SAMOA
Post-disaster Needs Assessment
Cyclone Evan 2012

Government of Samoa

March 2013

GOVERNMENT OF SAMOA

FA'AVAE I LE ATUA SAMOA

ACP-EU Natural Disaster Risk Reduction Program
An initiative of the African, Caribbean and Pacific Group, funded by the European Union and managed by GFDRR

GFDRR

Australian AID

NEW ZEALAND FOREIGN AFFAIRS & TRADE Aid Programme

THE WORLD BANK

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The estimated value of destroyed physical assets represents 109 percent of the normal value of construction activities in Samoa, from which it can be inferred that recovery and reconstruction will take between two and three years.

Photos

Top: NASA image courtesy Jeff Schmaltz, LANCE MODIS Rapid Response.

Center: Lefaga Community Health Center. Courtesy of GoS/PDNA Assessment team.

Bottom: Fusi Community Health Center. Courtesy of GoS/PDNA Assessment team.

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[1] United Nations support was through the Food and Agriculture Organization of the United Nations (FAO), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Development Programme (UNDP), UN-HABITAT, United Nations International Secretariat for Disaster Reduction (UNISDR), and UN Women.

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ACRONYMS AND ABBREVIATIONS

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
ADRA	Adventist Development and Relief Agency
APFP	Apia Physical Framework Plan
APHD	Animal Production and Health Division
APTC	Australia-Pacific Technical College
BEN	Beautiful Expression of Nature
BoP	Balance of Payments
CBR	Cost-Benefit Ratio
CCA	Climate Change Adaptation
CDD	Community Driven Development
CHC	Community Health Centre
CIM	Community Infrastructure Management
DALA	Damage and Loss Assessment
DEM	Disaster and Emergency Management Act
DRM	Sisaster Risk management
DRMCP	Disaster Risk Management Community Programme
DRR	Disaster Risk Reduction
EBA	Endemic Bird Area
EC	Evacuation Center
ECE	Early Childhood Education
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
EPC	Electric Power Corporation
FAO	Food and Agriculture Organization of the United Nations
FGD	focus group discussion
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GWh	Gigawatt hour
HDI	Human Development Index
HFA	Hyogo Framework for Action
HIES	Household Income and Expenditure Survey
HRNA	Human Recovery Needs Assessment
HSIA	Human And Social Impact Assessment
ICH	Intangible Cultural Heritage
IMF	International Monetary Fund
IWS	Independent Water Schemes

continues

IWSA	Independent Water Schemes Association
KII	Key Informant Interview
km²	Square Kilometer
km/h	Kilometers per hour
kv	Kilovolt
KWh	Kilowatt Hour
LTA	Land Transport Authority
m²	Square Meter
m³	Cubic Meter
MAF	Ministry of Agriculture and Fisheries
MDG	Millennium Development Goal
MESC	Ministry of Education, Sports and Culture
MNRE	Ministry of Natural Resources and Environment
MOH	Ministry of Finance
MOF	Ministry of Health
MW	Megawatt
MWCSD	Ministry of Women, Community and Social Development
MWTI	Ministry of Works, Transport and Infrastructure
NCD	Noncommunicable Disease
NDC	National Disaster Council
NDMO	National Disaster Management Office
NDMP	National Disaster Management Plan
NEOC	National Emergency Operations Center
NGO	Nongovernmental Organization
NHS	National Health Service
NKFS	National Kidney Foundation of Samoa
NPF	National Provident Fund
NRW	Nonrevenue Water
NSDS	National Sustainable Development Strategy
NTCCASS	National Tourism Climate Change Adaptation Strategy for Samoa

continues

NUS	National University of Samoa
PCRAFI	Pacific Catastrophe Risk Assessment and Financing Initiative
PDNA	Post-disaster Needs Assessment
PUMA	Planning and Urban Management Agency
RDH	Rural District Hospital
RLSM	Robert Louis Stevenson Museum
RN	Registered Nurse
SCV	Samoa Cultural Village
SIA	Social Impact Assessment
SMEs	Small and Medium Enterprises
SOP	Standard Operating Procedure
SPA	Samoa Ports Authority
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme
SRC	Samoa Red Cross
STA	Samoa Tourism Authority
SWA	Samoa Water Authority
TTM	Tupua Tamasese Meaole Hospital
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNISDR	United Nations International Secretariat for Disaster Reduction
VAGST	Value-Added Goods and Services Tax
WMO	World Meteorological Organization
WTP	Water Treatment Plant

Currency and Equivalents

Currency unit = Samoa tala

US$1 = SAT 2.281

Fiscal year: July 1–June 30

The total estimated damage and loss are equivalent to about 28 percent of the total value of goods and services produced in the countryin 2011.

Photos

Courtesy of GoS/PDNA Assessment team.

EXECUTIVE SUMMARY

Summary of Damage and Loss

Cyclone Evan hit Samoa in December 2012 and caused immense damage and significant losses. The value of durable physical assets across all economic and social sectors destroyed by Evan (referred to as *damage*) is estimated at SAT 235.7 million, equivalent to US$103.3 million. In addition, production losses and higher production costs arising from the disaster across all sectors (referred to as *losses*) are estimated at SAT 229.4 million, or US$100.6 million. Thus the total effects of the disaster amount to SAT 465 million, or US$203.9 million (see table 1).

Table 1. Summary of Damage and Loss Caused by Cyclone Evan in Samoa (thousand SAT)

	Disaster effects			Ownership by sector	
	Damage	Losses	Total	Public	Private
Productive sectors	**56,979.0**	**106,748.6**	**163,727.6**	**367.5**	**163,360.1**
Agriculture	4,905.0	58,060.5	62,965.5	275.0	62,690.5
Livestock	3,450.0	800.0	4,250.0	66.0	4,184.0
Fishery	2,069.0	5,493.0	7,562.0	25.0	7,537.0
Manufacturing	17,250.0	4,595.7	21,845.7	0.0	21,845.7
Commerce	1,605.0	15,589.9	17,194.9	0.0	17,194.9
Tourism	27,700.0	22,209.5	49,909.5	1.5	49,908.0
Social sectors	**49,182.3**	**7,587.5**	**56,769.7**	**13,462.5**	**43,307.2**
Education	7,222.1	628.0	7,850.1	6,733.9	1,116.2
Health	3,608.9	1,956.2	5,565.1	5,125.7	439.4
Housing	38,351.3	5,003.3	43,354.5	1,602.9	41,751.6
Infrastructure	**113,313.2**	**58,687.4**	**172,000.6**	**168,987.6**	**3,013.0**
Electricity	39,089.3	31,884.4	70,973.7	70,973.7	0.0
Water and sanitation	8,836.3	3,845.0	12,681.3	12,681.3	0.0
Transport	65,387.6	22,958.0	88,345.6	85,332.6	3,013.0
Cross-sectoral	**16,251.0**	**56,398.0**	**72,649.0**	**72,649.0**	**0.0**
Environment	16,251.0	56,398.0	72,649.0	72,649.0	0.0
Total	**235,725.5**	**229,421.4**	**465,146.9**	**255,466.6**	**209,680.3**

Source: Estimations by assessment team on the basis of official information.

These figures are very significant given the relatively small size of the Samoan economy; in fact, the total estimated damage and loss are equivalent to about 28 percent of the total value of goods and services produced in the country in 2011. Furthermore, the estimated value of destroyed physical assets represents 109 percent of the normal value of construction activities in Samoa, from which it can be inferred that recovery and reconstruction will take between two and three years.

While the destruction of physical assets by the cyclone occurred in December 2012, production losses and associated higher costs of production will linger for some time, perhaps until 2015. The negative impact of the disaster on overall economic conditions in the country will thus be felt for about four years.

It has been found that 55 percent of disaster effects fall within public sector ownership, while the remaining 45 percent of effects are within private enterprises and individual ownership. This breakdown provides guidance on the sharing of responsibilities during recovery and reconstruction. The government is expected not only to take care of the issues that fall within its purview, but also to exercise leadership and guidance in relation to the private sector, with special reference to addressing the post-disaster requirements of the poor.

Cyclone Evan produced different effects among the different economic and social sectors. In order of descending magnitude or intensity, the most affected sectors were transport, agriculture, the environment, electricity, and tourism (table 1).

Cyclone Evan is not the only disaster to cause havoc in Samoa's society and economy. In 2009 an earthquake and tsunami produced similar—although slightly more discrete—negative effects, which were estimated at the time to cost SAT 309 million. Other recent events have also harmed Samoa, although their effects and impact have not been quantified in the same detail as those for Cyclone Evan and the 2009 earthquake and tsunami.

Estimated Post-disaster Financial Requirements

The cost of overcoming the negative impact of Cyclone Evan has been estimated on the basis of assessment results, using evidence-based standard procedures. This estimated cost includes the amounts needed to achieve socioeconomic recovery, to rebuild destroyed assets using disaster-resilient standards, and to implement disaster risk reduction schemes.

The estimated value of these financial requirements is SAT 470 million, equivalent to US$206 million (see table 2). The most pressing requirements of socioeconomic recovery represent 21 percent of the estimated total amount; reconstruction costs represent 60 percent of the total, and disaster risk reduction activities represent the remaining 19 percent.

With due consideration for the limited insurance proceeds that are foreseen and the possible increase of family remittances from Samoans abroad, a preliminary analysis shows that the country is in no position to absorb such investment demands. Because the country and its government will be unable on their own to meet the financial requirements of recovery and reconstruction with risk reduction, the wholehearted support of the international community will be essential in assisting Samoa.

Economic Impact of the Disaster

To isolate the economic impact of the disaster, the estimated losses in production and higher expenditures arising from Cyclone Evan have been combined with the pre-disaster forecasted macroeconomic performance for the country.

If no recovery and reconstruction activities are undertaken, the growth of Samoa´s gross domestic product (GDP) will likely be slower than what the government predicted prior to the cyclone. Specifically, GDP growth will slow by 0.2 percent in 2012, may be nil or negative in 2013, and will slow by nearly one percentage point in 2014,

in comparison to the forecasted rates of growth that the government had made prior to the disaster. These estimated lower rates of economic growth represent the isolated impact of the disaster, and are a significant setback for the Samoan economy.

In the absence of recovery and reconstruction activities, the disaster would induce lower tax revenues from the value-added goods and services tax (VAGST)—and this at a time when the government is facing higher than normal, unexpected expenditures to meet the most pressing emergency needs of the population. These expenditures would increase the foreseen fiscal deficit to about SAT 90 million, which would bring it to the equivalent of 11.8 percent of GDP in 2012/13. Fiscal year 2013/14 is when the brunt of the impact on the fiscal deficit is expected, as the government would collect an additional SAT 50 million less in tax revenues while having to meet higher expenditures, resulting in a significant increase of the fiscal deficit above the pre-disaster forecast.

The impact of Cyclone Evan on the country´s balance of payments (BoP), again without considering recovery and reconstruction activities, would arise from the expected losses in revenues from the tourism sector as well as from lower tourism-related commerce sales. These losses in exports of goods and services would result in the BoP current account rising by –1 percent of GDP in 2013 and 2014, thus worsening the country´s external sector position.

Table 2. Summary of Recovery, Reconstruction, and Disaster Risk Reduction Needs

	Post-disaster needs (million SAT)			
	Recovery	Reconstruction	Disaster risk reduction	Total
Productive sectors	**26.6**	**58.7**	**1.0**	**86.3**
Agriculture	14.5	2.4	n.a.	16.9
Livestock	0.1	3.9	n.a.	4.0
Fishery	-	2.2	n.a.	2.2
Manufacturing	1.0	20.7	n.a.	21.7
Commerce	3.4	1.9	n.a.	5.3
Tourism	7.6	26.7	1.0	36.2
Social sectors	**18.6**	**60.9**	**22.9**	**102.4**
Education	0.6	8.7	n.a.	9.3
Health	2.0	4.5	21.9	28.4
Housing	2.2	47.7	n.a.	49.9
Social needs	13.8	0.0	1.0	14.2
Infrastructure	**48.5**	**141.9**	**29.5**	**219.9**
Electricity	28.5	35.0	26.1	89.6
Water and sanitation	3.0	9.5	3.4	15.9
Transport	17.0	97.4	0.0	89.6
Cross-sectoral	**4.9**	**17.5**	**39.3**	**61.7**
Environment	4.9	17.5	28.5	50.9
DRM needs	n.a.	n.a.	10.8	10.8
Total	**98.6**	**279.0**	**92.7**	**470.3**

Source: Estimations by assessment teams on the basis of damage and loss.

Note: n.a. = not applicable; - = negligible.

Possible Macroeconomic Impact of Recovery and Reconstruction

Recovery and reconstruction activities would generate an impact on overall macroeconomic performance in Samoa. *Recovery activities* are associated with post-disaster financial requirements, specifically ensuring availability of sufficient working capital for producers to restart production, meeting urgent social needs arising from the disaster, and making additional expenditures to restore a minimum provision of essential services. *Reconstruction activities* are associated with rebuilding destroyed assets under disaster-resilient standards; they would require significant investments.

It is estimated that recovery and reconstruction activities and investments would have a very positive effect on GDP growth, and that they would further negatively affect the external position and fiscal performance of the country.

To estimate the possible macroeconomic impact of recovery and reconstruction activities, several factors need to be fully considered. First is the likely delay of starting up the recovery and reconstruction programs. These would probably not begin until mid-2013 because of the need to develop detailed plans and secure the necessary financing. Second is the limitations posed by the small size and specific characteristics of the Samoan economy. These limitations mean that most of the required construction materials will need to be imported. The third factor is the limited execution capacity of the construction sector. This will require the period of reconstruction to extend for a minimum of three years. The analysis of the execution capacity of the construction sector in fact contradicts earlier and too-optimistic estimates that reconstruction could take place within the relatively short time period of six months.

If it is assumed that the financial resources required to achieve recovery and reconstruction are fully available when needed, the resulting growth of GDP would not only offset the negative growth expected in 2013 from the production losses caused by Cyclone Evan, it would continue beyond the next three years. The precise growth rate would depend on the availability of the additional funds required, the execution efficiency of the recovery and reconstruction program, and the program's effective starting date.

The recovery and reconstruction program will require Samoa to import construction materials as well as fuel for electricity generation. These imports will have a negative bearing on the BoP current account, raising it beyond –14 percent of GDP in 2013/14, and keeping it above –12 percent until 2015/16. Importation of fuel will also have an impact on Samoa's fiscal position. Depending on whether exceptions are granted for import taxes on construction materials for the reconstruction, the fiscal position may be further compromised. Until decisions about exceptions are made, it is not possible to estimate the fiscal impact arising from recovery and reconstruction.

Disaster's Impact on Employment and on Personal and Household Income

Estimates made during the post-disaster assessment indicate that the Samoan labor force will sustain losses in employment and income as a result of the cyclone. Based on estimated production losses and on the characteristics and size of the labor force, the assessment estimates that a loss of nearly 9,600 equivalent jobs has occurred for wage earners and the self-employed across many social and economic sectors, especially agriculture and tourism. The estimated gender-disaggregated disaster impact on employment and income shows that losses by men exceed losses by women at a nearly 9:1 ratio. These findings show the urgent need to provide income support at least for the lowest strata of the population until the envisaged recovery schemes bring about the recovery of production.

The employment losses just described would result in imputed personal income losses in all sectors of economic activity, especially in some of the productive sectors. It has been estimated that wage earners and self-employed persons in the agriculture sector would sustain a decline in their imputed personal income of 49 percent in 2013 relative to their normal income level, and of a further 8 percent in 2014, and that losses in the tourism sector would be of 11 and 6 percent, respectively. Such significant losses in personal income would require income support and food assistance to the affected persons and families at least until their respective sectors recover.

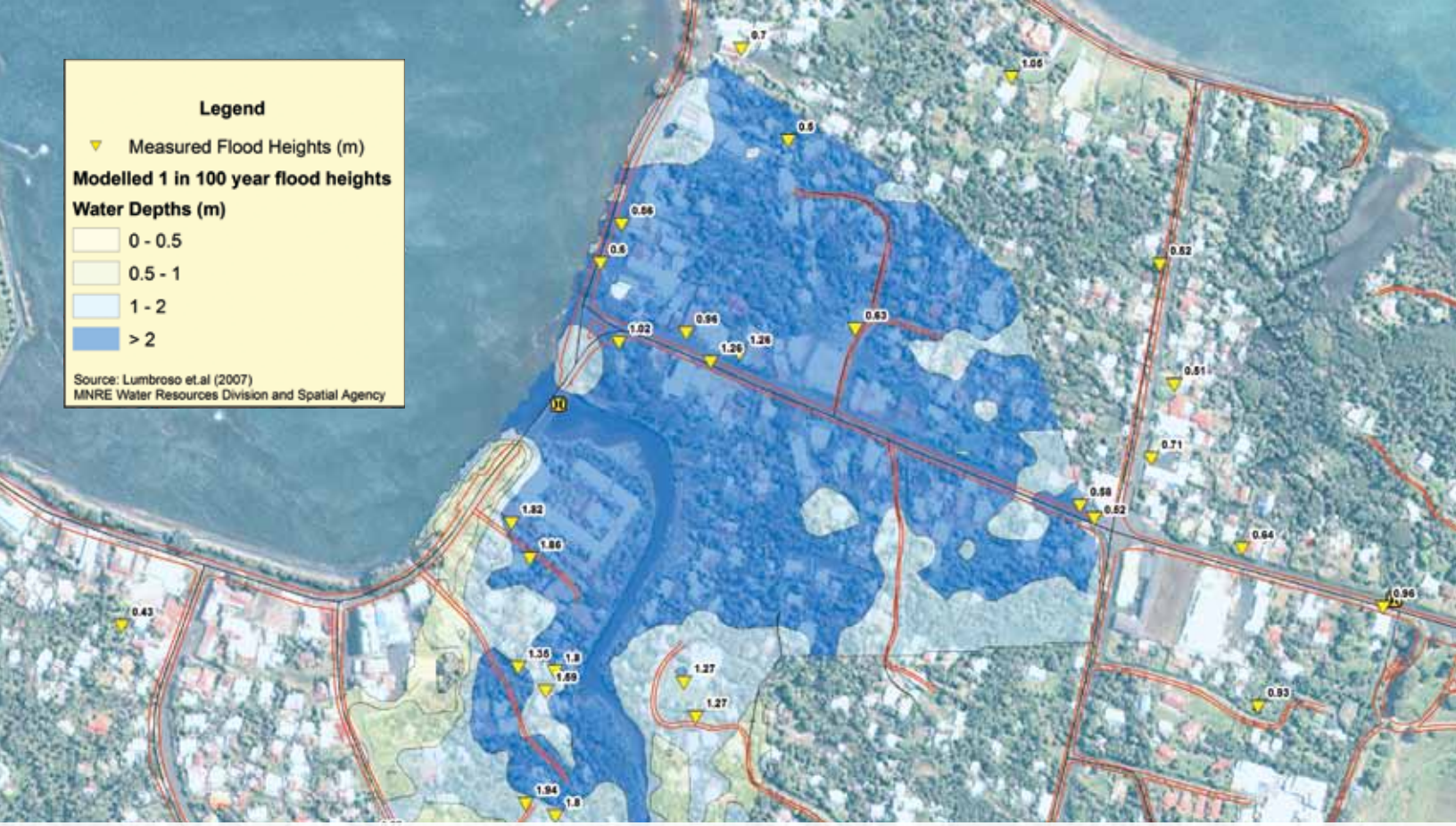
Disaster's Human and Social Impacts

The disaster affected communities and individuals in a number of ways that will require support, intervention, and monitoring. Regarding disaster preparedness and response, most communities indicated that they did not feel prepared for a storm of this intensity and indicated their desire to have improved plans. Communities' experiences of the disaster response underscored the need for future relief planning, training, and response efforts to incorporate lessons learned from Evan. Specifically, future efforts should take into account what worked well in rural settings and what worked well in urban settings; should clearly explain relief eligibility and how to access it; and should address issues such as equity versus equality in relief distribution, governance of relief distribution at the community level, and shelter management with holistic care for a range of people, including vulnerable groups.

Low-income individuals and those depending on subsistence livelihoods are suffering in the post-disaster period due to reduced incomes and food sources, and they will require support in the short term to meet minimum needs and to avoid negative coping strategies (for example, pulling children out of school or selling productive livelihoods assets) that could harm livelihoods and human and social well-being in the long term.

The cyclone affected vulnerable groups and also created new vulnerabilities. The elderly, children, and people with disabilities were recognized as vulnerable, and so were well taken care of by family and communities. Less visible individuals and families who are outside of community structures tend to be particularly vulnerable in disaster contexts. The cyclone severely damaged or destroyed homes and thus created a new group of vulnerable people: 606 households, or roughly 4,242 people, require immediate financial and technical assistance with reconstruction. Finally, some communities were still without clean water and sanitation facilities more than a month after the storm, which leaves them at risk of contracting water-borne and other bacterial diseases.

Though social cohesion and social relations were found to be strong throughout and after the disaster, with people supporting their extended families and communities well, some incidents of antisocial behavior were reported.



According to the World Bank, Samoa is ranked 30th of countries most exposed to three or more hazards. Samoa was ranked 51st out of 179 countries in the Global Climate Risk Index 2012 report on who suffers most from extreme weather event.

Photos

Top: Apia. Flood heights map.

SOURCE: Ministry of Natural Resources and Environment (2007) Samoa Floodplain Management: A Guideline For Planning And Development Assessment With Specific Reference To Vaisigano River. 59pp. Measured flood levels. Water Resources Division, MNRE.

Center: Log jam.

Right: Safaatoa primary school, inadequate structural tie-downs (non-engineered).

1. LIVING WITH DISASTER

Samoa's Disaster Risk Profile

Samoa comprises two large volcanic islands (Upolu and Savai'i) and several smaller islands with a total land area of approximately 2,935 km^2. It lies in the southwest Pacific within an exclusive economic zone of 120,000 km^2.

Samoa is exposed to a number of natural hazards, including tropical cyclones, floods, earthquakes, tsunamis, volcanic eruption, and drought. According to the World Bank, Samoa is ranked 30th of countries most exposed to three or more hazards. Samoa was ranked 51st out of 179 countries in the Global Climate Risk Index 2012 report on who suffers most from extreme weather events.[2]

Main Natural Hazards Affecting Samoa

Tropical Cyclones

Tropical storms and cyclones are the main hazards facing the islands. Cyclones are associated with damaging winds, rainfall, flooding, swells, storm surges, and even tornadoes. Samoa has been affected by devastating cyclones multiple times in the last few decades. Samoa's tropical cyclone risk is rated as "extreme."[3] The worst cyclones to have impacted Samoa in recent times are Ofa in 1990 and Val in 1991; combined, these caused 21 fatalities and widespread destruction, with total economic losses between US$300 million and US$500 million,[4] equivalent to about four times the country's gross domestic product.[5]

The Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) has estimated the average return period of different categories of tropical cyclone. For example, it is estimated that tropical cyclones of category 2 and 3 have a return period of 13 and 35 years respectively, based on the Saffir-Simpson hurricane scale (SSHS). Table 3 illustrates the intensity of different tropical cyclone categories and their respective average return period. The governing factors for increase in cyclone activity include the warm phase of the ENSO (El Niño–Southern Oscillation) phenomenon.

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[2] S. Harmeling, "Global Climate Risk Index 2012: Who Suffers Most from Extreme Weather Events? Weather-Related Loss Events in 2010 and 1991 to 2010," briefing paper, German Watch, Bonn, 2011.

[3] Samoa National Tropical Cyclone Plan, http://www.pacificdisaster.net/pdnadmin/data/original/samoa_national%20tropical%20cyclone%20plan%20approved%2020061102.pdf.

[4] PCRAFI (Pacific Catastrophe Risk Assessment and Financing Initiative), "Country Risk Profile: Samoa," September 2011.

[5] GFDRR (Global Facility for Disaster Reduction and Recovery), "Samoa—2009—PDNA Assessed Total Earthquake and Tsunami Impact at 22% of GDP," https://www.gfdrr.org/node/327.

Table 3. Return Period of Tropical Cyclones

Saffir-Simpson cyclone category	Average return period (years)
1	8
2	13
3	35
4	185
5	3,333

Source: PCRAFI, "Country Risk Profile: Samoa," September 2011.

Floods

Samoa, in particular the urban areas of Apia, suffers greatly from the effects of flooding. The last major flood, in 2001, caused direct losses of SAT 11 million. Other reported major floods have occurred in 1939, 1974, 1975, 1982, 1990, 1991, 2003, 2006, and 2008.[6] The most comprehensive summary of flood damages, including those that occurred in the lower Vaisigano catchment area, was compiled by Stephen Yeo in 2001.[7]

Earthquake and Tsunami Hazards

Samoa lies in a relatively less-active seismic area; however, it is surrounded by the Pacific "ring of fire." Around the boundaries of the tectonic plates are extremely seismically active areas, and earthquakes are not unusual. In some cases the earthquakes have generated tsunamis that have affected Samoa.

In September 2009, a devastating tsunami caused 143 reported deaths in Samoa. About 2.5 percent of the country's population was affected by the tsunami,[8] which destroyed many villages on Upolu. The tsunami was generated by a powerful earthquake of 8.0 magnitude some 200 km south, in the Tonga trench. The tsunami took less than 20 minutes to impact Samoa. Recent analysis suggests that Samoa has a 40 percent chance in the next 50 years of experiencing, at least once, moderate to very strong levels of ground shaking.[9]

Loss from Tropical Cyclone and Earthquake

Figure 1 shows the average annual loss estimated for tropical cyclones and earthquakes, including tsunami. Figure 2 shows how the relative risk of tropical cyclone and earthquake (ground shaking and tsunamis) varies across the country. In addition, possible future tropical cyclone and earthquake losses for both direct losses and emergency losses have been simulated. Samoa has a 50 percent chance of experiencing a loss exceeding US$130 million and casualties (fatalities and injuries) of up to 325 people in any 50-year period.

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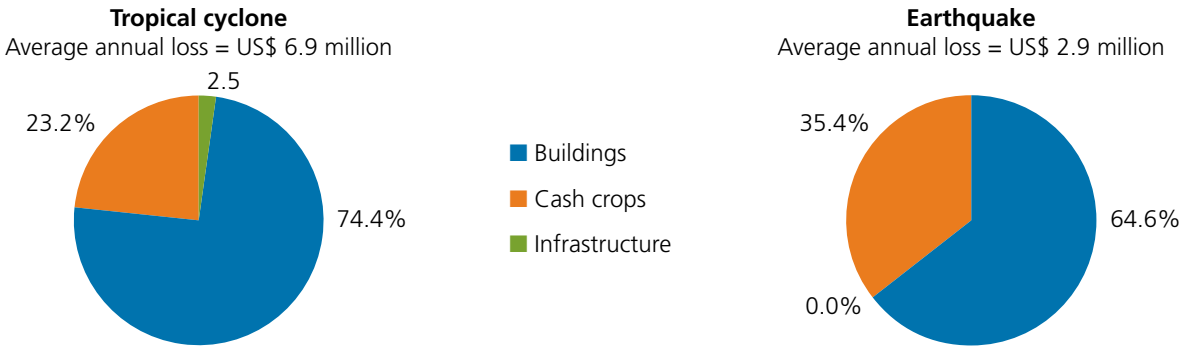
6 D. Lumbroso, A. Titimaea, A. Penaia, and M. Bonte-Grapentin, *Capacity Building in Flood Risk Management,* EU EDF 8–SOPAC Project Report No. ER0069a, 2006.

7 Stephen Yeo, *A Review of Flooding in Apia*, SOPAC Technical Report 338 (Suva: SOPAC, 2001); for further details see A. Woodruff, *Samoa Technical Report: Economic Analysis of Flood Risk Reduction Measures for the Lower Vaisigano Catchment Area*, EU EDF–SOPAC Project Report 69g, February 2008.

8 Government of Samoa, *Samoa Post-disaster Needs Assessment Following the Earthquake and Tsunami of 29th September 2009*, December 2009, http://www.gfdrr.org/sites/gfdrr.org/files/documents/PDNA_Samoa_2009.pdf.

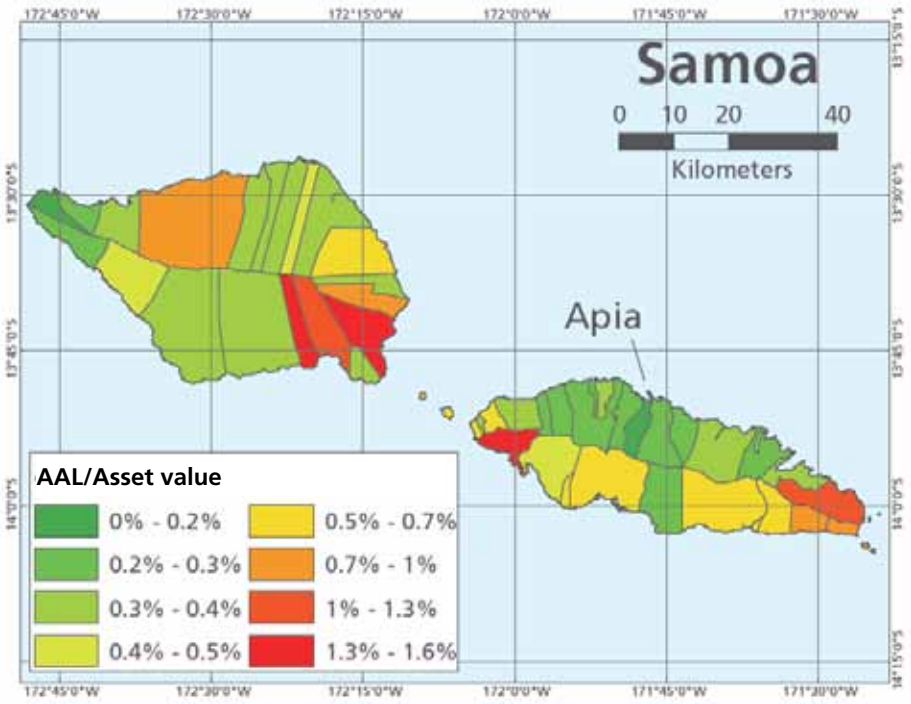
9 PCRAFI, "Country Risk Profile: Samoa."

Figure 1. Average Annual Loss Due to Tropical Cyclones and Earthquakes (from three types of assets)



Source: PCRAFI, "Country Risk Profile: Samoa," September 2011.

Figure 2. Relative Risk of Tropical Cyclone and Earthquake across Samoa



Source: © PCRAFI. Reproduced with permission from PCRAFI, "Country Risk Profile: Samoa," September 2011. Further permission required for reuse.

Note: AAL = average annual loss.

Climate Change

Future changes in exposure, vulnerability, and climate extremes resulting from natural climate variability, human-induced climate change, and socioeconomic development trends and patterns can alter the impacts of climate extremes on natural and human systems and hence influence the potential for disasters.[10]

[10] IPCC (Intergovernmental Panel on Climate Change), *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*, ed. C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G.-K. Plattner, S. K. Allen, M. Tignor, and P. M. Midgley (Cambridge: Cambridge University Press, 2012).

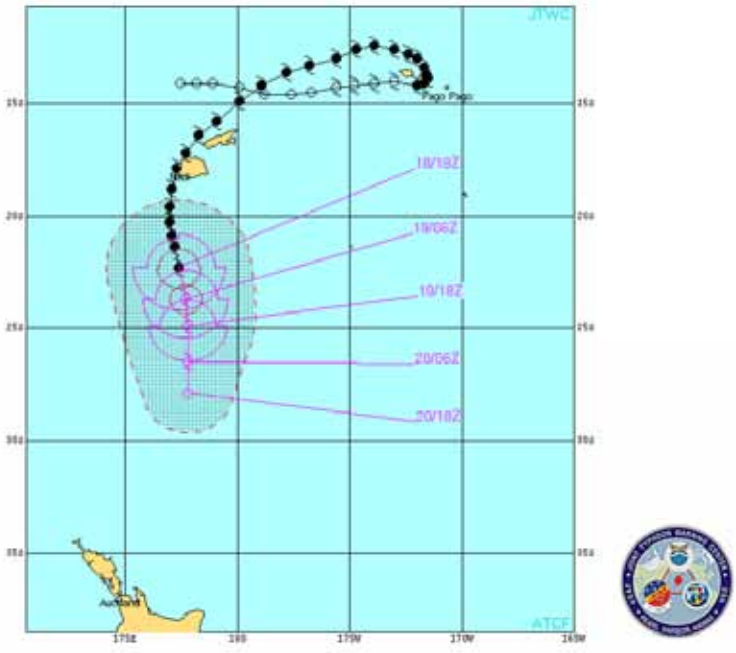
On a global scale, the projections indicate there is likely to be an increase in the average maximum wind speed of cyclones of between 2 percent and 11 percent and an increase in rainfall intensity of about 20 percent within 100 km of the cyclone center. In the Samoa region, projections tend to show a decrease in the frequency of tropical cyclones by the late 21st century and an increase in the proportion of the more intense storms.[11]

Tropical Cyclone Evan

Tropical Cyclone Evan was considered to be the worst tropical cyclone to impact Samoa since Cyclone Val in 1991. On December 9, 2012, Evan was detected as a weak tropical depression about 700 km to the northeast of Suva, Fiji. It was named Evan on December 11, as it had developed into a category 1 tropical cyclone. The tropical cyclone tracked eastwards (see figure 3) toward Samoa and was located 40 km to the southeast of Apia, Samoa, at 1800 UTC on December 12. Evan reached the equivalent of a category 1 hurricane on the SSHS, with one-minute sustained wind speeds of 120 km/h. Tropical Cyclone Evan made landfall at 1000 UTC on December 13 (as shown in figure 3). On December 13, the system continued to intensify as it started to recurve toward the west away from Samoa; at 1800 UTC the Joint Typhoon Warning Center reported that Evan had reached an intensity of 185 km/h, equivalent to a category 3 hurricane on the SSHS (see figure 4).

Evan tracked westward toward Fiji, where it reached its peak intensity; it had one-minute wind speeds of 210 km/h, equivalent to a category 4 hurricane on the SSHS, near the northwestern coast of the Fijian island of Vanua Levu. By December 18 at 1800 UTC, the system had weakened into a category 3 tropical cyclone.

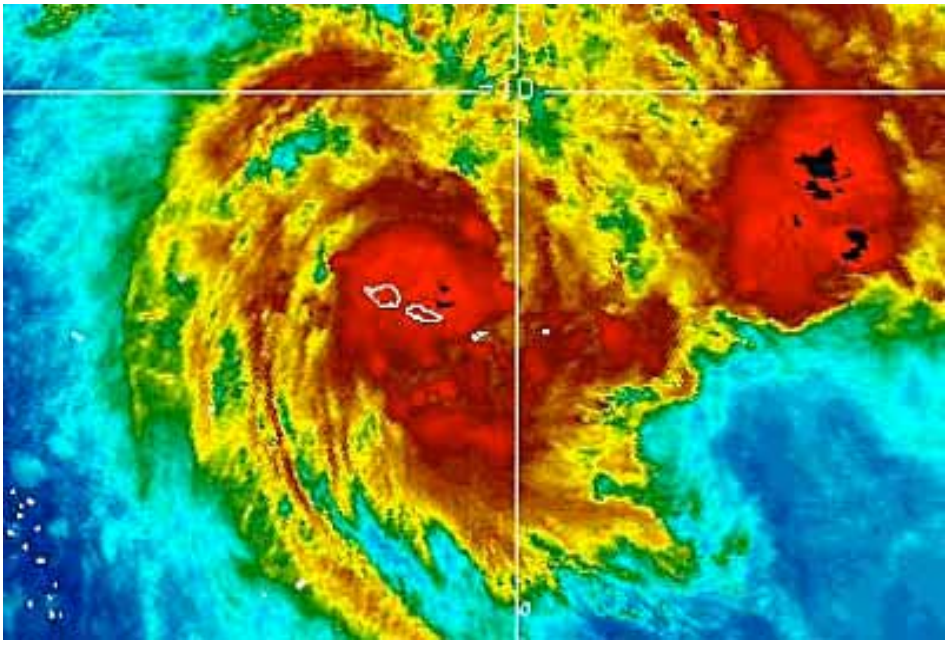
Figure 3. Tropical Cyclone Evan Track Information as of 1800 UTC December 18, 2012



Source: © Joint Typhoon Warning Center. Reproduced with permission from Joint Typhoon Warning Center; further permission required for reuse.

[11] Australian Bureau of Meteorology and CSIRO (Commonwealth Scientific and Industrial Research Organisation), *Climate Change in the Pacific: Scientific Assessment and New Research*, vol. 1, *Regional Overview*, and vol. 2, *Country Reports*, 2011.

Figure 4. Infrared Satellite Image of Tropical Cyclone Evan Taken over Samoa at 1230 UTC December 13, 2012



Source: © Samoa Meteorological Division/MTSAT. Reproduced with permission of Samoa Meteorological Division/MTSAT; further permission required for reuse.

Impact and National Response

When Cyclone Evan made landfall on December 13, 2012, it caused widespread damage across Samoa, with heavy rainfall and flash floods and maximum sustained winds up to 90 knots (166.7 km/h). The cyclone killed at least five people and displaced 4,763 people. Evan destroyed power plants, cutting power and disrupting communication services; it also ripped trees out of the ground, destroyed buildings and roads, and damaged vast swaths of crops. In addition, water facilities and distribution systems were badly damaged and disrupted nationwide.

Based on modeled ground-up losses per district, the highest impacts for Tropical Cyclone Evan were calculated for Apia and the districts surrounding Apia, as shown in figure 5.

Maximum rainfall values were recorded in the Vaisigano catchment at Afiamalu. These are shown in table 4, both as totals and as the equivalent hourly intensity. Based on the estimates of return periods for extreme rainfall events for the Vaisigano catchment and for Apia,[12] the return period for the extreme rainfall associated with Cyclone Evan is in excess of 100 years over all time scales from hourly to daily. Table 4 shows that the rainfall intensity for a 100-year event is estimated to be around 10 percent greater by 2055.

[12] For the Vaisigano catchment, see I. Punivalu, "Flood Design in Western Samoa" (BEng of civil engineering project, University of Newcastle, New South Wales, 1983). For Apia, see J. E. Hay and P. Hartley, *Climate Risk and Adaptation Assessments for the Samoa Parliament Complex Redevelopment Project*, report prepared for AusAID, Canberra, January 25, 2013.

Figure 5. Modeled Ground-Up Mean Loss per District of Samoa from Tropical Cyclone Evan and the Modeled Track for Tropical Cyclone Evan (from Joint Typhoon Warning Center Advisories)

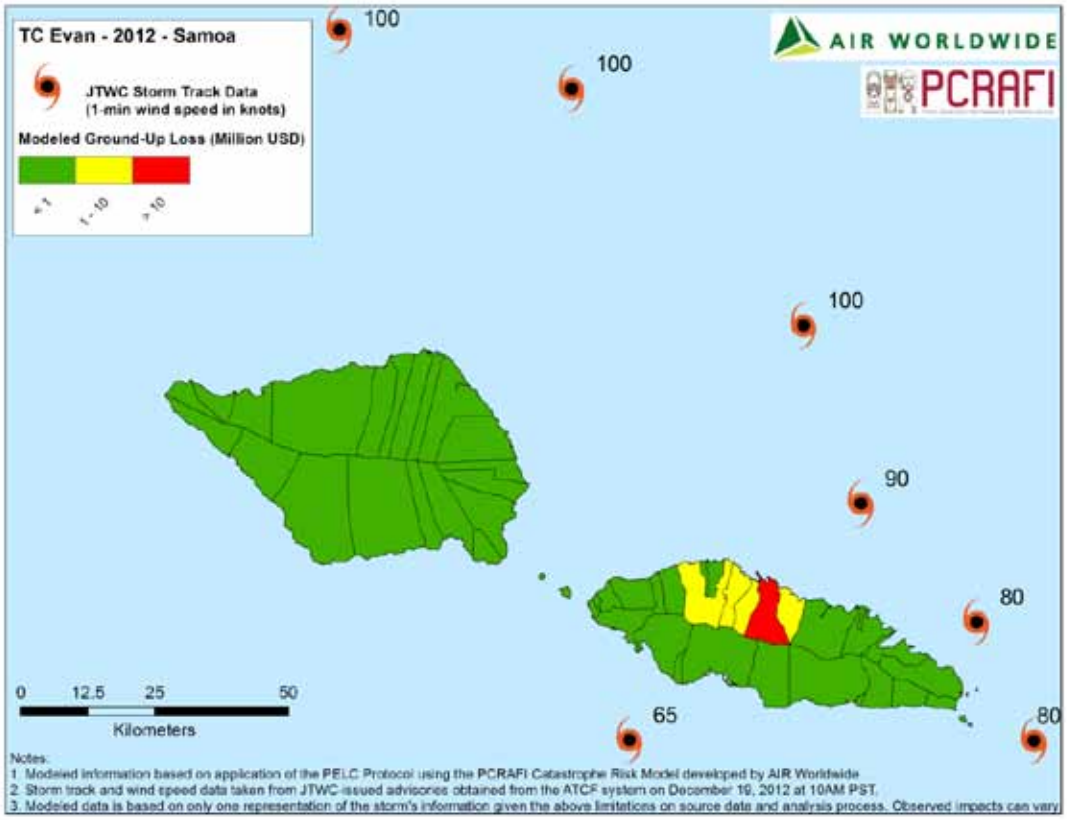


Table 4. Maximum Total Rainfall and Rainfall Intensity in Vaisigano Catchment

			100-year rainfall event		
				Apia current	Apia 2004–2065
Time period	Maximum total rainfall (mm)	Intensity (mm)	Vaisigano Catchment (Punivalu)	(Hay and Hartley)	
1 hour	156.8	156.8	142	102	114
2 hour	213.4	106.7	87	74	82
3 hour	252.2	84.4	62	59	65
1 day	617.0	25.7	16 (est.)	16	18

Sources: I. Punivalu, "Flood Design in Western Samoa" (BEng of civil engineering project, University of Newcastle, New South Wales, 1983); J. E. Hay and P. Hartley, *Climate Risk and Adaptation Assessments for the Samoa Parliament Complex Redevelopment Project*, report prepared for AusAID, Canberra, January 25, 2013.

Request for Assistance and International Response

The government of Samoa declared a state of emergency for a period of 30 days after the National Disaster Council conducted an inspection of the areas affected. About 6,000 people were evacuated after high winds damaged homes and Apia's Vaisigano River broke its bank, and the government called for international assistance. The government of Samoa, civil society groups, and the international community have been engaged in the relief and rehabilitation work.

On December 20, 2012, recalling the successful and coordinated government-led response following the tsunami of 2009, the government of Samoa requested support from the World Bank in working with other development partners on a damage and loss assessment (DALA). Per agreements between the United Nations (UN), World Bank, and European Commission (EC) on post-crisis cooperation, the World Bank has requested UN and EC participation in the assessment. The Asian Development Bank, the government of Australia, the government of New Zealand, the Secretariat of the Pacific Community, and several UN agencies have indicated that they will participate in the assessment.

As in 2009, Ms. Noumea Simi of the Ministry of Finance was appointed as the key coordination point for donors and experts. It should be noted that Samoan government officials and external experts engaged in the assessments received two days of training in DALA, Post-disaster Needs Assessment (PDNA), and social impact assessment (SIA). The assessment started on January 10, 2013.

The PDNA combined three complementary methodologies and used quantitative and qualitative data to achieve a holistic full assessment of the impacts of the disaster.

Photos

Top: Homeless after the storm. Thinkstock.com.

Center: Vaisigano, Maagao Pan. Courtesy of GoS/PDNA Assessment team.

Rght: Saint Mary primary school in Apia. © UNESCO/Laura Berdejo.

2. ASSESSMENT METHODOLOGY

The standard Post-disaster Needs Assessment (PDNA) methodology has been used after Cyclone Evan in Samoa to assess what is required for human development and economic recovery as well as for reconstruction using disaster-resilient standards.

The PDNA methodology combines two distinct and complementary approaches to assessing disaster effects, impacts, and needs: the time-proven damage and loss assessment (DALA) methodology, originally developed by the United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC)[13] in the early 1970s and further updated and expanded by the World Bank's Global Facility for Disaster Reduction and Recovery (GFDRR);[14] and the human recovery needs assessment (HRNA) methodology that is under further elaboration by the United Nations.

In the case of the Samoa disaster, it was felt that human development recovery needs could best be assessed by combining the social impact assessment (SIA) methodology recently developed by the World Bank[15] with the standard PDNA methodology, drawing as well on HRNA concepts.

The scope of the three complementary methodologies used in the Samoa assessment is described below. It should be noted that these methodologies complement each other and provide a complete view of the human and economic needs to achieve recovery and reconstruction.

The DALA Methodology

Under the DALA methodology's conceptual framework, the following *disaster effects* are measured during the assessment:

- *Damage* is the value of physical, durable assets that may be destroyed due to the action of the natural hazard that caused the disaster, expressed in terms of the replacement value of the assets assuming the same characteristics that they had prior to the disaster.
- *Losses* are changes in the normal flows of the economy that may arise in all sectors of economic and social activity due to the external shock brought about by the disaster, and that may continue until full economic recovery and reconstruction has been achieved, and are expressed in current values.

[13] ECLAC, *Handbook for Estimating the Socio-economic and Environmental Impact of Disasters* (Santiago: United Nations, 2003).

[14] GFDRR, *Guidance Notes for Damage, Loss and Needs Assessment*, vol. 1, *How to Conduct a Damage, Loss and Needs Assessment;* vol. 2, *How to Estimate Sectoral Damage and Loss;* vol. 3, *How to Estimate Post-disaster Needs for Economic Recovery and Reconstruction* (Washington, DC: World Bank, 2010); and vol. 4, *How to Estimate Disaster Impact at Macro-economic and at Personal Levels* (Washington, DC: World Bank, forthcoming).

[15] GFDRR, *Analyzing the Social Impact of Disasters,* vol. 1, *Methodology*; and vol. 2, *Tools* (Washington, DC: World Bank, 2011).

The following *disaster impacts* are also estimated as part of the assessment:

- Possible *macroeconomic performance modifications*, including possible slowdown of gross domestic production, deterioration of the balance of payments and of fiscal sector position, and increase in inflation, arising from the losses in production
- *Decline in personal or household living conditions*, livelihoods, and income; possible increase in costs of living; and poverty aggravation arising from the resulting losses caused by the disaster

Financial *needs for economic recovery and disaster-resilient reconstruction* constitute the third output of the assessment, and include the following:

- Requirements for immediate recovery of personal or household income, rehabilitation of basic services, and reactivation of productive activities
- Requirements for reconstruction of destroyed assets with improved, disaster-resilient standards under a "building-back-better" strategy

The HRNA Methodology

The HRNA methodology enables the following:

- Estimation of the *decline in human development*, expressed by the quantification of the Human Development Index (HDI), arising from the disaster effects and impact
- Estimation of possible *setbacks in the achievement of the Millennium Development Goals (MDGs)* for the affected country that may arise due to the disaster
- Estimation of needs to achieve early human recovery at the personal and community levels.

