing	111.5	-8.7	-0.8	10.9	-30.2
Construction	174.9	9.5	18.0	6.6	-10.6
Electricity and water	69.7	4.6	2.8	2.5	2.7
Commerce	285.1	4.3	3.6	2.2	-1.6
Hotels, restaurants	52.4	16.9	7.8	16.6	7.7
Transport, Communication	199.2	6.6	1.1	4.9	4.2
Public administration	119.4	1.4	1.5	3.6	3.6
Finance and business services	121.4	3.7	3.6	3.5	2.1
Less: Enterprise share of FISIM	-17.3	2.8	2.1	4.4	2.3
Ownership of dwellings	44.1	0.3	0.3	0.3	0.3
Personal and other services	63.5	-1.1	-11.5	11.0	-5.1
Total GDP (SAT$ millions)/% change	**1,413.2**	**2.2**	**2.3**	**5.0**	**-5.5**

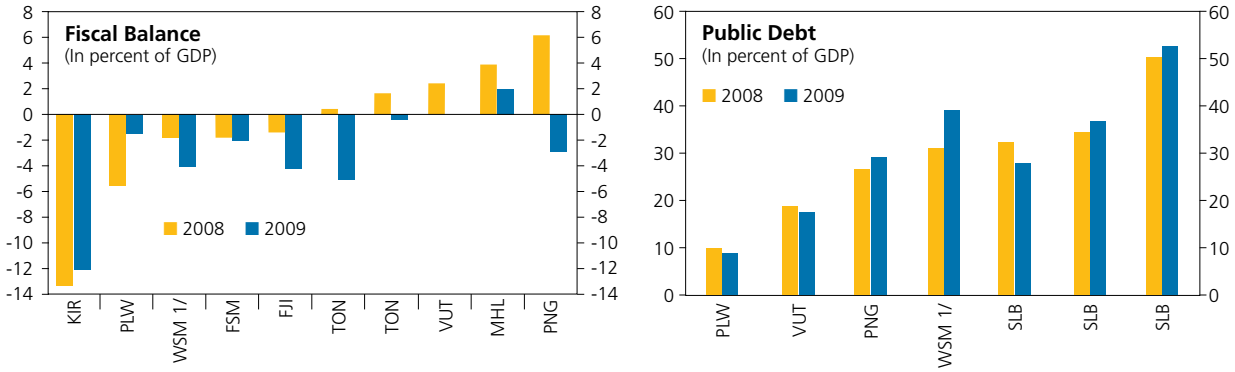
Note: FISIM stands for Financial Intermediation Services Indirectly Measured
FY is Financial Year 1 July - 30 June
Source: Samoa Bureau of Statistics

The agriculture sector suffered in 2008/09 as fish exports fell. Construction output was reduced due to a decline in activity following the South Pacific Games in 2007. However, the small, but growing tourism sector has had a positive impact on incomes especially in the tsunami affected area. This is reflected in growth in the hotels, restaurant, transport and commerce sectors.

Government targets an annual inflation rate of 3 – 4 percent. However, inflation reached 13.9 percent at the end of 2008/09 as the impact of higher food and fuel prices fed through the domestic economy.

Falling exports and rising imports as a result of higher food and fuel prices has considerably worsened the balance of payments although import cover has remained within the Government's target range due to high levels of remittances.

Samoa's Public Finance Management Act requires Government to adhere to a set of principles of responsible fiscal management. A Fiscal Strategy Statement is prepared as part of these requirements. The statement which accompanied the 2009/10 budget notes that the projected budget balance for 2009/10, -10.6 percent of GDP, is outside the range of -3.5 to +3.5 percent of GDP due to an increase in planned capital spending in public and social infrastructure including some large education and health investments. However, current spending has also increased due to an increase in public service wage rates.



Source: IMF APDLISC database
1/ in fiscal year July/June

Figure 20. Fiscal Balance and Public Debt of Samoa and peer countries

Public debt comprises mostly of concessional lending from the ADB and World Bank and is expected to reach 41 percent of GDP in 2009/10, slightly above government's target of no more than 40 percent of GDP.

Pre-Disaster Economic and Fiscal Outlook

The government notes in its Fiscal Strategy Statement for the Budget 2009/10 that "the outlook for Samoa in 2009/10 and the subsequent four years is one of further economic contraction. Consumption is forecast to grow as remittance flows and incomes rise. Private investment is forecast to grow again as confidence improves; and exports are expected to increase as world growth brings rising tourism. Government spending will fall as high levels of development expenditure declines, while imports will start to grow again as domestic spending rises. Inflation is forecast to stabilise at low levels." (page 9).

Table 45. Forecast Growth of GDP Expenditure Components (constant 2002 prices)

	2009/10	2010/11	2011/12	2012/13	2013/14
Consumption	-4.10%	-1.20%	1.70%	3.20%	4.10%
Private Investment	-5.00%	6.30%	5.40%	5.50%	5.60%
Government	12.70%	-7.60%	-5.40%	1.40%	1.50%
Exports	-2.50%	-0.30%	2.40%	3.00%	3.00%
Imports	1.10%	-4.60%	-0.60%	3.40%	4.10%
Gross Domestic Product	-0.80%	-0.60%	1.10%	2.90%	3.20%

Source: Ministry of Finance

Slow GDP growth is projected to result in declining tax revenue in 2009/10 constraining expenditure and public service delivery. The Fiscal Strategy Statement for the Budget 2009/10 notes that "donor assistance to finance some of an increase in expenditure would help mitigate the effects of the world recession on GDP, without putting undue pressure on the balance of payments or fuelling inflation." (page 10).

Lower GDP, and consequent lower revenues, combined with current planned development expenditures, will put the budget balance well above Government's target.

With lower remittances and constrained growth in tourism, government has been looking to donors to assist in providing budget support to cover current expenditures in the medium term. Current expenditures are forecast to be well below Government's target.

Government was also expecting to see increases in external debt as a result of increased borrowing to finance shortfalls in revenue stemming from the global economic crisis.

Economic and Fiscal Outlook following the Tsunami

In addition to the significant rehabilitation costs, the tsunami has undercut Samoa's economic resilience and prospects for a quick recovery from the global recession. The scale of the damage to physical infrastructure is of unprecedented proportions for Samoa and also stands out by international comparison. In particular, the impact on Samoa's fledgling tourism sector could be severe. Tourism receipts in FY 2008/09 accounted for 65 percent of all export earnings and the sector is estimated to contribute directly and indirectly (through domestic suppliers) about 14 percent of GDP. About a quarter of the tourism sector's capacity has been destroyed by the tsunami. Based on cross-country recovery experience and Samoa-specific seasonal and structural patterns of tourism demand, this means that about 1½–3½ percent of GDP could be lost in the first year after the tsunami.

As a result, the incipient recovery is likely to stall and real GDP to contract in 2010 by about 3 percent. Tentative staff estimates indicate that GDP growth would fall up to 5 percentage points short of the pre-tsunami baseline. Beyond tourism, the widespread damage to physical infrastructure implies that other key sectors such as commerce, transport, communication, and agriculture are also directly hit. With economic activity returning to normal from a low base and infrastructure rehabilitation spending providing a further boost, growth could exceed the baseline by 2 percentage points in 2011 before converging to potential.

At the same time, the current account deficit is set to widen. Before the tsunami, the current account deficit was already expected to deteriorate substantially, mainly as a result of the sizeable fiscal stimulus envisaged in the 2009/10 budget and increased private sector activity. In addition, as a result of the tsunami, shortfalls in tourism receipts of about US$20 million in FY 2009/10 (subject to a wide margin of error) would only partly be offset by lower imports of the tourism sector, while the increase in capital goods and other imports related to infrastructure rehabilitation would more than offset any decline from an initially weaker economy. However, a strong response from private overseas remittances would help reduce external financing pressures, as would insurance payments to international resorts. Both are currently difficult to gauge with precision.

The outlook is subject to considerable uncertainty. This relates above all to the unprecedented scale of the damage making predictions of a systematic rehabilitation and growth recovery challenging. Moreover, estimates are subject to weaknesses in Samoa's national accounts data. In addition, a key downside risk is that the reputational damage for Samoa's image as a safe destination could last longer than is usually the case, especially if the island is hit by another significant natural disaster.

The fiscal cost of emergency relief and rehabilitation will be significant. Based on the Damage and Losses estimates, the government would consider an economic recovery framework with a fiscal cost of about US$100 million (18 percent of GDP). This estimate is higher than the estimated damage to existing infrastructure, as the recovery framework would not only include resettlement to safer areas and repair of infrastructure to allow access to basic social services, but also provide for social safety nets, and investments in disaster risk reduction. The recovery framework would build on the government's Strategy for Development of Samoa (SDS), the blue-print for poverty reduction, and sustained high growth over the medium-term.

Therefore, a widening of the fiscal deficit to 12 percent of GDP in FY 2009/10 to accommodate Samoa's rehabilitation needs is unavoidable. The government has already identified 60 percent of the funding needs for the recovery framework in new grants and concessional financing. The government is preparing a supplementary budget for FY 2009/10 which would cover about a quarter of the recovery framework and focuses on the most urgent tasks, including humanitarian relief, road repair, maintaining access to priority social services, in particular to the most vulnerable segments of society in affected village communities, as well as water and electricity.

Table 46. Samoa's Debt Sustainability projections

External Debt Outlook: Before and After the Tsunami 1/												
	2010		2012		2014		2016		2018		2020	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
External debt 2/	45.7	52,7	47.2	59.4	44.8	57.8	43.8	54.3	41.5	50.5	39.4	47.1
NPV 2/	32.5	36.5	33.8	39.9	32.2	38.8	31.7	36.9	30.1	34.6	28.6	32.4
Debt service 3/	5.6	6.4	5.1	5.4	5.2	5.5	4.9	4.9	4.7	4.9	4.6	4.7

Source: Fund staff estimates
1/ Fiscal year ending in June
2/ In percent of GDP
3/ In prcent of exports
Source: International Monetary Fund

Results from a debt sustainability analysis suggest that even after taking into account the large deficits envisaged in 2009/10 through 2011/12, the debt outlook remains favorable. Between FY 2001/02 and FY 2007/08 public debt was nearly halved, falling to about 30 percent of GDP. However, it has risen since then on account of the government's expansionary fiscal policies in response to the global recession. Moreover, the government has virtually no domestic debt. As a result, the net present value of public debt stood at 28 percent of GDP as of June 2009, significantly below sustainability thresholds indicated for low income countries. However, maintaining fiscal sustainability is key for a small island such as Samoa that is susceptible to severe external shocks. Moreover, publicly guaranteed debt, which on partial data may amount to about 4 percent of GDP, constitutes an additional risk.

Poverty and Income impact

Samoa is presently classified as one of the forty-three poorest and least developed countries. This is largely result of Samoa's vulnerability as a result of its narrow economic base and vulnerability to natural disasters particularly cyclones. However, Samoa has a generally high level of human development rising from 0.682 in 1985 to 0.760 in 2006. As a result Samoa has been put on the LDC graduation list. This has been challenged by government arguing that the country is extremely vulnerable to external shocks such as those recently experienced through the global economic recession and the tsunami.

The tsunami affected areas of the east, south-east and southern coastal regions of Upolu comprise approximately one-quarter the Rest of Upolu (RoU) sub-region, as included in the 2008 household income and expenditure survey (HIES). Household size in the RoU sub-region including the affected areas was 7.7 persons (3.1 were children and 3.7 were females). This is slightly higher than the national average household size of 7.3 persons. For the poorest affected households, those in the bottom three deciles of per capita expenditure, the average household size was 10.0, of which 4.8 were children and 4.8 were females.

Those in the affected areas had amongst the lowest average weekly per capita household expenditure, SAT$95.64 per capita per week, being some 18.5% below the national average of SAT$117.34. For the poorest households, those in the bottom 30%, the average per capita weekly household expenditure amounted to only SAT$39.93. Comparison of the 2002 and 2008 household surveys indicates that the RoU sub-region experienced the lowest rate of increase in household income/expenditure rising by only 8.1% compared with a national average increase of 54.1%.

This has resulted in an increase in the incidence of poverty in this area of the country. The preliminary analysis of the 2008 household survey suggests that around 20.5% of households fell below the basic-need poverty line, an increase of 7.1 percentage points since 2002. A disaggregation of the tsunami affected areas of the RoU sub-region suggests that the tsunami affected areas have in fact fared even worse than the rest of the Rou sub-region with 23.5% of households below the basic needs poverty line.

Households in the tsunami-affected areas produce a higher proportion of their own food than any other part of the country. According to the 2008 HIES an average of about 44% of food consumed was home-produce compared with only 29% across the country as a whole. For households in the bottom 30% of per capita weekly expenditure the proportion of home produce in food consumption was 56% compared with 45% nationally. The average weekly household value of home produced food amounted to SAT$139.54, equivalent to an annual value of approximately SAT$7,256, in the tsumani affected areas.

Around 28% of working age people in the tsunami-affected areas were engaged in farming/fishing activities, either for domestic consumption (23%) or for produce sale (5%). This is primarily a male-dominated activity with females being primarily engaged in domestic duties; overall around 36-37% of working age people were engaged in these domestic duties. Amongst females approximately 70% were engaged in domestic duties with only about 10% in employment. For males approximately half were engaged in farming and fishing with 20% in either full or part-time employment.