The SIA Methodology

The SIA methodology aims to measure disaster impacts related to social cohesion, social relations, and governance. It aims to assess the human and social impacts of the disaster on communities and households and to develop recommendations for recovery and reconstruction. The SIA, as applied in Samoa, blended some HRNA and SIA methodologies, but was primarily founded on the World Bank's social impact assessment methodology.[16]

As applied in Samoa after Evan, the SIA methodology used qualitative research (focus group discussions, key informant interviews, and researcher observations) in five of the most affected districts in the country[17].

A two-pronged approach was followed: the SIA sought both to mainstream human and social issues into sectorial assessments and to conduct qualitative research on key human and social issues related to the impacts of the disaster.

The SIA had two objectives: provide a sense of the human and social impacts the cyclone and flood has had on communities and households, and make recommendations for recovery and reconstruction. The HSIA conducted

[16] For SIA methodology, see http://siteresources.worldbank.org/INTEAPREGTOPSOCDEV/Resources/PostDisasterocialAnalysisToolsVolumeI.pdf. For SIA tools, see http://siteresources.worldbank.org/INTEAPREGTOPSOCDEV/Resources/PostDisasterSocialAnalysisToolsVolumeII.pdf.

[17] The five districts included in the assessment were Safataa, Siumu, Anoamaa, Lefaga (rural), and Vaimauga (urban Apia).

qualitative research (focus group discussions, key informant interviews, and researcher observations) covering five of the most-affected districts in the country.[18]

The SIA took a two-pronged approach to the PDNA: the first was to mainstream human and social issues into sectoral assessments, and the second was to conduct independent qualitative research on key human and social issues related to the impacts of the disaster. To achieve these ends, HSIA members worked with sector assessments and also conducted independent assessment and analysis.[19] Therefore, some of HSIA's findings and recommendations have been integrated into sectoral chapters.[20]

Coverage of the Assessment

The Cyclone Evan post-disaster assessment analyzed sectors of economic and social activity included in the system of Samoa's national accounts that may have sustained destruction of physical, durable assets and/or modifications to the normal flows of the economy.

The following sectors of economic activity were separately included in the analysis:

- Agriculture (food and commercial crops)
- Livestock
- Fishery
- Manufacturing industry
- Commerce
- Tourism
- Electricity
- Drinking water supply and sanitation
- Transport
- Housing
- Education
- Health

In addition, cross-sectoral analysis was carried out for several areas, including the environment and gender impact disaggregation, in order to ascertain possible social and economic effects and impacts. Special attention was also given to community preparedness and response to disasters, post-disaster access to and governance of relief goods and services, access to social services in general, and effectiveness of social cohesion and social relations at times of disaster.

[18] A total of 102 men and 128 women participated in the HSIA field work. Nineteen focus group discussions were held, consisting of five male-only, seven female-only, and seven mixed groups. Twenty-four key informant interviews (KIIs) were held, consisting of 13 male and 11 female. FGDs and KIIs were sought with mixed groups; with separate groups of men, women, and youth; and with particular livelihoods groups, including subsistence farmers and merchants. The SIA was conducted under the oversight and with the participation of the Ministry of Women, Community and Social Development.

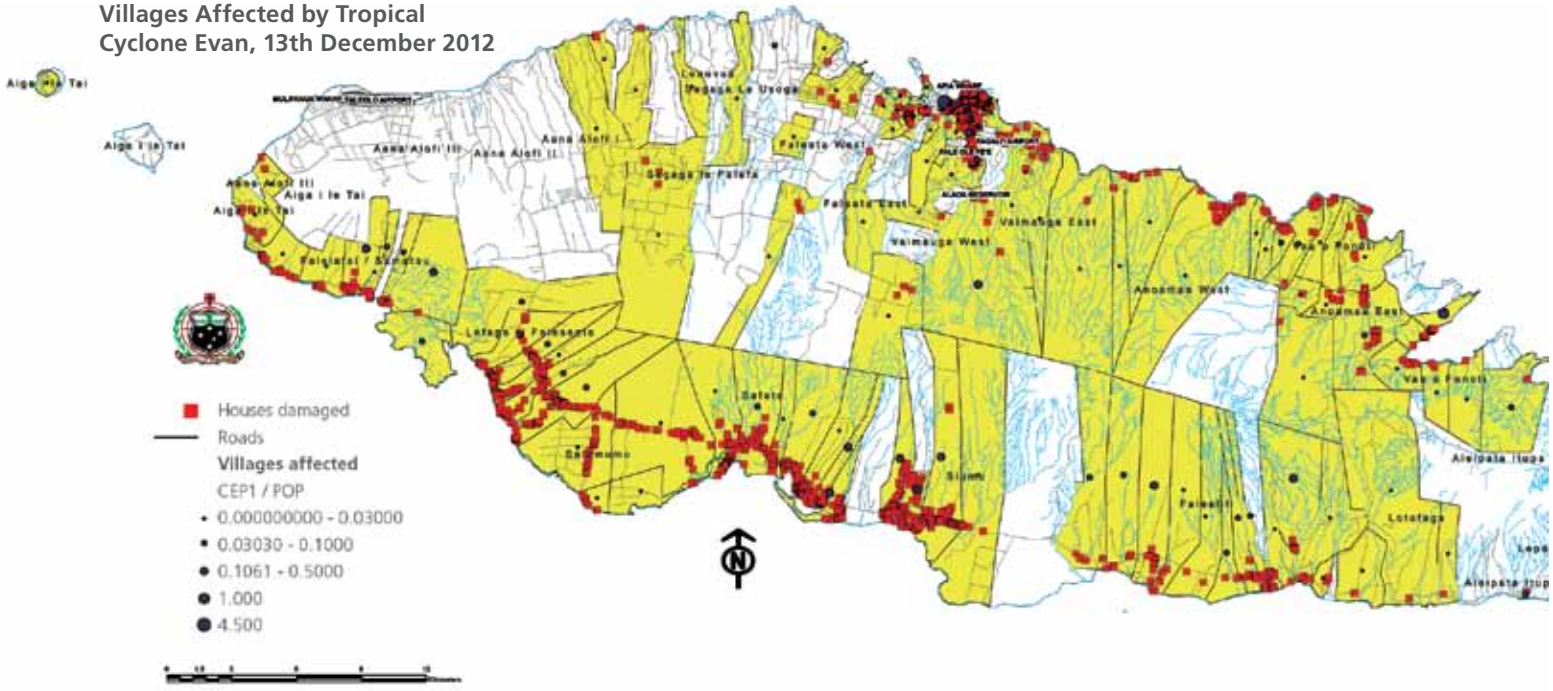
[19] The degree of integration of social issues into sectoral assessments was limited by the different assessment schedules, the level of field-based and household data collection undertaken by the different sectors, the availability of SIA experts, and the degree of receptivity of sector leads to integrating human and social needs assessments into largely DALA-focused assessments.

[20] A range of issues has been included in the sectoral chapters; a particular point of interest is the restoration of basic services.

Photo: Activated channel. Courtesy of GoS/PDNA Assessment team.

The extent and magnitude of the effects of Cyclone Evan on the Samoan economy were substantial: the value of damage and loss is equivalent to 29 percent of the country´s gross domestic product (GDP).

Villages Affected by Tropical Cyclone Evan, 13th December 2012



Source: Bureau of Statistics and Disaster Management Office, MNRE.

3. DAMAGE, LOSSES, AND NEEDS BY SECTOR

3.1 Summary of Damage and Loss

Based on the standard methodology for disaster impact assessment that utilizes the damage and loss methodology and the human recovery needs assessment tool, it is estimated that the total value of destroyed durable physical assets (usually referred to as *damage*) is SAT 235.7 million, or its equivalent of US$103.3 million. Subsequent production losses and higher related costs of production (referred to as *losses*) arising after the disaster amount to SAT 229.4 million, or its equivalent of US$100.6 million. In brief, the total estimated value of damage and loss is SAT 465 million, or US$203.9 million.[21] Table 5 presents the detailed results of these findings.

It should be noted that some sectors of economic activity, such as the communications sector, sustained comparatively minor damage that is not reported in the above figures.

The extent and magnitude of the effects of Cyclone Evan on the Samoan economy were substantial: the value of damage and loss is equivalent to 29 percent of the country´s gross domestic product (GDP). The figure indicates that Evan was a significant disaster for the economy, and that equally significant efforts will be required to achieve recovery and reconstruction and return the country to economic and social normalcy.

The assessment has revealed that 55 percent of the disaster effects fall under direct ownership of the public sector, including of course central-level agencies or local government institutions, while the remaining 45 percent belong to the private sector, including private enterprises and individuals (see table 5 and figure 6). Needless to say, this distribution will have a bearing on the relative efforts that will need to be made to achieve recovery and reconstruction after the disaster. Since the larger share of these efforts would fall within the purview of the public sector, the government of Samoa will need to spearhead and guide economic recovery and reconstruction efforts as well as to provide support to the private sector.

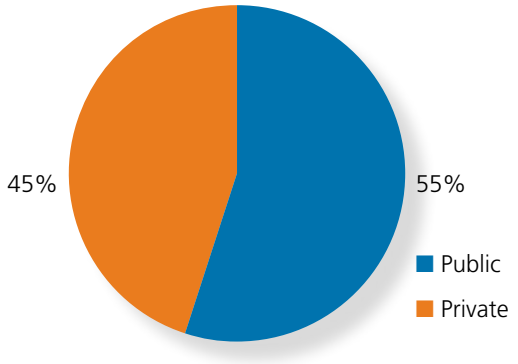
[21] A standard exchange rate of 2.281 tala per U.S. dollar was adopted for use throughout the assessment, as defined by the Central Bank of Samoa.

Table 5. Summary of Damage and Loss Caused by Cyclone Evan in Samoa (thousand SAT)

	Disaster effects			Ownership by sector	
	Damage	Losses	Total	Public	Private
Productive sectors	**56,979.0**	**106,748.6**	**163,727.6**	**367.5**	**163,360.1**
Agriculture	4,905.0	58,060.5	62,965.5	275.0	62,690.5
Livestock	3,450.0	800.0	4,250.0	66.0	4,184.0
Fishery	2,069.0	5,493.0	7,562.0	25.0	7,537.0
Manufacturing	17,250.0	4,595.7	21,845.7	0.0	21,845.7
Commerce	1,605.0	15,589.9	17,194.9	0.0	17,194.9
Tourism	27,700.0	22,209.5	49,909.5	1.5	49,908.0
Social sectors	**49,182.3**	**7,587.5**	**56,769.7**	**13,462.5**	**43,307.2**
Education	7,222.1	628.0	7,850.1	6,733.9	1,116.2
Health	3,608.9	1,956.2	5,565.1	5,125.7	439.4
Housing	38,351.3	5,003.3	43,354.5	1,602.9	41,751.6
Infrastructure	**113,313.2**	**58,687.4**	**172,000.6**	**168,987.6**	**3,013.0**
Electricity	39,089.3	31,884.4	70,973.7	70,973.7	0.0
Water and sanitation	8,836.3	3,845.0	12,681.3	12,681.3	0.0
Transport	65,387.6	22,958.0	88,345.6	85,332.6	3,013.0
Cross-sectoral	**16,251.0**	**56,398.0**	**72,649.0**	**72,649.0**	**0.0**
Environment	16,251.0	56,398.0	72,649.0	72,649.0	0.0
Total	**235,725.5**	**229,421.4**	**465,146.9**	**255,466.6**	**209,680.3**

Source: Estimations by assessment team using official information.

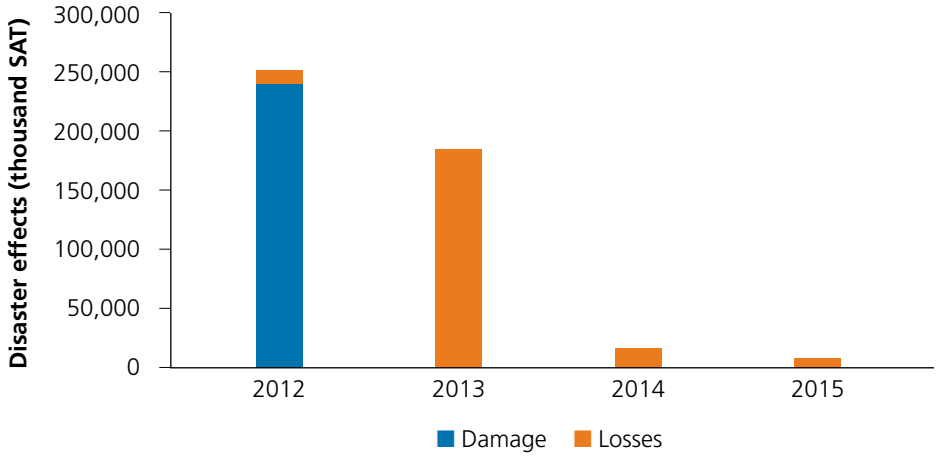
Figure 6. Cyclone Evan Disaster Effects, by Ownership



Source: Estimations by assessment team using official information.

The effects of the disaster will persist until late 2015, although they will spread at different rates and intensities. The destruction of durable physical assets occurred in mid-December 2012, when Cyclone Evan hit Samoa; production losses began immediately afterwards, concentrating heavily in calendar year 2013 but lingering on in some sectors until at least the last quarter of 2015. Figure 7 shows this chronological spread of damage and loss. With production losses lasting until late 2015, it would seem obvious that the impact on overall performance of the economy would last over a similar four-year period, as will be described below.

Figure 7. Chronological Variation of Damage and Loss Caused by Cyclone Evan in Samoa

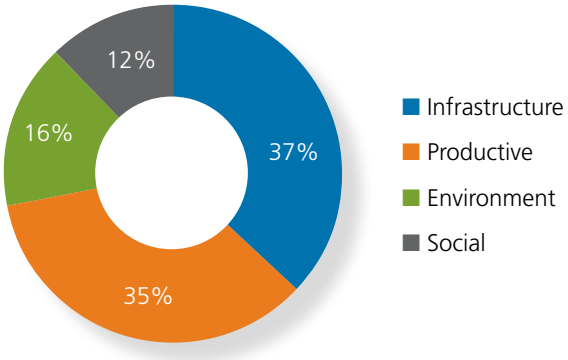


Source: Estimations by assessment team using official information.

The estimated value of destroyed assets is equivalent to nearly 109 percent of the value of construction sector GDP in 2011. Thus if the country were to stop all other normal construction activities and concentrate the entire capacity of the construction sector on rebuilding the assets destroyed by Cyclone Evan, almost a full year would be required to achieve full reconstruction. In reality, then, even assuming that some reconstruction would be carried out on an informal basis,[22] it will take a minimum of two years (and possibly three) to complete reconstruction after the disaster.

The distribution of damage and loss among main sectors of activity is uneven. Table 5 shows that the productive sectors were affected most, followed closely by infrastructure sectors; figure 8 shows that the environment and the social sectors were affected to a lesser extent. In terms of individual sectors of economic activity (as defined in the country´s system of national accounts), the most affected were transport, agriculture, the environment, electricity, and tourism (figure 9).

Figure 8. Breakdown of Damage and Loss, by Main Sectors of Activity



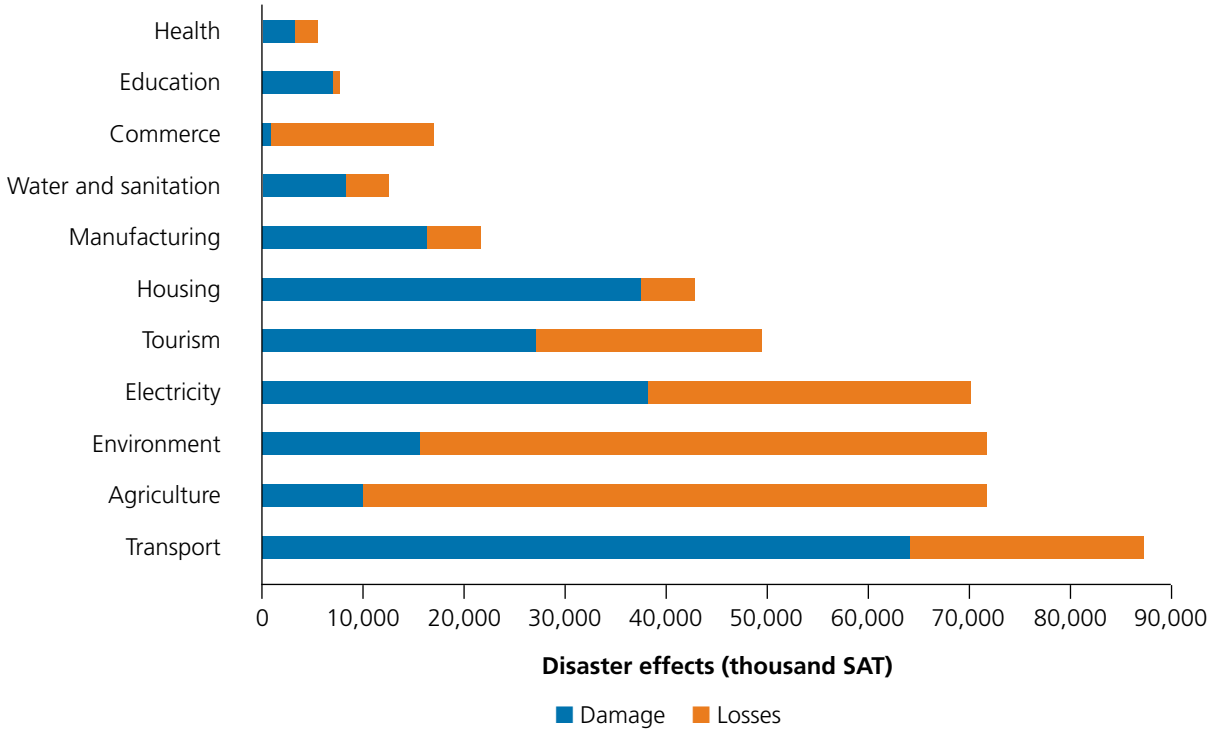
Source: Estimations by assessment team using official information.

The effects of this disaster are not entirely unprecedented in the Samoan economy, as other similar disastrous events have occurred in the past. To mention a relatively recent similar case, the 2009 earthquake and tsunami

[22] Even reconstruction carried out informally would follow improved, disaster-resilient standards to assure risk reduction.

caused damage and loss amounting to SAT 309 million.[23] Cyclone Evan has just exceeded that amount in damage and loss, and some similar cases of disasters in the not-too-recent past went unassessed. Clearly, then, the Samoan economy is affected relatively often by similar large events of natural origin. It follows that efforts to reduce vulnerability and disaster risk should become an integral part of the country´s plan for medium- and long-term socioeconomic development.

Figure 9. Sectoral Distribution of Damage and Loss, by Individual Sector of Economic Activity



Source: Estimations by assessment team using official information.

[23] Government of Samoa, *Samoa Post-disaster Needs Assessment following the Earthquake and Tsunami of 29th September 2009* (Apia: Government of Samoa, 2009).

Productive Sectors

3.2 Agriculture, Livestock, and Fisheries

Summary

This chapter outlines the impact of Cyclone Evan on the agriculture and fisheries sectors in Upolu. Agriculture contributes about 10 percent of Samoan gross domestic product (GDP), but it employs around two-thirds of the national labor force and is an important source of household income. About 75 percent of the agricultural area in Upolu was either severely or moderately affected by Cyclone Evan, and the crop subsector has been hardest hit both in Damage and Loss. Almost the entire banana and breadfruit crops are lost, and coconut plantations have sustained significant damage. Crop losses are high because the cyclone occurred during the peak production season for fruit trees and the off-season vegetable harvest. Destruction to root crops, including taro, has been modest, but much farm equipment as well as farm buildings, private farm roads, and farm vehicles were destroyed. While there were no reports of widespread flood and erosion damage to agricultural land, flash flooding in localized areas on Upolu wiped out or heavily damaged a number of farms. Many farmers having livestock report the death of animals and destruction of farm infrastructure, and widespread damage to fences due to fallen trees. Much of the damage to farm infrastructure has occurred on commercial fruit, vegetable, and livestock farms. In the commercial and artisanal fisheries sector, boats, canoes, and fishing gear have been destroyed, and some fresh water aquaculture farms have also sustained damage. The losses are estimated at about 30 percent of total agriculture sector GDP (crops, livestock, and fisheries) for 2013.[24] The priority now is to replace the productive assets of subsistence and commercial farmers and fishers in order to restore production across the sector as soon as possible.

Pre-disaster Situation

The performance of the agriculture sector has been poor in recent years, with agriculture's share of GDP declining from 19 percent in 1995 to 10 percent in 2011. In 2011 agriculture value added was SAT 155 million, with crops and livestock contributing 48 percent and the remaining percentage from fisheries. Nevertheless, agriculture continues to play an important role in the economy, employing around two-thirds of the national labor force. Rural households consisting of extended family units are the major producers, practicing small-scale and labor-intensive mixed farming on customary-owned land. Less than 20 percent of land is freehold or government owned, a proportion of the latter being leased to farmers for agricultural production.

Of the 17,511 households living in Upolu, about 60 percent are engaged in agriculture; 30 percent are subsistence households that produce crops for home consumption but do not sell; 26 percent produce largely for home consumption but also sell small amounts in the market; and 3 percent produce primarily for sale either in the local market or for export.

Farm size averages six acres focused predominantly on the subsistence staples of taro, banana, ta'amu, breadfruit, and coconut and a variety of fruits and vegetables. Farm surplus is generally sold locally. There is only a handful of bigger commercial farmers selling directly to supermarkets and/or institutions, but even these are quite small in scale.

Livestock farming is mostly smallholder production based on cattle, poultry, pigs, and sheep, with a few large commercial units also producing these livestock. Pre-cyclone Upolu had a cattle population of 19,000 head, about 115,000 pigs, and about 200,000 head of poultry.

[24] The 2013 losses are estimated at 49 percent of crop and livestock GDP and about 5 percent of fisheries GDP. GDP data are from the Samoa Ministry of Finance.

The 2009 agriculture census indicates one-quarter (24.8 percent) of households are engaged in fishing, with most of the catch used for home consumption. Only a few households engage in commercial fishing. The inshore coastal fishery is also vital to the village economy, having a subsistence catch estimated at 9,557 metric tons, valued at SAT 75 million, in 2012. The total commercial catch in 2011 was 2,402 metric tons, valued at SAT 16 million. By comparison, the small artisanal fishery has an annual value of less than SAT 50,000.

While there are traditional male/female roles in the production cycle, the agricultural workload is usually shared. The exception is fishing, where women and older men glean the lagoons and inner reefs while younger men fish the outer lagoons, reefs, and sea.

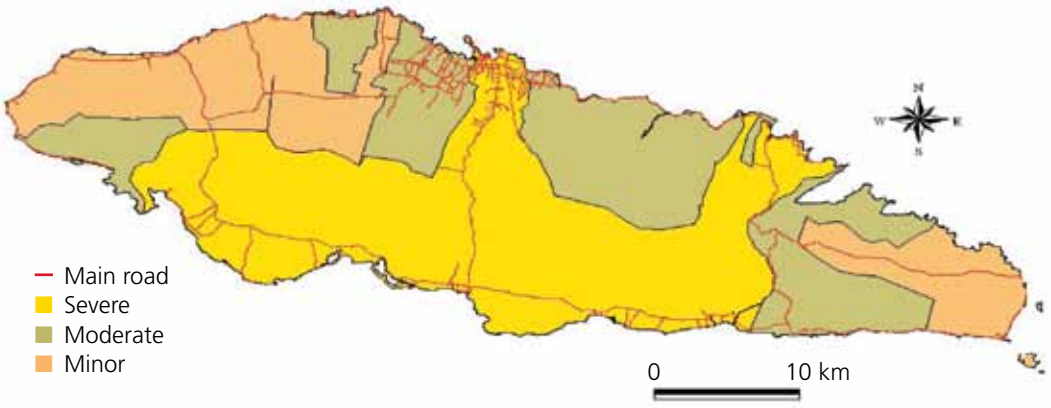
Agriculture in Samoa is very vulnerable to the adverse effects of climate change. Climate change is predicted to manifest itself in more frequent and extreme rainfall events, longer dryer spells and drought events, rising sea levels, extreme winds, and high air and water temperatures.

The Ministry of Agriculture and Fisheries (MAF) has prepared an Agriculture Sector Plan (2011–2015) to prioritize public and private investments in the sector. Government spending for agriculture in the 2010/11 budget was SAT 12.4 million, or about 2.3 percent of the budget for all ministries and departments. In addition to government expenditures, bilateral partners (Australia, New Zealand, and China) provide support to agriculture mainly through technical assistance, with multilateral partners (United Nations, World Bank, European Union) providing additional support through various projects. The Food and Agriculture Organization of the United Nations (FAO) includes Samoa in some national and regional technical cooperation projects. There are also regional programs implemented by the Secretariat of the Pacific Community (SPC), Secretariat of the Pacific Regional Environment Programme (SPREP), and Australian Centre for International Agricultural Research (ACIAR).

Damage and Loss

The agriculture and fisheries sectors sustained significant damage and loss. The worst hit agricultural areas are the southwest, central, and southern parts and the central highlands of Upolu island (see figure 10). Severe disaster effects occurred in the Lefaga, Salamumu, Safata, Siumu, and Falealili districts, including Aleisa and the Cross-Island Road.

Figure 10. Damage and Loss Assessment of Agriculture Sector in Upolu after Tropical Cyclone Evan, January 2013



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Damages

The major damage caused to the agriculture sector is summarized in table 6 and table 7. More details are given below.

Table 6. Agriculture Sector Damages (thousand SAT)

	Thousand SAT
Crops	
Destruction of trees	391
Damage/destruction of equipment and infrastructure	4,047
Damage/destruction of inputs	192
Damage to Crops Division infrastructure	275
Subtotal	4,905
Livestock	
Dead animals	690
Damage/destruction of equipment and infrastructure	2,760
Damage to Animal Production and Health Division infrastructure	66
Subtotal	3,516
Fisheries	
Damage/destruction of equipment and infrastructure	2,059
Damage to Fisheries Division infrastructure	25
Subtotal	2,084
Total	**10,505**

Source: Estimations by assessment team on basis of official information.

Crops. High winds caused extensive damage to tree crops, including coconuts, breadfruit, bananas, and cocoa, throughout Upolu. Based on field inspections and a rapid household survey undertaken by MAF for this assessment,[25] roughly 45 percent of the agricultural area in Upolu is assessed as being severely impacted by the cyclone and another 30 percent as being moderately impacted.

In the severely affected areas more than 80 percent of the banana crop has been destroyed, while 40 percent of breadfruit trees are estimated to be completely destroyed and the remainder heavily damaged. About 15 percent of cocoa trees and fruit trees, such as mango, rambutan, citrus, and avocado, have also been destroyed; much of their production was lost because they were at their productive peak when the damage occurred. The cost of replanting lost fruit trees is estimated at SAT 390,000.

Buildings, machinery, and equipment used for agricultural production have also been extensively damaged (SAT 4.05 million) across all farm types, with 90 percent of farms that were surveyed reporting some damage to their agricultural assets. These include items such as knapsack sprayers, chainsaws, mist blowers, and water tanks. About 50 percent of surveyed farmers also reported that stored agricultural inputs, such as fertilizers, seeds, and

[25] Between January 11 and 12, 2013, MAF undertook rapid household surveys to collect information on the extent of Damage and Loss to the crops, livestock, and fisheries sectors. The sample survey included 121 households engaged in crop- and livestock-related activities, focused on the most severely affected districts, and included commercial, semicommercial, and subsistence farmers (although semicommercial/commercial farmers were overrepresented). A separate survey covering 88 households was undertaken by the fisheries department to assess the impact on the artisanal fisheries sector.

agricultural chemicals, have been lost (cost estimated at SAT 0.2 million). Commercial vegetable farmers reported significant damage to their assets and operations. Most tunnel houses and the crops they sheltered were damaged or destroyed.

Livestock. Damage in the smallholder livestock sector includes the death of cattle, pigs, and poultry and destruction of farm equipment and animal housing. A large commercial layer operation reported losing about 8,000 chickens, or 13 percent of its flock. Damages due to death of livestock are estimated at SAT 0.69 million. Extensive livestock production infrastructure—fencing, housing, stockyards, water tanks, and farm vehicles—has been destroyed, with some farmers losing everything. These infrastructure and equipment losses are estimated at SAT 2.76 million.

While there were no reports of widespread flood and erosion damage to agricultural land, flash flooding in localized areas on Upolu has wiped out or heavily damaged a number of farms. In Magiagi village, the assessment team interviewed a farmer whose entire farm had been washed away due to flash flooding. Before the cyclone the farmer had 50 pigs. About a third of the pigs were able to get to higher ground, but the rest died. The farmer's pig shelter, fence, tool shed, and banana plot were also washed away.

Fisheries. Damages to fisheries have largely been in the artisanal sector, with about 27 percent of canoes owned by artisanal fishers being reported as damaged. The fishers also reported that about half of their fishing gear had been destroyed. Typically when fishers are not at sea their canoes are stored on the shoreline. Most of the damage to canoes was caused by fallen trees, and a few canoes were swept out to sea during the cyclone. Fishing nets, which are usually stored outdoors (either under trees or inside canoes), were damaged by debris. Other gear, such as spear guns and goggles, were damaged if the fishers' houses sustained damage.

In the commercial fishing sector, 12 out of 63 boats are assessed to have been damaged. Despite warnings issued by the Meteorological Service and the Fisheries Division, 5 boats went out fishing at the time of the cyclone. These vessels are still missing. The other damaged vessels were docked but were damaged by fallen trees or were rammed against seawalls during the cyclone. A vessel that was not brought to shore during the cyclone was swept ashore and damaged.

Twelve of the existing 51 tilapia ponds have been damaged, mainly because of flooding.

Losses

Crops. Total production losses to the crop subsector in 2013 have been estimated at approximately SAT 55 million. Apart from the extensive damage/destruction of the banana, breadfruit, and coconut crop, a large part of off-season vegetable crop production has been lost. Fruit trees (mango, rambutan, and avocado) were at their peak when the cyclone struck, and much of the production was also lost. The major root crops (taro, ta'amu, yams, and cassava) have not been as badly affected, although there has been leaf damage to taro plants, and yields will be reduced on the affected farms.

Farm households engaged in value-adding activities (such as copra drying, chip and biscuit making, etc.) reported losses arising from the unavailability of raw materials and from damaged infrastructure. Many farmers have already commenced replanting, but in the most affected areas households will prioritize rebuilding damaged housing before replanting. For many households it will take at least a year to get back to their pre-cyclone production levels, particularly for those with heavy damage to or destruction of coconuts, breadfruit, and banana trees.

Livestock. The main production losses in the livestock sector are likely to be incurred by commercial farmers. Production for the commercial layer farm has decreased by about 50 percent since the cyclone, and it will take about five months before the production of eggs is restored to the pre-cyclone levels.

Fisheries. In the fisheries subsector the largest production losses have been in artisanal fishing, where it is estimated that fishers will lose their fishing income for about two months—assuming that timely support is provided to restore the assets lost by these fishers in that period of time.

Public sector damage costs are estimated at SAT 366,000 (table 7), mainly comprising damage to buildings and infrastructure of the Crops Division, Animal Production and Health Division (APHD), and Fisheries Division.

Table 7. Agriculture Sector Damage and Loss (thousand SAT)

	Disaster effects			Ownership	
Sector/subsector /component	**Damage**	**Loss**	**Total**	**Public**	**Private**
Crops	4,905	58,061	62,966	275	62,691
Livestock	3,516	800	4,316	66	4,250
Fisheries	2,084	5,493	7,602	25	7,577
Total	**10,505**	**64,354**	**74,884**	**366**	**74,518**

Source: Estimations by assessment team on basis of official information.

Socioeconomic Impact and Human Recovery Needs

Among those in the agriculture and fisheries sectors, subsistence farmers are the most affected, as they rely heavily on their breadfruit, banana, coconut, and taro crop production for their daily consumption. With the destruction of their food crops, households will need to spend more on food, and without increased support from friends, relatives, or other sources these households will likely be forced to cut back on other essential expenditures. Most of these farmers have limited sources of disposable income. Prior to the cyclone, households in the lowest expenditure quintile already spent about 55 percent of their total expenditures on food.

The quality of the household diet is also likely to suffer, given that vegetable gardens have been destroyed and that subsistence households are unlikely to be able to afford fruit and vegetables from the market to substitute for lost home production. Samoan consumption of fresh fruits and vegetables pre-cyclone was already very low by international standards, at only 297g per day. The World Health Organization recommends as a population-wide intake goal the consumption of a minimum of 400g of fruits and vegetables per day (excluding potatoes and other starchy tubers) to help address the problem of chronic diseases such as heart disease, cancer, diabetes, and obesity, as well as to prevent and alleviate conditions due to micronutrient deficiencies. Were it not for the very high annual consumption of 76Kg of bananas per capita (equivalent to 208g per day per capita), total fruit and vegetable consumption pre-cyclone would be less than 100g per person per day. The loss of the banana crop is therefore disproportionally critical.

In monetary terms, semicommercial and commercial farmers have encountered the largest losses, as their farm assets and productive infrastructure have been heavily damaged. Farmers who have taken loans for agricultural activities may face difficulties in making loan repayments due to losses in revenue. One of the coping mechanisms reported has been the disposal of livestock. However, disposal of productive assets for meeting consumption requirements is not a sustainable solution, especially for subsistence farmers.

Agriculture is generally a family business, with women contributing substantially in terms of labor or management. The cyclone may affect the amount of time women have available for agricultural activities such as vegetable gardening, weeding, and marketing, since women in the most affected areas have reported spending more time on domestic chores, particularly fetching water. On the other hand, the additional work required to clear land, mend fences and sheds, and replant crops will provide opportunities for gainful employment for paid laborers till their normal cultivation work is resumed.

At present, food availability is not an issue for most households. Farmers currently have the salvaged crops of taro and bananas. In the coming months, however, there will be a severe shortage of bananas and breadfruit in Upolu. Taro shortages could also be experienced if households substitute taro for bananas and breadfruit. Households that have encountered large crop losses, particularly in the hard-hit areas, could shift to bread and rice.

Although the damages are lower in the fisheries sector, the artisanal fishers will not be able to resume fishing until their canoes and gear are replaced. With an estimate of one to six months for the replacement of the canoes, the artisanal fishers who do not have access to alternate means of support will be affected. As alternate forms of fishing (such as spearfishing) continue to be practiced, there has not been any serious change visible in the diet of affected fishers' families apart from a few cases of shifting to tinned tuna and chicken.

Women are usually involved in the cleaning and selling of the fish caught by their husbands. Women are also involved in gleaning of invertebrates and harvesting sea cucumbers. There is no apparent decrease in this activity except for the days of business lost due to the cyclone. Paid laborers in the affected commercial sector would be affected till fishing operations are resumed.

As of late January, food security does not seem to be a matter for serious concern. Other than the reported shift to purchased rice, decreases or changes in food consumption have not been reported. However, this situation needs to be closely monitored over the coming months as the demands on available income are likely to increase, with expenditures for replacing or repairing damaged infrastructure, replanting, equipping children for the new school year, and meeting family obligations, among other things. Sixty percent of households surveyed by MAF anticipated shortages in one or more food items in the next 12 months. About 36 percent of households were concerned about a shortage of bananas; 30 percent were concerned about a shortage of taro.

Economic Recovery Needs and Recommendations

The estimated cost of recovery for the agriculture and fisheries sectors, as assessed by MAF, is SAT 14.6 million (see table 8).

Table 8. Agriculture Sector Recovery Needs (thousand SAT)

Sector/subsector/component	Recovery needs
Food supply/income support	14,000
Vegetable seeds and planting material	345
Fertilizers and pesticides	230
Veterinary services	50
Total	14,625

Source: Estimations by assessment team on basis of official information.

For farmers producing primarily for subsistence, it is estimated that income from agriculture will be about 40 percent lower than in the period before the cyclone.[26] If agriculture accounts for 50 percent of total income for these households, this translates to a decline of 20 percent in household incomes compared to the pre-cyclone period.

The following are recommendations for assisting in the recovery of the agriculture and fisheries sectors:

- **Recovery assistance combining food supplies and income support for vulnerable households to compensate for the loss of agricultural income.** The cost of providing such assistance to about 3,500 households for 9 months is estimated at SAT 14 million.[27]
- **Production and distribution of vegetable seeds and planting material to cyclone-affected farmers.** Support of local nongovernmental organizations (NGOs) and other ministries, including the Ministry of Women and Community Development, should be mobilized for the distribution of seeds and planting material for vegetables. The Crops Division in MAF will need technical assistance to help strengthen capacity for rapidly producing planting material and seeds and to assess the need for seed importation.
- **Distribution of fertilizers and pesticides.** Agrochemicals should be provided to farmers to assist them in restarting fruit and vegetable production.
- **Provision of veterinary services.** At present Samoa only has one vet. The shortage of professional vets is constraining the level of support that can be provided to livestock owners. The Animal Production **and Health Division** requires technical assistance and additional resources to improve its veterinary surveillance capacity and service provision.

Reconstruction Needs

The estimated cost of reconstruction for the agriculture and fisheries sectors, as assessed by MAF, is SAT 8.6 million. The priority for this expenditure is to assist farmers and fishers to repair and replace damaged infrastructure in order to restart farm and fishing activities and restore livelihoods. Reconstruction efforts should give priority to the estimated 4,500 largely subsistence-oriented households in the most severely affected areas.

Crops. Reconstruction needs for crops include the following:

- **Seed and planting material for fruit trees.** Planting material for fruit trees needs to be produced and distributed, and farmers need to be trained in identification of pests and diseases and integrated pest management more generally. As mentioned above, the Crops Division in MAF needs technical assistance in order to strengthen capacity for rapid production of planting material and seeds and in order to assess the need for seed importation.
- **Land clearance and sanitation**. Farmers in the most affected areas need services to assist them with clearing fallen coconut and other trees so as to reduce potential breeding sites for the rhinoceros beetle.

[26] An analysis of the unit record data from the 2008 Household Income and Expenditure Survey (HIES) is needed to provide a more accurate estimate.

[27] This is equivalent to about SAT 4,000 per household. The 2008 HIES estimated that average weekly household food expenditure for the bottom three deciles was SAT 223. Assuming that about 40 percent of this expenditure is for subsistence food items that will not be available for all or part of the next nine months, and adjusting for inflation, it is estimated that the loss of subsistence food items would amount to about SAT 4,000 per household.

- **Distribution of agricultural equipment and tools.** Many households have reported loss or damage of tools and other agricultural equipment. These need to be replaced so that farmers can resume agricultural activities. Appropriate packages of small tools could be distributed together with planting material and seeds. Other agricultural equipment (knapsack sprayers, chainsaws, and mist blowers) may be provided as a package to communities in the most affected areas. There needs to be consultation with communities to assess the best modality for distribution of the equipment to ensure that, once provided, the equipment is available on an equitable basis for all households and to both men and women farmers.
- **Loan rescheduling and soft loans or matching grants to help semicommercial and commercial farmers rebuild damaged infrastructure.** Commercial and semicommercial farmers should be provided with some assistance to replace their damaged infrastructure and assets, particularly if these assets are not insured. To help farmers to restart their agribusinesses and get back to pre-cyclone conditions, options include rescheduling loans and providing soft loans and/or support through a matching grant scheme.
- **Repairs for APHD Crops Division infrastructure and demonstration plots**. Repair of damaged demonstration plots, buildings, nurseries, and tunnel houses is needed.

Livestock. The priority is to help households remove fallen trees and clear debris that is currently hampering efforts to rebuild fencing, and to provide assistance in restocking small backyard livestock farms (poultry and pigs).

Reconstruction needs for livestock include the following:

- **Assistance with removal of trees to enable farmers to repair damaged fences.** Assistance with tree cleanup should be provided to about 350 cattle farmers. APHD has a list of cattle farmers and will prioritize cleanup in the most affected villages. Tree removal and cleanup could be contracted out or done in-house by APHD.
- **Assistance with rebuilding fencing.** In-kind assistance in the form of fencing wire should be provided for subsistence households to replace the destroyed parts of their fencing in the most affected villages. Any existing fencing wire should first be recycled and reused. APHD would need to undertake a more detailed assessment of the level of fencing damage for each household in the severely affected areas and determine the maximum level of assistance that would be provided to any one household.
- **Community poultry and piggery scheme**. This scheme would provide small livestock such as chickens and pigs, along with startup kits including supplies for pig and poultry pens, feed for an initial period, training, and animal health support. There needs to be consultation with communities to assess the best modality for distribution of the small livestock to ensure that they are available on an equitable basis for all households that have lost animals. Support of local NGOs and other ministries, including the Ministry of Women and Community Development, should be mobilized. One possible option is for poultry and pig units to be provided to the community, with one unit for each of the 50 villages in the severely affected areas. The village would select either a poultry or piggery unit.
- **Loan rescheduling and soft loans or matching grants to help semicommercial and commercial farmers rebuild damaged infrastructure**. Same as for crops.
- **Repairs to APHD farms.** Repair of damaged animal shelters, fences, and other farm infrastructure for breeding farms is needed.

Fisheries. Reconstruction needs for fisheries include the following:

- **Replacement of commercial fishing boats**. In-kind assistance is needed to repair damaged commercial fishing boats.
- **Restoring lost assets for artisanal fishers**. In-kind assistance is needed to repair damaged canoes and nets and to replace other lost or damaged equipment.
- **Repairing tilapia ponds**. In-kind assistance is needed to repair tilapia ponds.
- **Repairs to the Fisheries Division aquaculture building, MAF's research vessel, and damaged markers for fish reserves**.

Key Challenges to Recovery and Reconstruction

Key challenges to recovery and reconstruction include the following:

- Measures to restore assets should be implemented as soon as possible; immediate action is vital for recovery. A clear strategy is needed to identify those households that are most affected and vulnerable, and to assess how to deliver services and support to them.
- Given the extent of damage, MAF is likely to experience institutional capacity constraints on its ability to respond to the reconstruction and recovery needs in a timely manner. Support of associated line ministries, NGOs, and other partners needs to be mobilized.
- The MAF does not have an established system for assessing farm Damage and Loss arising from disasters. It is recommended that a robust assessment methodology be developed for future disaster events. Many agricultural statistics are out of date, inconsistent, or absent (for example, there are no reliable statistics on total production volumes). Efforts are needed to strengthen agricultural statistical capacity.
- A balance between medium- and long-term recovery strategies must be struck. Tree crops will take a long time to recover, but short-duration crops suitable for the soil and climactic conditions of the affected area could be introduced to fill the gap. Households could be encouraged to plant early-maturing crops (such as cassava and sweet potato), given that there will be a shortage of vegetables for several months. Public awareness campaigns could be implemented to remind households that several plants in Samoa (such as the edible hibiscus) have nutritious leaves and can be prepared much like popular vegetables such as cabbage and beans.

Table 9 summarizes reconstruction needs in the agriculture sector.

Disaster Resilience in the Agriculture Sector

To improve preparedness, there is a need to prepare and widely disseminate information to farmers and fishers on disaster risk management in agriculture.

- For example, recommendations could be provided to livestock farmers to regularly clear trees close to fences (one of the main damaged inputs), to follow specifications for building animal shelters, and to move livestock housing to higher ground, away from rivers and watershed areas.

- For crops, farmers should be encouraged to diversify and plant a variety of different root or tuber crops such as yams, taro, cocoyam, ta'amu, and manioka. Crops that can be field stored during post-cyclone periods should be identified.
- For fisheries, ensure that there are adequate loading ramps in place to pull *alia* fishing vessels up on to dry land.

Table 9. Agriculture Sector Reconstruction Needs (thousand SAT)

Sector/subsector/component	Reconstruction needs
Crops	
Seeds and planting material for fruit trees & technical assistance	305
Land clearance and sanitation	135
Distribution of agricultural equipment	750
Support for commercial farmers	1,000
Crops Division repairs	275
Livestock	
Tree removal assistance	750
Assistance for rebuilding fences	1,500
Community piggeries and poultry	550
Support for commercial farmers	1,000
APHD repairs	65
Fisheries	
Replacement/repair of commercial fishing fleet	600
Replacement of lost assets for artisanal fishers	1,500
Repair of tilapia ponds	60
Repair of damaged markers for fish reserves	42
Fisheries Division facility repairs	25
Total	**8,557**

Source: Estimations by assessment team on basis of damage and loss.

3.3 Manufacturing and Commerce

Pre-disaster Situation

The manufacturing sector includes the components of food and beverage manufacturing and other manufacturing activities. Its annual output represents 8.9 percent of the country's gross domestic product (GDP). The commerce sector, at both wholesale and retail levels, represents a significant fraction of the Samoan economy, estimated at 18.7 percent of the value of GDP.

In terms of employment, 2,465 persons are formally employed in the manufacturing sector and 3,530 persons in the commerce sector, or 4.9 and 7.1 percent respectively of the total labor force of the country. Needless to say, many more persons are informally involved in trading, as a supplementary income-earning activity.

In 2011 production in the manufacturing sector experienced an overall 14.7 percent decline in growth when compared to the previous year, mainly due to a slowdown in the "other manufacturing" category, though growth in the food and beverage industry was 1.4 percent. A relatively robust growth of 3.0 percent occurred in the commerce sector that year. Prospects for growth in 2012 were relatively good, but the Cyclone Evan disaster introduced negative impacts which are to be felt mainly in 2013.

Effects of Cyclone Evan

In order to ascertain the effects and impact of Cyclone Evan on the manufacturing and commerce sectors, baseline information on production and production capacity was combined with detailed results of a special sample survey of manufacturing and commercial establishments, which was commissioned by the Post-disaster Needs Assessment team for the purpose in close collaboration with the Samoa Chamber of Commerce.

The questionnaire developed for the sample survey made it possible to compile information both on the estimated value of physical assets destroyed by the cyclone—including premises, equipment and machinery, stock of raw materials for processing or sale, and stocks of finished goods—and on the stoppage or slowdown of production and sales and other problems related to the operation of each establishment. A total of 100 individual manufacturing and commerce establishments was included in the survey, which covered manufacturing (15 percent of the total), processing (15 percent), cottage industries (23 percent), commercial establishments (22 percent), and informal traders (25 percent), and which provided a 5 percent sample of the combined installed capacity of the two sectors.

The values of destroyed assets and of production or sale losses were derived from the sample survey, and validated through special field visits conducted by the sector assessment team members. These average values of damage and loss were then combined with a baseline number of establishments in each category as provided by the Samoa Ministry of Revenue, in order to extrapolate assessment results to the entire universe of each sector. In addition to the categories mentioned above, the assessment considered indirect losses in sales (mainly to foreign tourists) for arts and crafts manufacturers and for commercial establishments (mainly to hotels); since tourism is being limited by the reduction in hotel room capacity arising from cyclone damage, these indirect losses are factored into the estimations of disaster effects. The resulting estimated values of damage and loss are shown in table 10.

Table 10. Damage and Loss in Manufacturing and Commerce Sectors (thousand SAT)

	Disaster effects			Ownership of effects	
Sector	Damage	Loss	Total	Public	Private
Manufacturing	17,250.0	4,595.7	21,845.7	n.a.	21,845.7
Commerce	1,605.0	15,989.9	17,194.9	n.a.	17,194.9

Source: Estimations by assessment team on the basis of official information.
Note: n.a. = not applicable.

It must be pointed out that the destruction of assets occurred during December 2012, and that production losses will spill over into 2013 for the manufacturing sector and into 2014 for the commerce sector, even as recovery and reconstruction activities are concluded. It is also important to point out that production losses in these sectors are due not only to the destruction of the sector assets (premises, equipment, machinery, raw materials, and finished goods) but also to the absence of electricity and water supply.

Socioeconomic Impacts

As table 10 shows, the damage and loss affected private sector entities exclusively; no government-owned establishments were affected by the cyclone. This distribution will translate into an impact at the macroeconomic level that includes lower overall production of goods and services, and reduced economic growth in 2012, 2013, and 2014, as will be described below. In addition, the forecasted losses in industrial production and commercial sales will mean less in value-added tax revenues, which will in turn have a negative impact on the fiscal sector. Replacing the destroyed goods and assets will require that a sizable fraction of the value of the goods be imported from abroad; thus reconstruction will have a negative impact on the balance of payments for the country. Full particulars of these negative impacts arising from the industry and commerce sector are described in the section of the report dealing with macroeconomic impacts.

An additional impact will be felt by some of the workers (both formal employees and self-employed persons) in each of the sectors, as the production losses will result in equivalent employment losses from December 2012 through 2014, until full recovery of production activities is achieved. Since estimated production losses are relatively small compared to the value of normal production in the sectors, equivalent employment losses will be relatively limited, with a total of 31 equivalent jobs lost in manufacturing and 226 equivalent jobs in commerce. It should be noted that these figures refer to the formal sector, and that additional losses in employment and livelihoods occurring in the informal sector are not included here.

Recovery and Reconstruction Requirements

Based on the analysis of damage and loss for each sector, estimations have been made of the financing requirement for activities designed to achieve recovery of production and to rebuild the destroyed assets using improved, disaster-resilient standards.

In connection with recovery activities, the needs include working capital to ensure smooth restoration of production. In addition, the owners or managers of the enterprises included in the sample survey perceived refinancing or rescheduling of old loans—nonperforming because of the disaster—to be essential for recovery. The amounts required for such recovery activities were estimated as a function of the value of production losses, taking into consideration the types of production and trade activities and their specific working capital requirements. It is foreseen that these funding requirements are to be split into two categories: a scheme of cash grants for microentrepreneurs and a second scheme of soft-term credit lines—with low interest rates and relatively long repayment periods—channeled through the national private or development banking system.

In regard to requirements for reconstruction, the value of destroyed durable, physical assets has been supplemented to introduce disaster-resilient features, including elevated floor levels in buildings and roof anchoring to prevent wind damage, as well as other considerations such as relocation to safer areas (in very limited cases), modernization of machinery, and others. The financial requirements for reconstruction are to be channeled in a manner similar to those for recovery: cash grants to microentrepreneurs and soft-term credit lines to creditworthy enterprises.

Recovery and reconstruction requirements in the manufacturing and commerce sectors are summarized in table 11.

Table 11. Recovery and Reconstruction Needs in Manufacturing and Commerce Sectors (thousand SAT)

Program and sector	Subprogram	Requirements (thousand SAT)	Implementing agency
Recovery			
Manufacture	Cash grants for microenterprise working capital recovery	325	TBD
	Soft-term credit lines for small and medium enterprise working capital recovery	780	Banking system
Commerce	Cash grants for microenterprise working capital recovery	1,000	TBD
	Soft-term credit lines for small and medium enterprise working capital recovery	2,370	Banking system
Reconstruction			
Manufacture	Cash grants for microenterprise reconstruction	6,000	TBD
	Soft-term credit lines for small and medium enterprise reconstruction	14,700	Banking system
Commerce	Cash grants for microenterprise reconstruction	500	TBD
	Soft-term credit lines for small and medium enterprise reconstruction	1,425	Banking system

Source: Estimations by assessment team on the basis of official information.

Key Challenges for Recovery and Reconstruction

Most of the challenges for recovery and reconstruction in manufacture and commerce reside with the private sector. However, participation by the government is essential for some of the components; this is especially true for attending to the needs of the microentrepreneurs in both formal and informal sectors. In addition, the government´s initiative and strong support are required to enable the banking sector to establish the special, post-disaster soft-term credit lines required for both recovery and reconstruction. It is foreseen that the cash grant scheme will also be left in the hands of the government of Samoa, through one of its ministries.

Provision of cash grants and soft-term credit lines to entrepreneurs in these two sectors is essential to keep them from falling prey to the action of private lenders and loan sharks, who would impose high credit terms that could easily wipe out the recovery and reconstruction efforts.

The timeliness of these recovery and reconstruction schemes is of particular relevance. Should there be delays in making these financing schemes available, owners of the manufacture and commerce establishments may—in their efforts to overcome the impact of the disaster—begin reconstructing their premises using the same pre-disaster standards and designs, instead of adopting disaster-resilient features. For that reason, prompt availability of these financing schemes should be combined with the required urgent technical assistance to define a new construction design and specifications. The government should consider making financing conditional on adopting these new standards, in order to lessen the risk in future disasters.

After the negative impact of the 2009 earthquake and tsunami, the tourism sector was showing clear signs of recovery on the demand side by 2012, when an estimated 134,916 visitors arrived.

Photos

Top: Vibrantly painted local bus is the main transport in Samoa, South Pacific. © Saikit Leung | Dreamstime.com.

Center: Maninoa Surf Camp – Siumu Upolu. Samoana Resort, Salamumu Upolu. Tanu Beach Fales. Right: Regina's Beach Fales, Manase Savaii. Photos: Courtesy of GoS/PDNA Assessment team.

3.4 Tourism

Summary

The tourism sector of Samoa has been seriously affected by the Cyclone Evan disaster. Detailed surveys conducted during field trips to the affected areas have shown that a total of 267 hotel rooms sustained total or partial destruction, and that their replacement cost is SAT 43.5 million. Subsequent estimations of losses in revenue over the time period required to reconstruct these facilities—a period expected to extend into 2015—reveal a value of SAT 21.7 million.

Such a high value in damage and loss will cause other negative effects in commerce and in arts and craft shops, as fewer foreign tourists will visit and there will be less demand for food from hotels; these negative effects have been included in the sectors of activity where they will occur to avoid double counting.

These losses will have a negative impact at the macroeconomic level because tourism has a relatively high weight in the Samoan economy. Growth of the Samoan gross domestic product (GDP) will decline, the balance of payments of the country will be negatively affected due to lower receipts of foreign exchange, and the fiscal sector will sustain tax revenue losses; these negative impacts are duly described under the macroeconomic analysis section of the report, where other negative impacts arising from the different affected sectors are included. The effects of the disaster on the tourism sector will also have a negative impact on employment; it is estimated that an equivalent of 974 jobs will be lost, 483 of them by men and 491 by women.

Pre-disaster Situation

Within the framework provided by the 2009–2013 Tourism Development Plan, development of the tourism sector is coordinated by the Tourist Sector Steering Committee, and the Samoa Tourism Authority provides strategic and policy direction advice in close consultation with the industry groups represented by the Samoa Hotel Association and the Savai'i Samoa Tourism Association.

After the negative impact of the 2009 earthquake and tsunami, the tourism sector was showing clear signs of recovery on the demand side by 2012, when an estimated 134,916 visitors arrived. The celebrations of the 50th anniversary of Samoan independence were partly responsible for such high numbers of visitors in the past year.

By late 2012, hotel capacity had increased from 1,437 rooms to 2,148 rooms, an increase of almost 50 percent (see table 12). Details of this capacity increase by room category are as follows:

- Budget accommodation increased to 418 rooms, from 406 in 2009 (2.9 percent increase)
- Superior accommodation increased to 253 rooms, from 135 in 2009 (87 percent increase)
- Standard accommodation increased to 494 rooms, from 315 in 2009 (53 percent increase)
- Deluxe accommodation increased to 494 room, from 326 in 2009 (51 percent increase)

While the deluxe and superior room capacities were mainly added to the rural resort sites, most of the budget and standard room capacities were added to the Apia urban areas.

Statistical data compiled by the Samoa National Bureau of Statistics and by the Central Bank of Samoa show that about 35 percent of visitor arrivals make use of existing hotel accommodations; of this, about 60 percent stay in deluxe category hotels, and the remaining 40 percent stay in the other categories of hotels.

Table 12. Tourism Capacity in Samoa, 2009 and 2012

	Pre-tsunami stock (2009)		Pre-cyclone stock (2012)	
Category	**Number of properties**	**Number of rooms**	**Number of properties**	**Number of rooms**
Deluxe	5	326	10	494
Superior standard	5	135	11	253
Standard	21	315	29	494
Holiday homes	0	0	3	10
Budget	27	406	36	418
Beach *fales*				
Overnight	9	153	20	320
List only	0	0	13	106
Total	**85**	**1,473**	**132**	**2,148**

Source: Estimations by assessment team on the basis of field data.

The increase in the national room capacity in all categories, coupled with stagnant demand, has led to relatively low occupancy rates for the standard, budget, and beach *fale* categories.

Demand in the tourism sector is characterized by pronounced monthly seasonal peaks and off-peaks (average occupancy rates range from 15 percent in the off-peak season to at least 50 percent in the peak season), by limited specific market/product-fit research and participation in international marketing activities by operators, and by continuing heavy dependence on a few key foreign markets, especially New Zealand, which accounts for approximately 40 percent of the visitor arrivals. These features of the tourism sector have created major operational challenges for sector operators.

Foreign exchange earnings from the tourism sector are estimated to have recovered to SAT 330 million in 2012, continuing the growth trend from SAT 308.1 million in 2010 and SAT 310.5 million in 2011.

Based on sector estimates, the total number of employees in the sector prior to the cyclone was approximately 1,792. The estimated total revenue of the sector based on 2012 arrivals by accommodation was approximately SAT 155 million per year.

In recognition of the pivotal role of the tourist sector in driving economic growth for Samoa, the government has taken a number of initiatives coordinated through the Samoa Tourism Authority and the 2009–2013 Tourism Development Plan. The main support programs for the tourism sector include the following:

- Marketing and promotions
  - Samoa Tourism Authority annual budget for marketing and promotions and aid assistance for attendance at trade and tourism fairs
  - Grant assistance for hotel operators' marketing efforts through the Private Sector Support Fund
- Capital Investments in upmarket tourist facilities
  - Income tax credits for investors
  - Income tax holidays for the approved hotel projects
  - Import duty concessions for capital imports for approved hotel projects
- Infrastructure support
  - Government assurance that any approved hotel project has access to the water, power, and telecommunications

Estimation of Damage and Loss

Damages

To estimate the number of accommodation rooms and beds affected by Cyclone Evan, the following categories were adopted to define the extent of damage to each accommodation property category:

- Critically damaged properties (C1): 100 percent of rooms disabled
- Damaged properties (C2): 75 percent of rooms disabled
- Partially damaged properties (C3/C4): 25 percent of rooms disabled

Disabled rooms were those considered at the time of the assessment not immediately available for occupation, because of structural damages, lack of access to water and/or electricity, or destruction of essential guest support facilities and services such as kitchens, restaurants, and laundries.

Field surveys were conducted in all affected areas in Upolu. The surveys determined the number of rooms fully or partially destroyed, as well as of other auxiliary structures and associated services that were affected. It was found that the most affected single property was the Aggie Grey's Hotel and Bungalows.

Table 13 shows the final estimated value of the damages by room category.

Table 13. Estimation of Damage to Tourism Sector Facilities

Room category	Damage (million SAT)
Deluxe	19.2
Superior	2.3
Holiday home	1.1
Standard	0.5
Budget	2.9
Beach fale	0.5
List only	0.2
Cultural assets	3.9
Less: estimated insurance proceeds	–2.5
Total	**27.7**

Source: Estimations by assessment team on the basis of field data.

The total value of destroyed assets in the sector is SAT 26.3 million, of which 21.9 million refer to destruction of hotel rooms and their contents, and 4.4 million refer to auxiliary services destruction.

In addition to the above, an assessment of damages to tourism sites, cultural heritage sites, and facilities deemed important to cultural heritage was carried out. The assessment revealed additional destruction. Partial information obtained from hotel owners indicates that an estimated SAT 2.5 million would be available from insurance proceeds for reconstruction, which is to be discounted from the estimated value of damage. Thus, the total value of damage, including hotel facilities and cultural heritage sites for tourism, minus estimated insurance proceeds, is SAT 27.7 million.

Losses

To estimate revenue losses for the sector, use has been made of the experience obtained after the 2009 earthquake and tsunami, and a three-year period has been assumed for achieving full recovery of tourism demand.

Comparisons were made between the baseline value of revenues for 2012—SAT 154.6 million—and forecasted annual revenues for 2013, 2014, and 2015, estimated on the basis of the recovery trend after the 2009 disaster. This approach enabled the estimation of revenue losses for the three calendar years after the cyclone, as shown in table 14.

Table 14. Estimation of Gross Revenue Losses for the Tourism Sector, 2013–2015 (million SAT)

	2012	2013	2014	2015	Total
Gross revenues	154.96				
Forecasted levels of annual revenue		141.54	147.63	154.01	
Estimated annual gross revenue losses		13.42	7.33	0.96	**21.71**

Source: Estimations by assessment team on the basis of field data.

It should be noted that visitors to Samoa, in addition to their direct expenditures on accommodation facilities, also spend money on arts and crafts as well as other goods in the manufacturing and commerce sectors; it has been estimated that nearly 40 percent of the average visitor expenditure refers to these additional expenditures. These additional losses arising from the absence of visitors have been estimated and added into the losses of the sectors of manufacturing and commerce in their separate section of this report; they are not included here to avoid double counting.

Socioeconomic Effects

At the macroeconomic level, the losses caused by Cyclone Evan will have a negative impact on the value and growth of GDP, on the balance of payments, and on the deficit of the fiscal sector. These impacts are described in the section of this report that deals with macroeconomic impact.

Corresponding negative impacts on employment will be felt in the tourism sector. Estimates made on the basis of the existing quasi-permanent relation between gross revenues and the size of the labor force for the country reveal that the disaster would cause a loss of 974 jobs, with a nearly equal distribution among men and women. Details of these estimated losses are described for all sectors of economic activity in the macroeconomic impact chapter of this report.

There are indirect impacts on other sectors arising from the estimated revenue losses in the tourism sector. These include lower sales of agriculture and fishery products to the hotels, lower sales of manufactured (especially arts and crafts) products, and lower commerce sales. Again, these indirect losses are included under each of the sectors where they occur and are not included here to avoid double counting.

Recovery and Reconstruction Requirements

Requirements to achieve recovery and disaster-resilient reconstruction of the sector have been estimated at SAT 35.21 million (see table 15).

These requirements include the costs of clearing debris and removing mud from hotels and associated structures, conducting different initiatives to build the capacity of the sector for recovery, establishing a soft-term credit line through the private banking system to replenish working capital for hotel and restaurant owners and operators, designing and conducting a special information and marketing campaign abroad to ensure recovery of tourism demand, and reconstructing the destroyed sector infrastructure using disaster-resilient standards.

Table 15. Recovery and Reconstruction Needs (thousand SAT)

	Estimated financial needs		
	Recovery	Reconstruction	Total
Clearing of debris and removal of mud	400	n.a.	400
Capacity building for sector recovery	700	n.a.	700
Soft-term credit for working capital	5,000	n.a.	5,000
Marketing campaign to recover demand	1,500	n.a.	1,500
Reconstruction of sector infrastructure	n.a.	27,610	27,610
Total	**7,600**	**27,610**	**35,210**

Source: Estimations by assessment team on the basis of damage and loss.

Note: n.a. = not applicable.

It should be noted that the financial requirements to achieve recovery and reconstruction for the tourism sector would be met through private resources and public sector support.

Key Challenges to Recovery and Reconstruction

In contrast to the 2009 tsunami in which most of the damaged properties and costs were in the beach *fales* and in budget and standard accommodations, the costs of damages from Cyclone Evan are mainly in the deluxe and superior categories. Thus a key challenge and priority is restoring deluxe and superior accommodations capacity as soon as possible, given the relatively high revenue yields of these categories. Detailed plans for reconstruction of these facilities are urgently required.

Another very important and urgent matter is the restoration of the water and electricity supply to the sector facilities, especially those located in areas outside of the capital city. Some of these facilities were only slightly affected, and with a water and electricity supply they could become operational in a relatively short period of time.

Of particular urgency is the setting up of soft-credit lines—with low interest rates and relatively long repayment periods—for recapitalization of sector enterprises and for reconstruction, as the post-disaster situation calls for. The government of Samoa may need to assume a lead role in the establishment of such credit lines by the private banks.

Another key challenge relates to whether the special investment incentives for the tourism projects will warrant extending the special legislation when it expires at end June 2013. While the current surplus of rooms in the budget and standard categories may not justify extension of the special investment incentives, the relative shortage of the up-market accommodations (mainly the superior and deluxe categories) may. It should be noted that there is currently a relatively low occupancy rate for the budget and standard accommodation properties, and profitability is also low. These properties have been financed with high debt levels that have resulted in tight liquidity situations, and if these are not addressed at the industry level a number of these properties could go out of business in the next 12 months.

The challenge of maintaining key employees for the affected operators during the recovery period will also need to be addressed. Government and sector interventions are necessary to provide support for training programs to upskill key employees of the affected accommodation properties during the recovery period (up to three years).

The Samoa Tourism Authority destination marketing program is in place and ongoing; thus the required major investment in marketing would supplement the program in terms of the scale and frequency of activities aimed at a number of target markets/market segments. Post-cyclone, the strategy highlighted that overall, the destination was in business-as-usual mode (for unaffected operators), and that affected operators were recovering and rebuilding quickly. Whether this trend continues will depend on market specifics (including the nature and extent of news coverage in source markets). New developments in the deluxe/superior category meeting market requirements for typical South Pacific/beachfront holiday accommodation are expected to come online during 2013 and will partially offset supply-led downfalls in demand.

The biggest individual estimated costs of damage and loss are for Aggie Grey's Hotel and Bungalows Ltd., Vaisigano; these made up 92 percent (SAT 17.61 million) of the total estimate damages in the deluxe category, and 67 percent of the total damages of the sector. Given the relatively large scale of Aggie Grey's operations (it represents 32 percent of the deluxe capacity) and employment (21 percent of sector employees), and given the high profile of the Aggie Grey's brand overseas and its close association with the profile of Samoan tourism in overseas markets, it is crucial that the business reestablish itself as soon as possible to facilitate recovery of the sector. The key challenge for the government is to consider whether Aggie Grey's warrants special government intervention. The nature and type of intervention would require careful and delicate consideration to ensure consistency in the application of the government's private sector policies, to minimize the adverse social impact of unemployment from closure of hotel operations, and to jumpstart the recovery of the tourism sector with the early relaunching of the Aggie Grey's brand.

Recommendations for Resilient Recovery and Reconstruction

The rapid and sustained recovery of the tourism sector requires the following:

- Building back better and improving the quality and standard of rooms and services
- Taking decisive action to stimulate overseas tourist demand for Samoa as a safe tourist destination
- Diversifying rapidly the source markets for tourists to reduce high dependence on a few sources
- Taking necessary initiatives to diversify tourist attraction and recreational facilities and services as well as to host regional and international meetings/conferences throughout the year to reduce the gap between the peak and off-peak demand
- Providing timely fiscal incentives to support the rapid increase in room capacity in the deluxe and superior accommodation properties with beachfronts to cater to the strong demand for those types of properties
- Considering special intervention to assist the rebuilding of Aggie Grey's Hotel and Bungalow Ltd., given its proximity to and vulnerability to serious flooding from the Vaisigano River. This may require the construction of an appropriate river levee.

As the main growth engine of the Samoan economy, the tourism sector needs to be assisted in recovering from the damage and loss incurred in Cyclone Evan in order to lead the overall economic recovery. The main rationales for any proposed interventions to assist the private businesses operating tourism accommodations are these: First, if the investment decision is left solely to private businesses in the sector, they will not be able to immediately recover or quickly "build back better" to achieve pre-cyclone room capacity (especially in superior and deluxe categories, which have the highest national foreign exchange earnings, government tax collections, and employment impacts in the tourism sector). Second, early recovery of the rural tourism businesses is critical for reviving

the income and employment activities in rural communities, which are in turn important components in the government's poverty alleviation strategy.

Key parameters for a targeted recovery program for the sector would include the following:

- Reconstruction of the damaged tourism sector accommodation stocks back to the pre-cyclone room capacity levels within the next 24 months
- Stimulation of market demand by an aggressive marketing and promotional campaign by the Samoa Tourism Authority and tourism properties to recover demand in the sector within 30 months
- Upskilling of the pool of employees in the tourism sector through development and support of tourism operations/management courses at Australia-Pacific Technical College (APTC) and National University of Samoa (NUS)
- Improvement of financial and environmental risk management in the tourism sector

The indicative commitments for resourcing, based on identified interventions for the tourism cyclone recovery program, are shown in table 16:

Table 16. Estimated Level of Resources for Tourism Recovery Program

Intervention	Indicative amount (million SAT)
Part 1. Building back better to pre-cyclone capacity levels	
• Development partner grants for the affected beach *fale*/budget/standard accommodation properties	4.0
• Subsidized or concessional credit lines to the superior/deluxe categories provided by the government through the Central Bank of Samoa and managed by the Development Bank of Samoa; provisions in the criteria for eligibility should allow standard/budget operators who meet the lending criteria to apply in future if they choose not to utilize the grant facility	16.0
• Interest rate subsidy for SAT 16 million credit line over 15 years	7.5
• Import duty concessions for reconstruction	0.8
Part 2. Demand enhancement	
• Contestable development partner and government grant for marketing and promoting operators affected by Cyclone Evan	2.5
Part 3. Skill enhancement	
• Development partner grant to support APTC training courses targeting displaced employees of the affected properties	1.0
• Development partner grant to support NUS development of tourism courses	
Part 4. Management and planning capacity	
• Development partner grant to enhance technical/engineering management and skills in the tourism sector as well as implementation and management of the Tourism Cyclone Recovery Programme	0.5
Part 5. Disaster resilience and recovery	
• Development partner grant for technical studies and designs to enhance capacity to identify need for foreshore and levee protection for tourism accommodations most affected by cyclone and flooding	1.0
Part 6. Tourism sector insurance scheme	
• Development partner grant for technical studies and designs to develop appropriate and affordable insurance coverage and policies for tourist operators	0.5
Total recovery program	**34.0**

Source: Estimations by assessment team on basis of official information.

Disaster and Climate Resilience in the Tourism Sector

The high vulnerability of the tourism sector to the impacts of climate change underscores the need to effectively increase the sector's capacity to be more adaptive and resilient to these kinds of impacts. The National Tourism Climate Change Adaptation Strategy for Samoa (NTCCASS) 2011–2016 seeks to increase the resilience and capacity of the tourism sector to adapt to the impacts of climate change.

The key objectives of the NTCCASS are as follows:

- Objective 1: Promote and support urgent and immediate climate change adaptation action for the tourism sector.
- Objective 2: Build and increase resilience of tourist facilities and infrastructure against the adverse impacts of climate change.
- Objective 3: Promote, develop, and support policies aimed at reduction of risks to tourism infrastructure and facilities from climate change impacts.
- Objective 4: Strengthen human capacity to identify, analyze, and implement cost-effective mitigation and adaptation measures.
- Objective 5: Raise awareness at the national, sector, and community levels about the need to promote and support climate change adaptation measures.
- Objective 6: Secure additional and sustainable financing mechanisms in support of tourism climate change adaptation actions nationwide.

The assessment of Cyclone Evan´s impact has revealed the relatively low degree of disaster risk transfer in the tourism sector. Only a few tourism facility owners and operators had insurance on assets and on revenues. This situation needs to be addressed, perhaps through a countrywide approach that would take advantage of economies of scale.

Photos

Social Sectors

3.5 Health

Summary

The value of damage and loss caused in Samoa by Cyclone Evan has been assessed in the health sector for national health surveillance, public health, health promotion, health protection, and additional primary and secondary care service in the amount of SAT 5.8 million. The value of destroyed physical assets in the sector amounts to SAT 3.6 million, while higher expenditures and losses in revenue represent SAT 2.0 million. The estimated losses include extraordinary expenditures to respond to the health needs of the population, such as outreach clinical services, public health services and surveillance, and human resources for health, including a program to meet the psychosocial health needs of the population affected by Cyclone Evan.

Pre-disaster Situation

Major policies and priorities for the health sector are reflected in the National Health Sector Plan 2008–2018, and there is a current Health Sector Wide Approach program to facilitate the implementation of the plan's key strategic areas.

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 is also responsible for (a) monitoring of overall health system performance; (b) disease surveillance; and (c) primordial health promotion and prevention services, including sanitation regulation and services. The National Health Service (NHS) is the biggest publicly funded provider of health services to the population and runs the main referral hospital in Apia (Tupua Tamasese Meaole [TTM] Hospital), the subsidiary referral hospital in Savai'i (Malietoa Tanumafili II Hospital), and six rural district hospitals (RDHs) throughout the country. Outreach services from the RDHs are provided at the Community Health Centres (CHCs), which are owned by and located in village communities. The National Kidney Foundation of Samoa (NKFS) is responsible for secondary prevention and terminal care.

Other key players in the health sector include private general practitioners, clinics, and nongovernmental organizations (such as Samoa Victim Support, Samoa Cancer Society, and National Council of Women, to name a few), which provide mostly primary health care and psychosocial services. The Oceania University of Medicine and National University of Samoa Faculty of Nursing provide facilities for training of health personnel.

The health sector's key response roles in any national emergency or disaster are coordinated by the Ministry of Health as the lead agent and chair of the National Health Disaster and Emergency Management Committee. These roles include

- Managing the sick already admitted in health facilities and the expected injured to prevent complications and minimize fatalities
- Undertaking rapid public health assessment to ascertain environmental, food, and water risks in order to protect the public and prevent any disease outbreaks

Background

Cyclone Evan reached Samoa on Thursday December 13, 2012, and was originally declared a category 1 cyclone; it had escalated to category 3 by 1400 UTC on Friday December 14. The most damaging effects of the cyclone

in the Apia urban area happened on Thursday afternoon. These were caused mainly by the combination of high winds and flash floods that demolished homes and properties, leaving many homeless and injured and also resulting in the loss of lives. The worst hit rural areas were in western Upolu and in Siumu, Safata, and Lefaga; in these areas, too, many homes were demolished. Nine emergency shelters were opened in the Apia urban area and about 11 in the rural area; these shelters temporarily accommodated displaced families, from December 13, 2012, to January 4, 2013. Most of the families who sought shelter had their homes destroyed and have nowhere else to live until their homes are rebuilt. Like the staff of other sectors, many health staff and their families were displaced, and many more sustained damages to their homes.

Immediate Response of Health Sector

The health sector response during and immediately after Cyclone Evan was as follows:

The Ministry of Health made its headquarters available as an emergency shelter from December 13 at about 3:30 p.m. to December 16. MOH management and a few displaced MOH staff looked after 605 people, including the elderly, pregnant mothers, children, and babies.

MOH teams started public health environmental and sanitation assessments on December 15, 2012, and were joined by a public health specialist from the New Zealand army on December 16. Three MOH clinical teams made up of doctors and nurses went into shelters and conducted clinical assessments.

NHS focused on maintaining services at the TTM Hospital with a skeleton staff, who camped on site to ensure 24-hour coverage. The staff included 35 registered nurses (RNs), of whom 16 were nurse managers (the usual number of RNs is 84), as well as some doctors, some administrative staff, and biomedical and kitchen staff. The following should be noted:

- The camps have closed but the same senior members of the staff were still doing 12-hour shifts at the time of writing (third week of January) to cope with an increasing influx of patients.
- By December 17, most of the nursing and medical workforce and other essential staff were back to work, with some senior medical and nursing staff due for leave.
- A quick count showed about 265 patients presenting to the OPED on December 19, of whom 68 were children; 276 presented on December 20, of whom 54 were children.
- The most common presenting problems were diarrhea, upper respiratory tract infection, septic wounds, and skin sepsis.
- The wards were fully operational at the time of writing, with occupancy rates at 83 percent to 90 percent.

Rural district hospital services were maintained by nurses who camped on site beginning on December 13, 2012. On December 17, nursing teams in rural areas went into shelters and undertook health assessments of the people staying there. On December 19, the nurses and doctor at the 20 rural centers and emergency shelters saw an average of 1,709 people needing health care.

NKFS closed on December 14 but reopened the next day. Because of water problems the number of dialysis sessions per day was reduced from 36 to 11. Given this reduction, the NKFS nurses and one doctor were assigned to assist the NHS clinic at the Leulumoega RDH.

A public health sector leadership and management meeting was called by the director general/chief executive officer of the Ministry of Health on December 19, and the following resolutions were unanimously agreed on:

- NHS will continue to focus on TTM hospital services and on district hospitals and shelters in Upolu and Savai'i rural areas.
- NKFS will assist with some nurses for the roster at TTM and a team to Leulumoega RDH.
- MOH will continue to focus on Apia urban emergency shelters and on public health inspections to ascertain food and water safety. It will also focus on environmental health sanitation and surveillance for any potential disease of public health importance (for example, one causing possible outbreaks/epidemics) and will seek to identify additional primary care static sites for Apia.

Data disaggregated by sex and age have yet to be analyzed in the patient information system for overall treatment trends. However, preliminary data from shelter outreach teams show that teams medically consulted an equal number of men, women, and children, but specific treatment data are not available.

Post-cyclone Health Situation through a Qualitative Lens

The social impact assessment carried out a qualitative analysis of issues facing communities impacted by the cyclone. Several focus groups and key informant interviews with village councils, women's and youth committees, evacuation shelter managers, and others further illustrated health needs at the village and community organizational levels.

Reports from community members mention the same health needs that have been addressed in preliminary post-cyclone assessments. Villages have seen increases in diarrhea, mostly linked to poor water quality and poor environmental sanitation due to flooding, and there have been some observed increases in mosquitoes, suggesting the need for vector control programs. Increases in influenza and general somatic complaints (for example, "weakness and aching body") were observed after the cyclone, mainly in children and the elderly. Untreated injuries were also reported, mostly minor (that is, small cuts and bruises), but some villages reported head injuries and major injuries from flying debris during the cyclone.

Additionally, many communities noted the difficulty in caring for their vulnerable populations, such as people with disabilities, the elderly, and special-needs family members. Displaced people with pre-existing conditions had difficulty coping if their medications or assistive devices were lost. Those who took refuge in the shelters did not have as many problems accessing health services, as medical care was amply provided by outreach teams from the sector. Sexual and reproductive health needs were largely unmet except in a few shelters that provided free condoms and family planning services in partnership with key NGOs in this area. These models for best practice should be considered in the future.

Access to health care was an issue discussed mostly by rural villagers in more remote parts of the island, where roads were destroyed or blocked by fallen trees and debris. The National Health Service was able to reach some of the rural villages to deliver care, but gaps were noted. Some families also did not seek health care from established facilities because of financial and resource issues (that is, "no money or petrol for transport"). Urban villages more easily accessed care at the national hospital and established free clinics in town.

Psychosocial Health

The mental, psychological, emotional, and spiritual response to the cyclone was quite profound, most notably among young children and youth populations, but it was felt through communities as a whole. Reported stress reactions to the disaster include concerns about further flooding, inability to sleep, loss of appetite, fearfulness (in children), depression, stress, and "becoming emotional" when thinking of the cyclone or flooding. Further, reports

in the shelters indicate a fair amount of child bullying, a decreased capacity in parenting, and incidents of interpersonal violence. Some villages report increases in use of tobacco and alcohol and in consumption of coffee/sugar as coping mechanisms; these are a concern due to the regional noncommunicable disease (NCD) crisis. Potential food security issues and changes in diet due to decreased availability of fruits, vegetables, and healthy staple foods (such as taro, bananas, and breadfruit) are also a concern from a nutritional standpoint.

Even before Cyclone Evan, psychosocial health had been noted as a large service gap by the health sector, community-based organizations and NGOs, and affected populations themselves. Currently psychosocial health services are provided by the Mental Health Unit of TTM Hospital and NGOs (namely SUNGO, Red Cross, Samoa Victim Support Group, Nuanua O Le Alofa, and Goshen, among others). Pastors, churches, and village representatives make up informal support networks at the community level.

The post-tsunami 2009 psychosocial report recommended an increase in support to scale up services and capacity of the National Health Service Mental Health Unit and NGOs. Efforts were made to launch a community of practice in psychosocial services after the tsunami in 2009 in order to strengthen the capacity of care provided to disaster-affected and vulnerable populations. Evidence from the cyclone suggests this area should continue to be strengthened and supported by health and other partners, as mental health is continuing to be highlighted as a need in the overall system, particularly in the context of disaster preparation and response. The gap in capacity noted universally across sectors and community perspectives confirms the need for increased system strengthening. The health sector is conducting a mental health needs analysis (including surveillance of domestic violence) in 2013 to support this key area for action.

The psychological impact on the population can be expected to endure over the next several months and years, as has been observed with the 2009 tsunami. It is appropriate to incorporate medium- to long-term psychological intervention into the planning and recovery needs framework. As the new national hospital is being built, the needs of the Mental Health Unit will be enhanced with the new facilities. Human resources in mental health should also be prioritized. Additional assistance is being requested to support the needs of the NGOs and other organizations providing psychosocial services, since some of these organizations were incapacitated by damage and loss from the cyclone and are key support systems for victims of violence, including sexual and child abuse, and for those affected by the cyclone.[28] As disasters and similarly stressful events often exacerbate interpersonal and gender-based violence, continued monitoring of domestic violence incidence and support for key organizations will be important in the upcoming months.

Damage and Loss

Damage and loss are divided into three categories: those of MOH infrastructure and facilities, those of NHS infrastructure and facilities, and those of infrastructure and facilities belonging to NGOs and the private sector.

Damage and loss to MOH infrastructure and facilities were not severe. Some areas of the new MOH headquarters, including the library, sustained damages, as did surrounding structures. But the physical structure of the building was generally unaffected.

[28] Psychosocial health is also addressed in the chapter on the social impact assessment, with more specific programmatic recommendations and separate costing. The health sector factored in costs for damages, losses, and recovery needs for current psychosocial service providers to resume operations and provide ongoing services to affected/vulnerable populations.

Damages to and loss to NHS infrastructure and facilities were more extensive. Table 17 shows damage by facility.

Table 17. Damage to NHS Buildings and Infrastructure

Facility	Damage
Tupua Tamasese Meaole Hospital & NHS headquarters	Damage to roofing and door; water pasteurization (hot water panels) partly damaged; damage to signage and fencing
Malietoa Tanumafili II Hospital	Damage to roofing
Sataua District Hospital	Seawater damage; damage to fencing and minor chattels
Safotu District Hospital and Foailalo District Hospitals	Nil
Fusi Health Centre	Major structural damages
Saanapu Health Centre	One building destroyed
Lefaga Health Centre	Major building destroyed
Poutasi District Hospital	Parts of fencing damaged; generator damaged
Lufilufi Community Health Centre	Windows needing storm proofing (leakage)
Lalomanu District Hospital	Water damage to minor chattels
Leulumoega District Hospital	Damage to skylight

Source: Assessment team on basis of official information.

Other damage and loss to NHS included the following:

- **Medications and hospitalization fees.** All medications were issued free at TTM Hospital from part of December 13 until the morning of December 17. Hospitalization fees and outpatient consultation fees were also waived during this period. Costing of medication dispensed is based on the utilization over the first three days; per-day utilization over a 30-day period is SAT 5,067, which amounts to SAT 152,000 over a 30-day period.
- **Water.** Water for cooking, sanitation, and other uses is a truly critical issue for NHS, at TTM Hospital in particular, which lacked running water from December 13, 2012, until January 14, 2013. The national hospital is fully dependent on rainwater and Samoa Water Authority (SWA) water tanks to refill storage tanks placed strategically around wards, outpatient areas, the operating theater, etc. Two SWA water trucks were dedicated to refill water tanks at TTM Hospital and storage containers. The interruption of water supply to TTM Hospital was a critical problem, not so much for its impact on ease of operations and cost as for the threat to sanitation and potential for spreading disease.
- **Electricity and fuel.** Because electricity is critical in ensuring delivery of health care services, especially at TTM Hospital, NHS has two levels of backup for power supply—a standby generator and mobile generators distributed in the key areas (theater, wards, accident and emergency department, etc.). The services of a specialist electrician were also made use of throughout most of December 20 and 21, to ensure this service was not critically affected.
- **Sanitation facilities.** Portable toilets were utilized at TTM Hospital together with existing toilets (which are flushed via manually filled toilet tanks). The cost incurred can be calculated as 10 portaloos @ SAT 235 ex goods and services tax per day for 30 days expected duration of being without running water.
- **Staff overtime.** Many of the clinical workforce were either working or on standby. Many of the staff camped on site (including 170 TTM staff). Estimated overtime costs are calculated as SAT 150,000 for four days.

- **Supplies.** Initial supplies included extension cords for portable generators, torches, batteries, and tarpaulins; some building materials were also purchased. Staff who camped at TTM Hospital were provided three meals a day. The daily cost of feeding almost 200 staff is valued at SAT 6,800, times four days on site, or SAT 27,200, with the total cost of supplies amounting to SAT 43,200.

Information on the damage and loss from NGOs and the private sector was ascertained through direct visits and telephone interviews.

Samoa Victim Support Group, a major support service and community resource, sustained major infrastructural and equipment damage and human resource losses. Its capacity has been extremely hampered due to the cyclone, and the organization requires urgent assistance. Other NGOs and private sector partners sustained minor damages or were unable to be reached given the time constraints of the exercise.

Table 18 summarizes damage and loss in the health sector.

Table 18. Health Sector Damage and Loss (thousand SAT)

Sector/subsector/component	Disaster effects		Ownership		
	Damage	Loss	Total	Public	Private
Ministry of Health	**724.0**	**738.9**	**1,463.0**	**1,463.0**	
Health protection	84.0	36.0	120.0		
Monitoring/control of disease outbreaks	n.a.	50.0	50.0		
Vector control	n.a.	100.0	100.0		
Primary health care and psychosocial	n.a.	303.0	303.0		
Health promotion	60.0	200.0	260.0		
Human resources	n.a.	50.0	50.0		
Infrastructure	580.0	n.a.	580.0		
National Health Service	**2,099.0**	**698.0**	**2,797.0**	**2,797.0**	
Primary and secondary health care	n.a.	350.0	350.0		
Medical supplies	n.a.	160.0	160.0		
Medical equipment	n.a.	42.0	42.0		
Water and sanitation	30.0	112.0	142.0		
Infrastructure	2,069.0	34.0	2,103.0		
Nongovernment organizations	**642.0**	**423.7**	**1,065.7**		**1,065.7**
Private health sector	**143.9**	**295.6**	**439.5**		**439.5**
Private clinics	128.9	181.6	310.5		
Private pharmacies	15.0	114.0	129.0		
Total	**3,608.9**	**2,156.2**	**5,765.1**	**4,260.0**	**1,505.2**

Source: Estimations by assessment team on the basis of official information.

Note: n.a. = not applicable.

Recovery and Reconstruction Requirements

Public Health Issues/Challenges

Given the general conditions of the environment and the emergency shelters in affected areas, the lack of water and proper sanitary facilities (especially in the Apia urban area and the Siumu and Lefaga rural communities), and

the growing numbers of people in the TTM Hospital OPED, there are major concerns about possible outbreaks and other health problems, including these:

- Diarrhea/gastroenteritis (taking into consideration the significant endemic rate of typhoid, the possibility of an outbreak increases)
- Septic wounds and sores (which may cause rheumatic heart disease among children and make it possible to develop tetanus)
- Upper respiratory tract infection (which may cause rheumatic fever)
- Skin infections (fungal, sores and boils)
- Chicken pox
- Scabies
- Conjunctivitis
- Poor control of NCDs
- Possible influenza outbreak with high number of viral infections
- Possible vector-borne diseases (dengue fever)
- Post-traumatic stress syndrome

According to the staff who were looking after the emergency shelters, psychological/mental health support is direly needed, especially for those who suffered significant losses in the cyclone.

Human Resources Challenges

The immediate challenge for the health sector is to continue to relieve local health professional staff, as it has been doing since the time of the cyclone. In view of the already increasing numbers requiring care and the potential for outbreaks of disease, specialized technical support and human resources are very much needed to relieve local health professional staff, to cover shortages, and to meet the increased demand arising from health-related problems in the aftermath of Cyclone Evan.

Meeting Human Resources Challenges

After the 2009 tsunami, when similar human resources challenges for the health sector arose, health professionals of Samoan descent were identified and judged appropriate for any setting because of their language and cultural competency. The following personnel are requested as soon as possible:

- 20 RNs, to be staggered over a two-week period (dates to be reconfirmed) are needed to relieve staff at OPED and in critical and high-dependency care.
- Doctors for general OPED, pediatrics, and obstetrics and gynecology are urgently required (dates to be reconfirmed) to provide relief to the limited numbers of doctors available.
- In the medium term there is a need for psychosocial and mental health support.
- Additional allied professional positions such as pharmacists, radiographers, social workers, etc., will have to be filled as the need arises.
- Recruitment of the Samoa Health Mission (Mission of Samoan Nurses and Doctors) should be considered.

Costs for staff coming from overseas will consist of airfares, accommodations, and per diems.

In addition to the need for temporary health care personnel, there is an urgent need to open the diabetes clinic in town as a general outpatient clinic to reduce the load at the TTM Hospital OPED; this need has been identified as a

priority. To operationalize this clinic, it will be necessary to pay for extended hours through the end of January 2013 for GPs and nurses who worked more hours than are covered in their current contracts. It will also be necessary for a civil engineer to assess the status of the MOH headquarters and NHS facilities/hospitals to ascertain their durability.

Table 19 summarizes recovery and reconstruction needs in the health sector.

Table 19. Recovery and Reconstruction Needs in the Health Sector (thousand SAT)

	Post-disaster activity	Recovery	Reconstruction
Ministry of Health		**617**	**3,332**
	Debris and mud removal, disinfection costs	17	n.a.
	Monitoring/control of disease outbreaks	50	n.a.
	Vector control	100	n.a.
	Primary health and psychosocial care	100	n.a.
	Health promotion	200	n.a.
	Human resources	150	n.a.
	Community health centers reconstruction	n.a.	1,419
	Rural district hospitals reconstruction	n.a.	218
	National hospital reconstruction	n.a.	849
	Ministry of Health premises	n.a.	846
National Health Service		**690**	**235**
	Primary and secondary health care and psychosocial	350	n.a.
	Medical supplies	160	n.a.
	Medical equipment	40	n.a.
	Water and sanitation	110	n.a.
	Infrastructure	30	n.a.
	NHS reconstruction in Savai'i	n.a.	88
	NHS administration reconstruction	n.a.	147
NGOs	Primary health care and psychosocial	**420**	**763**
	NGO reconstruction	n.a.	762
	National Kidney Foundation	n.a.	1
General practitioners	Primary health care and psychosocial	**180**	n.a.
Private pharmacies	Primary care	**110**	n.a.
	Private sector reconstruction	n.a.	139
Total		**2,017**	**4,469**

Source: Estimations by assessment team on the basis of damage and loss.

Note: n.a. = not applicable.

Recommendations for Resilient Recovery and Reconstruction and for Disaster and Climate Resilience in the Health Sector

As is to be expected, post-disaster injury infections and infectious diseases are emerging and need very active outreach services by both doctors and nurses. A failure to conduct active case detection among the affected populations would likely result in future outbreaks of diseases such as dengue and typhoid and would require far more expensive care to save lives, whereas managing and controlling these diseases would reduce future costs.

Other risks that need to be managed include potential nutritional issues arising from reduced livelihoods, particularly the potential reduction in access to green vegetables, poultry, pork, and fish. While physical disability needs

are not expected to be great, 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 NCDs.

A very serious and major need is for psychosocial services for three distinct groups: (a) the affected population (communities) that was severely affected by the cyclone; (b) volunteers; and (c) public servants, particularly the first responders (medical, police, emergency services) and others working on a daily basis with the response. 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 and that a number of individuals will require specialist psychosocial services. While the needs in this area are being further explored, immediate strengthening is necessary to service the needs of the population affected by the disaster.

There are two major risk management strategies proposed for the health sector. The first is to relocate some health facilities in the communities. Thus the damaged Poutasi District Hospital ought not to be rebuilt in situ, as indicated in the 2009 post-tsunami report. The cost for rebuilding it elsewhere is SAT 5.5 million, based on historical costs. Fusi Community Health Centre was not damaged during the tsunami, but it was also recommended for relocation inland. Lefaga Community Health Centre was completely destroyed during the cyclone and should be rebuilt inland, especially since the population it serves has over the years moved away from the coast. The cost to relocate both Fusi and Lefaga Community Health Centres would be around SAT 3.8 million per facility, for a total of SAT 7.6 million. Sataua District Hospital in Savai'i was first damaged by the 1990 and 1991 cyclones, which caused the building's foundation to become critically unstable; the earthquake and tsunami of 2009 along with Cyclone Evan caused more damage to the foundation. It is therefore urgent that the facility be relocated away from the current site. The cost for relocation is SAT 5.5 million, based on historical costs.

Photo Lefaga Community Health Center. Courtesy of GoS/PDNA Assessment team.

Table 20 summarizes disaster risk reduction needs in the health sector.

Table 20. Health Sector Disaster Risk Reduction Needs (thousand SAT)

Description	Value
Improve drainage at Lalomanu District Hospital	300
Relocate Poutasi District Hospital	5,500
Relocate Sataua District Hospital	5,500
Relocate Fusi Community Health Centre	3,800
Relocate Lefaga Community Health Centre	3,800
Carry out mass typhoid vaccination campaign	2,400
Provide psychosocial services	300
Provide health promotion services	300
Total	**21,900**

Source: Estimations by assessment team on the basis of damage and loss.

Linking Climate Change with Health: The Need for Disaster Risk Reduction Initiatives

The second risk management strategy proposed for the health sector is to increase disaster risk reduction in future programs. The importance of this strategy cannot be overstated, given the post-cyclone health and psychosocial analyses. A male focus group participant in Vaipuna (one of the most heavily affected villages) states the following: "Inland flooding is something very new to us and now I fear that we might get this frequently as global warming and climate change are becoming real issues now." The health and psychological impacts from these events are profound and endure over time.