Many of those in employment would have been engaged in the tourism related activities associated with the beach-fale and other resorts located along the southern coast. Others would have been employed in the automotive wiring-harness manufacturer based in Apia but which recruited workers from the rural parts of both Upolu and Savaii. Many of these workers may have lost their jobs as the global economic slowdown impacted on the demand for wiring harnesses and the factory in Apia reduced its workforce during 2008 and 2009.

Loss of livelihoods in the tsunami affected areas was substantial. It is estimated that there was significant damage to subsistence production through the destruction of small livestock, loss of agricultural tools and equipment and the destruction of close-to-household gardens and food trees. The loss of this subsistence production may put more households at risk of food poverty.

Those employed in the tourism sector in the tsunami-affected resorts and businesses have also been affected. It is estimated that some 500 workers lost their jobs in the tourism sector accounting for around SAT$240,000 per month in wage income.

SECTION IV – MANAGING DISASTER RISK

The number of disasters and their induced losses has been steadily increasing around the world driven by the growth in population, construction of exposed infrastructure and changes in climate. These disasters have thus come to be studied as socio-environmental by nature and their occurrence as the result of socially created risk. In this view of risk, a disaster event occurs from the confluence of both a hazardous phenomenon, such as the tsunami event, and the vulnerable conditions of the affected communities. Vulnerability is intimately related to social processes in hazard prone areas and is also usually related to the social fragility, environmental susceptibility or lack of economic resilience of the population.

As such, comprehensive Disaster Risk Management (DRM) encompasses a multi-sectoral approach including both productive economic and social sectors. In order to reduce disaster risk, society must seek to mainstream its reduction as an explicit objective into its decision-making processes; not only during the reconstruction phase immediately following a disaster, but also into overall public policy formulation and development planning.

Table 47. Key Elements of Disaster Risk Management

Disaster Risk Reduction and Transfer			Disaster / Emergency Management		
Risk Identification	**Risk Reduction**	**Risk Transfer**	**Preparedness**	**Emergency Response**	**Rehabilitation and Recovery**
Hazard Assessment (Frequency, magnitude and location)	Physical / Structural Mitigation Works	Insurance / reinsurance of public infrastructure & private assets	Early warning and communications systems	Humanitarian assistance	Rehabilitation / Reconstruction of damaged infrastructure
Vulnerability Assessment (population & assets)	Land use planning and building codes	Financial market instruments (CAT bonds, weather index hedge funds)	Contingency planning	Clean up, temporary service restoration,	Macroeconomic stabilization and budget management
Risk Assessment (a function of hazard & vulnerability)	Economic incentives for pro-mitigation behavior	Privatization of utilities	Emergency responder networks	Damage Assessment	Revitalization of affected sectors
Climate Change Impacts, Hazard monitoring and forecasting (GIS, mapping & scenario building)	Education, training and awareness of risks and prevention	Calamity funds (regional / national or local reserve mechanisms)	Shelter facilities & evacuation plans	Mobilization of recovery resources (public, multinational, insurance)	Incorporation of disaster risk reduction in reconstruction activities

Table 47 outlines the key elements of comprehensive disaster risk management. Activities fall broadly into two areas: long term planning actions that aim to reduce a communities overall risk of disaster losses, and event centric activities that seek to prepare for specific scenarios, respond, manage and recover from emergencies as they arise.

4.1. THE NATIONAL FRAMEWORK

Samoa's 2006 Disaster and Emergency Management Act establishes a modern comprehensive Disaster Management Framework, headed by the National Disaster Council, chaired by the Prime Minister, served by the Disaster Management Office (DMO) and advised by the Disaster Advisory Committee. The National Disaster Management Framework (NDMF) provides for:

- National Disaster Management Plan (NDMP);
- Creation of Hazard Plans for cyclone, tsunami, pandemic and fire;
- Agency Response Plans for most of the key government and private agencies;

Responsibility for Disaster Management is assigned to the Ministry of Natural Resources and Environment (MNRE). The Disaster Management Office (DMO) was established as a Section of the Meteorology Division with three staff members - a Principal Officer, Senior Officer and Officer. Overall the DMO manages the implementation of the NDMF. The main tasks involved include the:

- Coordination of National Disaster Council;
- Secretariat of the Disaster Advisory Committee, with 44 active public and private members;
- Securing development assistance to support NDMF implementation; and
- Implementation of the NDMF dealing with Disaster Preparation, Response and Recovery.

4.2. DISASTER RISK REDUCTION AND TRANSFER

Hazard & Risk Identification is mandated in the NDMP and responsibility of the Meteorological Services. An inventory of disasters is maintained by the Disaster Management Office (DMO) whilst climate impact analysis, hazard monitoring and forecasting is the responsibility of the Meteorological Office. As such climate change adaptation and responsibilities under the National Adaptation Plans for Action (NAPA) are well integrated with the overall disaster risk reduction framework. Modelling and mapping of hazards is supported by SOPAC. The NDMP also contains in annex 3 detailed considerations of maximum credible events (MCE) for each hazard to which Samoa is exposed. These MCEs are derived from a qualitative risk assessment approach based on the Australian New Zealand Risk Management Standard 4360 (AS/NZS 4360:1999).

Samoa also possesses up-to-date exposure data following an update of cadastral data and strategic infrastructure mapping in GIS based electronic formats.

The convolution of hazard maps with exposure and vulnerability of population and assets in order to arrive at a true evaluation of disaster risk – expressed as expected losses - has not however occurred in a quantitative manner. This is precluded by the lack of frequency analysis associated with the intensities of each hazard and by the lack of vulnerability assessment in the *sensu strictu* understanding of the term. This analysis entails the assignation of hazard specific vulnerability curves to common Samoan structures

and social groups in order to derive risk metrics such average annual losses, probable maximum losses and ultimately develop loss exceedence curves for Samoa. Such loss curves are useful for national planning and budgetary allocation as they allow for the comparison of risks across hazards and with varying recurrence characteristics, be they small frequent events or large in frequent ones.

Public information and community participation to raise awareness of risks is handled by the DMO. Following the NDMP, two tsunami drills were conducted in the past two years, with the intention of maintaining these as yearly occurrences.

Risk Reduction broadly entails structural mitigation works such as sea defenses, drainage, retrofitting or reinforcement, and non-structural means such as drain maintenance activities, establishing incentives for pro-mitigation behavior, and education awareness. Relocating communities is an example of an extreme risk reduction measure.

Any fresh review of a community's risk management plans also presents an opportunity to review the latest anticipated climate change impacts and ensure that these are well incorporated into the disaster risk reduction measures.