Increased capacity in preparation, response, and recovery is crucial to reducing the risks associated with natural disasters, particularly as these events are expected to intensify and increase in the context of climate change. Community-level preparedness exercises emphasizing an all-hazards approach, construction of cyclone-resistant infrastructure to prevent future flooding/damage, and first aid training in the communities are all recommendations made by the social impact analysis.

Another focus group participant emphasizes the rationale for a disaster risk reduction approach: "We would not want to face a similar disaster. Children rely on us for decisions on what to do next, and should we make the wrong decision now, they will be impacted by that."

3.6 Education

Summary

As part of ongoing government economic reform, the Ministry of Education, Sports and Culture (MESC) is clarifying its role across all subsectors within the education sector. Coordinated governance, planning, and budgeting arrangements with each of the subsector providers are being finalized, via a sectoral strategic plan that is near completion.

Upolu island sustained the major impact of Cyclone Evan, with the districts of Vaimauga West, Lefaga, Safata, and Siumu/Falealili being hardest hit. All primary and secondary government schools throughout Upolu were assessed, and 32 primary and 7 secondary were counted within the hardest hits districts. All 27 early childhood education (ECE) centers in these districts were assessed, out a total of 76 throughout Upolu. All 7 mission schools and both private schools in the affected areas were assessed (all of them based within the Vaimauga District).

Some educational institutions are not covered in this chapter as they were expected to be covered under other sectors, including institutions targeting children with special needs, the Oceania University of Medicine, and the arts and crafts institutions. Finally, time restrictions made it impossible to assess the 26 post-secondary education training institutions (PSETs) in Samoa, most of which are located within the Vaimauga West District.

The MESC headquarters, the Nelson Public Library in Apia, and the National University of Samoa (NUS) have also been included in the education sector assessment. The University of the South Pacific was not included.

The overall damages to government primary and secondary schools, mission schools, private schools, ECE pre-schools, NUS, and the public library are estimated at SAT 7.2 million.

Pre-disaster Situation

The education sector budget as a proportion of gross domestic product is 7.6 percent, while the education sector budget was 21.6 percent of the total budget in 2011. For the financial year 2011/12, the most significant areas of spending in the sector were on teaching services and development (35 percent). Grants and loans from development partners account for two-fifths of the sectoral expenditure. In 2012, such funds from AusAid, Asian Development Bank, New Zealand AID Programme, Japan Aid, People's Republic of China, and the European Union contributed 68 percent of the education sector expenditure.

The MESC headquarters is based in the country's capital with a teacher's resource center in Savai'i attached to the national public library at Salelologa. The total number of registered schools in 2012 was 208, of which 166 (80 percent) were government schools, 33 (16 percent) were mission schools, and 9 (4 percent) were private schools. Of the 142 primary schools, 15 percent are based in the Apia urban area, 51 percent are in the Upolu rural area, and the remaining 34 percent are in Savai'i. These schools had an average minimum enrollment of 33 and an average maximum size of 1,337. Of the 24 secondary schools, 5 were based in the Apia urban area, 10 in the Apia rural area, and 24 in Savai'i.

The national standard for the primary school student–teacher ratio is 30:1; for secondary schools the ratio is 20:1. Most government primary schools at the district level have student-teacher ratios below the national standard, except for the districts of Faleata (31:1), Vaimauga (33:1), Aana No. 1 (37:1), and Sagaga (31:1).

For the 2012 school year there were 39,073 primary school enrollments and 16,360 secondary school enrollments. Eighty-two percent of primary school pupils were enrolled in government schools, 13 percent in mission schools, and 5 percent in private schools. In secondary schools, 59 percent were enrolled in government schools, 38 percent in mission schools, and 3 percent in private schools. The female enrolled students edged out their male counterparts in both primary and secondary schools at 51 percent. In the seven most damaged (category 3) government schools affected by Cyclone Evan, 42 female and 16 male teachers were employed, and 433 female students and 517 male students were enrolled. One college was included in this category. In the partially damaged (category 2) schools, 42 female teachers and 16 male teachers were employed, and 490 female students and 420 male students were enrolled. Two colleges were included in this category.

Of the 2,454 teachers employed nationwide, 72 percent are employed by government, 23 percent by mission schools, and 5 percent by private schools. There were 3,491 enrollments under ECE in 2012 taught by 343 teachers under a plethora of religious, private, and community entities. The government teaching workforce is 70 percent female.

MESC works differently with each subsector. Whereas it takes full responsibility for government-run schools in nontraditional villages, its support to district-based schools (also included as government schools) is for operational costs such as staff salaries, curriculum-related resources, and teacher training. An agreement does not yet exist between the ministry and ECE, special needs, vocational, and creative arts education service providers, although the government actively seeks technical support and grants for all subsectors. One such grant is the annual grant that in 2012 provided financial support in the amount of SAT 5 million.

Damage and Loss

Public sector education infrastructure, furniture, equipment, and education materials were destroyed or damaged by Cyclone Evan; included under this item is the partial damage to the Nelson Public Library. Privately owned facilities, including mission and ECE schools, were also destroyed or damaged. Total value of damage was estimated as SAT 7.2 million.

Many public school buildings were used as temporary shelters, and because of overuse by the displaced families sustained damage that needs to be repaired before the start of the next school year. In addition, many schools that were flooded require clean-up of debris, removal of mud, and disinfection before opening of classes in 2013. These additional costs were estimated at SAT 628,000, and are accounted for as losses.

Photos Left: Salamumu Primary School, total rebuild required from foundations up. Right: Faleseela Primary School, Strengthening required for roof structure tie downs. Courtesy of GoS/PDNA Assessment team.

Table 21 shows the estimated values of damage and loss sustained by the education sector.

Table 21. Damage and Loss in Education (thousand SAT)

	Disaster effects			Ownership	
Sector/subsector/component	Damage	Loss	Total	Public	Private
Fully destroyed schools	4,984.0	n.a.	4,984.0	4,984.0	n.a.
Partially damaged schools	690.5	n.a.	690.5	690.5	n.a.
Premises with minor damage	225.4	n.a.	225.4	225.4	n.a.
Partially damaged buildings	206.0	n.a.	206.0	206.0	. n.a.
Mission schools	570.7	n.a.	570.7	n.a.	570.7
ECE schools	545.5	n.a.	545.5	n.a.	545.5
Repairs to schools-cum-shelters	n.a.	286.0	286.0	286.0	n.a.
Debris/mud removal	n.a.	342.0	342.0	342.0	n.a.
Total	**7,221.0**	**628.0**	**7,850.1**	**6,733.9**	**1,116.2**

Source: Estimations by assessment team on the basis of official information.

Note: Schools are assumed to be government schools unless otherwise specified. n.a. = not applicable.

Socioeconomic Effects

Cyclone Evan happened when the 2012 school year had just ended, and fortunately did not interrupt education activities. However, families with children in school did experience negative economic and social effects.

During interviews held by the assessment team with affected families, parents stated their commitment to pay school fees as usual, despite their losses in livelihoods. One family indicated its willingness to sell a pig in order to cover children's school expenditures; this decision may prevent the family from covering future expenditures during the recovery period. During a focus group discussion it was pointed out that most teachers are female, and that when schools are closed, women's income is negatively affected. Another concern expressed by some communities is whether schools will reopen on time in 2013, given that cleaning and disinfection of schools have been deferred and priority given to community and homes, and there was uncertainty about whether the government would provide assistance for getting schools ready.

The following are some examples of what community members are thinking and concerned about:

- "If I need to choose between which children to send, younger children would go to primary, older children would skip college and go to work."
- "The children are the most vulnerable people in the community because they are hard to take care of. They need to be watched and looked after but at the same time we have to get back and start cleaning and rebuilding our houses."
- "The children will be so happy when school starts again because they also would like to get away from the cleaning and the mess at home."
- "They are hard to take care of, children are just young and do not know what is going on. It is hard to forget what they have seen, they got scared and are still scared when it rains heavily."

There is a clear need for psychosocial support for young children to help them deal with ongoing trauma. Some families that were still in evacuation centers reported that they have not returned home because their young chil-

dren are afraid to. The assessment also found other issues of child protection and safety. The toilet/shower blocks for the hostel of a girls' college had safety and security issues, and did not provide adequate privacy for individual girls. According to an organization that supports victims of domestic and sexual violence, the homeless young children it works with need an ECE school, furniture, and learning materials.

Recovery and Reconstruction Requirements

On the basis of the estimated values of damage and loss, the financial requirements needed for post-disaster recovery and reconstruction in the sector have been estimated. They are summarized in table 22.

It has been estimated that public resources in the amount of SAT 628,000 will be required to ensure recovery of schools in time for the start of classes in 2013. This figure includes removing mud and debris and disinfecting schools, as well as repairing those schools that sustained damage when used as temporary shelters. Psychosocial assistance to students and teachers has been included as a need under the health sector, and arrangements are to be made between authorities of the two sectors to ensure its scope and timeliness.

Requirements for reconstruction of the affected infrastructure, equipment, furniture, and education supplies have been estimated at SAT 8.7 million. It should be noted that these amounts include the adoption of disaster-resilient standards for the design and construction of the new schools.

Table 22. Recovery and Reconstruction Needs in the Education Sector (thousand SAT)

	Post-disaster needs	
Post-disaster activities	**Recovery**	**Reconstruction**
Removal of mud from and disinfection of schools	342	n.a.
Repairs to schools used as temporary shelters	286	n.a.
Reconstruction of schools	n.a.	8,666
Total	**628**	**8,666**

Source: Estimations by assessment team on the basis of official information.

Note: n.a. = not applicable.

Key Challenges to Recovery and Reconstruction

Scrutiny needs to be given to the building standards of government schools, particularly with regards to roofing and ceiling fixtures, where the major damage was sustained. This goes for all buildings including sanitation blocks. For district-based government schools, communities are responsible for the buildings and their maintenance. Ensuring that proper building standards filter down to those responsible is vital.

As ECE pre-schools are either homes or village buildings offered as classrooms, MESC and the Planning and Urban Management Agency need to ensure that specific standards are developed so that pre-schoolers are safe within these premises.

Recommendations for Resilient Recovery and Reconstruction

A new school-building design needs to be developed so that classrooms are appropriate for learning in a humid and hot climate, as well as resilient to damage from rain and strong winds. Maintenance requirements for the buildings and sanitation blocks also need to be reviewed so that damage caused by natural disasters is minimized.

Windows should be improved in school buildings to keep rain from coming inside. Many schools did not have window louvers or window panes, which meant rainwater could easily cause damage within the classrooms. Improving windows would also improve ventilation in the classrooms.

Much of the damage to educational materials could have been prevented by water-tight containers for storing items prior to a cyclone and during weekends and holiday periods.

Schools located in low-lying areas should be relocated so that the risk of flood damage is limited. There should also be a further effort to assess the topography of the area to ensure that, with more frequent natural disasters expected, schools are not sitting on an ancient riverbed or floodplain, as turned out to be the case in the Vaimauga West district.

Disaster and Climate Change Resilience in the Education Sector

Disaster and climate change awareness, as well as safety and emergency procedures to be followed in the event of a natural disaster, should be a crucial part of the school curriculum. School committees, school staff, and students should assess their school environment to gauge how vulnerable they are to all relevant natural disasters and their effects, including water shortages, vector problems (for example, mosquitos and flies), and potential problems with access to electricity and emergency health care. Such participatory and practical approaches will develop and strengthen resilience.

The health sector can help to increase climate change resilience through the Health Promoting Schools partnership with MESC. The program identifies a number of ways that schools can become Health Promoting Schools, such as healthy canteens, healthy sanitation blocks, and smoking bans. Incentives such as awards or a grading system may need to be put in place for such initiatives to be effective.

Photo Lefaga Secondary School. Non-engineered building – catastrophic failure. Courtesy of GoS/PDNA Assessment team.

3.7 Housing

Summary

Cyclone Evan and the subsequent flooding it caused brought about extensive destruction in the housing sector of Samoa. The combined impact of strong winds and very high water levels affected 2,088 houses located across the country, though most of the damage was done in limited areas of Upolu. The flooding in houses also resulted in extensive destruction of household goods. Housing damages have been classified into three categories: completely destroyed, partially damaged, and with minimum damages.

About 7,500 people were temporarily displaced (brought into temporary shelters in some cases). Most of them have now returned to their places of residence, where they are living in temporary structures erected using tarpaulins, plastic sheeting, and timber. A few of them are housed with their extended families or friends in very crowded conditions. Homeowners are faced with the immediate priority of rebuilding their houses, and therefore need access to financial resources and technical assistance for their reconstruction efforts.

The overall damage and loss in the housing sector (including household goods) produced by Cyclone Evan are estimated at SAT 43.4 million. Of that amount, the value of damage to housing is SAT 38.4 million. If houses categorized as totally or partially destroyed are to be reconstructed (according to engineering standards and using disaster risk reduction techniques) and houses with minimum damage are to be repaired, the total cost for recovery and reconstruction (including demolition and rubble/debris/mud removal) will ascend to an estimated SAT 50 million.

The immediate priority for the housing sector following this disaster is to rebuild the houses that have collapsed or suffered extensive damage. Given the scale of damage—around 600 houses require reconstruction or major repairs—a program organized to rebuild these houses will realistically last two years. It is recommended that the reconstruction process follow a well-coordinated, owners-driven ("people's process") approach. It is also very important that the reconstruction process be closely monitored in order to ensure that pre-disaster vulnerabilities are not recreated. Homeowners should take the main responsibility for the effort, and the government should play a catalytic, facilitating role. Technical advice for reconstruction should be provided to allow home owners to build back better using disaster-resilient standards.

When hazards turn into disasters, recovery and reconstruction retard general developmental trends. Paradoxically, disasters can also be an opportunity. Recovery phases offer a unique chance to revisit past practices and rewrite policies affecting future development in disaster-prone areas. A range of mitigation measures can be incorporated during reconstruction to promote vulnerability reduction. Beyond the physical aspects of rehabilitation, the recovery period also offers an opportunity for the society at large to strengthen local organizational capacities, and to promote networks, awareness, and political mechanisms facilitating economic, social, and physical development long after a disaster—that is, to build its own sustainability.

Pre-disaster Housing Baseline

The 2011 Census of Population and Housing provides the baseline information on housing in Samoa. According to the census, there are a total of 51,240 houses that are enumerated as owned or rented by the households. While the census classified 12 different types of dwellings in Samoa (described below), there are two broad categories of houses—European style and Samoan.

Samoa has undergone a rapid transition in terms of housing characteristics. As the majority of houses earlier were Samoan, the unmistakable trend suggests that as people earn higher incomes they prefer to build European-style houses. The housing data show that more than two-thirds of buildings constructed in Samoa are of European type (68 percent) while 31 percent are of traditional Samoan type. Within the category of European-style houses, open European house is the most popular (22.3 percent), followed by closed European house (13.6 percent), and open European house with extension (10.1 percent).

Within the category of Samoan houses, the most popular type of house is *faleo'o*, which constitutes 24 percent of all Samoan houses. The *faleo'o* (small house), traditionally long in shape, was really an addition to the main house at the back of the main dwellings. In modern times, the term is also used for any type of small and simple *fale*, which is not the main house of dwelling.

Fale is the Samoan word for all types of houses, from small to large, and serves as prefix for all the different types of house—*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*),etc.

The architecture of Samoa is characterized by openness, with the design mirroring the culture and life of Samoan people. Most of the traditional houses have an oval or circular shape, with wooden posts holding up a domed roof. There are no walls. The base of the architecture is a skeleton frame. [29]

A slightly dated report (2006) prepared by the Beca International Consultants Ltd. for the government of Samoa suggests that Samoans' housing is reasonably well insured.[30] There are no official figures, but insurance companies suggest that 50 percent of homes are insured, with half of them taking a disaster extension. These figures were confirmed in interviews with architects and structural engineers in the city of Apia. About 25 percent of households have contents insurance. The government shows a good example by insuring most of its property, the major buildings through a centrally administered policy. By international standards, these are quite high take-up rates of insurance. However, *fales*, the most popular type of houses in rural areas, are not insured.

Damage and Loss

The physical survey of housing damages was carried out by the Ministry of Works, Transport and Infrastructure and the Samoa Bureau of Statistics. The affected housing units have been categorized as follows:

Type 1: Completely damaged and unsafe for further occupation
Type 2: Partially damaged and considered unsafe for further occupation
Type 3: Minimal damages sustained and considered safe for occupation

In addition, the houses were divided into the 12 different types of structures described in the 2011 Population and Housing Census. Data for the number and type of houses were ascertained from the same source. For each category of damages, the number of affected housing structures was determined in the field survey.

[29] Wikipedia, "Architecture of Samoa," http://en.wikipedia.org/wiki/Architecture_of_Samoa.
[30] Beca International Consultants Ltd., *Disaster Insurance for Samoa*, July 2006.

Table 23 shows the number of affected housing units in each district by damage category.

Table 23. Number of Affected Housing Units, by Damage Category

	Number of affected housing units			
District	Totally destroyed	Partially damaged and unsafe	Minor damage only	Total
Aiga I Le Tai	3	1	4	8
Aana Alofi 3	0	1	1	2
Aana Alofi 2	0	0	0	0
Aana Alofi 1	1	1	0	2
Sagaga Le Falefa	1	1	4	6
Gagaemauga	0	0	0	0
Sagaga Le Usoga	0	0	0	0
Faleata West	0	4	4	8
Faleata East	1	6	34	41
Vaimauga West	38	69	715	822
Vaimauga East	2	3	25	30
Anoamaa West	15	16	29	60
Anoamaa East	7	7	36	50
Vaa o Fonoti	12	11	8	31
Aleipata I Lalo	0	0	0	0
Aleipata I Luga	0	0	0	0
Lepa	1	0	0	1
Lotofaga	3	3	3	9
Falealili	25	13	46	84
Siumu	42	58	120	220
Safata	43	54	252	349
Gagaemauga 2	1	7	24	32
Lefaga ma Faleseela	26	54	124	204
Falelatai ma Samatau	9	25	30	64
New households	23	19	23	65
Total	**253**	**353**	**1,482**	**2,088**

Source: Estimations by assessment team using official information.

The assessments were conducted in three successive rounds. After each round, the data were corrected. During the final round, the category of damages (table 23) and type of housing affected (table 24) were verified and validated, along with cost of replacing the damaged housing (table 24). The physical survey of damages was carried out meticulously, and the Bureau of Statistics used satellite images to verify the location and condition of houses.

The number of houses damaged by Cyclone Evan is 2,088, out of which 253 are in the type 1 category, 353 in type 2, and 1,482 in the residual category of type 3. Thus the number of houses that were seriously damaged by the cyclone and need reconstruction is 606 in total (see table 23).

Damages are concentrated in a small number of districts. This should enable a more systematic approach to reconstruction support for the affected families. The most affected district is Vaimauga West in the north, followed by Safata and Siumu in the south. Anoamaa West, Falealili, Lefaga ma Faleseela, and Vaa o Fonoti are the other districts that have experienced significant housing damages.

Table 24. Categories of Housing Units and Replacement Costs

Category	Area (m^2)	Unit cost (SAT/m^2)	House value (SAT)
Open Samoan *fale*	90	200	18,000
Open Samoan *fale*	120	250	30,000
Closed Samoan *fale*	90	250	22,500
Closed Samoan *fale* with extension	120	250	30,000
Open European	90	400	36,000
Open European with extension	120	400	48,000
Closed European	90	800	72,000
Closed European with extension	120	800	96,000
Closed European, 2 floors	190	1,000	190,000
Samoan *fale*, 2 floors	190	800	152,000
Faleoo	25	250	6,250
Falepa Latiti	25	250	6,250
N.D.			**58,917**

Source: Estimations by assessment team using official information.

The value of damages was estimated on the basis of the actual cost of construction (in tala per square meter of surface area) for the different house styles, as determined by local engineering construction experts. The cost has been applied 100 percent to type 1 (completely destroyed) houses. For all houses included in type 2 (major damages), 50 percent of the replacement cost has been applied, while for the houses in type 3 (minor damages), 15 percent of the replacement cost has been applied. In addition, estimates were made of the value of destroyed household goods that could not be salvaged.[31] The total value of damages was estimated at SAT 38.4 million (see table 25).

Table 25. Estimated Damage and Loss Caused by Cyclone Evan in the Housing Sector (thousand SAT)

	Damage	Loss	Total
100% of destroyed housing unit cost	9,616.0	n.a.	9,616.0
50% of significantly damaged housing unit cost	9,001.4	n.a.	9,001.4
15% of damaged housing unit cost	14,830.2	n.a.	14,830.2
Destroyed household goods	4,903.7	n.a.	4,903.7
Demolition and rubble/mud removal	n.a.	1672.4	1,672.5
Temporary shelter costs (already spent)	n.a.	1,602.9	1,602.9
Rental losses	n.a.	1,728.0	1,728.0
Total	**38,351.3**	**5,003.3**	**43,354.5**

Source: Estimations made by assessment team on the basis of official and private information.

Note: n.a. = not applicable.

[31] For this purpose, use was made of information on the type and number of typical household goods as described in the most recent Household Income and Expenditure Survey conducted by the Samoa Bureau of Statistics, and current unit market prices were used to estimate their value.

It is important to note that the government of Samoa reacted immediately after the disaster, setting up 34 shelters and evacuation centers that accommodated more than 7,500 people for a period of 22 days. Temporary shelter assistance such as tents and tarpaulins, tool kits, hygiene kits, kitchenettes, and household items were also distributed to families leaving evacuation centers as well as those confirmed as type 1 and type 2 based on damage to houses. The total expenditure incurred on the provision of temporary shelter was estimated at SAT 1,602,876, which is classified as loss.

Further losses were estimated, including the cost of removing debris and mud to the side streets[32] and the value of rental losses for the destroyed and damaged housing units that were under rental agreements.[33] When these are included, the total value of losses for the sector comes to SAT 5.0 million (see table 25).

The overall damage and loss in the housing sector (including household goods) produced by Cyclone Evan is estimated at SAT 43.4 million.

Performance of Buildings

The wind hazard and the flash floods affected houses in two ways. They caused some houses simply to crumble, and they also caused a large number of houses to lose their roofs. It must be noted here that the majority of houses damaged in this disaster are of European style. These can be further categorized as belonging to one of four different styles: open European, open European with extension, closed European, and closed European with extension. Among the Samoan house types, the two types that were most affected are *faleo'o* and *falepa latiti*. These are inexpensive structures, not always part of the main dwelling place, and easier to reconstruct with local building materials.

Most of the European houses seemed to be non-engineered construction. They did not have foundational strength as reflected in adequate depth and weight to resist uplift. Most of them had been constructed in soft ground with inadequate shear friction resistance to prevent the pile from being pulled out of the ground. The connections between floor and walls and between floor and bearer seemed to be weak.

Lateral support by ceiling joists was inadequate in these houses, which allowed the roof and walls to be blown away. Internal walls were also blown over because of inadequate fixing. However, the most common damage involved loss of roof with the walls still standing. There could be several reasons for the failure of roof: the rafter or truss might not have been adequately tied down to the top plate; there might have been a lack of bracing, causing the collapse of trusses longitudinally; the ridge beam might have been improperly tied down to the foundation structure; or there might not have been enough fasteners through the roofing material.

In these European houses, some of the Samoan features, which favor openness, have been included. So the openings provided through doors and windows in these structures are unusually large. However, they are not supported through lintel beams or other reinforcements. These openings make the structure asymmetrical, incapable of bearing load. Thus any external pressure through shaking could cause these houses to collapse without much resistance. In brief, there are few reinforcements in these European-type houses.

[32] The cost of debris and mud removal to the side street was estimated as 5 percent of the cost of affected houses; the cost of debris and mud removal from the side street, for disposition in places where no damage to the environment would ensue, has been estimated under the environment sector assessment.

[33] Data on average number of housing units under rental agreement available in the most recent housing census for Samoa were used to estimate these rental losses, together with an average value of monthly rental over a period of two years required for reconstruction.

Many of the houses in the Apia urban area have no height of plinth. This oversight allowed the flood water to enter these houses even at a low level of flooding. Construction in a floodplain requires considerable care and regulation, but these have been absent or not enforced in the city of Apia.

Most of these European houses seem to have been constructed with the help of local carpenters or craftsmen and without any engineering design. Their origins showed clearly in the inadequacy of their design, execution, and performance. The problems caused by poor engineering and design are likely to worsen in the future, if they are not addressed on an urgent basis. At the very least, it is important that any reconstruction process consider elevation techniques.

Socioeconomic Effects

Households that have lost their houses have suffered a visible decline in the quality of life and well-being. Though they have erected temporary structures near their old house, and are living there, they are faced with the problems of a lack of space, congestion, and poor hygiene. In the heavy rains, their living conditions become even more precarious. The loss of household goods has created a sense of deprivation and stress.

Access to financial resources for purchase of building materials is an important constraint, as mentioned by the homeowners in interviews and focus group discussions. Some affected homeowners mentioned that they would get timber from their own plantations if needed. However, the quality of timber obtained through these plantations is not adequate (because not treated). Treated timber is generally imported and hence more expensive than untreated.

One of the options for better living conditions is for the households to relocate to a safer site. The prime minister of Samoa has called for people to relocate to higher ground. However, the availability of land is a critical issue that needs to be addressed to make the option of relocation feasible. The extent of freehold land is limited in Samoa. Further, in urban areas, where freehold land is available, purchase of land would require huge resources, which households affected by floods would find it difficult to manage. In the rural areas, most of the affected families have houses on their own land. They would find it difficult to get alternative land, as customary land cannot be sold. Most of the households seem to favor in situ reconstruction, as it is the easiest and most affordable option for them.

Recovery and Reconstruction Requirements

The total cost for recovery and reconstruction of the housing sector includes the reconstruction of totally and partially destroyed houses (according to engineering standards and disaster risk reduction techniques), the repair of houses with minimum damage, and the replacement of household goods. The total needs for recovery and reconstruction are estimated at SAT 50.0 million (see table 26).

Table 26. Estimated Post-disaster Requirements for Recovery and Reconstruction (thousand SAT)

Activities	Recovery	Reconstruction	Total
Demolition and debris/mud removal	1,672.4	n.a.	1,672.4
Development and transfer of reconstruction standards	500.0	n.a.	500.0
Housing reconstruction of totally destroyed homes	n.a.	14,502.5	14,502.5
Housing reconstruction of partially damaged homes	n.a.	13,548.7	13,548.7
Repairs to housing units with minor damage	n.a.	14,850.2	14,850.2
Replacement of household goods	n.a.	4,903.7	4,903.7
Total	**2,172.4**	**47,805.1**	**49,977.5**

Source: Estimations made by assessment team on the basis of damage and loss.

Note: n.a. = not applicable.

The recovery and reconstruction requirements/recommendations based on the assessment can be classified into two broad categories: immediate, and medium to long term.

Immediate Requirements

The immediate recommendation and need is to reconstruct and repair all the houses that are completely destroyed or partially damaged. Reconstruction and repair can proceed through a well-planned effort, based on an owner-driven (people's process) approach with full, active participation of the affected community. Disbursement of supporting funds can be done according to advance of work, and technical support can be provided at each stage. The reconstruction or repairs could be completed within a one- or two-year period.

Governments provide support for reconstruction all over the world in several ways: (a) financial assistance; (b) implementation arrangements with nongovernmental organizations (NGOs); (c) tie-up with financial/housing institutions for soft credit; and (d) technical assistance. Financial assistance is provided on the strength of the fiscal resources that governments command, so it is of varying levels across the countries. In the Asia-Pacific region, such cash assistance has varied between US$500 and US$5,000 for each household (Indonesia, Pakistan, and India). In some countries, there is no direct disbursement of cash assistance to homeowners, and assistance generally consists of free provision of a specified quantity of building materials (Bhutan).

Governments have also tied up with international and national NGOs to deliver housing to the people rendered homeless by disasters. In these cases NGOs work with the homeowners and assist them in reconstruction. Sometimes, the NGOs construct the houses themselves, while in many cases they provide cash assistance and technical support to the homeowners (Indonesia, Sri Lanka). In all cases, governments provide technical assistance to homeowners for safe reconstruction. Governments also provide concessions (tax relief and waivers) for provision of building materials. Proven good practice ensures the active engagement of male and female householders. The objective is to build back better.

In view of the Samoan tradition in house building, which is based on family and community efforts, an appropriate reconstruction strategy would largely consist of supporting the homeowners directly. The experience and lessons of reconstruction following the 2009 tsunami would also be a useful guide to developing the strategy. The government of Samoa should consider supporting a reconstruction program on an immediate basis.

Samoan homeowners affected by Cyclone Evan have invariably indicated that they need immediate access to financial resources. Such access could be provided through cash assistance, or soft loans, or subsidized building materials.

It is important to recognize that homeowners provide a lot of resources for the reconstruction effort through their own savings. Across the recovery programs, it is observed that the governments provide just 30 to 35 percent of the requirements through cash assistance, while about 65 percent of resources are contributed by the homeowners themselves. In Samoa, there is a communal tradition of house building, which would also be very helpful in organizing the process of reconstruction. It could be effectively used to assist women-headed households.

Along with the financial resources, the government needs to provide technical assistance to homeowners to ensure they rebuild houses in accordance with the National Building Code. This assistance would consist of engaging a few engineers and architects to work directly with homeowners. They would provide technical assistance through preparation of building designs and plans, and would help homeowners to implement them in accordance with industry standards. They could also assist with site preparations and provision of civic amenities such as sanitation. (Reconstruction offers an important opportunity to strengthen sanitation practices in the rural areas.) The construction of houses could be regularly supervised, and a wider awareness could be created about improving building skills and standards in Samoa.

As the government has identified all the affected homeowners through the survey, it is important that assistance be provided to them in a transparent and equitable way. There should be direct communication with the homeowners, which is very much feasible in Samoa. Couples and women-headed households should be included in the dialogue, and the program should be implemented in a way that has demonstration impact on the wider community.

Medium-Term Requirements

The present housing stock, which has come into existence through transition to European-type housing, is highly vulnerable. In future disasters, the impact on these houses could be very severe. It is important to address the source of physical vulnerability in several ways through the context of the recovery and reconstruction program.

The National Building Code, which was prepared with the assistance of Australia, dates back to 1992. The building code must be revised and updated in view of emerging building needs in Samoa. The new/updated building code should be adopted formally by the government through legislation. Certain features of building codes should be mandatory, and the oversight mechanism for implementation of these codes needs to be strengthened.

In several key informant interviews practicing architects and engineers in Samoa mentioned that the building plans that are approved are not implemented. In other words, the actual building often varies considerably from what is contained in the original plan. Building inspections are not conducted diligently, and often standards are compromised. It is necessary to strengthen the oversight mechanism for the building industry, and ensure that buildings constructed are properly engineered. There is a further need for overhaul of construction standards and practices in Samoa; the urgency of this need has been established by two successive disasters—the 2009 tsunami and Cyclone Evan.

Home insurance has taken off in Samoa. As homeowners have opted for insurance, which covers the peril of disaster, it is now the right time to expand it further. The insurance base among homeowners could be expanded in a very short time, both through government incentives and through necessary policy support to the insurance companies. There are at least three insurance companies in the private sector that could lead the expansion of insurance among homeowners. A key element of this expansion would be to link insurance policies to implementation of certain mitigation measures in respect to these houses.

A broader study looking at the entire housing sector in Samoa and identifying critical policy and technical issues related to building design, regulations, and enforcement would be a very useful contribution. Such a study would provide a basis for long-term development of the housing sector in Samoa.

Key Challenges to Recovery and Reconstruction

Implementing a housing recovery and reconstruction program requires more than disbursement of assistance to homeowners. It has a strong organizational and technical aspect, and requires a system through which financial and technical assistance can be provided to homeowners in a well-defined time frame. All the homeowners who are included in the database should receive assistance, with no misallocation of resources.

Similarly, technical assistance should be provided on a consistent basis through different stages of reconstruction. A range of technical resources—engineers, architects, masons, and carpenters—should be available. Organizing these technical resources in an integrated setup could be a challenge for Samoa, given its thin technical resource base.

Communication with homeowners, and specifically the need to convince them of the importance of good building practices and standards, will also be an important challenge for a recovery and reconstruction program. Homeowners may be keen to rebuild their houses in the shortest possible time, and may not adhere to the necessary engineering standards. It will be important to convince them of the imperative of building back better. It will be useful to discuss with community leadership the essential preparations for reconstruction of houses.

Enhancing Disaster Resilience in the Housing Sector

The level of physical vulnerability in Samoa has become higher because of climate change and increased incidence of hydrometeorological disasters. Seismic risks are also a very pronounced risk, as evidenced by the 2009 tsunami. It is necessary, therefore, to improve physical planning and building practices to enhance disaster resilience in Samoa.

In addition to updating building codes, as discussed earlier, it is important to prepare a land use plan for Samoa. As the country earns its major income from coastal tourism, such a land use plan would be very helpful in maintaining ecological balance. The areas for residential settlements should be clearly earmarked. Indiscriminate construction in riverbeds and floodplains, which caused havoc in the wake of flooding this time, needs to be stopped. Though people prefer to live in coastal areas, regulation of settlements in coastal areas would maintain the pristine beauty of Samoa's coastline and its fragile ecological balance.

It would be very useful to develop a technical assistance program designed to encourage homeowners in Samoa to undertake retrofitting of their houses. There are a number of measures that would strengthen existing houses and enable them to better withstand wind hazards and earthquakes. The floors and walls could be better tied, roof framing could be improved considerably, and braces and reinforcements could be introduced to improve structural performance of these buildings. A major housing improvement initiative, largely consisting of engineering services, would significantly improve disaster resilience in Samoa.

Building practices and standards in Samoa need to take into consideration the country's traditional architecture, local building materials, and community-oriented life style. Samoa has a rich building tradition as embodied in different variations of *fale*. It is important to infuse its new construction of European-type houses with these building traditions. Reviving the traditional building skills, upgrading the skills of Samoan craftsmen, and strengthening indigenous architecture would be important steps in increasing disaster resilience. It must be remembered that Samoan houses were not much damaged in Cyclone Evan.

In Samoa, the builders of houses were also the architects, and they belonged to an exclusive ancient guild of master builders, *tufunga fau fale*. The Samoan word *tufunga* denotes the status of master craftsmen who have achieved the highest rank in skill and knowledge in a particular traditional art form. It would be important to revive the skill base as embodied in these groups through appropriate incentives and encouragement.

3.8 Cultural Heritage

Summary

This section assesses the impact of Cyclone Evan on cultural heritage in the areas affected by the disaster. Some 10 cultural heritage sites and facilities were assessed using the damage and loss assessment (DALA) methodology guidelines on cultural heritage. The overall damages sustained to cultural heritage were assessed as moderate, although there are several landmarks of Samoa that suffered severe damages. The historic buildings of most concern are the Robert Louis Stevenson Museum (RLSM) and the Old Courthouse. Damages at RLSM are mostly to the botanical garden surrounding the museum. In the Old Courthouse, water leakage from the damaged ceiling continues to affect the floor in the building. The assessment also highlights the damage and loss relating to the integrity and authenticity of the Fagaloa–Uofato protected area.

Overall, the assessment shows the vulnerability of cultural heritage arising from the lack of cultural policy, from the limited capacity in disaster response activities, and from the lack of awareness of Samoan cultural heritage's unique value. Although Samoa is known for its cultural strength, the disaster has made Samoan traditional culture vulnerable—both through direct damages and through losses that may be incurred in carrying out post-disaster development projects that do not adequately factor in cultural values. Weakened by the disaster, Samoan cultural heritage is in need of urgent safeguarding. Proculture responses are needed, as are measures targeted for transmission and revitalization of culture in tandem with relief and reconstruction. Keys to success for culturally sensitive and appropriate recovery lie in community participation and the commitment of traditional leaders and the government.

Pre-disaster Situation

The traditional chieftain or Matai system is a key element in Samoan traditional culture. This system plays a dominant role at the village and the national level, and is widely considered to contribute towards national stability. The traditional governance system works 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 the Samoan way through the village committees. This unique governance blending traditional and modern systems contributes to social cohesion.

The cultural heritage of Samoa is valued not only as the foundation of people's identities and community continuity, but also as an important tourism resource; the Samoa Development Strategy 2012–2016 identifies heritage-based tourism as a potential growth area (key area 4 on sustainable tourism).

The culture sector of Samoa as part of national administration is managed by the Ministry of Education, Sports and Culture (MESC), while the Ministry of Natural Resources and Environment (MNRE) is entrusted with protecting nature and heritage sites. The draft cultural policy prepared by MESC awaits a formal endorsement by the government. Since 2010, MESC has organized a series of consultations and community hearings on the safeguarding of intangible cultural heritage (ICH) in Samoa and Samoa's ratification of the ICH Convention. Although an interministerial Heritage Committee was established, and representatives of civil society are able to serve on this committee, its activities have been focused on environmental heritage until now, leaving issues of the preservation of historic heritage sites and infrastructure largely unattended. However, when some of the important historic buildings in Samoa, including the Old Parliament and the German Hospital, were demolished in 2012 because of rapid urban development, an opportunity arose for nationwide reflection on and debate over the value of historic monuments and sites at both government and community levels.

Damage and Loss & Recovery and Reconstruction Needs

Traditional Samoan *Fale* in Vaimoso

Pre-disaster situation. From a heritage perspective, the traditional Samoan settlement at the village level represents a unique cultural space for community life. The different types of the traditional Samoan *fale*, or open house, are associated with different social functions—there is the *fale tele* or guest house, the *fale afolau*, or long house, the *fale umu* for cooking, and the smaller *fale* for family members to live in as vernacular housing. The different houses are laid out in accordance with traditional patterns and protocols.[34] The authentic Samoan *fale* is rapidly disappearing in the cultural landscape of Samoa, as the master craftsman, or *tufunga*, is passing away without transmitting knowledge and skills to younger generations. The traditional *fale* in Vaimoso with long thatched roofs is one of only a few representatives of the traditional Samoan *fale* in Samoa.

Damage and loss. Two old trees were blown down by high winds during the cyclone. Damages were sustained by the foundation of the *fale* and the roof. The foundation damage creates the risk of the building collapsing. Five holes were created in the roof, causing water leakage that has affected the intricate decorative works inside the house as well as the building structure and that is accelerating decay of materials.

Recovery and reconstruction needs. Downed trees must be removed to safe places. Restoration of the foundation, rafters, posts, and roofs of the building is urgently needed. Other needs include replanting of trees and installation of a security alarm system.

The Old Courthouse

Pre-disaster situation. Designed and built in 1902, the Old Courthouse in Apia opened in 1903 as a courthouse for the German colonial administration in Samoa. It was taken over by the New Zealand occupying forces in 1914 and used as their administration office. It became the Samoan government's own courthouse and seat of the prime minister after the independence of Western Samoa in 1962. The building was in use without interruption until 2010, when a new Ministry of Justice building was erected for the Samoan government in Mulin'u. Today, the Old Courthouse is one of the few remaining timber structures of German colonial design that exists anywhere in the world. The Trust for the Old Courthouse in Apia was established in 2010. With support from the German and New Zealand governments and with technical assistance from Unitec Institute and Archifact Ltd. in Auckland, a feasibility study for the preservation of the Old Courthouse was carried out and the result of the study put on display at the August 2012 exhibition in Apia. The conservation plan has been finalized, and the total cost is estimated at around SAT 6 million.

Damage and loss. Direct physical damage was sustained by the roof of the Old Courthouse in Apia. The building suffers from water leakage in four rooms and the second-floor balcony. This leakage will continue to cause accelerated decay of the timber structure of the building unless the damage is repaired.

Recovery and reconstruction needs. Recovery and reconstruction needs include removing debris and dirt; repair and reroofing of the building to stop water leakage are urgently needed. The conservation plan, which includes a fire alarm system, should be implemented.

[34] UNESCO, *The Samoan Fale* (Bangkok: UNESCO, 1992).

Robert Louis Stevenson Museum

Pre-disaster situation. One of the most important tourist attractions of Samoa is the RLSM in Vailima. Robert Louis Stevenson is famous for his many writings, including *Treasure Island* and *The Strange Case of Dr Jekyll and Mr Hyde*. Originally from Scotland, he spent his last years in his home in Vailima before he passed away in 1894 at the age of 44. He is buried in a tomb on top of Mount Vaea in Vailima, at a spot overlooking the sea. The building is owned by the Samoan government and is leased to the U.S.-based RLSM Foundation. The foundation restored the building and opened it to the public as a museum in 1994.

Damage and loss. The building itself escaped major damages with only minor harm to its balcony and gutter. The fence was damaged by some big trees that were blown down, and the botanical garden surrounding the museum was also damaged. Revenues from entry fees have declined. At this stage the track to Robert Louis Stevenson's grave site on the top of Mount Vaea is closed and impassable due to fallen trees.

Recovery and reconstruction needs. Fallen trees must be removed. The damaged fence and walking track are in urgent need of repair. The disaster risk reduction plan must be upgraded and should include an evacuation center for cultural objects and production of a replica as part of a conservation project planned for 2013 by the foundation.

Museum of Samoa

Pre-disaster situation. The Museum of Samoa is a national museum housed in a timber structure built during the early 1900s by the German administration. The museum is open to the general public free of charge on weekdays. The museum displays cultural objects that illustrate the history of Samoa as well as environmental objects and objects from the Pacific region more generally.

Damage and loss. No major damage was sustained by the Museum of Samoa, although a computer server in the staff room of the museum was affected by water leakage.

Recovery and reconstruction needs. Dirt must be removed and the museum must be cleaned. The office information system needs to be repaired. Disaster risk reduction measures need to be upgraded, including upgrading the alarm system and creating an evacuation space.

Traditional Samoan *Fales* at Aggie Grey's Hotel in Apia

Pre-disaster situation. The assessment of Aggie Grey's Hotel in Apia as a tourist accommodation is presented separately under the tourism sector assessment. This section focuses on the hotel as a landmark in Samoa. Aggie Grey (1897–1988), the daughter of William Swan, an English chemist, and his Samoan wife Peleis, was an hotelier and founder of Aggie Grey's Hotel (1933). The old building was damaged and reconstructed in 1989. Behind the main building there are three traditional Samoan *fales*. The most remarkable *fale* adjacent to the swimming pool was constructed in 1968 by *tufunga*. Entering the *fale* and gazing up, one can admire long, curved round rafters known as *fau*, which provide the rounded shape of the end of the *fale*. This architectural complex was a living museum showcasing Samoan traditional craftsmanship.

Damage and loss. The wooden structures and roofs of the traditional Samoan *fales* were damaged by the floods caused by the overflow of the Vaisigano River nearby. Lashings made of a braided coconut fiber rope, which bind wooden elements and add decorative elements, were also affected. Cultural shows performed with the participation of local employees of the hotel, and a buffet serving traditional Samoan cuisine, were suspended.

Recovery and reconstruction needs. Recovery and reconstruction needs include removal of debris and dirt. Cleaning and repair of the roof, lashings, wooden posts, and sculptures are urgently needed, and conservation work must be done on damaged roofs, rafters, lashings, and posts. The restoration process should be documented with a view to strengthening ICH transmission.

Samoa Cultural Village

Pre-disaster situation. The Samoa Cultural Village (SCV) was established in the Samoa Tourism Authority compound in Apia in October 2012 as a place to provide tourists with a glimpse of genuine Samoan life. Tourists visiting SCV can enjoy demonstrations of traditional weaving, tattooing, and carving as well as traditional *umu* or "earth oven" cooking. No entry fee is charged.

Damage and loss. One of SCV's traditional *fales* for crafts demonstrations was entirely collapsed, and the demonstration program was suspended after the disaster. Craftspeople who came to SCV from remote villages for crafts demonstration are now on standby.

Recovery and reconstruction needs. Recovery and reconstruction needs include removal of debris and dirt, as well as repair of the damaged roofs and displaced cultural assets. The affected craftspeople should be given financial/in-kind support. Disaster reduction measures, specifically covering the thatched roof with wire netting, should be taken.

Fagaloa Bay–Uafato Tiavea Conservation Zone

Pre-disaster situation. A party to the World Heritage Convention of the United Nations Educational, Scientific and Cultural Organization (UNESCO), Samoa has two sites—the Fagaloa Bay–Uafato Tiavea Conservation Zone and the Manono, Apolima, and Nuulopa Cultural Landscape—that are on the Tentative List for inclusion on the World Heritage List as mixed sites. This report focuses on the Fagaloa Bay area, since it has not been possible to visit and assess the Apolima/Manono islands.

Fagaloa Bay is located in Uafato Conservation Zone in the northeastern part of Upolu island. The area is geographically isolated; it has one of the largest rain forests in the Pacific and contains some of Samoa's endemic flora and fauna and marine resources. The traditional lifestyle under the Matai system remains largely intact here due to the area's isolation. The area is rich in ICH. The archaeological remains of Lapita pottery fragments have been found at the site of Fagaloa Bay. Several community consultations have been carried out by MNRE since 2006, when the site was put on the Tentative List for future World Heritage nomination. A tourism development plan for the area is under development by the Samoa Tourism Authority.

Damage and loss. The damage and loss related to the environmental aspect of the area are assessed under a separate section of the report. This section thus focuses on the cultural aspect of the area. The cultural elements of the site, such as dwellings for villagers, village open houses, and churches, were affected by the cyclone. The metal roofs of some houses were blown away, while the few remaining traditional Samoan *fales* appear to have survived with relatively minimal damages. Uafato Village is famous for its wood carvings and is one of the largest suppliers to the handicraft market in Apia. The craft activities in the village were interrupted by the cyclone.

Recovery and reconstruction needs. Recovery and reconstruction needs include removal of debris and dirt, repair of damaged roofs, and conservation and restoration of village *fales*, which need reroofing, repainting, or rethatching. There should also be international cooperation in a project for "Community-based heritage villages/towns conservation for sustainable development in the Pacific." This project seeks to (a) build capacity for developing nominations

for international recognition by UNESCO conventions; (b) prepare management/safeguarding plans, including disaster risk reduction and tourism management plans;[35] (c) build capacity in community-based landscape management of heritage villages/towns and share experiences with other heritage villages/towns in the Pacific and East Asia; and (d) revitalize traditional craftsmanship through an international meeting of expert thatchers.

Beautiful Expression of Nature (BEN) Workshop

Pre-disaster situation. Beautiful Expression of Nature was an art school established by sculptor and artist Papali'I Penehuro Papali'i. The workshop at Lelata was established in 1996 and provided a venue for artistic and creative activities as well as vocational training for some 20 young artists annually. Prior to the cyclone, BEN was in the process of moving works of arts in the Lelata workshop to a new center at Vaitele for exhibition.

Damage and loss. Twenty paintings, 30 small wood carvings, and five medium-size wood carvings stored in the workshop near the Vaisagano River at Lelata were completely destroyed when heavy floods demolished the workshop. Mr. Papali'I was reluctant to provide the estimate of damages, saying that his artistic activities were based not on commercial interest but on the pleasure of being creative and on his pride in Samoa's beautiful nature and culture. Three computers, one printer, numerous carving tools, various textbooks, and the library were also affected.