Activities are mainstreamed in the NDMP across sectors and government and non-government agencies with the provision of agency specific plans, actions and mandates. The Planning and Urban Management Authority has specific responsibility of integrating risk in land use and urban planning. The World Bank Strategic Infrastructure Asset Management project has included major national components in risk reduction measures and provides for Coastal Infrastructure Management (CIM) plans at the community level.

Implementation of control and protection techniques prior to hazard events are identified and primarily assigned to the Ministry of Works, Transport and Infrastructure. Such works should include the maintenance and clearing of storm drains and roads prior to forecast cyclones, slope stabilization schemes and coastal protection measures to prevent flooding, erosion and clear up of loose debris which can be hazardous in high winds. In the case of the tsunami large boulders used as components of the sea wall were swept large distances inland and became a significant cause of housing damage, destroying structural beams, foundation platforms and building walls. In response to the DMO's report on Apia Urban flooding at the end of January 2008, the Cabinet[23] approved MNRE to be responsible for the implementation of river protection works and river channel maintenance.

Mitigation activities are identified and incorporated into the national hazard management plans. For the Tsunami hazard, a national plan was produced in 2008 and sets out risk reduction measures for new developments, existing settlements including public safety measures and relocation options, tsunami signs and symbols, and evacuation routes and safe places. This plan is to be implemented in conjunction with existing programmes, policies and plans of government and NGO partners.

Reinforcement and retrofitting of public assets activities are specifically assessed at community level under the CIMs plans.

[23] Decision FK(08)04

Risk Transfer and Insurance do not directly reduce expected losses, but they can be used to improve a community's resilience by enabling them better meet the needs arising from a disaster and also can be used to encourage pro-mitigation behavior. A review of Samoa's Disaster Insurance[24] in 2006 found that:

- All major public buildings and utilities are fully insured for natural disaster through the commercial insurance market.
- 25% of residential bungalows (but not fales) are insured for natural disasters including some contents insurance

Samoa has cultural strengths that play an important role in risk transfer at the community level: the social cohesion provided by the family and village ties are a feature of Samoan life that encourages cooperation, mutual assistance and in effect risk pooling amongst an extended facility or community. Assistance within families extends to substantial remittances by emigrant Samoans which are estimated to comprise about 20% of Samoa's GDP. Remittances are expected to have increased as a result of the tsunami. These mechanisms help Samoa to deal with small to medium disaster events and serve as a means of risk transfer.

A national disaster insurance for major events begins with an *Unforeseen Needs fund*, equal to 3% of the government budget, which the DMO as well as other government agencies can call upon in the event of an emergency and thus serves as a contingency reserve. This fund however is not purely a disaster reserve and is shared with various eligible but unforeseen expenditures. Regional risk pooling mechanisms and international insurance for major catastrophes have been proposed for Samoa and the pacific islands states however no such mechanisms are yet in place in Samoa. The country is included under a study for a Pacific Catastrophe Risk Financing Initiative which is assessing the feasibility of various risk transfer options.

Currently the country relies on overseas aid partners to cover the shortfall for major events, however such reliance in the short run can divert funding from projects for sustained growth and in the long run may undermine national priorities.

4.3. EMERGENCY MANAGEMENT

Organization and coordination of emergency operations is well detailed with each agency required to maintain response plans. An Emergency Operations Center has been setup up in response to the tsunami at a secure location in Apia to coordinate the emergency response and recovery actions.

Community preparedness and training is required in the NDMP through a series of agency training, simulations and community plans involving response agencies and educational institutions. Interviews conducted by UN response team after the tsunami indicated that the level of community awareness was rather uneven across villages. Some, but not all, had participated in nation-wide drills. There are 329 villages in Samoa and regrettably not all were trained or developed plans by the time the tsunami struck. The pace of community training and preparedness is in part dictated by the need for facilitators to engage

[24] BECA International Consultants (2006), Disaster Insurance for Samoa, SIAM-2 C-4 Component, Environmental, Risk and Resource Management, provided by Samoa Disaster Management Agency

with communities in support of the training; in Samoa these are made up from representatives of Samoa Red Cross, and Ministries of Works, Women, Community and Social Development, Natural Resources and Environment, Agriculture and Health. Convening such a group of facilitators is not possible on a weekly basis and thus not all villages have been trained in the two years since the NDMP has been implemented. Up-to-date and widely disseminated village level contingency and preparedness plans are essential in local scale impacts such as the tsunami disaster since the first affected and first to respond are always the communities themselves.

Training on disaster preparedness delivered by the Disaster Management Office (DMO) focused on village functionaries but did not spread to all community members. School awareness programmes appear to have been effective based on reports of pupils warning their parents.

Emergency warning systems are primarily the responsibility of the Meteorological office, Ministry of Health or the Ministry of Police, Fire and Pensions. Official sources and recipients are identified and in the case of the tsunami the Meteorological Divisions' "National Forecasting Centre" sent an alert to media, government and local village representatives via sms. In Samoa local radio and TV stations close from 12:00 midnight to 6:00am and so alternative communications have to be considered in the plans. During the tsunami warning on September 29th 2009 the primary challenge was the short time interval between earthquake and tsunami impact – regional warning centers sent in alerts to the Meteorological office too late. The office therefore has the difficult task of determining if a tsunami is likely to have been generated and transmitting an alert within a window of approximately 5 minutes if the source is the Tonga trench and if the warning is to provide sufficient time. The tsunami experience also showed that many local people received their first alert from family living abroad and that the volume of international calls created network congestion.

Response arrangements include lead agencies and functions, proclamation of an emergency procedure, declaration of a disaster and emergency powers. Each agency is require to develop response plans and impact assessment is coordinated the Disaster Advisory Committee and with the Ministry of Women, Community and Social Development responsible for dialogue with affected communities. In the case of the tsunami, many villages have not been prepared for the trauma incurred, and early surveys indicated that many had not yet come together in village meetings to discuss the wider implications of the tsunami disaster and next steps. Most community discussion in the weeks following the emergency occurred amongst the community leaders.

Recovery begins once the emergency proclamation is lifted or the emergency operations centre is stood down. However preparation for rehabilitation and reconstruction planning should begin as soon as response begins. It is important throughout this phase to maintain good communication with the affected population. The tsunami experience has shown that these communities find it difficult to stay informed on the progress of the relief operations as well as the planned assistance of the government for the recovery process. This may lead to a feeling of insecurity and isolation, and comes in addition to the serious emotional trauma which the affected population must deal with.

4.4. COASTAL INFRASTRUCTURE MANAGEMENT PLANS

"To be resilient is to be adaptive, responsive and quick to recover so that communities are environmentally, socially and economically sustainable." (CIM Strategy, January 2001).