Recovery and reconstruction needs. Debris and dirt must be removed and the remaining damaged works of arts rescued. The Vaitele center should be enhanced by building basic facilities for educational activities. A disaster risk reduction plan, including fire alarm system, should be developed.

Samoa Ocean Canoe Association

Pre-disaster situation. Two paddling clubs in Samoa operated paddling activities with *vakas*, or traditional ocean canoes, owned by the Samoan government and leased through the Samoa Ocean Canoe Association. *Vakas* are considered cultural assets representing the traditional navigation that Pacific Islanders have practiced since ancient times.

Damage and loss. The paddling clubs lost 5 *vakas* in the cyclone.

Recovery and reconstruction needs. Recovery and reconstruction needs include removal of debris and dirt, cleaning of the premises, and replacement of the lost *vakas*.

Community Infrastructure: Village Churches and Family Grave Sites

Pre-disaster situation. Village churches are important institutions supported by the community. The pastor or minister exerts significant influence on the decisions of his followers. The respect the church earns from the community is high. Other community infrastructure includes family grave sites, which in Samoa are located close to houses or within the family compound.

Damage and loss. Village churches in the affected area sustained damage. Several family graves were affected by the cyclone, causing physical and emotional losses to the affected persons and families.

Recovery and reconstruction needs. Debris and dirt need to be removed, and the affected areas need to be cleaned. Trees need to be replanted, and a disaster risk reduction plan needs to be devised.

[35] UNESCO, *Managing Disaster Risks for World Heritage*, 2010, http://whc.unesco.org/uploads/activities/documents/activity-630-1.pdf.

Damage and loss for the sector are summarized in table 27.

Table 27. Estimation of Damage and Loss in the Cultural Heritage Sector (thousand SAT)

	Disaster effects			Ownership	
Sector/subsector/component	**Damage**	**Loss**	**Total**	**Public**	**Private**
Traditional Samoan *fale* in Vaimoso	200.0	10.0	210.0	n.a.	210.0
Old Courthouse	700.0	10.0	710.0	710.0	n.a.
Museum of Samoa	4.0	2.0	6.0	6.0	n.a.
Robert Louis Stevenson Museum	25.0	30.0	55.0	55.0	n.a.
Aggie Grey's Hotel–Traditional *fale*	40.0	50.0	90.0	n.a.	90.0
Samoa Ocean Canoe Association	25.0	1.0	26.0	n.a.	26.0
Fagaloa Bay–Uafato protected area	90.0	10.0	100.0	n.a.	100.0
Samoa Cultural Village	50.0	10.0	60.0	60.0	n.a.
Beautiful Expression of Nature	30.0	10.0	40.0	n.a.	40.0
Community infrastructure	120.0	10.0	130.0	n.a.	130.0
Total	**1,284.0**	**143.0**	**1,427.0**		

Source: Estimations made by assessment team on the basis of official and private information.

Note: n.a. = not applicable.

Socioeconomic Effects

Cultural heritage has strong symbolic value for the nation and communities, and it is essential for ensuring social cohesion. Projects for the restoration of affected cultural heritage will provide an opportunity for collaboration and bring displaced community members together.

Moreover, further losses in the cultural sector may occur if post-disaster development projects do not adequately factor in cultural values. Recovery and reconstruction of all sectors in the post-disaster phase must be carried out in a culturally sensitive and appropriate manner.

Key Challenges to Recovery and Reconstruction

Samoan cultural heritage must be safeguarded, both through pro-culture responses and through measures that seek to transmit and revitalize culture while meeting relief and reconstruction needs. The assessment of the sector shows that the vulnerability of Samoa's cultural heritage is due primarily to the lack of cultural policy and strategy, the limited capacity in disaster response activities, and the lack of awareness of the culture's unique value.

Recommendations for Resilient Recovery and Reconstruction

Resilient recovery and reconstruction can be achieved as follows:

- Conservation of historic buildings should be enhanced with a disaster risk reduction plan that (a) is aware of cultural heritage's intrinsic value and potential as a tourism resource; and (b) includes guidelines for conservation of historic buildings and their adaptive future uses.
- Community-based safeguarding of heritage villages in the protected area should be promoted (a) with an integrated approach to preserve built heritage, intangible cultural heritage, and natural heritage; and (b) by strengthening inter-ministerial cooperation through the Samoa Heritage Committee.

Disaster and Climate Resilience in the Sector

Although Samoa is known for its cultural strength and the resilience arising from traditional community-based governance, the disaster has made Samoan culture and communities vulnerable. Safeguarding Samoa's cultural heritage contributes to the restoration of the resilience inherent in community.

Infrastructure Sectors

3.9 Water Supply and Sanitation

Sector Overview

As defined under the recently updated Water for Life Sector Plan 2012–2016, the water supply and sanitation sector's domain includes the "conservation, development, use and monitoring and evaluation of all fresh water resources and the receiving coastal waters in Samoa both in terms of water quality and water quantity." With water playing a critical role in the realization of recognized sanitation improvements, it was inevitable that sanitation would quickly evolve as a priority issue in the sector. The domain of the sector therefore has expanded to mainstream sanitation (including emphasis on good hygiene practice) as it applies to this sector, and to include on-site as well as off-site sanitation systems, including the collection and treatment of septage and piped wastewater/sewerage collection, treatment, and disposal systems. Additionally, drainage issues limited within the scope of the lower Apia catchment or the urban drainage network are also included in the sector domain as part of the integrated water resources management planning process. Solid waste management, including hazardous waste management, is covered by the environment sector but for the purpose of this assessment, it has been included as part of the overall sector's Post-disaster Needs Assessment.

The sector comprises nine implementing agencies, four of which are government ministries; two government corporations or state-owned enterprises; and three nongovernmental organizations (NGOs). The diversity of actors involved makes it a highly complex sector compared to other sectors. Actors include the Ministry of Natural Resources and Environment (MNRE), which is the lead agency, Ministry of Health (MOH), Ministry of Women, Community and Social Development (MWCSD), Ministry of Works, Transport and Infrastructure (MWTI), Samoa Water Authority (SWA), Land Transport Authority, Independent Water Schemes Association (IWSA), Samoa Red Cross (SRC), and the Plumbers Association of Samoa.

The following subsectors together define the scope of developmental activities within the sector: the water supply subsector, made up of the Samoa Water Authority, the independent water schemes (IWS), and rainwater harvesting;[36] the drinking water quality subsector;[37] the water resources management subsector; the sanitation subsector; and the flood mitigation subsector.[38]

The overarching development goal for the sector is "reliable, clean, affordable water and basic sanitation within the framework of integrated water resources management, for all people in Samoa to sustain health improvements and alleviate poverty."

To achieve this goal, the sector's framework for action is guided by the following key objectives:

- To strengthen the sector's governance framework to guide and sustain sector developments
- To improve watershed management and reliability of water resource data through integrated water resource management

[36] The water supply subsector is divided into two subsector committees to separate SWA from IWS, given that the scope of technical and financial issues is very different for each. An ad hoc committee/taskforce chaired by the Ministry of Women, Community and Social Development oversees the implementation of the Millennium Development Goal initiative for increased access to water supply, improved sanitation, and food security targeting vulnerable households.

[37] Note that Post-disaster Needs Assessment and estimates of associated costs for this subsector are addressed under the heath sector.

[38] Note that Post-disaster Needs Assessment and estimates of associated costs for this subsector are addressed under the transport sector.

- To increase access to and improve provision of reliable, clean, and affordable water supplies
- To improve surveillance of drinking water quality and waterborne diseases
- To increase access to basic sanitation, improved wastewater systems, and improved hygiene practice
- To strengthen effectiveness of flood mitigation measures to reduce incidence and magnitude of flooding in the Apia urban area

Summary of Damags and Loss

Damages to the sector were mostly to water supply infrastructure and on-site sanitation systems, including septic tanks, pour flush pit latrines, and dry pit latrines. Total damages are estimated at SAT 8.8 million, while losses were estimated as SAT 3.8 million more. Substantial damages to the water supply infrastructure of SWA account for most of the public sector damages, while the destruction of 5,040 on-site systems accounts for most of the private sector damages. Interestingly enough, the losses for the public sector are much greater than for the private sector, due mainly to loss of revenue and higher operational costs incurred by the government in ensuring that the water supply was restored and in imposing temporary relief measures as restoration efforts were underway (such as renting portable toilets, setting up temporary water filling stations, and trucking drinking water and river water for sanitation purposes).

Pre-disaster Situation

Water Supply Subsector

SWA and IWSA are the main service providers for piped water supply in the country. Altogether, they serve an estimated 97 percent of the total population; SWA serves 80 percent, and 32 village-managed schemes collectively serve 17 percent. The remaining 3 percent obtain water through rain-fed systems, which are common in remote upland parts of the country outside the reticulated network of both providers, and in the northwestern part of Savai'i, where plans have yet to be implemented for SWA to provide service.

SWA bills an estimated 16,000 customers. Of this number, approximately 60 percent receive treated water supplies from the four main slow sand filter water treatment plants (WTPs) and five package plants[39] on a 24-hour basis depending on source supply. These WTPs can produce up to 33,000m^3 of treated supplies a day, which is equivalent to 3.4m^3 per connection per day. The remaining 40 percent of SWA customers receive water from springs and river intakes (24 hours a day) or boreholes (about 12 hours a day). However, these supplies are untreated and not disinfected. IWS customers receive a 24-hour supply of water depending on source supply. Water supplies from IWS are currently not treated. However, measures to improve the quality of the water have been factored into the sector's annual upgrade program. Twelve IWS have already benefitted from this program, and implementation is proceeding on a further three IWS.

High levels of nonrevenue water (NRW) are a major issue for both SWA and IWSA. SWA is committed to reducing these high levels in all its systems and has already embarked on a medium- to long-term NRW reduction program. Recent assessment of NRW levels in 2011/12 reported more than 10 percent reduction in NRW levels for the three main treated water service areas in Apia following a comprehensive meter replacement and relocation program and works to replace pipes in poor condition. For IWS, efforts are underway as part of the existing upgrades program to install bulk meters so production rates can be quantified, with a view to eventually installing household meters to improve demand management.

[39] Two more are under construction at present. Package WTPs use conventional rapid sand filter treatment.

Cost recovery for SWA has increased steadily from improved billing and collection efficiency as well as from reduced levels of NRW. SWA sales fund 77 percent of SWA operational costs, with remaining costs (mainly for payment of electricity for borehole supplies) subsidized through civil society organization grants. The 2011/12 annual report indicates SWA revenues at approximately SAT 1.1 million/month at the end of the year for a total water supply customer base of approximately 16,000.

SWA's current domestic water tariff is SAT 0.5/m^3 for the first 15m^3, SAT 1.4/m^3 for the next 25m^3, and SAT 1.9 for above 40m^3.The commercial tariff is SAT 1.5/m^3 for the first 40m^3 and SAT 2.0/m^3 thereafter. The cost of the SWA service even excluding depreciation is greater than all of these tariff rates. For IWS, customers generally pay a flat rate, which varies from scheme to scheme. Most schemes charge a flat rate of $10 a month for their water supply.

Sanitation

There are no established levels of service for sanitation overall except for those required under the new wastewater treatment plant serving the central business district. Most sanitation facilities are privately owned, and standards for such facilities are covered under the National Building Code 1992, which is enforced by the MWTI. A total of 26,100 on-site sanitation systems were recorded in the 2011 National Census Survey: 82 percent are septic tanks (19 percent in urban Apia, 27 percent in northwest Upolu, 17 percent in rural Savai'i, and 19 percent in the rest of Savai'i); 13 percent are pour flush pit latrines (1 percent in urban Apia, 5 percent in northwest Upolu, 4 percent in rural Upolu, and 3 percent in Savai'i); and 4 percent are dry pit latrines (2 percent in northwest Upolu, 1 percent in rural Upolu, and 1 percent in Savai'i).

A number of private sector companies provide septic tank pump-out services on a user-pay basis. Septage wastes are now disposed of at the new sludge treatment facilities in Tafaigata for Upolu and Vaiaata for Savai'i. The facilities are managed and operated by the MNRE Division of Environment and Conservation, which is also responsible for solid waste management and chemicals management.

The SWA manages the wastewater treatment plant at Sogi and the pressure sewer collection network comprising 6.7km of sewers, 2.4km of property service lines, and 77 pump stations, connecting 120 commercial customers. A wastewater tariff of SAT 5/m^3 wastewater (up to 72 m^3) and SAT 8.4/m^3 (greater than 72 m^3) was approved by the Cabinet in 2011 and has since been in effect.

There are currently two public toilet facilities, the recently upgraded Sogi public facility and the old facility at Eleele-fou, which is scheduled for upgrades in the coming fiscal year. Plans to construct new public facilities at other strategic locations are being developed. Maintenance of public facilities is outsourced to the private sector.

Solid Waste Management

The two solid waste disposal sites are located in Tafaigata, Upolu, and Vaiaata in Savai'i. These are semi-aerobic landfills designed to break down solid waste and treat leachate (from compacted waste) through natural processes. Collection and disposal of solid waste at the designated landfills are outsourced to private contractors.

Water Resources Management

Samoa receives average rainfall of well over 3,000mm/year, varying from 2,500mm in the northwest parts of the main islands to over 6,000mm in the highlands of Savai'i. Approximately 75 percent of the precipitation occurs in the period from November to January.

Conventional water resources are surface water and groundwater. The distribution of these resources across the country is fundamentally controlled by geology and topography. Catchment sizes are characteristically small, with steep slope gradients resulting in rapid responses to rainfall events and significant sediment loads. Low flows in dry periods can be significant enough to affect water supply, and rationing is sometimes required. Surface water provides approximately 65 percent of the water supply and groundwater 35 percent. All groundwater abstractions and surface water abstractions of more than $10m^3$ need to apply for a license under the National Water Abstraction Licensing Scheme. Water resource management constitutes watershed rehabilitation initiatives, resource monitoring and assessment through the National Hydrometric Network, and regulation of resources. The National Hydrometric Network is made up of 30 surface water gauging stations (14 rain gauges and 16 flow gauges), flood marks in four main river systems—Vaimoso, Vaisigano, Fugalei, and Sinamoga—that drain into the Apia urban area, and seven groundwater monitoring boreholes.

Gender Issues

Women have long played a critical and active role in water resource management, water supply (particularly in the case of IWS), and sanitation (implementing and monitoring improved hygiene practices). Men are usually more concerned with water for irrigation or for livestock, while women tend to be direct users of water, especially in the household. However, men traditionally have a greater role than women in public decision making. Because of these different roles and incentives, it is important to fully involve both women and men in demand-driven water and sanitation programs, in which villages decide what type of systems they want and are willing to contribute financing and other support.

To date the main interaction between the sector and communities has been through the IWSA. IWSA efforts to have at least two women on each community water committee demonstrate that the association recognizes the important role both women and men have in community water management.

Damage and Loss

Damage and loss suffered in the water supply and sanitation sector are described below and summarized in table 28.

Damages

Water Supply

An initial situational analysis of all SWA water supply systems, including damage and recovery needs assessment, was carried out three days after Cyclone Evan. The extent of damages to SWA's urban water supply schemes included the following: blocked intakes; damage to water treatment plants; destruction of raw water pipelines, transmission mains, and distribution pipes; and loss of access roads to intakes and WTPs. The Alaoa water supply system sustained substantial damages to the WTP filter systems, buildings, meters, and fencing and to the downstream transmission mains. The majority of SWA rural water supply schemes are borehole supplies. These needed generators to be operational during the power outage following the cyclone. The majority of damages sustained were to the intake systems, pipelines, and access roads. The Tafitoala water supply system received substantial damages to the access road, intake and raw water and treated water transmission mains, and WTP facilities when the river re-routed. SWA water supply systems in Savai'i did not sustain any major damages.

Of the 32 IWS across Samoa, 25 experienced damage as a result of the cyclone. Since the cyclone, all but two schemes, Letogo and Aleisa West, have been temporarily repaired such that supply to the majority of the vil-

lages has been restored. Schemes such as Nuusuatia and Saoluafata have reverted temporarily to previously used sources located closer to the village.

For rainwater-dependent areas, minimal damages were reported from around the Tafitoala, Fusi, Vaie'e, and Mulivai areas, where most of the community is not connected to a reticulated supply. While a majority of rainwater tanks were found to be still intact, damages to guttering systems, including down pipes and elbow connections, were reportedly common for all these areas.

Sanitation

On-site sanitation. The extent of damages sustained by on-site sanitation systems was gauged from detailed housing assessments of damaged properties throughout the country. Based on the number of damaged properties we can assume that on-site systems have also been damaged or completely destroyed. A total of 5,040 systems are reported to have been damaged. Of this number 65.4 percent are septic tanks, 21.2 percent are pour flush pit latrines, and 13.3 percent are dry pit latrines.

Off-site sanitation. There were no damages reported from the SWA-managed WTP in Sogi, though two wastewater pump stations at Aggie Grey's Hotel were reported to be completely destroyed.

Only minimal damages were reported at the sludge treatment facility at Tafaigata and the two public toilet facilities in Sogi and Eleele-fou, though both facilities were closed down following the cyclone due to lack of water supply.

Solid waste management. Electricity supply to both waste disposal facilities was cut off when trees fell on power lines. Loss of electricity severely damaged water pumps and the aerator, affecting crucial components of the leachate treatment process.

Water Resources

Damages sustained by the National Hydrometric Network are attributed to river flooding, resembling as they do the flooding impact experienced and observed in affected areas. The gauging stations located at the Alaoa West and Tafitoala river systems, which experienced severe flooding, have been completely destroyed, while stations in other areas sustained minimal or no damages. Flood marks or staff gauges that had been installed at the Vaisigano and Vaimoso rivers were washed away. No damages were sustained by groundwater monitoring borehole supplies.

Losses

Water Supply

SWA was not able to read customer meters, process bills, or deliver bills in Upolu for the month of December 2012 because of difficulties accessing meters and lack of power. Meter reading operations commenced again on January 9, 2013, when meter readers returned to work after the New Year break. Essentially SWA will lose revenue for the full period from December 1 to January 8. Future revenue losses defined include those from customers who have closed down for a period of reconstruction; those from systems operating with temporary intake and distribution facilities such that intermittent supply is likely; and those from delayed implementation of planned service area expansions. Total lost revenue amounts to about SAT 1.5 million.

SWA incurred significant unanticipated costs as a result of Cyclone Evan. These stem from the need to pay staff at overtime rates for many hours of work through the Christmas and New Year period for damage assessments and repair of damaged facilities. Costs were also incurred for food at the emergency headquarters, for SWA vehicles (including water tankers), and for additional communications and media expenses.

Further unexpected costs were also incurred for purchase of new generators and fuel to provide power to rural boreholes; for the clearing of access roads, intakes, and water treatment plants; for construction of temporary intakes; for pipeline repair; and for the hire of excavators, loaders, and other equipment for clean-up operations and repair works. Finally, costs were incurred for the establishment of temporary water filling stations.

Like SWA, IWS also lost revenue because of the cyclone, specifically because of the high operational and capital costs involved in carrying out urgent repair work and in installing rainwater tanks for temporary water supply storage and distribution in the worst-hit areas.

Sanitation

On-site sanitation. Losses relating to on-site latrines include the disinfection of affected areas and cost of maintaining sanitary facilities at established evacuation centers for displaced households. In urban areas and rural areas with some public areas, portable toilets were rented to supplement sanitation facilities in large evacuation centers. There were also costs incurred for constructing VIP latrines in the affected rural areas such as Fusi, Vaie'e, and Tafitoala.

Off-site sanitation. Losses relating to the SWA-operated wastewater treatment plant relate to loss of revenue from sales not made. That is, no wastewater customers could be billed for the period from December 1, 2012, to January 8, 2013. Average monthly wastewater billings are SAT 250,000. Additionally, loss of future billings from Aggie Grey's Hotel for approximately 12 months has been factored into overall losses. The average monthly wastewater bill from the hotel is SAT 15,550.

Water Resources Management

The MNRE will incur a loss of revenue from charges and fees not paid due to loss of data. Losses also include the costs incurred in carrying out damage assessments (staff overtime and use of vehicles), cleanup, water relief support,[40] and flood surveys. Unexpected costs were incurred in the hiring of equipment to clear access roads.

[40] This support for the most severely affected and water-stressed areas in Upolu involved establishing 16 temporary water filling stations, carting river water, and monitoring carting of river water by three private tankers.

Table 28. Damags and Loss for the Water and Sanitation Sector (thousand SAT)

		Damage	Loss	Total
Water supply		**8,746.3**	**3,340.9**	**12,087.2**
	Damage to IWSA transmission and distribution system	291.1	n.a.	291.1
	Revenue losses by IWSA	n.a.	35.7	35.7
	Urgent repairs ro reestablish system delivery	n.a.	15.0	15.0
	Damage to SWA water supply system	8,455.2	n.a.	8,455.2
	Revenue losses by SWA	n.a.	1,547.4	1,547.4
	Higher costs of operation	n.a.	879.8	879.8
	Urgent repair work to reestablish operation	n.a	863.0	863.0
Wastewater		**90.0**	**504.1**	**594.1**
	Damage to SWA sewerage system	90.0	n.a.	90.0
	Revenue losses in SWA sewerage system	n.a.	504.1	504.1
Total		**8,836.3**	**3,845.0**	**12,681.3**

Source: Estimations by assessment team on the basis of official information.

Note: n.a. = not applicable.

Socioeconomic Impacts

Interviews held in evacuation camps confirmed that bottled drinking water was promptly provided to evacuees, although minor problems arose in its distribution. Access to water for washing was often limited; privacy and harassment concerns did arise, and there were no clear guidelines to ensure that lactating and pregnant mothers had priority access to meet their special needs. In private shelters run by NGOs, the situation was efficiently handled at all times. In brief, affected individuals identified their main burden as safely accessing water to clean houses and to maintain personal hygiene.

The public-private partnership in water provision, which involved SWA, Oxfam, Adventist Development and Relief Agency (ADRA), and the Samoan Red Cross, was widely regarded to have been an effective and efficient collaboration. Water providers commented that private sector support for the water sector was generally more responsive, better equipped, and more beneficiary friendly after Cyclone Evan than after the 2009 tsunami. This perception suggests that disaster planning and disaster risk reduction (DRR) training in the sector are building more productive disaster response partnerships.

Surveys also confirmed that portable toilets were dispatched quickly to registered shelters in Apia that did not have adequate sanitation. In informal rural shelters, there were consistent reports of open defecation when toilet capacity was exceeded; there were also concerns about the safety of women and girls using the toilets and about the limited flush water. Apia's two public toilet blocks were closed when the cyclone alert was given and replaced by only four portable toilets, which offered less than 20 percent of normal services during a high-demand time.

The SWA showed significant flexibility and speed in responding to water restoration needs, as the following stories suggest:

- When the Malololelei intake and raw water pipeline was damaged and the river was too powerful and unpredictable to allow for immediate repair, four female SWA staff stemmed the flow while their male colleagues constructed a new intake, a process that took only a couple of days.

- Lack of power prevented many rural communities from accessing their borehole water. Within seven days of the cyclone, SWA engineers and technicians identified the communities in need, obtained quotes, partnered with the New Zealand Aid Programme to fly in seven generators, and had the generators installed.
- A partnership program involving the SWA and the European Union (EU) made funds for tanks and latrines available to rainwater-dependent households that had been affected by the cyclone. Latrines were prioritized for households with low income, disabilities, or no able-bodied male.

The dynamic partnership of men and women in the water sector is now a reality in Samoa's disaster preparedness and response. What was enshrined in policy is now part of practice. The National Water Resources Strategy 2007–2017, guided by the four Dublin principles, put emphasis on the importance of women's role in water resource management. MNRE efforts to build resilient, responsive water systems have emphasized including not only women but also the untitled, as these examples show:

- Under the MNRE framework, communities are creating bylaws to govern their water resources. These collaborations may serve as effective entry points for the titled and untitled, men and women, to collectively protect, conserve, and efficiently use their local water sources. Though only two sets of bylaws were in place before the tsunami, the trend has rapidly grown since then.
- The Independent Water Schemes Association commits to inclusiveness through encouraging a minimum of two women members on each scheme committee. To date 27 of the 32 registered independent schemes have both men and women on their committees.
- Because an equal number of men and women now participate in governance training, there is a sizable pool of talent for chiefs wishing to appoint women to water committees. MNRE's water and sanitation team commits to including representatives of the chief's council, women's committee, and untitled committee in all in-community engagement activities.

The MWCSD and SRC are the water sector's partners in improving water and sanitation access to rainwater-dependent communities through the EU-funded Millennium Development Goal (MDG) budget support program. SRC has near equal numbers of men and women, primarily youths, in its cyclone response team. MWCSD also has a mixed team of water and sanitation field staff. SWA, itself, has more female engineers than other Pacific Island countries, and has achieved a gender balance in its management team as well as its total staff.

The efficiency and effectiveness of the water and sanitation sector in emergency shelters and in water system repairs has been markedly enhanced after the tsunami through increased sector preparedness, better communication, and active NDMO facilitation of intercluster collaboration.

Recovery and Reconstruction Needs

Water Supply

Approximately 95 percent of the total population now has access to water collectively through SWA, IWS, or rain-fed systems. Most water supply systems have been restored, though some are still operating from temporary alternative water supplies until systems are fully repaired or replaced.

Recovery needs for SWA are expected to extend well beyond the initial emergency relief phase; temporary pipe networks will need repairs until permanent works can be constructed, water will need to be trucked to areas still without a piped supply, and fuel for generators will be required because of fluctuating EPC power. Reconstruction needs for all damaged facilities have been developed based on revised designs to suit the situation following the

cyclone, including use of different materials and design standards. This has entailed the change from uPVC pipe to ductile iron pipe for some scheme elements, the provision of culvert and causeway river crossings where necessary, and the strengthening of embankments as deemed necessary.

Recovery needs for IWS require temporary repair of schemes until proper reconstruction can occur. These costs are on top of the reconstruction costs, as pipes were often cut or bent in order to get the supply reconnected as soon as possible, and they cannot be reused in the reconstruction. Labor costs for the construction of temporary repairs have been estimated at SAT 5,000 per damaged scheme and SAT 2,000 for schemes that had minimal or no reported damage. A cost has been included for undamaged schemes, since the assumption is that some schemes did not report—but still carried out and incurred costs for—a variety of repairs, such as repair of minor damage (done by villagers with training in plumbing), clearing of fallen trees on access roads, or removal of silt in inlet structures. Accordingly, a nominal price of 2,000 SAT has been claimed. Schemes on Savai'i were assumed to not incur any recovery costs.

Recovery efforts to provide alternative water storage using water tanks, water purification, and distribution commenced immediately after the cyclone in the worst-hit areas. The whole operation cost SAT 224,925, and additional work will continue for some time. Installation of temporary water filling stations in affected communities and water-stressed areas provided short-term relief while water supplies were being restored. Reconstruction needs for rain-fed systems are minimal, but the Samoa Red Cross, in partnership with the government (working through the EU-funded water and sanitation sector MDG initiative), will install rain-fed systems and VIP latrines in 1,000 vulnerable households, targeting families outside of existing reticulated supplies at an estimated cost of SAT 3.5 million. In a parallel effort, a partnership with the Civil Society Support Program, chaired by the Ministry of Finance and supported by AUSAid, NZAid, and the EU, will install communal tanks nationwide.

Sanitation

Recovery and reconstruction needs for on-site systems are estimated at SAT 4.3 million. Replacement of wastewater pump stations at Aggie Grey's Hotel may take some time, as the hotel has closed down for major repairs and reconstruction work. The sludge facility at Tafaigata was not damaged aside from needing refencing. The recently upgraded Sogi public toilet facility, although unscathed, will need water tanks installed to ensure the facility has water to accommodate demands during emergency periods. The Eleele-fou public facility is scheduled for upgrades in fiscal year 2013/14.

Solid Waste Management

The leachate treatment component of the solid waste disposal landfill urgently needs the replacement of water pumps and aerator to speed up treatments. This equipment is estimated to cost about SAT 6,000.

Water Resources Management

There is now an urgent need to improve and expand the existing hydrologic network in order to enhance data collection; with high-quality, detailed information for all the major rivers in Samoa, a better understanding of the major causes of floods, especially those during cyclone and thunderstorm events, will be possible. Improving the hydrologic network includes procuring robust equipment and machines, relocating stations to safer areas, and building back better to withstand cyclones' wind strength, etc. There is also a need to update and improve the existing rainfall/runoff and inundation models based on new data, in order to more accurately delineate areas of flood inundation and flood hazard, and thereby support the government's planning, management, and investment response to flood risk.

With limited expertise in country, there is an urgent need to build the capacity of the local staff to carry out data collection, assessments, and modeling of all major rivers in Samoa in order to identify associated risks and better prepare for future disasters.

Recovery and reconstruction needs in the water and sanitation sector are summarized in table 29.

Table 29. Estimation of Recovery and Reconstruction Needs (thousand SAT)

	Recovery	Reconstruction	DRR	Total
	3,059	**9,449**	**3,400**	**15,907**
Temporary service provision costs	3,059	n.a.	n.a.	3,059
Reconstruction of water supply systems	n.a.	4,981	n.a.	4,981
Reconstruction of sanitation systems	n.a.	4,398	n.a.	4,398
Reconstruction of hydrometeorological network	n.a.	70	n.a.	70
Introduction to DRR measures into reconstruction	n.a.	n.a.	3,400	3,400

Source: Estimations by assessment team on the basis of damage and loss.

Key Challenges to Recovery and Reconstruction

A very important challenge for recovery and reconstruction in the sector is the timely availability of the funding needed to start and complete the recovery and reconstruction process. The capacity of key implementing agencies to juggle both the cyclone recovery program and previous development works—now either delayed or deferred—will also be a challenge. The need for recovery and reconstruction means that the sector must revise its current investment program to mainstream new and priority recovery and reconstruction works into current commitments and existing priority investments.

Disaster Resilience in the Water and Sanitation Sector

The sector plays a particularly important and potentially complex role in DRR and disaster response. The need for urgent humanitarian response may compete with the need to undertake other core roles in the lead up to and period just after a disaster (such as the need to secure infrastructure, to maintain gauging stations, and to record flood heights). These responsibilities are spread across several, often interconnecting, agencies, and it would be helpful if a sectorwide disaster management plan and standard operating procedures could be developed, as already identified in the sector's framework for action 2012–2016. Such a plan should be an identified recovery need of the Post-disaster Needs Assessment. It would provide a platform and guide for facilitating and coordinating sectorwide response during emergency situations.

The damage and needs assessments made clear that some water supply systems would benefit from additional works to reduce the risk of future damage. Two schemes are proposed for the Alaoa system—flood protection works upstream of the current WTP and realignment of the transmission main (which currently runs for a substantial length along a major river bank); and one scheme is proposed for the Tafitoala system—the construction of a diversion channel and bund wall upstream from the WTP to protect the WTP and train potential river-overtopping flows back into the river system.

Most of the IWS were originally constructed by the local villages and consist of above-ground pipework that has been put together with whatever fittings, tools, and pipes were available at the time of construction. The alignment of pipework typically follows the river, making the pipes highly vulnerable to natural disasters. There is cur-

rently a program to upgrade these schemes to meet future demand, and their design has been undertaken by engineers for each of the schemes. The proposed upgrades include changing pipe alignments and using below-ground pipework, both of which are aimed at mitigating flood and other natural disaster impacts.

In order to reduce the risk of future natural disasters, upgrades to a number of IWS are required. Twelve of the schemes have already been upgraded, but that leaves 20 schemes requiring upgrades. Specific components of the upgrade works for the remaining 20 IWS upgrade designs have been identified as having a high ability to reduce risk of future natural disasters. Costs for these components have been included in the needs analysis under risk reduction. These components are listed here:

- **Relocate IWS inlet to new source.** To reduce the risk of contaminated source water and increase reliability of supply, designs have been undertaken to construct new inlet structures at new water sources for the following IWS: Luatuanuu, Lona, Leusoalii, and Nuusuatia. This project has been included in the risk reduction cost estimates, as these new water sources will mitigate the risk from natural disasters and climate change.
- **Upgrade IWS inlet at current source.** To reduce the risk of flood damage to the existing inlet and increase capture efficiency of the source water, designs have been undertaken to upgrade the existing inlet structures. These upgrade costs have been itemized into river and spring sources. Although upgrades of river inlets are more critical for withstanding flooding, springs often turn into waterways during natural disasters such as cyclones, so costing for spring inlet upgrades has also been included. The inlet upgrade costs were included only for the older "yet to be upgraded" schemes.
- **Upgrade transmission mains.** Many of the existing transmission mains, from the inlet to the village storage tank, follow an alignment along the river or water courses. Most of the older "yet to be upgraded" schemes have above-ground pipes that are vulnerable to damage from flooding and cyclones. Designs have been undertake to upgrade the transmission mains within these schemes. The upgrade costs have been itemized into river and spring sources. Although the transmission mains that follow rivers are more vulnerable, springs discharge to gullies that turn into waterways during natural disasters, so costing for transmission main upgrades for the spring-sourced schemes has also been included. The transmission main upgrade costs were included only for the older "yet to be upgraded" schemes.

To flood-proof the hydrometric network, there is a need to include flood protection works upstream of the existing river and rainfall gauging stations, as well as to relocate damaged stations from critical areas to safer locations.

Power sector employees worked around the clock to rebuild lines to reconnect customers with electricity.

Photos

Top/Center: Courtesy of GoS/PDNA Assessment team.

Left: Samasoni headpond, December 17, 2012. Taken by Alfred Matatia (civil engineer) & Iosefa Aiolupotea (environment specialist) after the Evan cyclone. Courtesy of GoS/PDNA Assessment team.

3.10 Electricity

Summary

Approximately 97 percent of the population of Samoa has access to distributed electricity provided by the Electric Power Corporation (EPC). Following Cyclone Evan, the entire island of Upolu and part of Savai'i were without power (though power in Savai'i was restored quickly afterwards). Within one week, power was restored to approximately 10 percent of the population of Upolu, and within four weeks, about 60 percent were reconnected. Full reconnection was achieved by mid-February 2013.

Cyclone Evan caused significant damage to three hydropower plants (Samasoni, Alaoa, and Fale ole Fee) and minor damage to two additional hydropower plants. The cyclone also damaged Upolu's main Tanugamanono Diesel Power Station. Damage to the transmission and distribution grid included 1,198 power poles damaged (833 leaning, 245 broken, 120 fallen), 158 power meters destroyed, 6.7km of power line requiring replacement, 25 transformers destroyed, and significant damage to the radio network. The estimated cost for replacement of damaged power sector infrastructure is SAT 39.1 million. Losses to EPC are estimated at SAT 31.9 million more, mainly from loss of revenue but also from the need to replace low-cost hydropower generation with high-cost diesel generation.

Pre-disaster Situation

Electric Power Corporation is a wholly owned government corporation that is responsible for generation, transmission, distribution, and retail of electricity in Samoa. EPC operates as a corporatized entity under the Public Bodies Act 2001. EPC services about 26,730 residential customers on Upolu and 7,238 residential customers on Savai'i, and approximately 97 percent of the population has access to electricity. EPC operates separate power grids on Upolu (89.8 percent of energy generated) and Savai'i (10.2 percent of energy generated) and has a small solar power system on Apolima (<0.1 percent of energy generated).

Electricity generation on Upolu is a mix of diesel and hydropower generation. The main diesel power station on Upolu is located at Tanugamanono. The remaining hydropower capacity comes from four run-of-river schemes (combined installed capacity 4.5MW) and one scheme with a reservoir. During the 12-month period from November 1, 2011, to November 1, 2012, EPC generated 102.5GWh of energy in Upolu, of which 40.0GWh (39.1 percent) was generated by hydropower schemes. Peak load for Upolu prior to Cyclone Evan was 17.5MW. Losses (both technical and nontechnical) are estimated at 17.8 percent (12-month rolling average). Over the same period, EPC had total sales revenue of approximately SAT 73.2 million.

The electricity tariff in Samoa consists of a base tariff and a variable fuel surcharge that adjusts monthly based on fluctuations in the price of diesel. In November 2012, domestic customers were charged SAT 0.86 for the first 50 kilowatt hours and SAT 1.01 for each kilowatt hour in excess of 50, based on a monthly billing cycle. All other EPC customers (commercial and government) were charged at SAT 1.01/kWh.

Damage and Loss

Damage

Generation assets. Damage to the electricity system resulting from Cyclone Evan was largely limited to Upolu, with minimal damage experienced on Savai'i. Damage to the generation assets involved the elimination of 100 percent capacity at the Samasoni and Fale ole Fee hydropower plants, and partial elimination (estimated as 66 percent) at the Alaoa hydropower plant. This represents a decline of 34 percent in overall hydropower generation capacity on Upolu. Minor damage was sustained at the remaining two hydropower sites; however, generation was not affected in the short term.

Considerable flood damage was also experienced at the Tanugamanono diesel power plant, resulting in a decline of approximately 4MW, or 25 percent of total diesel generation capacity in Tanugamanono. As of January 14, 2013, the system generation capacity for Upolu is 17MW to meet a peak demand of 17.5MW.

Transmission and distribution assets. Cyclone Evan caused significant harm to the transmission and distribution grid: 1,198 power poles were damaged (833 leaning, 245 broken, 120 fallen), 158 power meters were destroyed, 6.7km of power line required replacement, 25 transformers were destroyed, and the radio network sustained significant damage. Restoration of service activities focused initially on reconnecting high-density urban areas and commercial districts. Cost estimates for damage to generation and transmission/distribution assets are summarized in table 30.

Table 30. Estimation of Damage to the Power Sector

Component	Damage (thousand SAT)
Power generation	
Hydropower plants	
Samasoni	18,000.0
Alaoa	2,076.3
Fale ole Fee	11,780.6
Lalomauga	656.5
Taelefaga	287.8
Thermal plants	
Tanugamanono (diesel)	1,665.0
Savai'i (diesel)	65.0
Transmission and distribution	
Power poles (833 leaning, 245 broken, 120 fallen)	861.5
Power meters (158 meters destroyed)	95.9
Cross-arms (195 broken)	483.7
Power lines (6.7km needing replacement)	1,460.7
Transformers (25 destroyed)	437.7
Radio network (destroyed)	418.8
Total	**39,089.1**

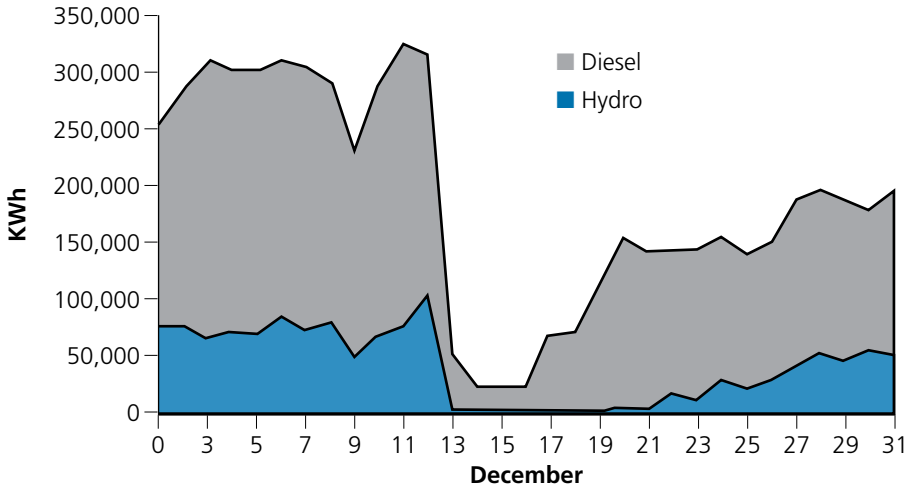
Source: Electric Power Corporation.

Loss

Losses to the electrical sector arising from Cyclone Evan consist of (a) costs for immediate restoration of power (labor, materials, etc.); (b) lost revenue from lower demand due to temporary customer disconnection; (c) costs for short-term hiring of generators; and (d) medium-term higher generation costs due to replacement of damaged hydropower generation with higher-cost diesel generation.

The power supply to Upolu was shut down at 4:00 p.m. on December 13, 2012, due to safety issues posed by the high winds.[41] Between December 13 and 17, 2012, Upolu remained without power, but by December 28, 2012, peak demand had returned to 10.45MW (60 percent of pre-cyclone peak demand). Full connection of customers was achieved by mid-February 2013. A summary of the daily generation for Samoa during December 2012 is presented in figure 11.

Figure 11. Daily Power Generation in Samoa, December 2012



It is estimated that EPC will lose SAT 6.0 million in revenues from (a) disconnection of customers between December 13, 2012, and January 31, 2013 (when full reconnection is anticipated); (b) lack of generation capacity to meet Upolu peak demand until end February 2013 (when the Fiaga diesel power plant is commissioned); and (c) ongoing reduced demand from approximately 600 customers whose houses have been destroyed.

In addition to the losses in sales and revenue, EPC is now facing extraordinary higher costs of electricity production, arising from the need to temporarily replace damaged power units with higher-operation-cost diesel power plants. The estimated value of these additional losses is SAT 21.6 million.

Socioeconomic Impacts and Human Recovery Needs

The socioeconomic impact faced by power customers immediately after Cyclone Evan was evident with the loss of electricity on the island of Upolu. Human recovery needs required power sector employees to work around the clock to start rebuilding lines and reconnecting customers with electricity; repairs were felt to be especially urgent because Christmas and the New Year's holiday were so close.

[41] Motootua Hospital was shut down briefly to secure power and then backup generation was restored.

The economic impact of the loss of hydropower generation is higher costs to produce electricity while diesel generation is used instead. The lack of generation capacity has required the hiring of diesel generators to ensure that the demand peak can be met and that the power sector can operate safely.

Recovery and Reconstruction Requirements

The total cost of recovery and reconstruction for the electrical sector has been estimated, as shown in table 31. Needs for recovery include (a) the cost of urgent works to reestablish electricity supply to the entire country (SAT 6.9 million); and (b) higher production costs of electricity supply arising from temporary use of alternative power sources to substitute for the hydropower plants that were damaged (SAT 21.6 million). The total requirements for reconstruction of the system were estimated at SAT 35.3 million (table 31).

Table 31. Estimated Financial Requirements for Recovery and Reconstruction in the Power Sector (thousand SAT)

	Recovery	Reconstruction	DRR	Total
Higher production costs	21,600	n.a.	n.a.	21,600
Urgent works to reestablish service	6,900	n.a	n.a.	6,900
System reconstruction	n.a.	35,300	26,136	61,436
Reestablishing service total	**28,500**	**35,300**	**26,136**	**89,936**
East coast underground work in flood risk areas	n.a.	n.a.	26,095	26,095
Distribution lines	n.a.	n.a.	20	20
Tree trimming/cutting campaign	n.a.	n.a.	20	20
DRR subtotal	n.a.	n.a.	**26,135**	**26,135**
Grand total				**116,071**

Source: Estimations by assessment team on the basis of damage and loss.

Note: DRR = disaster risk reduction.

Disaster Resilience in the Power Sector

The power sector faced two main disasters: strong winds and flooding. The following are recommendations for reducing infrastructure damages in future.

Distribution

For power poles, underground lines are proposed for flood risk areas. For areas using overhead lines, disaster preparedness standards should be followed, including

- cutting down or trimming hazardous trees (downed trees were the main cause of damage)
- updating and improving EPC's standard design for line construction (loading, compaction, line sagging, etc.) for specific locations and pole types
- developing and following strict procedures for adding extra load to poles
- improving the asset management database

Generation

At all three power plants that sustained significant damage in Cyclone Evan—Samasoni, Alaoa, and Fale ole Fee—there is a need for better-designed and reinforced roofs. Specific recommendations for each of the three power plants are given below.

For the Samasoni hydropower plant,

- Replace and position underground the 1km of steel penstock at the hardest-hit area with buried high-density polyethylene (HDPE) pipes.
- Build 1km of protective shoring along river bank to protect existing penstock from flooding.
- Install a hydraulic control gate at the power station tailrace to stop floodwater from back-feeding into the power station and flooding the basement, where two generators are installed. Also plug all ventilation openings in power station walls to stop water from entering and flooding the basement generator room.
- Replace cooling system of diesel generators in Tanugamanono with closed-circuit radiators to eliminate large amount of water currently used and avoid need to feed off penstock pipe. Cooling tap off pipe was washed out with penstock which seriously affected the supply of cooling water for diesel engines.
- Modify diversion weir for headpond to stop logs from entering and lodging in pond.
- Install concrete reinforcement walls along the penstock.

For the Alaoa hydropower plant,

- Modify the route of the east headrace canal and use penstock pipe to avoid being affected by land slide. Also stabilize side banks adjacent to the open canal to minimize landslides.
- Shore up the river bank upstream of the powerhouse to divert flood waters from it (to address the significant erosion of the river bank adjacent to the powerhouse).
- Underground 400m of 22kv overhead transmission power line from the power plant, and then reconnect it to the overhead transmission line to the Tanugamanono power station (in response to overhead transmission lines from this powerhouse being washed away by the flood).
- Reconstruct two intakes with gates in order to flush silt buildup in intakes.

For the Fale ole Fee hydropower plant,

- Build shore protection on the riverbank to stop flow into the powerhouse.
- Reconstruct two intakes (FOF and Vaivase) to improve silt flushing gates.
- Underground/replace 0.5km section of pipe from intakes to the headpond, where pipes are close to the riverbank.

Recovery and Reconstruction Needs

A summary of the estimated schedule for reconstruction of damaged assets and restoration of losses is presented in table 32.

Table 32. Estimated Rehabilitation Schedule for the Power Sector

Item	Estimated period
Restoration of Alaoa Hydropower Station	6 months
Restoration of Samasoni Hydropower Station	2 years
Restoration of Fale ole Fee Hydropower Station	1 year
Reconnection of all Upolu customers except damaged homes	By end January 2013
Generation capacity commissioned to meet peak load	By end February 2013

Source: Estimations by assessment team on the basis of damage and loss.

The Land Transport Authority employed local contractors to help clear roads; by two days after the disaster, 90 percent of primary and secondary roads had been cleared.

Photos

Top: Log jams rendered many roads and bridges inaccesible. Center/ Bottom: Vaisigano. Courtesy of GoS/PDNA Assessment team..

3.11 Transport

Pre-disaster Situation

Samoa's airports, road networks, and ports are of critical importance to the country's economy and economic development. They support trade and promote commercial activity by facilitating the movement of goods and services. These transport systems also provide safe and efficient access to social services, including schools and health facilities, both domestically and internationally.