Samoa's Coastal Infrastructure Management plans provide for two activities: i) community and stake holder consultations to raise awareness of coastal hazards, identify risk reduction measures, response and recovery options; ii) implementation guidelines that describe the solutions proposed that will increase the resilience of the villages in the Plan area and the ways these solutions can be implemented. The CIMs have been expanded by the Government of Samoa to apply not only to coastal areas but on a watershed basis and hence now cover the entire country. The small measures identified by the CIMs serve as the reference risk management plan for the communities and often inform subsequent climate change adaptation priorities.

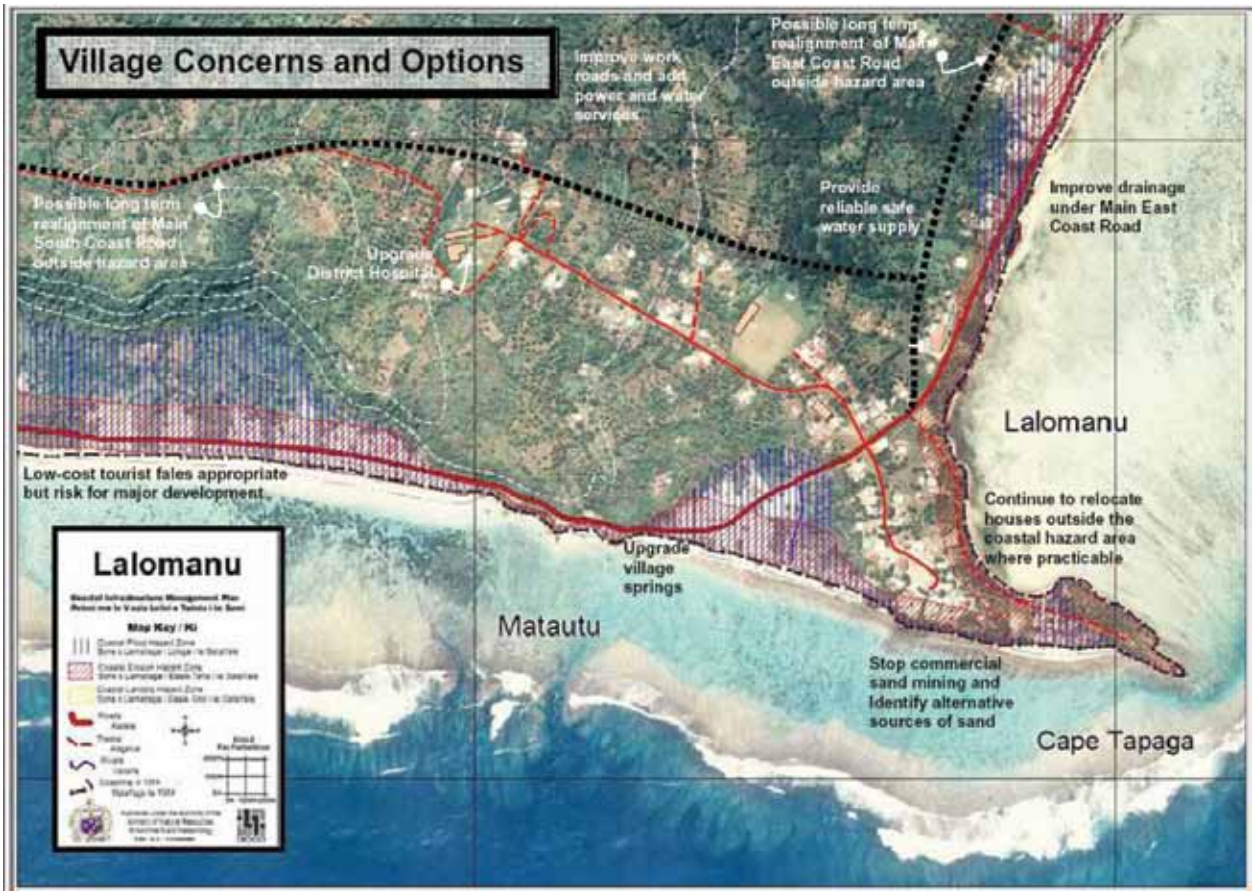


Figure 21. Lalomanu Village CIM Map

Implementation is considered to be the joint responsibility of both the villages and the government in partnership. The government is responsible for the provision of national and district "Public", infrastructure, while villages are responsible for local and community infrastructure. Solutions for both District infrastructure and Village infrastructure, and the responsibility of both partners, should be considered together as they combine to provide for the integrated management of all coastal infrastructure.

The examples of the CIM maps illustrate some of the recommended long term actions identified. Whilst these actions are primarily to protect from cyclones, tsunamis are taken into consideration. Critical infrastructure assets identified include houses, roads, telephone and power, water, hospitals, sea walls, and tourist site and marine environment. Of note are the extensive references to identifying long term relocation sites and options with some CIMs from villages severely affected by the tsunami already proposing to relocate communities including roads, churches, schools, power and water inland from the coast. As most affected villages had not yet developed their community hazard and risk management plans, the CIMS have become the *de facto* community recovery plan. As such many village leaders are sensitized to long term issues of risk reduction and planning and thus community discussion early on in the recovery process has revolved around relocation options and targets. These CIMs do not represent short term emergency contingency plans however and are not an adequate substitute for fully consulted community response and contingency plans as foreseen under the NDMP and yet to be developed in most villages.

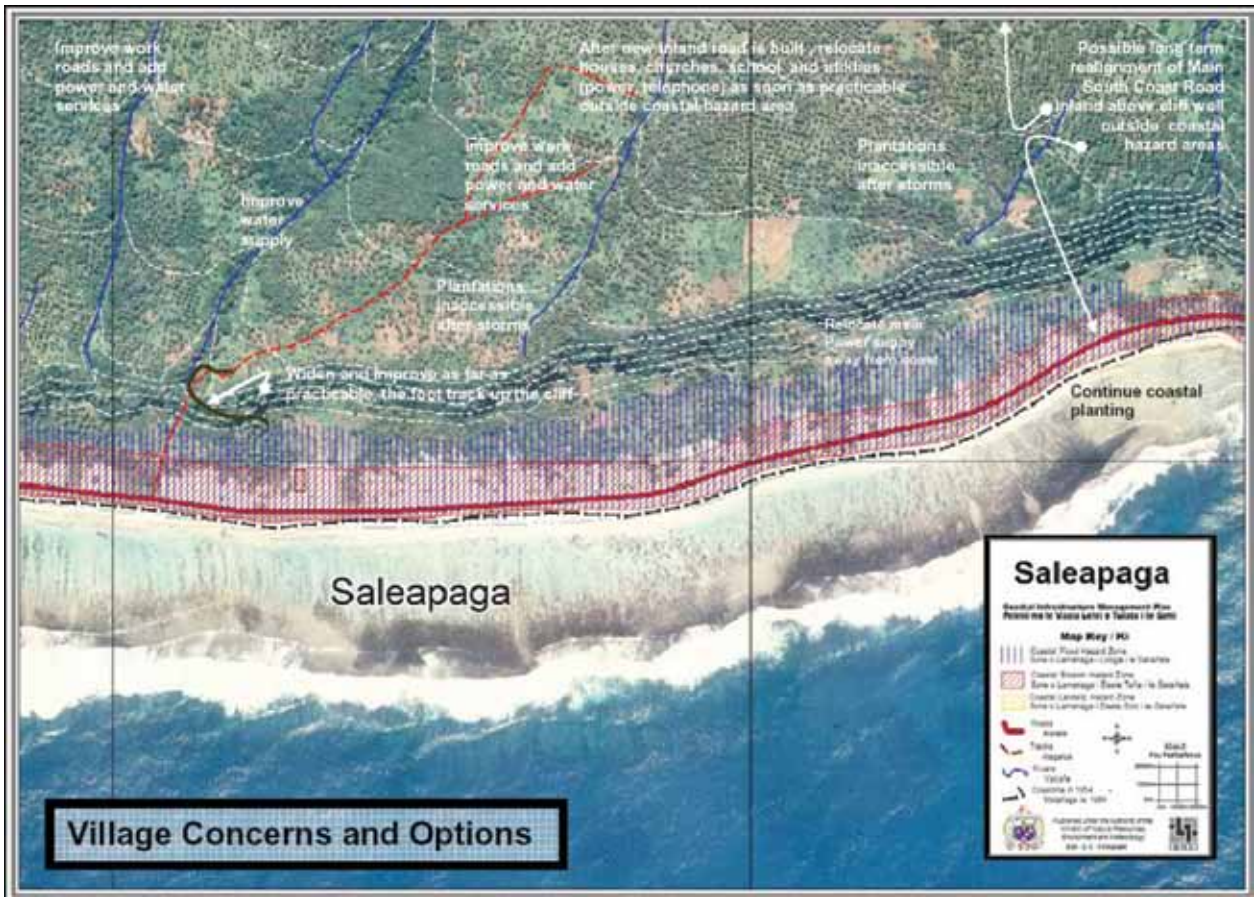


Figure 22. Saleapaga Village CIM Map

4.5. NEEDS ARISING FROM THE TSUNAMI

The proposed disaster risk management needs follow Samoa comprehensive Disaster Risk Management Framework and combine the broad strategic priorities and goals contained in the National Disaster Management Plan (2006 2009), as well as emergent needs and lessons learned from the recent tsunami. Needs for disaster risk management are distributed across the following four strategic pillars: (i) risk identification and assessment; (ii) risk mitigation planning and investment; (iii) strengthening and enhancing emergency preparedness and management; (iv) institutional capacity and risk financing;

The underlying principles of this approach are that both loss of life and the economic impact of disasters can be reduced through advance planning and investment.

Table 48. External Funding for Disaster Management Programmes, 2008-2012

Program	Activity	Funding Source	Est. Cost
Media Awareness	Develop television and radio programmes on safety procedures for tsunamis, earthquakes, cyclones, flooding and fire	AusAID	191,000
Village &	Conduct awareness workshops on NDMF	World Bank GEF	120,000 50,000
School Awareness	Develop response plans for villages including schools within villages part of the awareness workshop	UNDP	625,000
	Develop household booklets on disaster risk reduction and preparedness	UNDP	225,000
Total			**SAT$1,211,000**

[Source: DMO]

Samoa has already made great advances in its disaster risk management framework and in establishing a process for community level and agency contingency plans. Sadly the tsunami of 29 September 2009 struck before the full cycle of planning and preparedness activities had reached all villages in the country and work remains to be done. Samoa's currently financed Disaster Risk Management activities are focused on awareness raising and address some of the needs of the tsunami. Additional needs arising are outlined in this section.

Table 49. Climate Change Adaptation Pipeline Projects for Samoa, 2008-2013

Project	Activity Type	Funding Source	Est. Cost
Integrated Climate Change Adaptation in the Agriculture & Health Sectors	Adaptation	GEF	US$2,000,000
Pacific Adaptation for Climate Change (regional) – Coastal Sector	Adaptation	GEF	US$700,000
Integrated Climate Change Adaptation in the Forestry and Environment Sectors	Adaptation	GEF	US$2,500,000
Integrated Climate Adaptation in the Water, Forestry and Tourism Sectors	Adaptation	AusAID	AU$2,500,000
Total			**US$7,700,000**

[Source: Samoa DMO]

It important to incorporate the anticipated climate changes into Samoa's risk profile and conversely the newly identified needs and vulnerabilities of the tsunami affected communities into projected risk management activities and climate change adaptation plans. The resilience of communities will need to be reassessed and rebuilt in light of changes to infrastructure, housing stock and relocated communities, changes in social attitudes and possibly shifts in livelihood practices such as increased focus on in-land agriculture over coastal tourism in the affected areas. Newly displaced communities inland will need to adapt to the wind, flood, and landslide hazards that cyclones may generate in the steeper and in some areas more exposed slopes. Previous to the tsunami event Samoa had identified resources for climate risk management in agriculture, health, coastal zones, forestry and tourism.

Risk Identification and Awareness

Information about hazard and risk is the critical first step to any comprehensive risk management plan. Often the desire to build back better following a disaster demands an improvement in risk information and public awareness in order to avoid rebuilding vulnerability into the reconstruction process. The tsunami of 29 September 2009 is no exception. Many villages find themselves asking why some houses where undamaged and others completely destroyed. Decisions on whether to relocate in land and how far are complicated by the perception of an uneven impact of the wave run up across the southern coastal communities.

The tsunami hazard assessments for Samoa have been qualitative or based on coarse statistical review of a limited set of historical events. The results have been useful for national level planning, as they identified a 4m wave generated from the Tonga trench as the maximum credible event with a return period of between 50 - 100 years.