Samoa's airport systems underpin the tourism sector, which is an important part of the economy, and support international commerce and travel. The country has five airports, including two on the main island Upolu and three on the other large island of Savai'i. Faleolo International Airport on Upolu is the main airport for both domestic and international flights, while Upolu's other airport—Fagali'i International Airport—provides international flights to American Samoa. Savai'i has three airports, including Maota Airport (the main domestic airport), Asau, and Lalomalava, which serve only domestic connections. In 2011, an average of 16 flights from Australia and New Zealand and 45 flights from other international locations (primarily American Samoa) provided service to Samoa on a weekly basis, and about 4,300 passengers arrived at Faleolo International Airport every week.

The road network provides for the day-to-day well-being of Samoan citizens by increasing their access to economic activities and social services. On the principal islands of Upolu and Savai'i, there are about 2,340km of roads, 332km (14 percent) of which are paved, and 52 bridges (44 bridges on Upolu and 8 on Savai'i).

With approximately 70 percent of Samoa's population living within one kilometer of the coast, and critical infrastructure (hospitals, schools, places of employment, tourist infrastructure, port facilities, power plants, airports, and roads) located primarily in the coastal zone, roads are extremely important. However, the Samoa road network faces a range of vulnerability issues: (a) coastal exposure to sea-level rise, storm surge, and wave action during cyclones and tsunamis; (b) inland flooding and landslips during extreme rainfall events; (c) damage from earthquakes; and (d) accelerated pavement deterioration due to extreme weather and rising water tables in some locations.

Samoa's port infrastructure consists of five primary ports, including three on Upolu (Aliepata, Apia, and Mulifanua) and two on Savai'i (Asau and Saleloga). All of the ports service both passengers and cargo, and the Ports of Mulifanua and Saleloga offer important inter-island passenger services. The Port of Apia is the most important economically and has been assessed as one of the best-performing ports in the Pacific region. In 2011, an average of 11 container ships stopped at Apia Port, about half of which were multipurpose and half cargo, making it one of the largest ports in the Pacific as measured by container ship visits. Overall, nearly 225 ships, including containers, fuel tankers, cruise liners, and smaller regional vessels made calls at the country's ports in 2011.

Effects of Cyclone Evan

Tropical Cyclone Evan caused damage to the country's main international airport at Faleolo, destroyed several roads and at least one bridge, and damaged a number of ports on Upolu and Savai'i. Its most immediate effect on transport was in the form of downed trees, which blocked many roads. There was no reported major damage to transport assets, including roads and bridges, on Samoa's other islands of Manono, Apolima, Namu'a, Nu'utele, and Nu'ulu.

Although the cyclone caused the closure of Faleolo International Airport, flights were able to resume as soon as the storm cleared, in spite of some damage to navigational aids on the ground at the airport.

In addition to downing trees that blocked roads, Cyclone Evan caused flooding and rapid runoff of water on roadways, which caused damage to several roads and at least one bridge. The overall extent of the damage to roads may not be fully apparent for some time; if water penetrated the surface and affected the base and subbase courses, some sections of roadway could eventually experience subsidence.

The gale-force winds associated with the cyclone inflicted damage on port sector assets. In addition, heavy sea swells the following day caused further damage, particularly to the old wharf at Apia, which had been damaged in 2009. The heavy rains caused flooding in low-lying areas, which resulted in heavy debris deposition within the wharf area, especially at the marina and the old wharf area.

Government Response

One of the first priorities was to remove the trees that were blocking roads so that connectivity could be reestablished and services reconnected. The Land Transport Authority (LTA) employed 12 local contractors to help clear roads, and by December 15, 2012, two days after the disaster occurred, 90 percent of primary and secondary roads had been cleared, and access across Upolu's road network had been reestablished. About one week later, contractors shifted their focus to cleaning up the Vaisigano River basin area. The only roads not opened within two weeks of the cyclone were the road to Taelefaga, which reopened in late December, and the Leone Bridge, which has not been reopened.

Another priority was to clear the main harbor around the Port of Apia, which was temporarily closed due to debris in the water, including numerous trees and logs.

Damage and Loss

Damages

Damages to transport sector assets relate to the amount of physical destruction to physical infrastructure, such as roads, bridges, and ports. Damages are calculated by determining the total quantity of damage to structures, defining an average cost per unit, such as a kilometer, and calculating a monetary value. The estimated damages to the transport sector amount to SAT 59.2 million.

Several airport assets at Faleolo International Airport were damaged during Tropical Cyclone Evan. The high winds damaged navigational aids, including a VHF omnirange and nondirectional beacon, as well as communications equipment (a VHF antenna) at Mount Fiamoe Transmitter Station. Damage was also reported to the doors of a cargo building at the airport. The overall damages to the country's airports are estimated at SAT 100,000.[42]

Several roads and associated drainage systems were damaged during Tropical Cyclone Evan. Overall, some 30km of class 1 roads were damaged, 2.74km of class 2 roads, and of 3.14km of class 3 roads. To restore damaged roads to their condition prior to the disaster, both rehabilitation and reconstruction works will be required. The rehabilitation activities are expected to include resealing, major patching, redefinition of drainage systems, edge break repairs, and shoulder grading. Reconstruction works will involve pavement construction, including subbase

[42] It was reported that there was SAT 17.5 million worth of damage to the runway, taxiways, and aprons at Faleolo International Airport, but the assessment team was not able to validate this claim.

and base courses, sealing (asphalt and double chip sealing), and repair and/or installation of open and closed drainage systems.

Significant damage was caused to sections of the main cross-island road, as well as the Siumu Road. On the south side of the main cross-island road, there are six sections, ranging in length from 50m to 200m, where runoff from natural drainage basins overwhelmed the road and washed it away. When crews arrived, they reported that large boulders covered the road and extended the length of the natural basins. Scouring of drainage systems parallel to the road to depths as much as 3m below the road surface (in Tiavi near Siumu) has undermined the integrity of the main cross-island road in several locations. There are also a number of smaller breaks in the road where water cut channels in the asphalt up to 50cm wide.

The 30m two-lane Leone Bridge in the Leone area of Apia was damaged when its central pier was displaced vertically and sunk about 60cm as a result of the severe flood waters. The decking remains intact, but the road has been closed since the disaster occurred. While both abutments are in place and the central pier seems not to have shifted laterally, bridge engineers will need to assess the integrity of its foundation and structure to determine whether the bridge can be repaired or will need to be replaced. The LTA estimates that on weekdays, a total of 6,834 vehicles use the bridge daily, while the average daily traffic for the entire week is 6,078. Approximately 16 percent of the vehicles using this bridge are classified as heavy vehicles.

There is some concern that the Lelata Bridge, which is of similar size to the Leone Bridge and located about 200m upriver, may have also been damaged, although there are no visual signs of damage or distress. The Lelata Bridge is located along a main east-west route for heavy vehicles traveling through Apia, and along with the Leone Bridge, carries more heavy loads than the main road through Apia. This bridge, as well as all other bridges, will need to be assessed for damage.

There was also localized damage to bus shelters, particularly in the main bus depot near the fish market. There were no reports of damage to seawalls.

The overall damages to the country's roads and bridges are estimated at SAT 59.1 million.

Losses

Losses refer to changes in economic flows as a result of interruptions or modifications to transport flows, including to traffic flows; losses include higher vehicle operating costs that arise because alternative routes are being used until an asset is restored and fully functional again. Typically, alternative routes require additional time, which is also an economic loss. The estimated losses to the transport sector amount to SAT 21.0 million.

The primary economic losses are in the land transport and port sector. Although reconstruction activities are already underway on most of the roads that were damaged, the only location that will create economic losses is the Leone Bridge. The Leone Bridge was damaged by the flood waters that came down the Vaisigano River, causing the central pier to settle about 60cm. As a result, the bridge was closed and will not reopen for about three months. As a result, drivers must use the Lelata Bridge, which is a diversion of approximately 5km, to access central Apia town. The additional traffic using the Lelata Bridge will also increase travel times by an estimated 10 minutes. For marginal operating costs, it was assumed that average daily traffic along the affected roads would be 6,834 vehicles per day (5,467 light vehicles and 1,367 heavy vehicles). Based on prevailing costs for labor and fuel, and a three-month period for rehabilitation, the economic losses of this one diversion are estimated to be SAT 3 million.

To clear and reopen key roads and clean up affected areas, particularly the Lelata, Vaisigano, Apia Park, and Faatoia areas, the LTA mobilized crews and hired machinery at an estimated cost of SAT 18.0 million.

Damage and loss in the transport sector are summarized in table 33.

Table 33. Estimated Value of Damage and Loss in Transport Sector (thousand SAT)

		Damage	Loss	Total
Damage		**59,252.6**		**59,252.6**
	Partially damaged roads	13,101.7	n.a.	13,101.7
	Fully destroyed roads	37,769.6	n.a.	37,769.6
	Bridges	8,281.3	n.a.	8,281.3
	Other infrastructure	100.0	n.a.	100.0
Loss			**21,013.0**	**21,013.0**
	Urgent cost of traffic reopening	n.a.	18,000.0	18,000.0
	Higher transport costs	n.a.	3,013.0	3,013.0
Total		**59,252.6**	**21,013.0**	**80,265.6**

Source: Estimations by assessment team using official information.

Note: n.a. = not applicable.

Recovery and Reconstruction Needs

Estimations have been made, on the basis of the value of damage and loss described in the preceding section, of the financial requirements to achieve recovery and reconstruction of the sector's infrastructure and services. These requirements amount to a total of SAT 114.3 million (see table 34).

Table 34. Estimation of Recovery and Reconstruction Needs in Transport Sector (thousand SAT)

	Recovery	Reconstruction	Total
Cleanup and restoration of minimum traffic	17,000	n.a.	17,000
Reconstruction of roads	n.a.	65,093	65,093
Reconstruction of bridges	n.a.	32,245	32,245
Total	**17,000**	**97,338**	**114,338**

Source: Estimations by assessment team on the basis of damage and loss.

Note: n.a. = not applicable.

In terms of recovery activities, an amount of SAT 17 million is required to complete the cleanup of trees and other debris deposited by Cyclone Evan and to restore traffic flows to the minimum acceptable conditions throughout the affected areas.

In regard to reconstruction requirements, it is estimated that a total of SAT 97.3 million is required to repair and reconstruct all roads and bridges that were affected by the disaster.

3.12 Environment

Summary

The environment is intricately linked to the livelihoods of the cyclone-affected communities because of their dependence on natural resources. In Samoa, a number of sectors, including water, forestry, agriculture, fisheries, and tourism, rely on the sustainable management of natural resources. The environmental assets most affected by Cyclone Evan were the lowland forest areas on the southern coast of Upolu. Damage to these assets are expected to result in substantial production losses to the water, forestry, and tourism sectors in particular, as well as cause harm to biodiversity in these areas.

Pre-disaster Situation

Forest (Native and Nonnative)

Samoa's upland habitats are largely intact, with a high percentage of forest cover (99 percent) unharmed in both Upolu and Savai'i. The nature and quality of forests in the upland areas of the two islands are now significantly different. In Savai'i, 91 percent of the upland forest area is dominated by native species. In Upolu, nonnative species dominate much of the upland area. The impact of the invasive vine *Merremia* remains a threat.

The remaining forests in the lowland areas are predominantly of nonnative species of *Tamaligi, Pata, Pulu vao*, and a host of other light-demanding and fast-growing species that invade open spaces created by cyclones, wind throws, and abandoned agricultural sites. These forests are less dense and don't offer the range of habitats to a diversity of native fauna species that native forests would. Ecologically they are less stable. These forests, however, will dominate Samoa's lowland, possibly in perpetuity, if the process of natural succession is regularly set back by cyclones and man-made disturbances. The higher frequency and intensity of cyclones that has been predicted as a result of climate change is thus likely to assist in perpetuating the dominance and continuing spread of nonnative species.

Fauna (Native and Nonnative)

Samoa's fauna consists of 21 butterfly species, 11 species of reptiles, 43 resident bird species (8 of which are endemic), and 3 flying fox species.[43]

Available literature indicates that approximately 12 sea bird and shore bird species that are of global or national conservation concern have been recorded in Samoa.

Within the Samoan Islands endemic bird area (EBA), 20 bird species are identified as having restricted range, making it important as a site for trigger species and for conservation efforts to establish Important Bird Areas. Of the 20 restricted-range species for the Samoa EBA, 19 are found in Samoa. Six of these restricted-range birds (together with the wide-ranging Bristle-Thighed Curlew) are also considered to be globally threatened based on surveys and assessments over the last 20 years using *International Union for Conservation of Nature* Red List criteria. All the land bird species classified as globally threatened are endemic at least to the subspecies level to Samoa.

Natural disasters such as cyclones pose one of the biggest threats to native birds and other wildlife. The effects of cyclones include death of birds and increased vulnerability of birds arising from the loss of their normal habitat and food supplies, as the forest only slowly regenerates and recovers. For flying foxes, the biggest threat is continued

[43] See government of Samoa, Samoa's Biodiversity Strategy and Action Plan, http://www.cbd.int/doc/world/ws/ws-nbsap-01-en.pdf.

hunting, though with the ban on exports largely effective, hunting has declined. Pigeons are hunted seasonally, and remain vulnerable to unsustainable levels of hunting.

Marine and Mangrove Areas

The health of corals and coral reefs within the marine/offshore habitats varies throughout Samoa, but the most healthy reefs and coral assemblages are found in northwestern Savai'i, with the least healthy coral reefs along the northern coast of Upolu, from the Apolima Strait to the Fagaloa coast. Reef fish are correspondingly more abundant in northern Savai'i and less abundant off the northern coast of Upolu. There is, however, a greater variety of fish species off the northern coast of Upolu, despite lower coral abundance, than in northwestern Savai'i. The greater diversity of fish in northern Upolu is important information for conservation purposes because it suggests the presence of unique coral assemblages not found elsewhere in the country that should be targeted for protection.

A survey published in 1996 reported coral reefs and reef fronts were in good condition despite previous cyclones and other impacts.[44] However, assessments conducted after the September 2009 tsunami indicated the Marine Protected Areas of Aleipata and Safata and their "No Take" zones sustained significant damage, and that their ability to support substance fishing would be reduced over time.

Mangrove swamps and seasonal wetlands, a rare habitat type, are dispersed throughout Samoa, with the largest mangrove area located near Apia. Mangroves continue to suffer from coastal development, despite the institution of conservation and mitigation strategies. Protection of mangrove ecosystems is regulated under the Lands and Environment Act 1989 and PUMA (Planning and Urban Management Agency) Act 2004, but to date there are no regulations specifically governing the protection of mangroves. However, there are several communities with community-based management plans that opt to impose appropriate actions to manage activities adversely impacting on mangroves.

Damage and Loss

Although Cyclone Evan lasted just one day in Samoa, according to MNRE the damage it caused is comparable to the devastation by the three cyclones (Ofa, Val, and Heta) of the early nineties that lasted for three to five days. Flooding reached its peak in water catchment areas, causing extreme damage and taking lives. Damage and loss to the environment are documented in all categories, from mountainous forests to the living creatures in the ocean. During the aftermath of Evan, the Ministry of Natural Resources and Environment, with assistance from the Secretariat of the Pacific Regional Environment Programme, the United Nations Development Programme, and local consultants, conducted its first terrestrial and forest damage rapid assessment to report on the basic damages caused to the environment.[45]

Forest

Samoa has a total land area of 2,857 km^2 (Upolu 1,122 km^2 and Savai'i 1,714 km^2). More than half of the remaining primary forest on Upolu was destroyed by Cyclone Evan. Forest ecosystems have been greatly impacted by

[44] A. Green, *Status of the Coral Reefs of the Samoan Archipelago*, Department of Marine and Wildlife Resources, American Samoa, July 1996, http://www.botany.hawaii.edu/basch/uhnpscesu/pdfs/sam/Green1996StatusAS.pdf.

[45] There are several impacts that are cross-sectoral and covered by other sectors. These include the hydrological services of forests, which are addressed by the water sector through the Samoa Water Authority and affiliated ministries. Waste removal to landfills is addressed by public works and affiliated ministries.

Protection of mangrove ecosystems is regulated under the Lands and Environment Act 1989 and Planning and Urban Management Agency Act 2004, but to date there are no regulations specifically governing the protection of mangroves.

Photos

Damage and loss to the environment are documented in all categories, from mountainous forests to the living creatures in the ocean. Top and bottom: Courtesy of GoS/PDNA Assessment team.
Center: © Thinkstock.com.

the cyclone, with about 80 percent of forest cover damaged, including defoliation and crown loss, and about 20 percent of the forest completely destroyed (that is, tree throw). Forest and forest ecosystems are vital for both biodiversity and the livelihoods of the people. Timber and nontimber forest products provide many Samoan families with income and are also used in the home. Moreover, forest trees are a major carbon sequestration element and a leading factor in sustaining water catchment health. The damages caused by the cyclone pose threats to both the health and livelihoods of the people.

Key Areas

O Le Pupu Pu'e National Park, Vailima National Reserve, the area from Matafaa District to Falealili District, the Vaisigano catchment, and Safata District are the areas heavily impacted by winds and heavy flooding. In the future management of these areas, it is recommended that extra precautions be taken to address the likely increase in the density of invasive weeds spreading to more open areas. Of the areas assessed, significant numbers of trails within parks and reserves have been damaged by fallen trees and erosion.

According to the terrestrial and forest damage assessment report, *Ficus spp* and coconuts, two of the resilient native trees, remained standing throughout the cyclone. Invasive trees such as the *Albizia spp* and African tulip were the most vulnerable during the cyclone, largely due to their abundance and shallow roots. Because invasive trees are faster growing than native trees, many were uprooted by cyclonic winds, soil erosion, and flooding and then washed downhill to low-lying areas, devastating the communities situated in these areas. The logs became floating missiles that destroyed properties in their path and blocked river systems, causing water diversion and riverbank erosion. These log jams may in part be responsible for causing flash floods, like those seen in Faatoia and Lelata.

Fauna

The damage to or destruction of most of the forest area caused significant harm to the native and endemic birds of Samoa, which now lack suitable habitat and have low food availability. Days after the cyclone, birds were observed near human habitation, where they become vulnerable to hunting and to predation by rats, wild cats, dogs, and pigs, and where they must compete further with introduced invasive birds (mynas and bulbuls) for food and roosting sites. The Pacific pigeon, fruit doves, and flying foxes are critically threatened, and without the protection provided by forest cover may become further endangered by being hunted for food.

Marine and Mangrove Areas

Storm surges were minimal, and little damage to coral reefs was observed, even along the south coast of Upolu, which bore the brunt of the wind. However, reefs adjacent to rivers have experienced additional damage from debris (including logs and trees) and sedimentation (a very high volume of fine sediment and mud was washed downriver, and especially into Apia harbor). In the worst-affected areas, mangroves were defoliated with very little other damage, and should recover in the medium term. Some significant sea grass areas have already been impacted by dredging, but are unlikely to have suffered severe impacts from the cyclone. The shallow reef flats of the south coast of Upolu predominantly have meadows of *Halophila*, which is a resilient and dynamic species well adapted to returning after disturbance. However, sediment and nutrients discharged by rivers and the erosion of the shoreline have the potential to affect the suitability of these habitats for sea grass growth.

In the absence of market values to estimate the cost of damage to forests, damages to natural forest and key areas were estimated indirectly as the loss of their environmental services over 10 years, making the calculation for a total of 16,744 hectares. The services of the ecosystem include carbon sequestration, scenery/aesthetics, and biodiversity but exclude water-cycle regulation services. Valuation of the environmental services that have been lost

due to Cyclone Evan was accomplished through the transposition of measured ecosystem services in Costa Rica, applying the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) methodology[46] and with remote, substantive support from ECLAC.[47]

Damage and loss to the environment from Cyclone Evan are summarized in table 35.

Table 35. Damage and Loss to the Environment (thousand SAT)

	Disaster effects			Ownership by sector	
	Damage	Loss	Total	Public	Private
Damage to natural forest areas	16,251	n.a.	16,251	16,251	n.a
Losses of environmental services in mixed-use forest areas	n.a.	56,398	56,398	23,502	32,898
Total	**16,251**	**56,398**	**72,649**	**39,753**	**32,898**

Source: Estimations by assessment team on the basis of official information.

Note: n.a. = not applicable.

Recovery and Reconstruction Requirements

Risk Management Issues

Ecosystem-based interventions provide communities with the opportunity to take control of their immediate surroundings and to develop disaster risk and climate adaptation responses that are financially, socially, and culturally sustainable. Healthy ecosystems that house native species not only benefit people's livelihoods and well-being, but also offer a buffer against natural hazards and rising sea levels. Unhealthy ecosystems are more vulnerable; lowlands and flat open areas have been dramatically affected by water and flooding. The terrestrial and forest damage assessment report found that bulky waste deposited by the flood was mainly nonnative tree species. A survey of resilient species following the 2009 tsunami found that native coastal species had the highest survival rates. These same native species, including Fetau (*Calohyllum inophyllum)*, talie (*Terminalia catappa),* and coconut tree (*Cocos nucifera)*, also survived the cyclone, as did mangroves, poumuli (*Flueggea flexuosa*), *Ficus* spp, and others.

One of the serious consequences of the cyclone is the rapid spread and colonization of invasive plants (weeds, vines, and trees) due to dispersion of seeds and propagules by floods, winds, soil erosion, and animals. The opening up of forests' understory provides favorable conditions for fast-colonizing invasive plants. It is vitally important that a monitoring and surveillance program be immediately implemented and steps be taken to restore native forest biodiversity, with active participation of communities, church groups, youth, and chiefs.

Climate change as a major biodiversity issue also needs to be considered in the restoration process. Immediate safety precautions should include deliberate relocation of communities to safer grounds. Evan showed that Lelata, Satitoa, and Mulivai Safata were among the areas highly vulnerable to flooding. This does not mean other similar areas and communities should be excluded from taking extra precautions in the future.

[46] See Economic Commission for Latin America and the Caribbean, *Handbook for Estimating the Socio-economic and Environmental Impact of Disasters*, Vol. 4 (Santiago: United Nations, 2003), 1–44.

[47] Mr. Jose Javier Gómez, a senior official of the Environment and Development Division of UN-ECLAC, gratuitously provided his expertise and support for the transposition of losses of environmental services to Samoa.

Immediate Priorities

Restoring the natural environment to its former state will require significant efforts and must take into account active stakeholders and available funding opportunities. The following are immediate priorities for the restoration process:

- The conservation of remaining wildlife habitats must be recognized as highly important to ensuring the continued survival of native species and habitats.
  - The public must be advised to stop cutting down remaining native stands, as these provide important food sources for native wildlife and for natural regeneration of native forest in the aftermath of the cyclone.
  - It is essential that the ban on hunting of native bird species, forest birds (especially pigeons, fruit doves, and starlings), and flying foxes be enforced through community outreach and media engagement, to allow populations of these species to recover.
  - It would also be advantageous to establish a "Save Our Birds" taskforce that focuses on prosecuting those caught hunting birds and that establishes a hotline for the public to report those seen hunting birds.
- Restoration and rehabilitation programs of native plants in affected areas should be undertaken, as these plants are proven to withstand and resist strong winds. They will lessen vulnerability of affected areas to invasive species.
- The status of coral reefs and species, especially on areas affected by significant river discharges, should be assessed.
- Bulky debris should be immediately removed from affected areas.

Medium-Term Priorities

Medium-term priorities for restoration include the following:

- Refuge areas with native forest still standing should be identified and their conservation promoted.
- Conservation of areas with high biodiversity value should be facilitated.
- For conservation of undamaged or minimally damaged areas, the highest-priority sites are these:
  - Saanapu Uta mangrove
  - Aleipata inland area and off-shore islands
  - Other mangrove areas
- For restoration and rehabilitation of damaged areas, the highest-priority sites are these:
  - le Pupu Pue National Park
  - Vailima National Reserve
  - Uafato-Tiavea coastal forest
  - Fausaga mangrove area
  - Tafitoala mangrove area
  - Papapapaiuta Falls (Tiavi)
  - Fuluasou River
  - Matafaa craters

Long-Term Priorities

Long-term priorities for restoration include the following:

- A biodiversity survey of all key lowland and upland sites recommended for conservation in national ecological surveys should be carried out. The survey should include all parks and reserves, the Savai'i

uplands, and other native habitats severely damaged, and it should thoroughly assess forest damage and bird and flying fox counts, etc. Findings from these surveys are needed to determine further actions for specific recovery strategies for wildlife species at risk.

- A follow-up survey of the Aleipata Islands should be carried out for new invasions to Nuulua Island and impacts of the cyclone on both plants and birds. Surveys should also be conducted for Apolima and Manono islands.
- Data should be compiled on the food and feeding behavior of pigeons, doves, honeyeaters, and bats, from as wide a field of practical expertise as is practical, for use in either a cyclone contingency plan or captive breeding.
- A wildlife recovery strategy for Samoa should be drawn up using the guidelines outlined in this report so that immediate priorities can be established and management begun as soon as possible.
- The serious threat posed by the inappropriate introduction of exotic species with the potential to become pests or weeds should be recognized.
- Opportunities for establishing a captive breeding program and facilities to promote rearing and nurturing of native and endemic birds should be explored.
- Wildlife conservation education programs aimed at rural villages in Samoa should be developed and promoted.
- Existing wildlife regulations should be reviewed and extended so that they focus on native species and not just endemic species.
- An effective monitoring program for exploited species should be established so that population trends can be translated into effective hunting management.
- The feasibility of a cyclone contingency plan to protect threatened wildlife in the event of another cyclone should be assessed.

Recovery, reconstruction, and disaster risk reduction (DRR) needs have been estimated in accordance with the damage and loss assessment (DALA) methodology, using as a basis the values of the damage and loss to the ecosystem arising from the disaster. The estimated values are shown in table 36.

Table 36. Estimation of Recovery, Reconstruction, and Risk Reduction Needs in the Environment Sector (thousand SAT)

	Recovery	Reconstruction	DRR	Total
Removal and disposal of downed trees	4,893	n.a.	n.a.	4,893
Replanting of trees in natural forest areas	n.a.	7,702	n.a.	7,702
Replanting of mixed-use forest areas	n.a.	9,682	n.a.	9,682
Infrastructure reconstruction	n.a.	97	n.a.	97
Control of invasive species	n.a.	n.a.	28,465	28,465
Total	**4,893**	**17,481**	**28,465**	**50,839**

Source: Estimations by assessment team on the basis of damage and loss.

Note: n.a. = not applicable.

The impact on GDP growth rate is expected to slow down by 0.2 percent in 2012, may be zero or negative in 2013, and may not fully recover even in 2014.

Photos

Damage to commercial, private, and public buildings was extensive.

Top and bottom: Courtesy of GoS/PDNA Assessment team.
Center: © Thinkstock.com.

4. ECONOMIC IMPACTS

On the basis of damage and loss information obtained during the Cyclone Evan assessment, sufficient information is available both to analyze disaster impact at the macroeconomic level—with reference to gross domestic product (GDP) performance and external sector and fiscal position—and to estimate disaster impact at the household and personal level, including imputed personal or household income decline and the possible aggravation of poverty.

Macroeconomic Impact Analysis

Pre-disaster Economic Performance and Forecasts

The Samoan economy is relatively small and is very vulnerable to external shocks caused by international crisis and disasters of natural origin, such as the one caused by Cyclone Evan at the end of 2012. It also has a relatively high dependency on imports to meet the basic demands of its population, as the productive base is limited.

As may be observed in table 37, production in Samoa is concentrated mainly in commerce activities, transport and communications services, the construction sector, and finance and business services, while agriculture, livestock, fishery, and manufacturing production are smaller in their contribution to GDP.

Annual GDP growth has varied from a vigorous 5 percent in 2007, to a low of –3.7 percent in 2008; that value was caused by a decline in fish exports as well as the slowdown of construction, transport, and tourism revenues after the Pacific Games in the preceding year. In 2009, GDP declined by 1.4 percent because of the impact of the earthquake and tsunami, which was partially offset by reconstruction investments. In 2010 a growth rate of 1.8 percent was achieved, followed by 1.3 percent in 2011. The growth forecast for 2012 was of 2.8 percent.

According to International Monetary Fund (IMF) figures, Samoa´s current account balance of payments worsened continuously after the earthquake and tsunami in 2009, both in quantitative terms and in the relation to GDP. Fiscal year 2012/13 was expected to provide a turning point in the negative trend (see table 38), but these forecasts will now need to be revised because of the impact of Cyclone Evan.

Table 37. Gross Domestic Product of Samoa, 2007–2011

	Gross domestic product by sector, million SAT (constant prices)				
Sector of economic activity	**2007**	**2008**	**2009**	**2010**	**2011**
Agriculture	67.8	60.9	59.1	53.9	55.4
Fishing	53.2	47.7	49.3	45.6	44.9
Food and beverage manufacturing	27.7	20.8	17.1	21.5	21.8
Other manufacturing	129.2	106.6	84.8	90.2	74.1
Construction	135.8	129.0	126.6	133.3	145.0
Electricity and water	48.5	49.4	52.5	54.8	56.0
Commerce	194.4	192.8	192.0	195.6	201.6
Hotels, restaurants	36.3	38.2	36.2	33.8	34.5

continues

Table 37. Gross Domestic Product of Samoa, 2007–2011 (continuation)

	Gross domestic product by sector, million SAT (constant prices)				
Sector of economic activity	**2007**	**2008**	**2009**	**2010**	**2011**
Transport, communication	148.2	150.1	160.6	165.4	168.9
Public administration	84.2	87.1	91.0	93.0	95.2
Finance and business services	100.6	103.0	106.5	106.6	110.6
Ownership of dwellings	31.1	31.2	31.3	31.4	31.4
Personal and other services	58.4	58.3	53.6	54.7	54.6
Less: Enterprise share of FISM	-12.7	-13.2	-14.0	-14.1	-14.5
Total	**1,102.8**	**1,061.8**	**1,046.5**	**1,065.7**	**1,079.4**

Source: Samoa Bureau of Statistics.

Note: FISM = Financial Services Indirectly Measured.

Table 38. Historical Data and Projections of Samoa's Current Account Balance of Payments

	Historical data			Projections		
Current account balance	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**
Million US$	-18.0	-45.0	-54.7	-81.5	-87.8	-82.6
As percent of GDP	-3.1	-7.2	-8.6	-11.4	-11.8	-10.8

Source: IMF, *Samoa 2012 Article IV Consultations.*

In regard to the fiscal position, it should be pointed out that as a consequence of the 2009 earthquake and tsunami, total revenues declined and grants increased, and current and development expenditures also increased, resulting in an increased fiscal deficit. The fiscal deficit reached –7.6 percent of GDP in 2009, but it has been declining since that time, and reached –5.2 percent in 2012 (see table 39). The impact of Cyclone Evan may reverse the recent trend.

Table 39. Fiscal Balance Information for Samoa, 2007–2012 (million SAT)

	Historical data				Projected	
	2007/08	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**
Total revenue and grants	**454.9**	**492.0**	**525.2**	**567.2**	**535.3**	**543.3**
Domestic revenue	378.0	381.4	372.4	423.8	396.0	422.2
Grants	76.9	110.7	152.8	143.4	139.3	121.1
Total expenditure and net lending	**476.5**	**552.5**	**633.8**	**664.6**	**605.1**	**628.8**
Current expenditure	372.4	358.8	349.1	374.8	384.8	395.0
Development expenditure	96.2	182.1	273.8	272.9	212.9	220.0
Net lending	7.8	11.7	10.9	16.8	7.4	14.0
Overall fiscal balance	**-21.6**	**-60.5**	**-108.7**	**-97.4**	**-69.8**	**-85.5**

Sources: Samoa Bureau of Statistics; IMF, *Samoa 2012 Article IV Consultations.*

Isolated Disaster Impact

The estimated values of losses in production and of higher expenditures arising from Cyclone Evan have been combined with the forecasted macroeconomic performance for the country in order to ascertain possible disaster impact. For this purpose, the analysis has been conducted in two phases: the first phase assumes that no recovery and reconstruction interventions are ever made, to obtain the isolated impact of the disaster; and the second phase involves introducing the foreseen economic recovery and envisaged reconstruction activities.

From past experiences in the world, it can be inferred that not all disasters cause a measurable impact at macroeconomic level, since these events may involve comparatively small areas of a country and not affect strategic sectors of economic activity. However, in small island countries, disaster impact at the macroeconomic level is often of significance in view of the smaller size of such economies.

The process for analysis involves using as a basis the forecasted performance of GDP,[48] in combination with the values of estimated production losses and higher expenditures that arise due to the disaster over the entire recovery and reconstruction period. To avoid any possibility of double counting in the analysis, sectoral production losses are converted into value added, using technical coefficients that relate gross production to value added, as obtained from input/output tables or supply and use tables for the country, thus eliminating intermediate consumption.[49]

The estimated annual values of production losses and higher expenditures were obtained from the assessment, as shown in figure 7, and the post-disaster GDP values were derived as indicated in table 40.

Table 40. Estimated Disaster Impact on Forecasted GDP, 2012–2014 (million SAT)

	2012	2013	2014
Forecasted GDP	**1,110.1**	**1,135.6**	**1,164.0**
Production losses	2.8	38.1	6.8
Higher expenditures	1.1	13.7	n.a.
Net losses	1.7	24.4	6.8
Post-disaster GDP	**1,108.4**	**1,111.3**	**1,157.2**

Source: Estimations by assessment team on the basis of official information.

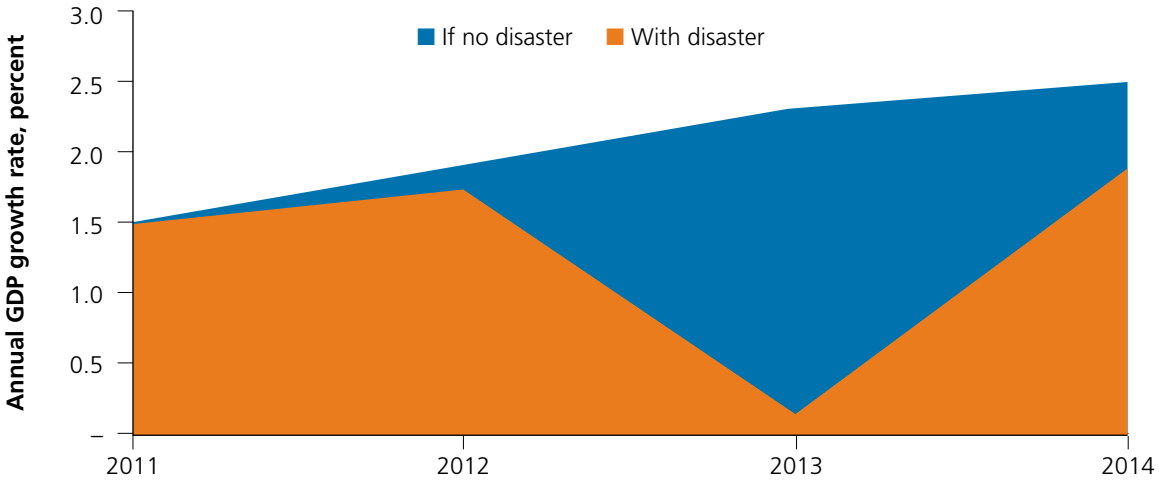
Note: All amounts shown are constant prices. n.a. = not applicable.

Annual values of decline in GDP growth caused by the disaster were estimated in a first phase of the analysis, representing the growth rate modifications that are due to the isolated impact of the disaster—that is, assuming that no recovery and reconstruction interventions are ever made. Under that assumption, it is foreseen that GDP growth will slow down by 0.2 percent in 2012, may be zero or negative in 2013, and may not fully recover even in 2014 (see figure 12, which shows GDP growth rates without and after Cyclone Evan).

[48] Official projections were obtained from IMF, *Samoa 2012 Article IV Consultations*.

[49] For the case of Samoa, and in the absence of such input/output information, use was made of value-added goods and services tax (VAGST) data for most sectors of economic activity; for agriculture and fishery, the value-added coefficients were derived from household income and expenditure survey data supplemented by regular market supply surveys, as provided by the Statistical Office and the Ministry of Revenue of Samoa.

Figure 12. Estimated Cyclone Evan Impact on GDP Growth Rate, Assuming No Recovery and Reconstruction Activities and Investments, 2012–2014



Source: Estimations by assessment team on the basis of official information.

In regard to the possible impact of the cyclone on the fiscal balance, estimations were made of the lower tax revenues (VAGST) that would be forthcoming in view of both production losses across all affected sectors of economic activity and higher current expenditures that have to be met after the disaster. As in the case of the GDP impact analysis, this analysis was conducted assuming that no economic recovery activities and reconstruction investments were to be done, thus isolating the impact of the disaster from such post-disaster interventions.

It was estimated that the fiscal balance in 2012/13 would slightly worsen to SAT -89.7 million (compared to -85.5 million), since the disaster only occurred in mid-December of that year. In 2013/14, however, the fiscal balance would worsen by about SAT -47 million exclusively due to the disaster, as shown in table 41. It should be noted that these results apply to the situation before undertaking any recovery and reconstruction activities, which—when implemented—would modify the fiscal imbalance further.

Table 41. Estimated Cyclone Evan Impact on Fiscal Position, 2012–2014 (thousand SAT)

	2012/13	2013/14	2014/15
Lower tax revenues	567.5	5,270.6	1,154.7
Higher current expenditures[a]	3,642.4	43,940.8	-

Source: Estimations by assessment team on the basis of official information.

[a] These higher expenditures include the cost of emergency relief provision and higher cost of provision of water, sanitation, electricity generation, and other similar unexpected operational costs arising from the disaster.

When considering only the isolated impact of the disaster, there will be a measurable negative impact on the balance of payments in view of the revenues lost in the tourism sector and in tourism-related sales of the commerce sector; these losses will increase the current account balance by –1 percent of GDP in fiscal years 2013 and 2014[50] (see table 42).

[50] No significant losses of export-oriented production were identified in other sectors of economic activity.

Table 42. Estimated Cyclone Evan Impact on Balance of Payments, 2012–2014

	2012/13	2013/14	2014/15
Pre-disaster current account balance, million US$	-87.8	-82.6	-78.5
Pre-disaster current account balance, as % of GDP	-11.8	-10.8	-9.9
Post-disaster current account balance, million US$	-88.1	-90.8	-83.0
Post-disaster current account balance, as % of GDP	-11.8	-11.9	-10.5

Source: Estimations by assessment team on the basis of official information.

Impact of Post-disaster Economic Recovery and Reconstruction

The impact of post-disaster economic recovery measures and of reconstruction investments may have a significant positive bearing on Samoa´s economic performance, in relation to the isolated-disaster-impact scenario previously described. Recovery activities are designed to ensure that adequate levels of working capital are available to producers and that the level of services provision recovers to at least pre-disaster levels for the population at large. Reconstruction needs refer to investments required to rebuild destroyed assets with added risk reduction features to ensure disaster resilience of the buildings and infrastructure for the benefit of the population at large, as part of a "building-back-better" strategy. Execution of these recovery and reconstruction activities will require considerable amounts of financing that, when put into practice, will provide for increased levels of economic activity and result in increased economic growth.

There are, however, several factors to be considered in analyzing the impact of recovery and reconstruction on the country's macroeconomic performance. On one hand, the availability of detailed reconstruction plans and their financing need to be factored in; it is very likely that these plans and the required funding will not be available until perhaps mid-2013. Thus, the resulting increased growth of the economy would not start to be felt until the second part of the present calendar year.

On the other hand, the Samoan economy's execution capacity is limited, which would result in a relatively long period of recovery and, especially, of reconstruction. Just to point out one such limitation, the estimated capacity of the local construction service is such that the period of reconstruction will likely last for at least three calendar years, beginning from when funding and detailed plans are available.[51]

Recovery activities have been estimated as the financial requirements to ensure that (a) sufficient working capital is available for producers to restart their activities in their respective sectors; (b) urgent social needs arising from the disaster are met; and (c) the additional budget resources required by the government to restore a minimum provision of essential services (education, health, water and sanitation, electricity, etc.) are obtained. In broad terms, these recovery needs amount to about SAT 100 million, with front-loading in 2013 (75 million), 20 million more in 2014, and the balance in 2015 (3 million). Annual reconstruction requirements across all affected sectors of social and economic activities have been estimated to be an average rate of SAT 75 million per year, extending through 2016.[52]

An analysis of the impact of recovery and reconstruction on gross domestic product, assuming that all needs are met—through a combination of government funds and private sector funds (including expanded family remit-

[51] The summary of damage and loss indicates that the value of destroyed assets is equivalent to 116 percent of the construction sector GDP in 2011. Since reconstruction requirements are higher than the value of damage, it is easy to foresee that reconstruction will take more than two years, and possibly three to four years.

[52] For details on the required levels of recovery activities and reconstruction investments, see the appropriate report section on the estimation of post-disaster needs.

tances from abroad as well as soft-term financing channeled through the private banking system for recapitalization and reconstruction of productive sector activities)—shows that the resulting growth of GDP would offset the negative growth expected in 2013 as induced by the production losses caused by Cyclone Evan, and continue beyond the next three years. The value of this higher growth rate would depend on the availability of the additional funds required, the execution efficiency of the recovery and reconstruction program, and its effective starting date, and would continue beyond the present calendar year and possibly go forward into 2016.

For the recovery and reconstruction program Samoa will need to import large amounts of construction materials and fuel for electricity generation, since these are not produced domestically, and these imports will have a negative bearing on the balance of payments current account. Superimposing these import requirements for recovery and reconstruction on the current account balance, it may be observed that once recovery and reconstruction begin, the current account balance would increase to levels beyond –14 percent of GDP in 2013/14, and would not go below –12 percent until 2015/16, instead of declining from 11 percent in 2013/14 towards about 9 percent in 2015/16 (see table 43).

Table 43. Estimated Impact of Recovery and Reconstruction on Samoa's Balance of Payments

	2012/13	2013/14	2014/15	2015/16
Pre-disaster				
Current account balance of payments, million US$	–87.8	–82.6	–78.5	–74.4
Current account balance of payments, as % of GDP	–11.8	–10.8	–9.9	–9.1
Post-recovery and reconstruction				
Import requirements for recovery and reconstruction, million US$	4.5	25.0	23.0	23.0
Current account balance of payments, million US$	–88.1	–107.6	–101.5	–97.4
Current account balance of payment, as % of GDP	–12.4	–14.1	–12.8	–11.9

Source: Estimations by assessment team on the basis of official information.

A full and thorough analysis would need to be made on the possible impact of recovery and reconstruction on the fiscal sector position, where the possibilities of reducing or eliminating import taxes on construction materials may be considered as part of a way to reduce the total cost of reconstruction after Cyclone Evan. If no such modifications are made, overall tax revenues may increase and help the government of Samoa to reduce the current account balance after the disaster.

Employment and Personal Income Impact Analysis

On the basis of the macroeconomic impact analysis results, and in combination with information on the labor force and average earnings, it is possible to indirectly estimate disaster impact on employment, income, and poverty levels.

Equivalent Employment Losses

An estimation of equivalent employment losses—considering both employed and self-employed persons—as a result of the Cyclone Evan disaster was arrived at based on an assumed constant national relation between quantity of sector production and the size of the labor force, in combination with the estimated values of sectoral production losses.

Results of this indirect analysis reveal that an estimated total equivalent of 9,671 work-years of employment were lost due to the disaster from 2012 to 2014 (see table 44), of which 89 percent refer to men and the remaining

11 percent refer to women. They further reveal that 82 percent of these equivalent employment losses will occur in 2013, 13 percent will occur in 2014, and 5 percent already occurred in 2012. They show in addition that agriculture was the most impacted sector, with 91 percent of equivalent employment losses, followed by tourism (5 percent of the estimated losses).

Table 44. Estimated Losses in Equivalent Employment Due to Cyclone Evan (work-years)

	2012		2013		2014		Total	
	Men	Women	Men	Women	Men	Women	Men	Women
Agriculture	375	24	6,937	438	1,071	68	8,384	529
Fishery	5	1	101	10	-	-	107	10
Manufacture	3	3	14	11	-	-	17	14
Commerce	8	7	61	60	10	10	79	77
Tourism	5	5	141	144	79	80	225	229
Total	**397**	**39**	**7,255**	**662**	**1,160**	**158**	**8,812**	**859**

Source: Estimations by assessment team on the basis of official information.

Note: - = negligible.

Imputed Personal Income Losses

Using recent information on the average wages earned by the labor force in each sector of economic activity, in combination with previously described equivalent employment losses, estimations were made of imputed personal income decline of wage earners and self-employed workers caused by the disaster (see table 45).

Table 45. Imputed Annual Personal Income by Sector and Gender before and after Cyclone Evan, SAT/Person

		Agriculture	Manufacture	Commerce	Tourism
2011	Men	14,189	16,330	9,394	7,051
	Women	9,149	7,613	8,640	6,624
2012	Men	13,817	16,287	9,358	7,051
	Women	8,909	7,593	8,607	6,624
2013	Men	7,263	16,167	9,064	5,223
	Women	4,683	7,537	8,337	4,907
2014	Men	13,138	-	9,285	6,155
	Women	8,472	-	8,540	5,782

Source: Estimations by assessment team on the basis of official information.

Note: - = negligible.

The estimations contained in table 45 reveal that the average wage-earning and self-employed worker in the agriculture sector would sustain an imputed reduction of annual income in the order of 49 percent in 2013, and that the same worker in tourism would face an 11 percent imputed income decline in the same year, as a result of the production losses caused by Cyclone Evan. These imputed income losses would continue until at least 2014.

Possible Aggravation of Poverty

In view of the temporary decline in imputed personal income described above, it is very likely that many families will temporarily fall below the poverty line as a result of Cyclone Evan, and that reinforcement of ongoing government efforts to reduce poverty will be required. Further analyses are required in order to define requirements to address this situation.

"Communities are strong; always strong.
There is vulnerability, but there is also capacity."

—Emergency worker, Apia

Photos

Top: Samoan children, © Saikit Leung | Dreamstime.com.

Center/Left: Destruction to infrastructure.

5. HUMAN AND SOCIAL IMPACTS AND NEEDS

Key Findings and Recommendations

The assessment of the human and social impacts of Cyclone Evan, and of the needs arising from these impacts, found the following:

- Social cohesion and social relations were strong, with communities supporting their members and extended families well. Some incidents of antisocial behavior were reported.
- Subsistence livelihoods and low-income households have been heavily impacted by the storm and will require support in order to restore and maintain livelihoods. Food security is not an immediate concern but should be monitored in the coming months, as staple food stocks start to run low in rural areas and urban markets, and incomes remain low over the year.
- Vulnerable groups have been impacted, and new vulnerabilities have been created. The elderly, children, and people with disabilities were recognized as the most vulnerable, but were well taken care of by families and communities. A less visible group of individuals and families that are outside of community structures emerged as particularly vulnerable in disaster contexts. In addition, a new group of vulnerable people has been created due to severely damaged or destroyed homes: there are 606 households, or roughly 4,242 people, who will require immediate financial and technical reconstruction assistance. Finally, some communities are still without clean water and sanitation facilities more than a month after the storm, which leaves them at risk of contracting waterborne diseases and vulnerable to other possible disease outbreaks.[53]
- Communities felt they were unprepared for such a severe disaster. They lacked community-based disaster plans, and in rural areas received limited official assistance in the way of first responders and evacuation centers.
- The governance of relief assistance could be improved by focusing attention on equity versus equality of assistance distribution within communities and between urban and rural areas; on transparency and accountability of distribution by the government and at the community level; on improved communications regarding assistance between government and communities, and within communities; and on shelter management.