Similar events are possible on the northern coast and affecting Apia, but are shown to be much rarer and importantly are also expected to provide much more warning time as the sources are likely far away close to Chile or Japan. This is useful to put the tsunami hazard in context to other hazards such as cyclones and to support design of the early warning system. Nevertheless there exists a wide margin of error in the analysis and no local level modeling. A need exists to improve the overall accuracy of the assessment by employing a full probabilistic analysis of pacific wide modeled tsunamigenic events incorporating ideally results from the geological record as well as recorded history. At the local level, wave run up and return period analysis can be modeled only if the input data is of sufficient quality. Samoa counts with relatively good national topographic information and elevation models however detailed bathymetry only exists for certain ports and is not widely available to modelers. More precise bathymetric data and accurate mapping of coastal barriers such as coral reefs are needed for improved tsunami modeling and assess expected run ups at the village level. Whilst the principal need for such local analysis in tsunami modeling is for the exposed southern coastal communities, such input data is useful to many other sectors such as environment, fisheries, ports authority etc… If coast sharing can be achieved it may be useful to cover the entire island coast and release the information as a public good for multiple applications.

Following good hazard data, tools for assessment and risk management are important. International standards exist for tsunami vulnerability assessment of structures and free and open source software appropriate for the pacific region is currently being developed under various international initiatives including New Zealand's Riskscape and by the Global Earthquake Model. Such models must always be calibrated

by a record of historical events which needs to be systematically updated and published. Exposure maps of houses, infrastructure and building code recommendations should ideally be conducted by accredited structural engineers listed on a national register.

Hazard monitoring is the responsibility of the meteorological services of Samoa in MNRE and benefits from close SOPAC assistance, nevertheless the challenge to provide quick alerts for the Tonga trench tsunamis is big one and requires access to monitoring networks, a cadre of trained staff and reliable communications equipment. There is a new need for training and capacity in satellite services for hazard monitoring, communication and mapping such as those developed under the Global Earth Observing System of Systems and networks of experts supported by the UN Space Based Information Platform for Disaster Reduction.

Table 50. Risk Identification Needs 2009-2013

Project	Activity	Cost		
Risk Identification and Awareness		**New Tsunami related Needs**		**Previously Identified needs**
		Short Term	**Medium & Long term**	
Review hazard and risk management plans for relocated communities	risk assessments for gap areas (focus on tsunami, climate change impacts, cyclones, earthquakes) in order to identify mitigation measures for inclusion into all recovery programmes	SAT$475,000		
National Inventory of Disaster Losses	Establish systematic geo-reference digital inventory of disaster events and publish		SAT$20,000	
Improve Baseline datasets	Near Shore Bathymetric mapping; Coral reef and coastal barrier mapping; Near Shore Topographic LiDAR mapping; Aerial Imagery and exposure mapping		SAT$1,560,000	
Seismic risk assessment of Samoa	Hazard modelling; Vulnerability and Risk assessment; Building code recommendations; Register of Structural Engineers; Stakeholder awareness			SAT$137,500
Probabilistic Tsunami Assessment	Using improved baseline data and seismic assessment		SAT$360,000	
Volcano Hazard Assessment	Historical Events study and geological sampling; Community consultations; Geo-tectonics study and GPS monitoring			SAT$428,000
Volcano Observatory	GPS and Seismic Stations; Training			SAT$$580,000
National Hazard Plans	Hazard plans for Flood, Volcano and Earthquake; Scenarios & Stakeholder consultations; Response plans and cabinet approval			SAT$27,000
National Indicators of Risk, Vulnerability and Risk Management	Disaster Deficit Index; Local Disaster Index; Prevalent Vulnerability Index; Risk Management Index			US$180,000
Training on new Earth Observation Services	Workshops on satellite data mapping services available under GEOSS, International Charter and UN SPIDER workshop		SAT$45,000	
Total		**SAT$475,000**	**SAT$1,985,000**	

Whilst these needs are highlighted by the tsunami experience, they should not deflect from the existing needs, identified by DMO, for ongoing and multi hazard assessments. The next event may well be from a cyclone, local earthquake or volcano and Samoa has identified unfunded needs in seismic risk assessment, volcano hazard mapping and monitoring and development of flood, volcano and earthquake national plans in addition to the tsunami plans. The activities should as often as possible be accompanied by ongoing risk management training and education in both the techno-scientific community as well as public at large.

Risk Reduction and Climate Change Adaptation

The post-recovery phase often presents opportunities to build back better and take stock of newly identified needs to also improve long term risk reduction activities.

An early need identified is to review the hazard and risk information for the currently affected communities some of which have spontaneously relocated inland and may face new hazards – in particular cyclone wind, flood and landslides – and some of which may have stayed in place but under newly vulnerable conditions and may not have the resilience to face a cyclone. Should the displaced communities relocate permanently; long term risk reduction plans and measure will have to be taken to face the needs of their new environment. Plans for river basin management and flood protection techniques should be reviewed in the displaced areas. Road access, drainage and maintenance will be especially important during the cyclone season if larger than normal traffic and heavy vehicles for reconstruction are planned along unpaved roads. The tsunami has highlighted the need to fund and accelerate the roll out of facilitation to communities to develop their risk management and contingency plans under the NDMP.

Table 51. Needs on Risk Reduction

Project	Activity	Cost		
Risk Reduction		**New Tsunami related Needs**		**Previously Identified long term needs**
		Short Term	**Medium & Long Term**	
Accelerate comprehensive village disaster preparedness plans and committees	Complete the planned village level NDMP hazard and risk management plans, prioritizing affected areas		SAT$125,000	
training on safe construction techniques	carpenters for wind, flood, landslide, tsunami	SAT$125,000		
National Building Code	review			SAT$12,500
Total		**SAT$125,000**	**SAT$125,000**	

Long term reviews of the national building codes that incorporate anticipated climate changes and multiples hazards are an important need. The needs of new communities created through relocation should be incorporated into the planned coastal climate change adaptation activities and those in health, agriculture, water and forestry. In the short run there exists the need to provide training on safe construction practices for carpenters and foremen that includes design techniques for wind, flood, ground shaking and tsunami.

Most physical risk reduction needs are captured within the sectors – for instance coastal erosion stabilization efforts are detailed in environment section and road maintenance and drainage works in transport. The table above identifies only new risk reduction needs arising from the tsunami pertaining to the risk management plans. The need to relocate the meteorological office and DMO, whilst certainly a risk reduc-

tion measure, is discussed in the institutional needs section. Likewise community based measures such as escape routes along the escarpment are discussed in the community infrastructure and religious and cultural heritage section.

Disaster / Emergency Management

Samoa's organization and coordination of emergency operations has been swift and commendable. The lessons learnt from the experience demonstrate a need for an improved early warning system that can focus sms alerts on target communities and priorities communications over a congested network. Principle mechanisms remain cell phone messaging, radio, TV, and community alerts such as church bells and school sirens. Robust communications system is need for the midnight to 6am window when TV and radio stations are off. Samoa has a need for reverse emergency calls whereby cell phones within a certain geographical radius can be targeted for automated emergency bulletins.