The following are key recommendations for short- and medium-term recovery:

- Provide a one-time cash transfer for the most-vulnerable persons.
- Facilitate debt-relief measures for the most-vulnerable households and persons with loans.
- Provide a credit scheme with low collateral requirements for low-income men and women currently unable to get loans.
- Establish a Community Driven Development (CDD) program to facilitate livelihoods and community recovery.
- Monitor the food security and nutrition status of impacted communities.

[53] See the water and sanitation chapter for these findings.

Human and Social Dynamics of Disaster Preparedness and Response

Community Preparedness

"I took for granted that people would know what to do, as cyclone season is every year."
—Mayor, male, Falefa, Anoamaa Sasae (rural)

"There are awareness programs for tsunami but not for cyclone or any other disaster."
—Woman representative,[54] Siumu, Faipule (rural)

At the community level, disaster preparedness is generally low, although there had been efforts to improve preparedness in the recent past. None of the communities visited, in either urban or rural areas, had a general disaster preparedness plan. As cyclones are a recurring natural event in the region, most respondents, men and women alike, felt they had a sufficient understanding of cyclone preparedness, and reported that the speed, intensity, and consequent flooding of Cyclone Evan took all respondents by surprise. People's knowledge about cyclones is informed by government-sponsored cyclone awareness spots on TV and radio (the majority of respondents relied on radio) and in large part by local knowledge based on past experience. Rural villages seemed to be less prepared than urban Apia, possibly due to urban dwellers' greater access to and consumption of information.[55] No significant differences were found between men and women in regard to information access and levels of preparedness. Although a majority of respondents thought it was the responsibility of each family to prepare, on reflection, many wished there had been a community action plan. Most respondents agreed that a general natural disaster preparedness plan for the community was needed, and that such a plan should be general (that is, should deal with multiple hazards) rather than event specific.

In the village of Moata'a, in Apia, preliminary training for multihazard community risk management had begun the week before the cyclone. One respondent explained that *"a week before the cyclone the Samoan Red Cross . . . held a training on general disaster management. They were locating shelters in the village and talking about how to maintain them, . . . discussing establishing several committees such as first aid teams, and rescue teams. They were supposed to meet the week of the cyclone to establish the teams and delegate responsibilities. The training was good, but it needs to be finished."* It was found that this training was part of a joint, comprehensive disaster risk management (DRM) planning and training program by the National Disaster Management Office (NDMO) and Red Cross. It was also learned that broader community village development planning exercises run by the Ministry of National Resources and Environment (MNRE) and the Ministry of Women, Community and Social Development (MWCSD) had included DRM issues. It was not possible to assess whether any of these initiatives had contributed to better community preparedness, given their (still) limited geographical coverage. A multihazard, community-based disaster risk management program is likely to respond to many of the preparedness gaps that communities reported during the assessment.

Evacuation

Setup and Management of Evacuation Centers

There were 10 formal evacuation centers (ECs), all in urban Apia, 5 run by the government and 5 by nongovernmental organizations (NGOs). The ECs housed up to 7,700 people during the height of the emergency, but there

[54] A woman representative is a government-sponsored position that exists in each village in Samoa and plays a key role in development planning and activities in the community.

[55] Radio, television, telephone, texting (locally and with family and friends abroad), and Facebook were common channels of information, though all of these were cut off after the power went out in heavily affected areas.

was no disaggregated information on how that was divided among men, women, and children. The duration of stay at evacuation centers varied; some stayed overnight or for periods of 2–5 days, while others stayed for the full duration of the emergency phase, that is, 30 days.

Government institutions and NGOs involved in the emergency thought that since this was the first time Samoa was operating officially designated ECs, the experiences and lessons would be valuable in informing and improving the management of shelters in the future. One immediate area for consideration was the geographical spread of the ECs. All were located in urban areas, and respondents from rural communities reported seeking refuge in make-shift shelters (for example, church halls) or with host families.

Overall, shelter managers reported mixed experiences. Several said their coordination with the NDMO had been very effective, better than in previous experiences. NGOs with prior shelter-management experience felt they were better prepared this time. For example, one faith-based NGO reported that because it had invested in formulating preparedness plans, procuring and prepositioning nonfood items, training staff, and making contacts with private sector actors (who, for example, had assisted with catering), it was better prepared to manage the shelter in the case of Evan.

It was found that effective shelter management had a direct impact on residents' well-being. For example, residents in particular ECs reported that shelter managers were fair and effective in distributing relief, disaggregating the needs of vulnerable groups, and paying attention to interpersonal needs. In other ECs, families reported that managers did not have the required skills to run a complex shelter operation well. Examples of good practices were garnered that are worth exploring for future standardization or replication, such as providing psychosocial assistance (for example, art sessions for children, pastoral outreach), selecting community volunteers as shelter leaders, organizing a division of labor among shelter volunteers, ensuring a better gender balance among staff and volunteers, and partnering with the private sector in food preparation and water purification. Other good practices included distribution of tool kits for families to use in rebuilding work; outreach, treatment, and monitoring of health by medical teams; separate sleep and hygiene areas for men and for women and children; accommodation of the elderly and special-needs evacuees in close proximity to toilets; setup of community water tanks and other facilities; and strong communication links with NDMO and other response/aid organizations.

Conditions, Facilities, and Services at Evacuation Centers

"We felt safe in the shelter—it was warm, the food supply was good, and there was water."
—Male shelter resident, Sisifo, Faelata'i (rural)

"There were issues of safety and privacy for my family because of the overcrowding: sleeping next to strangers, risk of catching diseases. We returned [home]."
—Male shelter resident, Sisifo, Faelata'i (rural)

Depending on the specific EC and duration of stay, there were mixed assessments about conditions and facilities. Most resident respondents, both men and women, responded favorably to questions about the availability of food and drinking water. Most respondents, both men and women, responded less favorably to questions on overcrowding and access to sanitation facilities. They reported a drop in hygiene standards (for example, open defecation), resulting in an increased risk of illness and disease. These responses were supported by several reports of children contracting diarrhea and skin rashes during their stay at some shelters. Families also reported that overcrowding, undivided sleeping quarters, an insufficient number of toilets, and unlocked toilets caused particular difficulties for women and girls and raised concerns for their safety, though no specific incidents were

reported. Respondents also indicated that these limitations, along with the lack of disability-friendly toilets and access ramps, made living conditions harder for the elderly and those with disabilities and special needs.

Shelter managers shared similar assessments about conditions and facilities, but also reported that the centers moved from chaos to relative stability over time. For example, in the first 24–48 hours, access to water and sanitation facilities was extremely inadequate, but once these were functional and available (if still insufficient in number), on average 48–72 hours later, conditions improved significantly. The availability of power seems to have been a significant improvement, and EC managers reported that the restoration of power also helped people to charge their phones and reconnect with family members and friends outside. Based on the interviews, it was found that most of the recurring challenges and concerns were attributable to the fact that the centers had not been built to serve as shelters, and therefore were not able to accommodate and provide facilities for the numbers and categories of people they were housing.

Living with Host Families

"We did not have any problems providing for them, we still had enough supplies for everyone."
—Female host family member, Fusi Safata, Safata (rural)

In urban and rural areas, many families were hosted by extended family and/or host families. This was the primary type of shelter in rural areas, which had no formal ECs. Respondents who had lived with host families reported positive experiences overall, which they largely attributed to the fact that they knew or were related to their hosts. These reports indicate strong social cohesion at the community level, particularly in rural areas. Interviewed host families did not report any serious concerns arising from hosting, with the exception of having to accommodate relatively large numbers of people. In Samoan culture, a host family would be expected to pay for all meals for guests. Though one would assume that such a responsibility could have been a significant strain on household resources, it was raised as a concern in only one instance, where the host did not personally know any of the people he was hosting. One urban family hosted two large families totaling 40 people, and indicated that they emptied their freezer in feeding everyone. Aside from this indication of significant resources spent, there were few complaints by hosts of their responsibilities. However, many hosts and guests in urban areas raised questions about why they had not received relief assistance.[56]

Governance and Equity of Relief and Assistance

"Our village received two sets of relief from government. One went to the mayor and the other to the woman representative. They were not sure why this assistance was given. All the office told them was to distribute to the families that were affected. "
—Female focus group discussion (FGD) member, Falefa, Anomaa Sasae (rural)

"At a later point the food distribution truck came, but only three families were considered in need and provided for. The community decided that this was unfair and told the food distributors to take the food away if they would not provide for the whole village. "
—Male FGD member, Manunu, Anoamaa Sasae (rural)

[56] The differences in distribution of urban and rural relief assistance are discussed below in the section on governance and equity of relief assistance.

Those who received assistance identified the main providers as NDMO, the Samoa Red Cross, the government (MNRE, MWCSD, Ministry of Health, and Samoa Water Authority), and church-based organizations such as Caritas, Adventist Development and Relief Agency (ADRA), and the Mormon Church. Assistance came in a variety of commodities: food, clean drinking water and tanks, tarpaulins, hygiene kits, clothes and blankets, rebuilding tool kits, and household goods. Urban residents spoke more about primary and supplementary assistance from faith-based organizations than did rural residents, though these resources seemed to vary according to what these organizations had at their disposal. In a number of cases, these organizations offered support only to their own members, despite the needs of the entire village. A number of private sector agencies were also mentioned as informal distributors. Villages and individuals were also assisted by relatives, both in Samoa and overseas, who donated cash, food, and building materials. Communities noted that some government and NGO relief distributers had conducted assessments prior to distribution, though the team determined that no comprehensive or consultative damage or needs assessments had been done.

There seemed to be limited understanding among respondents of how to access relief outside of delivery structures in ECs and in rural villages. The NDMO had invited people, via TV, radio, and Facebook, to contact them directly or go to distribution centers, but only one interviewed family—who had a prior relationship with the MWCSD and knew someone to contact[57]—reported having done this. One urban respondent noted that *"NDMO was very busy. They said 'keep on calling and reminding us.'"* Overall, the option of contacting NDMO for assistance did not seem to have been used extensively, especially by remote villages without access to power and telecommunications, and it was unclear how widely this message was communicated or received.

Urban Experiences of Assistance Distribution

Perceptions of assistance differed considerably among urban households depending on whether they had been evacuated to a shelter, stayed at home, or stayed with a host family. Respondents located in ECs had more positive experiences overall with regular distribution of food and supplies, though issues arose when ECs were filled beyond capacity and resources were strained. However, many respondents felt that those in shelters had been prioritized at the cost of neglecting those in the communities. In urban areas, distribution took place at shelters, and those who stayed at home or in host families were required to travel to distribution centers to get assistance. Many urban households seemed unaware that distribution was taking place at shelters, and many respondents expressed confusion about why they had not received assistance. One man speculated that perhaps the village mayor did not understand his responsibilities or was corrupt. These findings are concerning, and suggest that inadequate communication regarding assistance eligibility may have undermined community members' trust in village leaders and representatives.

Rural Experiences of Assistance Distribution

Rural residents had mixed levels of understanding and opinions about eligibility. Cultural practice in Samoa demands that assistance be evenly distributed among all village residents. This runs contrary to typical aid distribution practices, where aid is distributed with priority for those most affected or those with pre-existing vulnerabilities. In this disaster, the NDMO took the decision to provide assistance to households whose homes had been assessed as completely or partially damaged.[58] Thus only enough supplies to cover the needs of the families that had incurred

[57] This family had been banished from its rural village after disagreements with the Matai. Familiar with the government because of its ongoing discussions regarding the dispute, this family called the MWCSD to say they had been left out of the village distribution process, to which the ministry responded by driving out and delivering assistance directly.

[58] In the assessment these were classified as priority 1 (completely damaged and unsafe for further occupation) and priority 2 (partially damaged and unsafe for further occupation).

this level of damage would have been delivered to rural communities. However, responsibility for actual distribution of supplies to the villagers was left in the hands of community leaders or representatives (for example, the Matai, mayor, pastor). This arrangement led to different distribution criteria being applied in different villages, and resulted in mixed opinions about equal versus equitable distribution. A majority of respondents indicated that the assistance was not enough or was disproportionate to the number and specific needs of the family.

There were mixed feelings about the role that community leaders and representatives, especially mayors, played in distributing aid. In some areas, respondents were concerned that community governance structures had been undermined by government during the distribution. In some villages, the role of the village representatives in coordinating relief was recognized and appreciated. Positive examples were observed of local leaders trying to strike a balance between cultural norms and customary aid distribution practices. For example, one village mayor explained that in his village, *"We received assistance of rice, tinned fish, sugar, tarpaulin, water bottle, blanket, and so forth. I called every family of the village to my house and we distributed them equally. They all saw what the village received and were satisfied with the distribution."* In many other villages, however, people thought too much discretion had been given to the local leader or representative, and that this led to inefficiencies and unfair distribution. It seems that the involvement and oversight by a local, third-party representative, along with some sort of grievance structure, would have helped mitigate some of the concerns that communities expressed.

Socioeconomic Impacts on Households

Livelihoods Impacts

"From next month there will be no income flow in the family, which means they (men) will have to find employment to meet the daily family needs."
—Female, FGD respondent, Falefa, Anomaa Sasae (rural)

"Our main source of income is the land. Right now there are no more plantations, families are starting to replant again but that will take maybe another year for things to get back to normal."
—*Female* FGD respondent, Manunu, Anoamaa (rural)

The impact on subsistence households has been significant, with loss of crops and destruction of fruit trees, agricultural inputs and assets, livestock, and fishing gear. Of the four rural districts visited during the assessment, subsistence farming, with some fishing, was the livelihood for the vast majority. Subsistence households are likely to have a couple of plots for plantation of ufi,[59] banana, taro, coconut, and breadfruit, which are produced for consumption and some sale on the side of the road. The majority of these households indicated that between 70 and 95 percent of their income (food and cash) derived from their plantations. The agriculture sector findings in this report show dramatic losses of these primary crops, except taro, which it suggests was only moderately affected. Many households have a few small livestock holdings, including chickens, pigs, and cows, though not every household has all of these. Households also fish (with spear and small nets) as a supplement to their plantation work, largely for consumption.

Informal self-employment seems to have been moderately to heavily impacted. The commerce sample survey indicates that small-scale and one-person businesses, such as those of vegetable sellers, seamstresses, craftspeople, and market stall owners, are experiencing a decline in sales. Vegetable sellers in particular worry about the reduc-

[59] Ufi is a root crop similar to manioc. It grows three years before it can be harvested.

tion in availability of stock (as much of the vegetable harvest was affected by the storm) and possible high prices due to scarcity, which many customers may not be able to afford. Small businesses expressed worry that their lack of access to capital may hinder their ability to pay for repairs and restocking, and in general to reestablish their businesses, particularly at a time when sales are significantly reduced. One type of business that seems to have benefitted from the storm is small, rural shops that did not sustain heavy damages. Respondents who owned such shops indicated an increase in business as the community's needs had increased and as access to transport had remained limited, meaning fewer people than normal were going to town to shop.

Women's sources of subsistence income in rural areas have been negatively impacted. Women in subsistence households are primarily responsible for cultivating vegetables such as cucumbers, tomatoes, and eggplant. Respondents reported that these fragile crops were lost during the cyclone and will need replanting. Mat weaving, another source of income for women primarily, may have been negatively impacted by the storm, but respondents had not yet been out to see the *panadas* (grasses used in weaving) since the storm, and therefore did not know whether their income would be disrupted in the future. A possible disruption in livelihoods may come for teachers—a vast majority of whom are women—if schools are not able to reopen at the end of January and if no substitute premises are made available. Livelihoods for women who sell commercial fishing bycatches may be harmed if fishers have not resumed activity. Women involved in primary fishing activities, such as collecting of invertebrates, did not report any negative impacts due to the cyclone or floods.

In urban Vaimauga, the impact on employment is mixed, as the majority of people depend on salaried jobs that have not been heavily impacted, but some informal sector and self-employed workers have lost important livelihood assets. Respondents in the heavily affected district of Vaimauga indicated that roughly 70 to 80 percent of the working-age adults in their communities have salaried positions in the government, private sector, and tourism sector. Though the industry and commerce sector analysis indicates that a limited number of equivalent jobs was lost—a total of 31 in manufacturing and 226 in commerce—the tourism assessment indicates a much higher number of 974. These equivalent job losses refer not to salaried workers but to those paid by time-related wages. Government jobs were not assessed but seem to be relatively stable according to respondents.

Imputed income decline analyses for wage-salaried and self-employed persons show that livelihoods in agriculture and fisheries[60] will be most heavily impacted, incurring an overall 49 percent decline in 2013 before returning to roughly 92 percent of 2011 levels in 2014 (see table 46). This breaks down to more than 66 percent of households[61] in Samoa experiencing this halving of income in the year to come. Tourism employees are expected to experience a roughly 11 percent decline in income over 2013, and to reach only 94 percent of 2011 levels in 2014. Manufacturing and commerce are unlikely to see a large change in their incomes due to the storm.

Table 46. Estimated Imputed Personal Income Decline for Wage-Earners and Self-Employed Workers after Disaster (percent)

	2012	2013	2014
Agriculture	3	49	8
Manufacture	0	2	0
Commerce	0	3	1
Tourism	0	11	6

Source: Estimations by assessment team for macroeconomic impact analysis.

[60] The category includes paid agricultural workers as well as subsistence agricultural livelihoods.

[61] This category includes all "subsistence," "mainly home consumption," and "mainly for sale" households in Upolu, as found in the agricultural census.

The impact of these income declines will reach far beyond the households that experience the direct reduction. Households in agriculture will, over the next year, grapple with difficult decisions on how to reduce expenditure, weighing immediate needs such as food, health, and valued social expenses (such as ceremonies) against long-term investments in livelihoods and education. These decisions could have long-reaching effects on families' future opportunities if education, health, and livelihoods prospects are compromised in this process. This pressure will be passed on to relatives in urban environments and overseas, who will be expected to provide remittances and other support for these struggling families. Moreover, standard community support systems, such as churches and community savings pots, will not be as well funded or as able to support the needy. This ripple effect of household resources constraint is likely to increase vulnerability across the country. Vulnerability to poverty and to natural disasters are of particular concern as households have less income, less in savings, and fewer assets as a safety net both for themselves and the wider community everyone is expected to support.

Coping Strategies

"Since we live in the town area where everything depends on the income you get, it is even harder now. I find that I have to place control on our spending as well as what we eat. I get frustrated when the kids waste food as we don't have that much to be wasted. "
—Male FGD member, Vaipuna, Vaimauga (urban)

"Most people don't have collateral and are subsistence farmers so have no access to loans."
—Male FGD member, Musumusu, Va'a o Fonoti (rural)

Most rural families that are primarily dependent on their plantations for food and income have estimated that it will take 6-12 months before production can be harvested again, and a year and a half to two years before they will be back to pre-cyclone levels of production. However, no rural households suggested that they are looking to change their livelihoods in the meantime; most are preparing to reinvest in their plantations and reestablish their existing livelihoods. The impact on rural households, where subsistence farming is the primary livelihood, will therefore be a significantly reduced income for at least six to eight months.

There have been some changes to food consumption amounts and patterns in rural areas, though there seems little risk of a severe food shortage in the immediate future. Respondents indicated that there were no significant changes in consumption for the first few weeks following the cyclone, as they were able to salvage the bananas, coconuts, and breadfruit that had fallen during the storm, and taro remained relatively undamaged. However, these supplies are starting to dwindle, and some households indicated that they are eating less, eating fewer types of foods (particularly fewer bananas, coconuts, breadfruit, and imported food), and eating less-preferred foods (such as rice, a common food eaten in small quantities, and relief assistance food). Some households indicated that they anticipate needing to slaughter productive animals in order to meet food needs, particularly because the number of people requiring support in badly affected communities has increased. The general trend of using or selling productive assets to meet immediate food or cash needs was worrying, as it raised concerns both about people's ability to meet their food needs in the next six to eight months and their income-earning potential in the future.

Food security in urban areas may be impacted by losses to backyard gardens as well as the increased cost of food on the market. Households in urban areas get their food from backyard gardens, their rural plantations, and the market, though specific trends in which source supplied how much food were not easy to obtain. It is, nevertheless, clear that urban households could struggle to meet food needs in the coming months, until their own garden and plantation production is restored and market prices for local goods come down as new stock becomes available.

Evidence suggests that remittances from family overseas contribute a significant amount of household income for those who receive them. Between 1976 and 2005, total remittances were higher than tourism revenue, and after the tsunami in 2009, total remittances topped SAT 350 million.[62] However, respondents were not very forthcoming about remittances, and it was difficult to determine how much households had depended on these before the storm, and how their dependence has changed or is likely to change since. There was evidence of a variety of arrangements, including support only for large expenditures, such as school fees, weddings, funerals, and other social events; irregular but general support for household needs; and regular monthly, biweekly, or even weekly support. In urban Vaimauga, one respondent speculated that some 40 percent of families received remittances in her village, though there was no specificity regarding regularity of support or the percentage of income it represented. Many households in both urban and rural areas indicated that they had received remittances since the cyclone. Both cash and in-kind support were common, with some food and nonfood items, and some families calling local food shops to arrange for the payment of food. Transfers within Samoa were also found; families living in areas that were not as badly affected by the cyclone sent support to families in heavily affected areas. Though it is clear that many affected households are receiving support, the information is too vague to be able to confidently use in calculating assistance and needs.

Few households have loans, and few have considered taking a loan as a means of coping with the recovery process. In rural areas, very few respondents indicated having a loan before the cyclone hit, which means that loan repayment will not be a widespread problem in these areas. The most common reason reported for not having a loan was the lack of collateral, with some limited number of respondents pointing to high interest rates as a deterrent. An exception to this finding is the financial inclusion programs that help women access small-scale loans.[63] It was not possible to glean any information regarding informal loans, either from community-based informal lenders or from family. A positive finding is that one respondent with a loan had been able to renegotiate his repayment plan, which gives some indication that banks have been willing to be flexible. Two key issues emerge from these findings. First, women who have taken out microloans may struggle to repay them if their businesses have been affected, either by lost assets and stock or by reduction in business due to the disaster. Second, accessing credit is clearly a challenge for low-income households with no collateral, which limits these households' options for independent recovery.

Though all respondents indicated that they intend for every child to go back to school, some indicated that they are nervous about meeting the associated costs of schooling, including uniforms and school committee fees. Respondents indicated that, as the costs of meeting daily needs mount over time, the pressure to reduce expenditure on investments such as education will increase. Some indicated that they are considering selling a productive livelihood asset, such as a pig or a cow, in order to pay for school expenses, but recognized that this will hinder their ability to earn income in the future. When asked if they would hold one child back because they lacked the funds to pay for all their children, only one respondent answered that he or she would send the primary school students and consider keeping the secondary students home to work on the farm. There were no indications that keeping either a male or female child from school would be more likely in the event of someone not being able to attend; indeed, the answer given was often "We hope they can all go back to school."

[62] UNRISD, *Social Policies in Samoa* (London: Commonwealth Secretariat, 2012).

[63] The MWCSD Women's Division currently has 260 microloans to women in Upolu, divided into three tiers: SAT 1,000, SAT 2,500 and SAT 5,000. NGOs known to the human and social impact assessment team to have made microloans include ADRA, Women in Business, and the Samoan Small Business Enterprise Centre.

Social Cohesion and Social Relations

"Communities are strong; always strong. There is vulnerability, but there is also capacity."
—Emergency worker, Apia

Community Resilience, Cohesion, and Governance

"There is something called the 'Samoan heart.' If this had happened somewhere else, people would have been broken. But Samoan hearts are strong."
—Pastor, Vaimauga Sisifo

Evidence of strong levels of resilience in the communities was found. People expressed hope and determination to move on, to recover from the disaster, and to learn from this experience. Some seemed to find their strength in having their families around them and others in getting on with cleanup and rebuilding activities so that they could return to the lives they had led before. People seemed keen to take initiative. For example, a village had undertaken its own damage assessment and had already started rebuilding the worst-damaged homes without waiting for government assistance. In another village, one with an independent water scheme, residents came together to repair and reconnect the water supply so the village had access to water 24 hours after losing it.

In spite of the strong indications of self-reliance and community interdependence, some people voiced expectations of external assistance, especially from the government. Government institutions, NGOs, and some respondents thought these expectations were stronger now than they had been before the 2009 tsunami disaster. This change was attributed to the post-tsunami relief and recovery operations, which created a new precedent of external assistance for disaster relief.

Evidence of strong levels of social cohesion in communities was also found. People expressed willingness to *"stand together and support each other,"* and these assertions were confirmed by examples, from a cross-section of areas the team visited, of people assisting their more vulnerable neighbors during the evacuation. People opened up their homes to those who had lost their own, shared food and nonfood items with each other, and helped neighbors to rebuild. Many church leaders housed large numbers of families in their own homes, and men and youth played a vital role in assisting the elderly and hard-hit families by cleaning up debris in their neighborhoods. These types of assistance were found in both urban and rural settings. However, relatively speaking, the sense of solidarity and collective action was more pronounced in rural areas; more people in urban areas originally lived somewhere else, and as a result they have relatively less access to family and community networks. While strong social cohesion was evident in both contexts, people spoke of prioritizing the needs of their own immediate and extended families ahead of those of the communities. And though respondents shared examples of helping the more vulnerable among them, they also maintained that these people were primarily the responsibility of their own families.

While there was no indication of any specific conflict, the assessment noted both latent and open tensions in communities, largely over the governance of aid distribution. The assessment noted some exceptions to the overall trend of strong social cohesion, notably in cases where families who had been estranged from their villages reported feeling mistreated or isolated when they were not included in post-disaster emergency efforts.[64] Findings on social cohesion overall confirm the strong traditions of community-led social protection and at the same time make clear that these organic social safety nets may not be accessible to all individuals and groups in the same way.

[64] As explained above in the section on governance and equity of relief and assistance, the family in question called the MWCSD and asked for assistance because the village had not included the family in its collective distribution. The NDMO and MWCSD responded to this call and took relief supplies to them.

Some evidence was found of short-term changes in social behaviors and relations, including reports of parental neglect, increased alcohol and cigarette consumption, incidents of theft and burglary, and some incidents of domestic violence.[65] Specific to the evacuation centers, there were reports of more-open social and sexual relations between young people and sexual harassment of young girls as well as tensions between youth and elderly and between rural and urban evacuees. Some efforts to reduce negative social practices were noted. For example, at the evacuation centers, some shelter managers offered awareness sessions on sexual and reproductive health and had condoms available on-site, as ways of reducing irresponsible or dangerous sexual behavior at the centers.

Communities, especially rural communities, highlighted the important role played by their leaders in the emergency phase.[66] Some people, however, reported feeling that their local leaders had been too preoccupied with their own families, had been inefficient, or had been biased or corrupt in their distribution of assistance. In these cases, the team found that trust had been eroded between local leaders and their villagers. People also reported concerns about the capacities of community leaders to act in times of emergency, and noted their disappointment when leaders did not step up to the task. People felt that it was important to have strong leaders who are well informed about which people in the village need special assistance and who can assess disaster impacts, provide early warning and general information to the village, and advocate on behalf of the village. Local leaders the team interviewed shared their experiences of identifying and prioritizing those most affected and the challenges they faced in allocating small amounts of aid equitably across large numbers.

Gender and Intergenerational Relations

There was no evidence of any significant changes to gender and intergenerational relations attributable to the disaster. Communities often spoke of everyone being impacted the same way, though when the team probed, they found indications of differential impacts. For example, a proportionately larger number of women spoke of disaster impacts on their children and concerns for their safety and well-being. The additional responsibilities and chores following the disaster seemed to be divided, by gender and generation, in a way that is typical for Samoa. For example, in the majority of cases, men and young boys had been involved in "outside" and "heavier" activities (removing debris and trees, rebuilding houses, replanting, collecting water, etc.), while women and young girls had been involved in "inside" activities (gathering household belongings, cooking, laundering, looking after children, caring for the needs of families they were hosting, etc.). People noted that they were receiving the assistance of children in their communities, while the elderly were contributing where possible, including by looking after young children. Across rural and urban areas the team visited, youth were credited with helping community emergency and relief efforts. These examples underscore the significant potential for young men and women to take on positions of leadership in disaster contexts, as well as the potential for more effectively integrating them into community governance structures in general and community disaster preparedness efforts in particular in the future.

No specific incidents of sexual and gender-based violence attributable to the disaster were recorded, but communities and service providers raised concerns about the increased risks of such violence following the disaster. Further, it was learned that the police Domestic Violence Unit responded to a total of 53 domestic violence incidents as reported from December 21, 2012, to January 16, 2013. Police said it was not possible to discern clearly whether these incidents were linked to the cyclone, the Christmas and New Year festive season, or neither. The Domestic Violence Unit was merged into general policing operations for the first week after the cyclone: domes-

[65] Domestic violence reports came from the police.

[66] The leaders meant here are Matai, mayor, representative of the women's committee, representative of the youth committee, church leaders, etc.

tic violence data had not been extrapolated for this period at the time of the assessment. Many respondents felt that an increased risk of sexual or gender-based violence could arise from overcrowding and lack of privacy in the evacuation centers (undivided sleeping facilities, unlocked toilets, etc.), the more-open social relations between young men and women in the ECs and in the communities, the early closure of some centers when families were not ready to return to safe homes, parental neglect of children and youth due to disaster-related responsibilities and anxieties, and heightened emotional and social frustrations as a result of the disaster.

Vulnerable and Special-Needs Groups

"I care for my elderly, crippled, and blind sister along with my children and grandchildren. I first had to ensure my sister was taken to a safe place along with my grandchildren."
—Female, Falefa, Anoama'a (rural)

"I was very worried about my special-needs child as well as my 88-year-old grandmother. It was very hard to decide which one to take first! I couldn't think!"
—Female, Manunu, Anoama'a (rural)

Communities, local leaders, government, and NGOs all agreed that the elderly, women, children, the disabled, and those with special needs were particularly vulnerable during the disaster and required priority or special assistance. Community respondents thought that it was important for local leaders to have an accurate sense of the numbers of elderly, disabled, and special-needs individuals in each village so that their needs could be prioritized during an emergency. Some families reported that they had found it difficult to fulfill some of their primary responsibilities in relation to vulnerable family members, especially because of poor road conditions, lack of access to transport, and disruption of health services.

A large number thought that the elderly, particularly those with pre-existing health conditions, were probably the most vulnerable group during and after the disaster, particularly because of their physical immobility, vulnerability to disease, and difficulties in accessing health care. One urban male respondent expressed his sadness at losing his elderly father, who breathed with the help of an oxygen tank, because he was unable to get him to hospital in time once the village lost power.

Many families reported concerns about their children's safety and well-being, both in the immediate aftermath of the disaster and in the medium and longer term. They reported the difficulties of balancing their parental responsibilities with the additional work generated by the disaster. Children, girls and boys alike, were looking forward to returning to school, partly as a means of escaping from the "cleaning and mess" at home. However, some parents voiced concerns about the cost of school fees in the context of currently stretched finances and lost income opportunities.

Service providers working with people with disabilities and special needs report that these groups were particularly exposed to disaster risk. This was so in part because early warning systems were not designed to meet their needs (for example, to provide information to those with impaired hearing and vision); these groups had not been prioritized during the evacuation and for relief assistance. Further, many evacuation centers had not been equipped to host people with disabilities and special needs (for example, they lacked disability-accessible toilet facilities).

Families and individuals who have been pushed out of communities are particularly vulnerable in disasters. A majority of judicial processes in Samoa still happen at the village level, and it is possible for villages to banish individuals or families as a form of punishment. The team found one incident where, long before the disaster struck, a

family that had disagreed with the mayor on an unspecified issue had been sent away from the village. This family is no longer considered part of the village and is regularly left out of all aspects of village life. While the team heard that this type of situation "happens sometimes," it was not able to assess how often it actually occurs. Additional examples of such unsupported individuals are young offenders, both men and women, who have been banished from the community and are now gathering in Apia, far away from community and family support systems. The existence of families and individuals who are outside of community structures is concerning if the government depends heavily on these structures to provide social assistance, both in normal and post-disaster contexts. These pushed-out or banished people clearly comprise a vulnerable group that requires special attention in planning recovery and reconstruction operations.

Psychosocial Impacts

"People do not want to talk about anything at the moment, they will only talk when you talk to them."

—Male, FGD member, Fusi Safata, Safata (rural)

"I cannot explain what I have seen in my real life, I am very emotional when I think about the cyclone and flooding."

—Female, FGD member, Vaipuna, Vaimauga (urban)

People were reluctant to openly discuss mental health issues, or were slow to attribute their behaviors and emotions to issues of psychological well-being. While these tendencies are in line with traditional societal norms around these issues, the human and social impact assessment (HSIA) team nevertheless documented many indications of disaster-related psychological impacts, across urban and rural settings and among both men and women. Some respondents, predominantly men, said they were too preoccupied with cleaning, rebuilding, and getting their lives back on track to think about or talk about these issues. However, when probed, both men and women talked about experiencing various symptoms: sleeplessness; loss of appetite; increased consumption of alcohol, cigarettes, coffee, tea, and sugar; feelings of depression, inadequacy, and helplessness; fear for their children; neglect of their children; etc. At the same time, most people did not express a need to talk to anyone or to seek help.

Many parents, community leaders, and service providers reported that children (including older girls and boys) were showing signs of psychological impact, for example crying; being afraid of rain, water, and the outdoors; being uncommunicative; or bullying other children. While respondents felt it was the primary responsibility of parents to address these impacts, they also recognized that doing so is not necessarily part of parental norms in traditional Samoan society, and that parents may not always know how best to deal with such situations. Some respondents also spoke of similar impacts (for example, distress, fretfulness) among the elderly, who were fearful of future disasters given the challenges they faced in evacuating to safety when Cyclone Evan hit.

Community leaders and service providers had mixed views on and responses to the psychological impacts attributable to the disaster. Church leaders who had not been approached for psychosocial support by their community members were interviewed during the assessment. Some of these church leaders had used their prayer services as platforms for people to share their experiences and fears, and they reported that such platforms had helped parishioners to deal with their emotions and experience solidarity with others affected. The team spoke to a teacher who planned to encourage her class to illustrate their experiences through drawings as a way of helping them cope. Shelter managers at some evacuation centers had addressed mental health issues as part of their mandates, for example by facilitating prayer sessions, showing movies, celebrating Christmas (by decorating the tree and

giving presents to children), and holding an art exhibition for artwork by children depicting their experiences, as a way of promoting both mental healing and social well-being.

These findings are evidence of a relative lack of self-recognition and considerable societal reticence around mental health issues; they are also evidence of disaster-related psychosocial impacts in communities. They suggest a need for improving awareness about these issues, strengthening people's access to both informal and formal psychosocial caregivers, improving the awareness and capacities of both formal and informal service providers, and making proactive efforts to address these impacts in a more standardized way in the future.

Relocation

"Yes, I would like to relocate, but I am not sure where to go."
—Male resident, Falefa, Anoama'a (rural)

"We can't relocate—this is our land from our ancestors."
—Male resident, Siumu West, Siumu (rural)

At the time interviews were conducted, the majority of families had returned to their villages, even if they were temporarily residing with friends and relatives, with the exception of a limited number of people still living in evacuation centers. Some people expressed an interest in relocating to safer (higher or inland) areas in their own village, or to other villages. But they tempered this interest against realities, such as the lack of inland property, the disaster threats to their villages regardless of where they moved within the village, the usually lengthy negotiations needed for acquiring new land, and the issues involved in living in a village one doesn't belong to; they also note the lack of resources for relocating and rebuilding. It was found that a larger proportion of people, notably from rural areas, expressed no interest in relocating; this lack of interest was attributed to their emotional ties to ancestral lands, the links between their lands and current livelihoods, their existing community and social networks, the additional financial costs and time needed for relocating and rebuilding, and the potential risks of the same and new disasters even if they relocated. Across the board, it seemed that respondents were either preoccupied with their daily survival in the emergency phase or psychologically affected by their experiences, and had not given serious thought to issues of resettlement. Many respondents did talk about their interest in rebuilding homes that would be more resistant to future disasters.

It is important to emphasize that relocation cannot be imposed. People should freely decide if they want to move or not. It is well known that forced relocation is never successful, and when populations forced to move come back to their places of origin, their condition is probably worse and more risky than it was originally.

Summary of Human and Social Impact Assessment Needs and Recommendations

Table 47 summarizes the main findings presented in this chapter.

Table 47. Human and Social Impact Assessment Recommendations and Needs

	Finding & analysis	Recommendation	Comment	Needs in million SAT
Immediate recovery needs				**8.02**
1.	Subsistence farmers have incurred significant damage and loss of crops, livelihood assets (including tools and livestock), and income-earning opportunities and will be in this situation for the next 6–8 months.	**Provide agricultural inputs and replace lost implements, assets, and equipment to help subsistence farmers quickly reestablish agricultural livelihoods.**	• Ensure appropriate assistance packages (seeds/seedlings, tools, livestock) for male and female livelihoods options. • Provide agriculture inputs that allow households to produce and earn quickly as well as consistently over several months.	Included in agriculture sector
2.	Significant damage occurred to natural resources which is hindering farmers' ability to reestablish livelihoods quickly.	**Ensure appropriate assistance for debris cleanup so that households can return to homes and livelihoods.**	• It appeared that while communities were willing and able to engage in cleanup, in some cases they didn't have equipment and capacities to do so. • Subsidizing the rent of large equipment and linking communities with service-providers will enable them to complete these activities, without which economic recovery would be curtailed.	Included in agriculture sector
3.	Many low-income and vulnerable households have incurred significant damage to assets and losses to income earning-opportunities.	**Provide a one-time cash transfer for most vulnerable households/ persons, based on clear criteria.**	• Cash, rather than in-kind transfers, can be used in a variety of ways and as each household specifically requires; cash is also less costly to administer than in-kind transfers. • Possible criteria to be considered for receipt of assistance are cyclone damage to income-earning opportunities and demonstrated financial hardship (single-income earner household, informal income-earner household; no alternate means of financial support, disabled or special-needs income-earner, etc.). • Vulnerability criteria would be transparently applied by a representative decision-making mechanism at community level. • The agriculture sector has a similar recommendation, and so this recommendation would prioritize nonsubsistence farmers and fishers.	5.00
4.	Holders of loans are likely to find repayment difficult in the coming months as livelihoods are recovering.	**Facilitate debt-relief measures for most vulnerable households/ persons with loans.**	• Measures to be considered include extended repayment schedules, grace periods for repayment of a minimum of 6 months, reduced interest rates for families/persons with either formal or informal livelihood sector loans. • Encourage microfinance institutions and informal lenders to do the same.	Nil

Table 47. Human and Social Impact Assessment Recommendations and Needs (continuation)

	Finding & analysis	Recommendation	Comment	Needs in million SAT
Immediate recovery needs (continuation)				
5.	A large portion of the population in subsistence agriculture and low-income informal sector work are unable to secure loans due to requirements for collateral and high interest rates.	**Provide credit schemes with low collateral requirements for low-income men and women currently unable to get loans.**	• This targets small-scale informal traders and subsistence farmers or fishers who do not have the financial collateral to access loans. • Criteria should be based on a combination of need and social capital (ingenuity, work ethic, market savvy, etc.) • As there are more barriers for women accessing credit, a gender analysis should inform the full and appropriate participation of both women and men.	3.00
6.	Many subsistence farmers have sufficient food currently, but may run into problems in the next few months.	**Monitor the food security and nutrition status of impacted communities; monitor market prices.**	• First monitoring is to be three months after the storm (mid-March). • Ensure nutrition monitoring data are disaggregated by sex, for children under five, and for pregnant and lactating women.	0.02
Longer-term planning needs				**10.1**
7.	Community infrastructure and livelihoods resources have been damaged.	**Establish Community Driven Development programs to facilitate livelihoods and community recovery.**	• Support should be targeted at three specific areas: medium-term livelihood recovery through provision of implements, assets, equipment, and infrastructure for agricultural livelihoods; alternative livelihoods, through skills training; and small business, through microcapitol grants, microcredit, and training. • CDD programs prioritize the communities' needs, facilitate the realization of their goals, and harness their energy by providing resources (materials, machinery, technical expertise) that communities can then use to drive the process and build their own assets. • Programs often build community assets that everyone can benefit from (e.g., livelihoods infrastructure, community infrastructure). • Programs could have a strong DRR focus. • The MWCSD has done considerable community-planning work through the Community Disaster Climate Risk Management program, which could be used as a platform for launching implementation.	4.00
8.	There seemed to be confusion and limited awareness of government's policies regarding relief distribution, and community dissatisfaction about how resources were distributed.	**Improve clarity, transparency, and accountability around aid distribution and DRR activities through (a) clear and communicated policy directives; (b) strengthened mechanisms for collective decision making and oversight at the village level; and (c) strengthened mechanisms for grievance redress.**	• Establish clearer guidelines for eligibility, better information sharing between national and community levels on relief distribution, and some oversight of and more representative decision making concerning aid distribution at the community level. Some sort of grievance mechanism (e.g., confidential hotline, ombudsperson) would have helped mitigate some of the concerns that communities shared with the HSIA team. • Create a certification system at evacuation centers to identify those who are entitled to relief supplies once they leave to ensure continued supplies to the entitled. • Some of these actions can be built into planned community disaster preparedness activities (e.g., providing training in DRM leadership roles and responsibilities with emphasis on regular consultation with women and men, titled and untitled, and vulnerable groups; setting up aid distribution committees with representation from titled and untitled groups, etc.).	0.05

Table 47. Human and Social Impact Assessment Recommendations and Needs (continuation)

	Finding & analysis	Recommendation	Comment	Needs in million SAT
Longer-term planning needs (continuation)				
9.	Relocation is being highlighted by communities and government as a key issue.	**Conduct a broad-based community consultation process for relocation that includes community wishes and needs as well as government considerations for change.**	• The exercise should be a two-way feedback process, giving the government the opportunity to share information and elicit feedback from communities. • The team does not endorse relocation; but there is enough discussion about it to warrant open and participatory discussion between citizens and government.	0.30
10.	Restoration of power was critical in determining both people's access to early warning and disaster information, and their well-being in evacuation centers and households.	**Improve alternative sources of and access to power, especially in rural areas.**	• Ensure that robust and context-appropriate technology (e.g., solar, generators) is available to charge mobile phones in villages.	0.50
11.	Community preparedness was found to be weak in all villages visited.	**Scale up the NDMO's multihazard Disaster Risk Management Community Programme (DRMCP), which has implementation support from UNESCO and Samoa Red Cross, and add new modules.**	• Ensure the program prioritizes communities that face high risk of natural disaster; geographically isolated villages that are hard to reach during emergencies should also be priorities. • Identify and include those local residents who are excluded from or are for other reasons not participants in village governance or church circles. • Facilitate active participation of women and men, titled and untitled, and vulnerable groups. • Increase transparency and accountability of aid distribution and DRR activities through joint leadership. • Include clear guidelines in the training on the principles of aid effectiveness: guidelines should address equity versus equality in distribution (see recommendation 8), transparency of distribution, and representative community engagement, including men, women, youth, untitled.	Included in DRM section
12.	There were many lessons learned from the Cyclone Evan experience, which should be harnessed to improve the capacity of and strengthen partnerships between government, NGOs, and community and faith-based response agencies.	**Strengthen the capacity of NDMO's emergency response staff, service providers, and partners by conducting "lessons learned" exercises and training.**	• Provide training for public, private, and church-based teams in emergency shelter management, including lessons from Cyclone Even good practice operations. Possible topics include hygiene, STDs, and good parenting; provision of condoms; child art, movies, guided play activities; blood pressure and sugar-level readings; counseling; pastoral visits. • Do a "lessons learned" exercise on partnerships for effective humanitarian and disaster response; build sustainable partnerships between public, private, civil society, and faith-based partners. • Ensure the training includes issues of transparency, accountability, and equity versus equality in aid distribution.	Included in DRM section

Table 47. Human and Social Impact Assessment Recommendations and Needs (continuation)

	Finding & analysis	Recommendation	Comment	Needs in million SAT
Longer-term planning needs (continuation)				
13.	Findings show that psychosocial issues are prevalent among respondents (adults and children, male and female alike) in the wake of the disaster.	**Revitalize the process to support the standardization, coordination, capacity building, and resourcing of a psychosocial services network.**	• Strengthen capacity building of the formal and informal psychosocial service providers and counselors. Mapping of expertise and needs as well as other preparatory work was done to establish a network a few years ago, but the initiative stalled. • The aim is to strengthen existing psychosocial services in Samoa, which will allow for a coordinated, more extensive, and sustainable response to victims affected by disaster. • Ensure counseling training includes the trauma (disaster) as well as an abuse focus; include counseling for first-responders and service providers. • Ensure counselors know how to conduct outreach to communities while respecting norms around mental health.	0.80
14.	This assessment has highlighted a range of social impacts from Cyclone Evan that will require ongoing monitoring.	**Conduct medium- and long-term social impact monitoring with the impacted communities on recovery outcomes/ progress after Cyclone Evan.**	• At 6- and 12-month intervals, follow up on the HSIA key findings to ensure reconstruction efforts are meeting the needs of communities. • These efforts can be integrated into ongoing outreach activities undertaken by ministries, with an opportunity for real-time information sharing and feedback.	0.70

Some additional comments on the recommendations listed in table 47 are these:

- Cash-for-work has been used successfully in some post-disaster contexts as a way of providing income-earning opportunities to those who need them. In Samoa, there is a strong culture of volunteerism and community dedication to maintaining community assets, and cash-for-work may undermine this culture. The team is therefore refraining from recommending this type of intervention, but it should be considered if there are non-community-based works that the government needs support for.
- Community churches have skills, networks, and resources that allow them to effectively contribute to the economic, physical, and mental well-being of vulnerable people affected by the disaster. The government could encourage churches to contribute to local disaster response from existing mission funds to facilitate recovery and reconstruction of communities.
- Providers of social and psychosocial health services have themselves been directly impacted by the cyclone, and they are struggling to meet the demand of clients seeking services in the wake of the disaster. The HSIA suggests supporting these service providers so they can reestablish service and operations and respond to the increased demands for their services. This recommendation has been included and costed in the health chapter, and is endorsed by the HSIA team.
- The National Provident Fund (NPF) is discussing making 10 percent of each participant's fund available in grant form. This would be a useful way make cash available to NPF participants who have suffered in the disaster, but will do little to provide coverage to the most vulnerable and poorest, who are unlikely to be NFP participants.

Finally, the HSIA team has identified the following areas as significant knowledge gaps that require further research.