Emergency response planning and implementation drills of warning systems should be strengthened with greater participation. DMO has a need for equipment, tools and testing of inter-institutional response capabilities as well as community preparedness and training.

Under the rehabilitation and reconstruction planning process there exists a new need for strengthening governance arrangements, information flow and dialogue with affected communities and implementation of a monitoring and report mechanism to track the progress of recovery efforts and conditions of affected communities.

Table 52. Recovery and Rehabilitation Needs on Risk Management

Project	Activity	Cost	
Emergency Management, Recovery & Rehabilitation		**New Tsunami related Needs**	
		Short term	**Medium & Long Term**
Strengthen overall emergency management arrangements	Guidelines and training for post-tsunami recovery process, national recovery standards, principles and priorities, roles and responsibilities of authorities at all levels and other stakeholders	SAT$250,000	
Survivor Stories record	Train persons to collect and record survivor stories to: i) gather lessons learned; ii) raise awareness; and iii) as part of the community healing process	SAT$50,000	
Community information centres and organization	Community based information centres to provide information on relief, recovery and reconstruction policies, plans and projects, compensation packages and citizens rights. Community consultation in the design, implementation and monitoring of recovery and reconstruction programmes	SAT$350,000	
Recovery monitoring and reporting system	Establish a comprehensive system of collating, analyzing, monitoring and disseminating information on the recovery operations and inputs of different partners involved in the relief and recovery process	SAT$25,000	
Tsunami early warning system	Improvement in alerting process and prioritization of sms messaging to affected areas		SAT$325,000
Disaster Preparedness Plans and drills for Schools	Increased drills in school and inclusion of preparedness and recovery training		SAT$15,000
Total		**SAT$675,000**	**SAT$340,000**

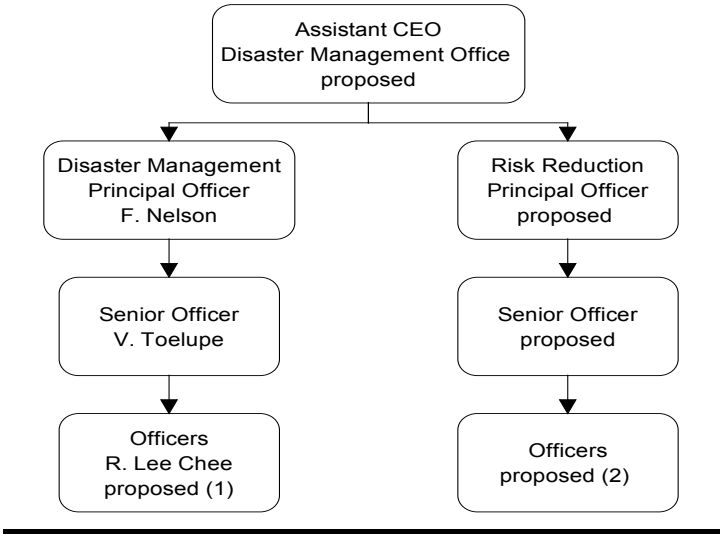
Institutional Capacities and Regulatory framework

Samoa's Disaster Risk Management Framework is relatively new and whilst it can be considered state of the art, institutional capacity needs are identified to improve and accelerate the implementation of the framework. The NDMP correctly separates into two streams of work Disaster Risk Reduction activities from Disaster or Emergency management responsibilities. The DMO in particular with only 3 staff is in need of strengthening and organizational review in order to meet its full responsibilities under the NDMP.

The NDMP also implies significant responsibilities in risk reduction mainstreaming. However DMO staff a likely to be overwhelmed during any emergency and unable to address risk reduction needs. Additional and separate capacity within MNRE / DMO for risk reduction or mitigation activities that can include responsibility for building code reviews; Risk reduction training; Risk reduction and climate change adaptation sector and community plans facilitation; as well as coordination on actions in MNRE for river banks protection, river channel maintenance; coastal zone protection, coastal wetland rehabilitation, and coastal springs restoration.

An enlarged DMO structure is currently under consideration by the government that would establish an assistance CEO as head of DMO and incorporate a section dedicated specifically to risk reduction responsibilities.

Figure 23. DMO Proposal to add staff and separate DRR from DM [source:DMO]



Currently the main responsibilities for hazard monitoring, alerting and all clear signs lie with the meteorological services, which is also set to include DMO and climate change actions. A need has been identified to locate such a critical facility in a multi-hazard secure location and away from the current coastal location. The site of the current emergency operation centre at the fire station has been proposed as a good candidate. Such relocation would improve the national systems resilience and coordination with the emergency operations.

Budget allocation and mobilization needs to be reviewed in the event of any emergency for gaps or bottlenecks in the emergency financing and overall disaster risk financing. In the case of Samoa an operational and legislative review is needed that can consider not just the sizing and appropriation of the 3% unforeseen needs fund but also the availability of resources for institutional strengthening and the existence of social safety nets and flows in remittances that play an important role in Samoa. Means and recommendations to facilitate remittances during an emergency should be sought and discussed with remitting nations such as New Zealand and Australia.

In general the partnership of central government and village leaders for implementing the NDMP is should be strengthened with regular training of village focal points on NDMP requirements and coastal infrastructure management options.

Formally recognizing the private sector in disaster management planning and response arrangements enables more effective partnerships to be created.

Table 53. Institutional Capacity and Risk Financing Needs

Project	Activity	Cost	
Institutional Capacity and Risk Financing Needs		**New Needs**	**Long term**
Strengthen DMO	Organizational Review, IT office equipment, field radios and communication equipment	SAT$175,000	
Relocate Met Office, Early warning and DMO to non-hazard site	Nb. Costing varies depending on number of functions to be moved: i) early warning and all clear alerts should be located in seismic/cyclone resistant building outside of tsunami hazard zones. Other functions to move could be emergency management, hazard monitoring and communications, risk management and planning		(SAT$1,000,000)
Operational and legislative review of budget allocation and mobilization	Assessment of disaster financing framework of Samoa		SAT$25,000
Total		**SAT$175,000**	**SAT$1,025,000**

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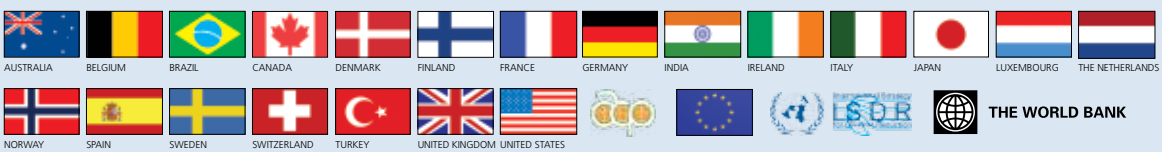

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