- There is limited understanding of how the reconstruction needs, as outlined in the DALA, will impact and support communities. A fuller understanding of how they will do so would be useful.
- Social protection is an area that should be further researched. There are clearly vulnerable groups, such as troubled youth and banished families, that are not receiving sufficient support from community and family networks. There needs to be some exploration of how to support these groups who stand outside of the standard community supports.
- It would be useful to explore how the National Provident Fund could expand its coverage to the informal sector. The NFP would provide a useful pension fund savings resource to low-income and formal sector employment, and could also be used as an insurance scheme in the future if the government allows access to it in post-disaster situations.
- More detailed and areas-based assessments on the extent of impacts on livelihoods and livelihoods infrastructure would be helpful in informing recovery and reconstruction programs. These assessments would look at subsistence farmers and informal sector business in commerce and tourism, with special attention to livelihoods options for youth and those with special needs.

The identification of risk refers to the activities, tools, and instruments involved in obtaining better knowledge of the hazards that affect a community and contribute to its vulnerability.

Photos

Top: The MODIS instrument onboard NASA's Aqua satellite captured this true-color image of Tropical Cyclone Evan. Image courtesy Jesse Allen, based on data from the MODIS Rapid Response Team at NASA GSFC.

Left: MS-MAF staff interviewing affected farmers. Courtesy of GoS/PDNA Assessment team.

6. MANAGING DISASTER RISK

This chapter deals with the disaster risk management (DRM) system in Samoa, specifically in relation to Tropical Cyclone Evan and subsequent flooding. The approach aims to prioritize specific tools, such as multihazard early warning systems (EWSs) and building codes, in order to promote effective disaster risk reduction (DRR) within a climate change context. In particular, flood management options for the Vaisigano River and other watersheds are examined, as floods in this area have contributed significantly to the losses experienced.

The analysis of Cyclone Evan centers on describing the overall performance of the DRM system, the needs arising from the cyclone's impacts, and lessons learned.

Performance of Disaster Risk Management

Institutional Capacities

Institutional capacity can be viewed as the degree to which the DRM system had the resources and ability to mobilize and/or adapt institutions to address policy goals.

The *Samoa National Progress Report on the Implementation of the Hyogo Framework for Action (2011–2013)* ranked the "national policy, legal framework, and plans for DRR" 4 out of 5;[67] this grade is a substantial achievement but suggests some limitations in key areas, such as financial resources and/or operational capacities.

National Policy, Legal Framework, and Plans

The national policy and legal framework for DRM in Samoa comprises the Disaster and Emergency Management (DEM) Act (2007), the National Disaster Management Plan (NDMP) (2011–2014), the National Action Plan for DRM (2011–2016), and a range of related agency-specific plans and policies. DRM is also firmly embedded in Samoa's National Sustainable Development Strategy (NSDS) 2012–2016 as key outcome 14, on climate and disaster resilience.

The DEM Act provides the legal DRM framework—from planning, risk reduction, response, and recovery procedures, to coordination among response agencies. A highlight of the act is that it provides for the establishment of the disaster management structure—which includes such institutions as the National Disaster Management Office (NDMO), National Emergency Operations Center (NEOC), and National Disaster Council (NDC)—with authority over and responsibilities for DRM. The act is heavily focused on response and relief, although there are certain aspects of risk reduction being undertaken as part of NDMO's responsibility.

The NDC, chaired by the prime minister, has been an effective coordination mechanism in tropical cyclone season preparations and in disaster response coordination. A number of reports on the Cyclone Evan disaster and the response to it have been successfully prepared and distributed to all interested stakeholders.

[67] The report is available at http://www.preventionweb.net/files/28739_wsm_NationalHFAprogress_2011-13.pdf.

The revised NDMP provides an opportunity to review the arrangements for the various hazards that pose a threat to Samoa's development agenda and to incorporate DRR and climate change adaptation (CCA) considerations. Of note is that the DRM arrangements stipulated in the NDMP are very much dependent on the capacity and ability of the government ministries and their respective divisions to implement disaster and climate risk reduction initiatives. For example, the comparatively well-developed climate and disaster risk–sensitive regulatory framework for urban management and development control is limited in its effectiveness by the lack of enforcement capacity and land zoning.

An important and significant institutional change is the fact that the NDMO is no longer a unit of the Meteorological Office, but has been a division of Ministry of Natural Resources and Environment (MNRE) as of February 2012. This organizational change is a reflection of the government's commitment to DRM and provides the NDMO with the flexibility and autonomy to enable its further development. In addition, the position of assistant CEODMO is now filled, as was recommended in the previous Post-disaster Needs Assessment (PDNA). This will provide the leadership in Samoa for DRM. Furthermore, since 2006, the number of staff has increased from three to six, with additional positions to be filled.

The government's response to the disaster was immediate. The prime minister issued the Declaration of Disaster on December 13 and the Proclamation of State of Emergency on December 17; under the DEM Act, the head of state may declare a state of emergency for 30 days. It is difficult to ascertain the effectiveness of the coordination between different agencies, but a debrief of the agencies and key actors involved in the response will help identify strengths, weakness, challenges, and opportunities to improve the system. Whatever the debrief finds, the NDMO recognizes that coordination between the various agencies has significantly improved since the 2009 tsunami.

A key governance issue to address is the need for effective partnerships, and especially to strengthen the link between government and village leaders in implementing the NDMP. The NDMP spells out clearly the role of the village council and local groups such as women's committees in implementing disaster mitigation and preparedness programs at the community level. However, community assessments indicate that disaster mitigation is not effectively implemented, as village mayors are inclined to make their own decisions.[68] Interviews with some of the mayors highlighted their lack of knowledge of government DRR/DRM arrangements, and of their responsibilities. This shortcoming requires a more concerted effort by government and DRM actors and the proactive behavior of community leaders. DRM-related interventions by nongovernmental organizations (NGOs) and civil society organizations at the village level should be prioritized and realigned to government policies and directions. A number of DRM actors are already doing this by implementing DRM, CCA, and development priorities in Community Infrastructure Management (CIM) plans. The establishment of a national platform would provide an avenue for community leaders, DRM actors, and the government to progress on DRM.

Accessibility to Resources and Risk Financing

As indicated in the 2009 PDNA following the tsunami, the "unforeseen needs funds," consisting of 3 percent of the government budget, is not purely a disaster reserve.[69] It is used to cover various eligible and unforeseen expenditures. The planned operational and legislative review of this funding mechanism has not been executed. The DEM Act 2007 does not cover or specify financial resources, allocation, or mobilization for risk reduction, although such activities are said to be partly covered by the annual budget. Following Evan, the government of Samoa has demonstrated its ability and commitment to procure and lead the emergency response and restoration prior to requesting international assistance.

[68] The village mayor is government's focal point in communities.

[69] Government of Samoa, *Samoa Post-disaster Needs Assessment Following the Earthquake and Tsunami of 29th September 2009*, December 2009, http://www.gfdrr.org/sites/gfdrr.org/files/documents/PDNA_Samoa_2009.pdf.

Samoa is one of five countries included in a feasibility study to establish a catastrophe risk pool in the region under the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI). This disaster risk financing program aims to provide countries that qualify with immediate liquidity following a disaster to serve as a bridging fund while other post-disaster sources are being mobilized.

Small businesses and home owners are challenged by the high cost of insurance premiums, which deters them from buying insurance. It was also suggested that interest rates could be subsidized for home loans used to rebuild homes after disasters. The heavy damage and loss in the agriculture sector from Cyclone Evan suggest an opportunity may be available to engage with insurance providers to investigate more effective property and crop insurance.

Vulnerability and Risk Assessment

The identification of risk refers to the activities, tools, and instruments involved in obtaining a better knowledge of the hazards that affect a community and contribute to its vulnerability. Both scientific and community-based methods are taken into account, as well as historical reviews and traditional behavior based on natural indicators.

Risk and vulnerability mapping and assessment are an important prerequisite for effective prevention strategies, such as the integration of risk zones in urban and spatial planning.

Various hazard risk profiles have been prepared for Samoa, including those generated by PCRAFI, the Australian Pacific Climate Change Science Program, and the Global Risk Index. Large-scale hazard mapping has been carried out and is available for the following:

- Coastal flooding, landslides, and coastal erosion countrywide as part of developing the CIM plans
- River flood hazard maps for urban Apia as part of an Asian Development Bank drainage program and the Applied Science and Technology Division (SOPAC) capacity-building program in flood modeling
- Tsunami evacuation maps, developed by GNS New Zealand following the 2009 tsunami
- Wind hazard and earthquake ground-shaking intensities, modeled for Samoa as part of PCRAFI

However, the existing risk assessments could be further improved by including socioeconomic elements that adequately define the state of vulnerability.

Risk information needs to be available and accessible to planners, decision makers, and the affected population at large to ensure risk-sensitive decisions for public and private developments are taken. Risk information is being made available to the public through various government ministries and agencies that deal with development issues. Effective sharing, dissemination, and understanding of risk information need to be further strengthened, particularly within the general public domain.

Disaster Preparedness and Emergency Management

Systems are in place for disaster preparedness and response, but the respective components—risk knowledge, monitoring and warning services, dissemination and communication, and response capabilities—differ in their relative strengths. At the time leading up to and at the onset of Cyclone Evan, warning systems were implemented, but these systems' content or messages could be improved. They could be better understood at the community level. There is perhaps need for exercises in a rotating set of communities and areas of Apia to test actions and decisions or to brief new leaders so that communities remain aligned to the national disaster guidance and plans.

Stockpiling

For humanitarian relief, the NDMO, Red Cross, Caritas, Mormon Church, and Adventist Development and Relief Agency maintain stockpiles of nonfood items. The distribution of the items is based on assessments of need. Organizations began developing response plans as well as stockpiling following the 2009 tsunami. This practice is a reflection of their commitment to building community resilience and capacities.

It has been recommended that a stock of emergency equipment and materials be available to ensure the timely reestablishment of basic services after a disaster. This stock should include Bailey bridges to enable rapid breach of flooded water courses so critical installations can be accessed or regions connected.

Early Warning Systems

Early warning systems are a major element of disaster reduction. The Samoa Meteorology Division of MNRE is the mandated government agency to monitor and forecast natural hazards, including meteorological, hydrological, and seismic hazards. It is the official tropical cyclone warning center for Samoa, and it provides information on hydrometeorological and seismic hazards to the media, NDMO, and National Disaster Council (NDC). The Meteorology Division has human resource constraints—that is, lacks sufficient World Meteorological Organization (WMO) class 1 meteorologists—and is also constrained in its ability to engage in formal research activities as part of Meteorology Division's functions and responsibilities. These constraints weaken the Meteorology Division's scientific development as well as its real-time forecasting capabilities.

In the case of Tropical Cyclone Evan, there are a number of issues to point out regarding the performance of the technical component of the EWS. Procedural issues on naming of the tropical cyclone at the regional forecast center delayed the timely communication of the threat to the public. Forecasters in Samoa were challenged to make critical and timely decisions on upgrading the alert level.

In addition, there were several issues related to predicting the cyclone track. Three different models at the time each showed a different scenario. Fortunately, Evan did not follow one forecasted track to double back and hit Samoa again, but instead moved away from Samoa after its initial impact. It should be noted that the Joint Typhoon Warning Center correctly predicted Cyclone Evan's track after impact on Samoa compared to the other models. In the absence of weather radar, the Meteorology Division needs to identify potential capacity support from its regional counterparts at the Regional Specialized Meteorological Centre Nadi and Wellington and review the tools being developed to assist them through the Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project.

An important point to highlight is the institutional and functional issues surrounding flood warnings and alert levels. In the absence of a flood forecasting system, the Meteorology Division issues only flood advisories, as it did in this event. However, comprehensive evacuations did not take place until flood levels were life threatening and crops inundated. It is important that the Meteorology Division and Water Resources Division collaborate on developing standard operating procedures (SOPs) for an identified potential flood. Public awareness campaigns are needed to provide guidance on the appropriate responses and to reiterate the importance of communities' responsibility to respond to warnings and advisories.

In the case of tsunamis, advisories and warnings are disseminated via mobile SMS, radio, TV, church bells, and school sirens. A dedicated and robust system for dissemination and communication of early warning for multiple hazards is being established to address any technical gaps. The NDMO is planning to install 23 additional coastal sirens, which

will be automatically activated by the emergency radio communication system currently in the process of installation. It is critical that communities and government agencies understand how to respond to the alerts.

Given that awareness of DRM is uneven within the community and the NDMO has limited capacity, it is recommended that DRM be further mainstreamed into existing community-driven development programs. By strengthening existing partnerships with existing community programs, the NDMO can continue to extend its activities in communities following its standard format.

Reduction of the Underlying Risk Factors

Reducing underlying risk factors involves tools, methods, and instruments that address both structural and nonstructural measures, such as planning and development programs, and structural mitigation measures related to engineering works. The *National Progress Report on the Implementation of the Hyogo Framework for Action (2011–2013)* assesses Samoa's progress toward addressing underlying risk factors as 4 out of 5, but in the current assessment, this was found to be the weakest pillar of the DRM framework.

Box 5.1. Integrated Flood Risk Management

Samoa suffers greatly from the effects of flooding, in particular the urban areas of Apia. The social impact assessment survey suggests that since the 2001 flood, little has been done. A number of catchments flooded during Cyclone Evan, including the Vaisigano, where 156.8mm of rain fell within a one-hour period. Based on the estimates of return periods for extreme rainfall events in the Vaisigano catchment[70] and for Apia,[71] the return period for the extreme rainfall associated with Cyclone Evan is in excess of 100 years over all time scales from hourly to daily. Impacts were visible from the upper catchment in Alaoa to the lower catchment. Initial assessments have attributed the flood to a number of factors: intense rainfall within a saturated catchment; intermittent blocking of river channels at several locations by debris and logs; and increased (regulated and nonregulated) urban settlement and development within the floodplain. An integrated flood management approach is needed in the Vaisigano River, given the interactions between the natural and the built physical environment and the gamut of development activities within the catchment. A range of solutions, both engineering and non-engineering, needs to be considered in order to reduce flood risk in the catchment; these are outlined in table B5.1.1. Currently, the responsibility of flood risk management does not lie with a single division. This arrangement reflects the complexities of dealing with flooding issues, which require the inputs of a number of technical agencies as well as local communities.

Photo: Surveing the damage in Vaisigano. Courtesy of GoS/PDNA Assessment team.

[70] I. Punivalu, "Flood Design in Western Samoa" (BEng of civil engineering project, University of Newcastle, New South Wales, 1983).

[71] J. E. Hay and P. Hartley, *Climate Risk and Adaptation Assessments for the Samoa Parliament Complex Redevelopment Project*, report prepared for AusAID, Canberra, January 25, 2013.

Box 5.1. (continuation): Table B5.1.1. Summary of Previous Assessments of Flood Mitigation Options

Mitigation options	Cost	Cost effectiveness	Issues to consider	Conclusion
Recommended for immediate action				
Improved application of development controls	-	Highly cost-effective for new dwellings, with potential higher costs to achieve compliance of existing dwellings	Implementation of minimum floor levels throughout flood zone and no construction in areas of high risk and potential obstruction. Would require application of a mixture of enforcement and incentives.[b]	Recommended[a, b]
Elevating floor heights of new and rebuilt buildings	$	Highly cost-effective (estimated CBR of between 5 and 8 at 7%)[b]	Cost of elevating floor estimated at 2–12% of total construction costs, depending on materials and location.[b] Could be a condition of financial support for building back.	Recommended[a]
Recommended with further design and investigation				
Improved flood forecasting, warning, and preparedness	$	Cost-effective (CBR of approx. 1.8 at 7%)[b]	Flash floods are difficult to forecast accurately, but improvements can be made to forecasting (with improved data collection) and warning and response (with improved communications and awareness).	Recommended (with further design and investigation)[a]
Maintenance of riverbanks and streamside vegetation	$	Not assessed	River maintenance would have only a small direct impact on flood levels, but could potentially reduce river debris that would otherwise cause damage and obstruct flow.[a]	Recommended (with further design and investigation)[a]
Elevating floor heights of existing buildings	$$	Cost-effective, particularly for wooden buildings[b]	Cost of elevating floor estimated at 11–50% of total construction costs, depending on materials and location. Incentives are required for implementation.	Recommended (with development of appropriate incentives)[a]
Further investigation required to determine feasibility				
In-stream flood storage dam at Alaoa	$$$$	Not assessed, but very dependent on dam's provision of other services, such as hydropower and water supply[a]	Significant investment in multipurpose dam and associated facilities on government land, and relocation of Alaoa water treatment plant.[a]	Investigate further to assess feasibility[a]
Not currently recommended				
Land use change in upper catchment	-	No significant effect in reducing flood risk[a]	Vegetation intercepts only a limited amount of rainfall once the catchment is saturated, with little impact on mitigating peak flood flows.[a]	Minimal impact on flooding[a]
River dredging	$$	Unlikely to be cost-effective[a]	Little effect on peak flood heights (even with 2m depth of dredging).[a]	Minimal impact on flooding[a]
Flood embankments and walls	$$$$	Not cost-effective (estimated 0.46 CBR at 7%)[b]	Requires construction of high embankments (up to 5m) and acquisition of large areas of private land.[a]	Not feasible[a]
Bypass or diversion channel	$$$$	Not cost-effective (estimated 0.07 CBR at 7%)[b]	Requires acquisition of large areas of private land and construction of embankments. Potential social and environmental issues.[a]	Not feasible[a]
Pumping	$$$$	Not cost-effective	Not feasible for catchments above 1km^2.[a]	Not feasible[a]
Increasing channel conveyance	$$$$	Not assessed, although capital, land purchase, and maintenance costs would be high[a]	Requires acquisition of large areas of private land. Potential exacerbation of velocities and downstream flood levels.[a]	Not feasible[a]

Note: Dollar signs indicate cost, with one dollar sign the least and four the most expensive. – = negligible; CBR = cost-benefit ratio.

a. Government of Samoa, *Samoa Flood Management Action Plan 2007–2012, with Specific Reference to Vaisigano River,* March 2007, http://www.pacificdisaster.net/pdnadmin/data/original/samoa_flood_mngmt_action_plan_2007_2012.pdf.

b SOPAC, *Economic Analysis of Flood Risk Reduction Measures for the Lower Vaisigano Catchment Area,* February 2008, http://www.pacificwater.org/userfiles/file/IWRM/Toolboxes/financing%20IWRM/Samoa.pdf.

Social Development and Economic Activity Plans

Although they are among the most important areas in which risk should be addressed, a number of challenges remain for mainstreaming DRR in social development, economic activities, and implementation of plans and policies. The social impact assessment of the affected areas shed light on the vulnerability of disadvantaged people throughout Samoan rural communities. Though the government has been praised in various social policy reports[72] for its social policy designed to elevate the social status of Samoans, the assessments shows that more work needs to be done to create the social conditions that facilitate safer and more resilient community livelihoods. The assessment reveals that there was uneven knowledge of and activity in disaster risk management among affected communities. It shows the important role the education and community governance sectors play in increasing knowledge about DRM. For example, the NDMO is working with the Ministry of Education, Sports and Culture on improving preparedness and contingency planning for all schools and has developed a toolkit similar to that developed for the village-based DRM planning.

Disaster Risk Reduction as an Integrated Objective of Environment and Development Policies and Plans

The recent Hyogo Framework Action (HFA) assessment states that DRR is not normally an "integral objective," though the links between environmental management and quality of life are understood. There is a growing appreciation of the characteristics of island ecosystems and of the need to regulate human activities. Environmental impact assessment regulation was introduced in Samoa in 2007. Environmental management strategies are integrated as part of DRR. It should be noted that when DRR and climate change adaptation become an integral part of environmental and development policies and plans, DRR initiatives and activities become more effective and sustainable.

The Planning and Urban Management Agency (PUMA) is the lead agency in coordinating and planning the physical, social, and economic environment of Apia, as well as the rural areas of Samoa. Presently most population growth in Samoa is in and around Apia, so it is imperative that appropriate land use zoning is carried out by adopting a process of inclusive consultations. The settlement and development along the Vaisigano riverbanks, channels, and floodplain have in fact increased the exposure and vulnerability and potential severity of impacts on people and infrastructure from river flooding. This area could benefit from floodplain planning with associated mitigation measures or relocations.

The Samoa National Building Code 1992 is overseen by the Ministry of Works, Transport and Infrastructure. The code is quite out of date; it allows for variations in climate and geological conditions but fails to cover coastal inundation and flooding. It needs to be updated to include building design, particularly in the case of innovative, complex, or unusually hazardous building proposals, or building work beyond the scope of the code.

Needs and Recommendations

This section identifies DRM-related needs that will further strengthen Samoa's resilience to various natural hazards. The needs are summarized in table 48.

[72] See D. Amosa, *Social Policies in Samoa* (London: Commonwealth Secreteriat and UNRISD, 2012); AusAID, *Samoa Country Case Study*, March 2012, http://www.ausaid.gov.au/countries/pacific/rp/Documents/samoa-case-study.pdf.

Institutional Capacities

Institutional capacities for DRM need to be strengthened. The DEM Act 2007 primarily focuses on disaster management. It is in this light that a review to incorporate risk reduction as an integral part of a comprehensive legal framework for DRM should be undertaken. This has been prioritized for the medium to long term. Possible options, including the revision of the act and/or the formulation of a regulation, should be explored to transform the policy and institutional arrangements toward a stronger risk reduction approach, backed by a specific disaster risk financial mechanism.

DRM-related plans also need updating. The tropical cyclone plan and a national flood management plan and guidelines need to be revised and developed respectively in order to reflect the current situation, including new challenges related to climate change and development trends and patterns. The SOPs for monitoring and forecasting of tropical cyclone threats should be revisited, as should the frequency and type of advisories and warnings issued to the general public.

Understanding Risk

Comprehensive and high-resolution multihazard (cyclones, earthquakes, tsunami, flooding) risk maps and other risk information need to be integrated into decision-making processes in plans for development, early warning, emergency, recovery, and reconstruction. There is also a need to improve risk assessments by considering social elements (for example, age, gender, education, social networks, etc.), economic exposure, and climate change risks. Assessments should take account of the coping or adaptive capacities of different systems.

Disaster Preparedness and Emergency Planning/Management

There is currently a need to match the improvement in instrumentation with specialized high-level training, given the lack of meteorologists and hydrometeorologists of WMO class 1 or higher at the Meteorology Division. In addition, there is a need to strengthen the Meteorology Division's institutional framework and capacity in conducting applied research related to improving real-time forecasting and climate information application services.

There is also a need to improve EWSs for hydrometeorological hazards. The Meteorology Division needs to move beyond procedural methods of cyclone prediction and factor the element of surprise into the process of early warning and decision making. Moreover, it needs to consider integrating cyclone-caused damaging winds, storm surges, rainfall, and river flooding into EWSs and alerts systems. The arrangements for flood warning need to be clarified, and the responsible agency needs to be adequately resourced. In the interim, while the Meteorology Division provides flood advisories, it should establish SOPs to ensure that the Water Resources Division, NDMO, PUMA, and Land Transport Authority are well positioned to act on the information.

A multimode communication and dissemination system exists in Samoa; however, a robust system for communication and dissemination of early warning for various hazards is needed to allow information to flow effectively between institutional actors (such as NDMO) to the communities at risk. A communications strategy is required to ensure that the appropriate communications media are selected, key messages are developed for specific target groups, and communities and responsible agencies are informed of the system and the responses or reactions expected. An effective strategy will require consultations with communities involving the technical agencies responsible.

A robust communication system that allowed communication at all times between agencies and the NEOC, as well as among agencies' personnel, would further strengthen response coordination. The NDMO is in the process of installing an emergency radio communication system, but agencies need to get their own radios.

Finally, communities' role in DRM cannot be ignored. There needs to be a better understanding of communities' risk perceptions, since these shape behavior and actions. In Samoa, communities rely on traditional and local knowledge about natural indicators (like weather patterns) as disaster warnings. A number of Pacific countries have attempted to incorporate this knowledge into their school curriculums. It would be helpful to review the effectiveness of integrating DRM into the curriculum at all education levels so that effective educational programs could be tailored, and students could convey risk information to their families and communities.

It would also be helpful for public awareness campaigns to engage with communities more frequently. The assessments have shown that there are misconceptions about community and individual responsibilities versus government's capacities in ensuring the safety of the public in a disaster, and these should be addressed.

Reduction of the Underlying Risk Factors

DRR and CCA should be seen as an integral part of environmental and development policies and plans. PUMA should review the Apia Physical Framework Plan 2003–2013 (APFP) in light of the increasing urbanization and incorporate aspects of DRR and CCA. Both the Building Code 1992 and national home-building manual must be revised and updated. Review should also consider the climate change scenarios for Samoa. Given the opportunities presented to limit and restrict redevelopment and rebuilding in the areas most affected by flooding, options identified by key government agencies and supporting partners should be taken on immediately during this recovery process.

Table 48. Disaster Risk Management Needs

Needs	Activities		Thousand SAT
	Short-term needs	**Medium- and long-term needs**	
Strengthening of flood forecasting and warning systems		Improve understanding of hydrometeorological hazards and risk, including high-resolution vulnerability and risk modeling and mapping	800
	n.a.	Improve real-time monitoring of rainfall and stream flow Establish an operational flood forecast system Establish a network of robust communication and dissemination system	1,700
		Improve community outreach, incorporate understanding of risk perceptions and behavior, carry out community response planning and drills	500
Subtotal			3,000
Mainstreaming of DRR and CCA in urban and coastal zone management	Investigate focused land acquisition and resettlement plans for critical sites Prevent infill and redevelopment within the flood zone and/or land subject to inundation Promote public awareness and advocacy on the issue of development and building codes in relation to multiple hazards	n.a.	700
	Maintain riverbanks and streamside vegetation	Review APFP including DRM and CCA considerations Develop and implement an integrated land use plan to include drainage and floodplain development plans incorporating flood risk management Develop design standards for flood-proofing and strong-wind-proofing of buildings, utilities, and public infrastructure, considering climate resilience and training on building standards and codes Review development and flood plain guidelines and management plan	2,500
Subtotal			3,200
Scale up the NDMO's multihazard community DRM program	Awareness of and training in DRR and CCA for village mayors /leaders	Mainstream DRM/CCA into existing community-driven development programs	3,000
Subtotal			3,000

Needs	Activities		Thousand SAT
	Short-term needs	**Medium- and long-term needs**	
Improve evacuation facilities and services	n.a.	Train personnel and communities in food distribution, counseling, and shelter management	7,000
		Improve water and sanitation facilities	6,000
Subtotal			1,300
Strengthen DRM governance arrangements	n.a.	Review DEM Act 2007 and relevant legislation and institutional arrangements, including SOPs	100
	Review tropical cyclone and flood management plan, etc.	Develop sector-specific DRM plans	100
	Establish and launch national disaster risk platform for multisectoral DRR dialogue	n.a.	100
Subtotal			300
Total			**10,800**

Source: Based on estimates from assessment team in close consultation with institutional actors.

Note: n.a. = not applicable.

Annual reconstruction requirements across all affected sectors of social and economic activities are estimated to be, on average, SAT 75 million per year, extending through 2016.

Photos

Top: Courtesy of GoS/PDNA Assessment team.

Center: © Valery Shanin | Dreamstime.com.

Left: © Derek Rogers | Dreamstime.com.

7. SUMMARY OF POST-DISASTER RECOVERY AND RECONSTRUCTION NEEDS

General Considerations

After estimating the value of destroyed physical assets (*damage*) and of production losses caused by the floods, along with the resulting macroeconomic and household income impacts, it is possible to estimate two sets of financial requirements: those to ensure recovery of the economy to at least pre-flood levels, and those to reconstruct destroyed assets according to improved, disaster-resilient standards, under a building-back-better strategy.

From the outset, it must be clear that requirements for economic recovery include both financing to ensure that private sector entities and individuals obtain sufficient working capital to reinitiate their productive activities, and the financing required by the government to meet increased expenditures in the services sectors under its purview. In that sense, the value of recovery needs is usually a fraction of the value of production losses and higher costs of services, which vary among sectors depending on their characteristics.

The needs for reconstruction, however, represent the amounts required to rebuild destroyed assets so that they meet improved standards of quality and modernization, to relocate selected assets to safer areas, and to establish disaster-resilient norms to reduce risk. Thus once these improved standards have been factored in, the amounts needed for reconstruction will often exceed the estimated value of damage.

It must also be mentioned that recovery and reconstruction needs refer to both the private and public sectors, as both have been affected by the disaster, and do not represent any type of compensation from the government to affected persons. The estimated needs represent the amounts of financing that are required to achieve recovery and reconstruction; they include cash grants or in-kind donations for the poor as well as soft-term credit (as appropriate under post-disaster conditions) channeled through the development banks and private banks for affected creditworthy individuals and private enterprises.

Full particulars on estimating post-disaster needs for economic recovery and disaster-resilient reconstruction are given in *Guidance Notes for Conducting Post-disaster Needs Assessment*, prepared by the World Bank's Global Facility for Disaster Reduction and Recovery (GFDRR).[73]

In regard to the social side of the assessment, post-disaster requirements were estimated using qualitative methods that involved interviews with affected persons and other means of identifying needs. Disaster requirements for reducing disaster risk were estimated based on a preliminary risk analysis for Samoa, and include activities that correlate to best practices in the world.

[73] See Global Facility for Disaster Reduction and Recovery, *Damage, Loss and Needs Assessment Guidance Notes*, vol. 3 (Washington, DC: World Bank, 2010).

Socioeconomic Recovery Needs

Socioeconomic recovery needs can be divided into three main subprograms or classifications: recovery of personal or household income, rehabilitation of basic services to the population, and recovery of production. They are grouped together under the major sector classification of social, productive, and infrastructure.

Social Sectors Recovery

Recovery in the social sectors includes the following subprograms: housing, health, and education. Specific subprogram content for each and its monetary requirements or needs are described here and summarized in table 49.

Personal income recovery. Personal income recovery should be accorded top priority in the hierarchy of recovery needs stemming from Cyclone Evan, as families need to be able to count on a minimum income for their most pressing requirements. Some of these requirements have been included in the formal sector of economic activity where they belong (for example, the agriculture sector) and others are included under the social impact assessment identified needs.

Housing sector recovery. Under this subprogram two types of activities have been envisaged: demolition, clean-up, and environmentally safe disposal of mud and debris (SAT 1.7 million); and technical assistance and capacity building related to design and construction of engineered-design and elevated housing units (SAT 0.5 million).

Health sector recovery. To restore health care services to the affected population after the disaster, it will be necessary to meet the higher costs involved in serving an increased number of people (SAT 2.0 million).

Education sector recovery. The education sector demands two types of recovery activities: demolition and debris/mud disposal in affected schools (SAT 0.3 million), and repairs before the start of the new school year to schools that were used as shelter camps (SAT 0.3 million).

Table 49. Estimation of Economic Recovery Needs for Social Sectors

		Value (thousand SAT)	Executing agency
Housing		**2,172**	
	Cost of demolition and removal of mud/debris	1,672	Private
	Technical assistance and training of workers on new standards for housing design	500	Public
Education		**628**	
	Removal of mud and disinfection	342	Public
	Repairs to school-cum-shelter	286	Public
Health		**2,017**	
	Higher costs of health care provision	2,017	Public
Total		**4,817**	

Source: Estimations by assessment team on the basis of damage and loss.

Social impact recovery. The social impact assessment, which was carried out in Samoa in lieu of the human recovery needs assessment, identified special activities to enable recovery after the negative social impact of Cyclone Evan. These activities include among other things the provision of cash grants to affected households in the

amount of SAT 5.0 million;[74] the provision of microcredit for income recovery in the amount of SAT 3.0 million more;[75] a scheme of food security monitoring for SAT 20,000; a subprogram of Community Driven Development (CDD) activities at a cost of SAT 4.0 million; financing of a consultation process to define possible community resettlement (SAT 0.3 million); a scheme of capacity development for psychosocial monitoring (SAT 0.8 million); and a social impact monitoring subprogram (SAT 0.7 million). These social recovery needs are shown in table 50.

Table 50. Estimation of Social Recovery Needs

Need	Value (thousand SAT)
Cash grant transfers for income recovery	5,000
Soft-term credit facility for income recovery	3,000
Food security monitoring	20
Community Driven Development scheme	4,000
Consultation process on resettlement	300
Capacity building for psychosocial monitoring	800
Social impact monitoring	700
Total	**13,820**

Source: Estimations by assessment team.

Note: The relevant executing agencies are to be determined.

Productive Sectors Recovery

The recovery of production activities and levels involves specific subprograms for the agriculture, manufacturing, commerce, and tourism sectors. The total estimated value of needs to restore production in the affected areas amounts to SAT 26.6 million. This total, along with the value of needs for individual sectors, is shown in table 51.

Agriculture and livestock sector recovery. This sector includes several subprograms that cover recovery of food crops and livestock production. There is a subprogram to provide minimum food and income to affected agriculture sector families in order to ensure that they will be able to meet basic needs until the next harvest is collected (SAT 14.0 million). There is also a subprogram to ensure the timely and effective planting of the next harvest; an estimated amount of SAT 0.4 million is required to provide farmers with seed and other inputs. Finally, there is a scheme of land clearing and sanitizing, which is intended to facilitate the planting of the next crop (SAT 0.1 million).

Manufacturing sector recovery. In this sector, needs refer to working capital and rescheduling of nonperforming loans to ensure recovery of production for the affected small and medium manufacturing industries, in the amount of SAT 1.1 million. The funding is to be channeled through special credit lines with soft interest rates and repayment terms, which should be made available through the private banks. (See table 51).

Commerce sector recovery. Recovery of the commerce sector requires credit assistance to owners of trade shops so they can obtain working capital and reschedule loans, for an estimated amount of SAT 3.4 million. The funds are to be channeled through the private banking system.

[74] This amount is in addition to the amount for assistance for household income recovery as included under the agriculture sector.

[75] This amount is in addition to the similar credit lines for working capital for recovery of microenterprises and small and medium enterprises under each sector of economic activity.

Tourism sector recovery. Four types of activities are required to ensure recovery of demand in the tourism sector: clearing of debris and removal of mud in tourism areas (SAT 0.4 million); design and implementation abroad of a marketing campaign to regain foreign tourist demand (SAT 1.5 million); capacity building to ensure tourism recovery (SAT 0.7 million); and establishment of soft-term credit lines for hotel and restaurant owners so they have sufficient working capital to restart their activities, with funds channeled through the private banking system (SAT 5.0 million).

Table 51. Estimation of Recovery Needs for Productive Sectors

	Subprogram	Value (million SAT)	Executing agency
Agriculture crops		**14.5**	
	Provision of food and income to affected farmer families	14.0	Public
	Provision of seeds and other inputs for planting next harvest	0.4	Public
	Land clearance and sanitizing	0.1	Public
Livestock		**0.1**	
	Provision of veterinarian assistance and supplies	0.1	Public
Manufacture		**1.0**	
	Soft-term credit lines for working capital and loan rescheduling	1.0	Private
Commerce		**3.4**	
	Soft-term credit lines for working capital and loan rescheduling	3.4	Private
Tourism		**7.6**	
	Clearing and removal of debris and mud	0.4	Private
	Marketing campaign to restore demand	1.5	Public/ Private
	Capacity building for sector recovery	0.7	Private
	Soft-term credit lines for working capital	5.0	Private
Total		**26.6**	

Source: Estimations by assessment teams on the basis of damage and loss.

Infrastructure Sectors Recovery

A total of SAT 48.5 million is required to ensure the recovery of basic infrastructure in transport, water and sanitation, and electricity supply sectors, which are essential to ensure overall recovery of the national economy. Table 52 shows this total and summarizes the needs for the individual sectors.

Transport sector recovery. The completion of the already-started scheme of cleaning up of trees, debris, and mud from roads in all affected areas requires an amount of SAT 17.0 million.

Water and sanitation sector recovery. Recovery requirements in this sector involve the costs of meeting extraordinary expenditures to provide minimum water supply and sanitation services and facilities to the population in the areas affected by the disaster, at a value of SAT 3.0 million.

Electricity sector recovery. Two activities, which together are estimated to cost a total of SAT 28.5 million, are essential for the recovery of the supply of electricity to the entire country. The first is generating electricity using alternative—and more expensive—thermal power plants instead of generating electricity in damaged hydropower units, at a value of 21.6 million; and the second is the urgent rehabilitation of the transmission and distribution subsystems, at a cost of 6.9 million.

Table 52. Estimation of Recovery Needs for Infrastructure Sectors

	Subprogram	Value (million SAT)	Executing agency
Transport		**17.0**	
	Cleanup and restoration of minimum traffic in affected areas	17.0	Public
Water and sanitation		**3.0**	
	Higher costs of provision of water and sanitation services	3.0	Public
Electricity		**28.5**	
	Higher cost of electricity production through thermal plants	21.6	Public
	Urgent rehabilitation of electrical transmission and distribution	6.9	Public
Total		**48.5**	

Source: Estimations by assessment teams on the basis of damage and loss.

Environment Recovery

For the environment, a recovery activity designed specifically for the collection and environmentally safe disposal of downed trees and other debris has been envisaged at a cost of SAT 4.9 million. This activity involves collecting downed trees throughout the affected area as well as removing debris and mud from the street adjacent to destroyed housing units, but it should be clarified that there is no double counting of the same needs within the housing sector.

Reconstruction Needs

Needs for reconstruction have been grouped under the four main sectors: social, productive, infrastructure, and environment. The assessments assumed a building-back-better strategy, meaning that assets destroyed by the floods are to be rebuilt with improved engineered standards that involve better quality and modernization, that there will be selected relocation of strategic activities, and that disaster-resilient norms will be adhered to in order to reduce risk.

Social Sectors Reconstruction

Reconstruction in the social sectors includes the following subprograms: housing, health, and education. Specific subprogram content and monetary requirements or needs for each are described here and summarized in table 53.

Housing sector reconstruction. A subprogram of housing reconstruction under engineered standards is envisaged. It includes raising the base of the new homes to reduce flood risk at an estimated cost of SAT 28.0 million, part of which would consist of cash grants or in-kind donations for the poorest families that were affected, and the balance of which would be channeled through the private banking system as soft-term credit lines for house reconstruction.

A second subprogram would consist of providing both cash grants and similar soft-term credit lines to homeowners whose houses were only partially affected. Its estimated cost is SAT 14.8 million.

Finally, a third subprogram would provide financing and cash grants and in-kind donations for the replacement of household goods destroyed by the cyclone and floods, at an estimated cost of SAT 4.9 million.

Total reconstruction needs for the housing sector amount to an estimated value of SAT 47.7 million.

Health sector reconstruction. Reconstruction needs for the health sector include hospital and clinic reconstruction, for an estimated amount of SAT 4.5 million.

Education sector reconstruction. In the education sector, reconstruction needs of SAT 8.7 million have been estimated for repair and reconstruction of damaged or destroyed schools, and for replacement of equipment, furniture, and education materials destroyed by the floods.

Table 53. Estimation of Reconstruction Needs for Social Sectors

Subprogram	Value (million SAT)	Executing agency
Housing	**47.7**	
Reconstruction of housing units with flood-proofing features	28.0	Public/Private
Repairs to housing units that were partially damaged	14.8	Public/Private
Replacement of household goods	4.9	Public/Private
Health	**4.5**	
Hospital and clinic reconstruction	4.5	Public
Education	**8.7**	
Reconstruction of destroyed and damaged schools using engineered standards	8.7	Public
Total	**61.0**	

Source: Estimations by assessment teams on the basis of damage and loss.

Productive Sectors Reconstruction

The reconstruction of production includes specific subprograms for agriculture, livestock, fishery, manufacturing, commerce, and tourism sectors. The total estimated value of needs to rebuild production assets in the affected areas amounts to SAT 58.8 million. Table 54 shows the total and summarizes the values for the individual subprograms.

Agriculture sector reconstruction. Under agriculture, four subprograms are envisaged at a total cost of SAT 2.3 million: replacement of minor agriculture machinery and equipment through in-kind donations (0.8 million); replanting of permanent fruit trees (0.3 million); reconstruction of agriculture infrastructure through cash grants and soft-term credit lines (1.0 million); and reconstruction of the Crop Division premises (0.3 million).

Livestock sector reconstruction. Total needs for reconstruction in the livestock sector have been estimated as SAT 4.0 million, and include four subprograms: removal of downed trees and repair of fencing (2.3 million); reconstruction of infrastructure for poultry and pig farms (0.5 million); livestock reconstruction (1.0 million); and reconstruction of the Animal Production and Health Division (APHD) farm (0.1 million).

Fishery sector reconstruction. Requirements for the reconstruction of fishery assets have been estimated as SAT 2.2 million, and include replacement of the commercial fleet assets (0.6 million); replacement of artisan fishery gear and equipment (1.5 million); and reconstruction of other assets (0.1 million).

Manufacturing sector reconstruction. Reconstruction needs of affected micro, small, and medium-sized enterprises have been estimated as SAT 20.7 million, and include introduction of engineered specifications to reduce

flood and wind risks. This amount is to be in the form of a special subprogram of cash grants for microentrepreneurs, along with soft-term credit lines to be channeled through the private banking system.

Commerce sector reconstruction. Reconstruction needs in the commerce sector have been estimated at SAT 1.9 million. This amount is needed to enable individual traders to rebuild their destroyed physical facilities using improved quality standards and flood-resilient features. It is to be in the form of cash grants for microtraders and soft-term loans for creditworthy individuals, channeled through the private banks.

Tourism sector reconstruction. Reconstruction requirements for the tourism sector were estimated at SAT 26.7 million, to be channeled through the private banking system under a scheme of soft-term credit, for hotel and restaurant owners to rebuild their facilities using flood-resilient standards.

Table 54. Estimation of Reconstruction Needs for Productive Sectors

Subprogram	Value (million SAT)	Executing agency
Agriculture	**2.4**	
Replacement of agriculture machinery and equipment	0.8	Public/Private
Replanting of permanent fruit trees	0.3	Public/Private
Cash grants and soft-term credit for agriculture infrastructure reconstruction	1.0	Public/Private
Crop Division premises reconstruction	0.3	Public
Livestock	**4.0**	
Removal of fallen trees and repairs to fences	2.3	Public/Private
Reconstruction of infrastructure for poultry and pig farms	0.5	Private
Reconstruction of livestock infrastructure	1.0	Private
Reconstruction of APHD farm	0.1	Public
Fisheries	**2.2**	
Replacement of commercial fleet assets	0.6	Private
Replacement of artisan fishery gear and equipment	1.5	Public/Private
Replacement of other fishery sector assets	0.1	Public
Manufacturing	**20.7**	
Cash grants and soft-term credit for reconstruction of manufacturing sector	20.7	Private
Commerce	**1.9**	
Cash grants and soft-term credit for reconstruction of commerce sector	1.9	Private
Tourism	**27.6**	
Reconstruction of hotels and restaurants	27.6	Private
Total	**58.8**	

Source: Estimations by assessment teams on the basis of damage and loss.

Infrastructure Reconstruction

Reconstruction requirements have also been estimated for the affected infrastructure sectors of transport, electricity, and water supply and sanitation, at a value of SAT 141.9 million. Table 55 shows the total and summarizes the individual subprograms.

Transport sector reconstruction. In the road transport sector, total reconstruction requirements were estimated

at SAT 97.4 million and include two subprograms: first, the reconstruction of roads (65.1 million); and, second, the reconstruction of bridges (32.3 million), some of which require a different design and full reconstruction under longer spans.

Water supply and sanitation sector. Three subprograms are envisaged for this sector at a total cost requirement of SAT 9.5 million: the reconstruction of destroyed water supply systems (5.0 million); the reconstruction of destroyed sanitation facilities (4.4 million); and the replacement of the network of hydrometeorological stations (0.1 million).

Electricity sector reconstruction. Reconstruction requirements in the transmission and distribution systems of electricity amount to an estimated value of SAT 35.0 million.

Table 55. Estimation of Reconstruction Needs for Infrastructure Sectors

	Subprogram	Value (million SAT)	Executing agency
Transport		**97.4**	
	Reconstruction of destroyed and partially destroyed road sections	65.1	Public
	Reconstruction of bridges using different design characteristics	32.3	Public
Water supply and sanitation		**9.5**	
	Reconstruction of water supply systems	5.0	Public
	Reconstruction of sanitation facilities	4.4	Public
	Replacement of hydrometeorological stations network	0.1	Public
Electricity		**35.0**	Public
	Reconstruction of transmission and distribution networks	35.0	Public
Total		**141.9**	

Source: Estimations by assessment teams on the basis of damage and loss.

Environment Reconstruction

Needs for reconstruction of the environment include three types of activities, and amount to SAT 17.5 million: replanting of trees in natural forest areas (7.7 million); replanting in mixed-use areas (9.7 million); and infrastructure reconstruction (0.1 million).

Disaster Risk Reduction Needs

While reconstruction needs as described in the preceding section include the introduction of improved standards for increasing disaster resilience, specific additional needs to reduce disaster risk were identified in some key sectors of economic activity—including health, water and sanitation, electricity, tourism, and the environment—that amount to SAT 80.9 million (see table 56). In addition, a number of non-sector-specific activities related to disaster risk management, which have been identified on the basis of best practices in flood-related disasters, would demand an additional SAT 11.8 million (see table 57).

Table 56. Estimation of Sector-Specific Disaster Risk Reduction Needs

Subprogram	Value (million SAT)	Executing agency
Health	**21.9**	
Flood-control works in hospital	0.3	Public
Disease control campaigns	3.0	Public
Relocation of health infrastructure into safer areas	18.6	Public
Water supply and sanitation	**3.4**	
Introduction of DRR features into systems	3.4	Public
Tourism	**1.0**	
Reduction of disaster risk in tourism activities	1.0	Private
Electricity	**26.1**	
DRR through use of underground cabling and other features	26.1	Public
Environment	**28.5**	
Control of invasive species in forests	28.5	Public
Total	**80.9**	

Source: Estimations by assessment teams on the basis of damage and loss.

Table 57. Estimated Additional and Non-sector-specific Disaster Risk Reduction Needs

Subprogram	Value (million SAT)	Executing agency
Social DRM needs	**1.0**	
Provision of alternative power sources for communities	0.5	TBD
Improving governance on distribution mechanisms	0.5	Public
Cross-cutting DRM needs	**10.8**	
Strengthening flood forecasting systems	3.0	Public
Mainstreaming DRR and CCA	3.2	Public
Scaling up community DRM program	3.0	Public
Improvement of evacuation facilities and services	1.3	Public
Strengthening DRM governance	0.3	Public
Total	**11.8**	

Source: Estimations by assessment team.

Summary of Recovery, Reconstruction, and Disaster Risk Reduction Needs

The total financial requirements for post-disaster economic recovery, reconstruction, and disaster risk reduction in connection with the Cyclone Evan disaster in Samoa have been estimated for all affected sectors of economic and social activity.

A total amount of SAT 470.3 million (or its equivalent of US$206 million at the current rate of exchange) is required to cover these needs. Of that amount, SAT 98.6 million (US$43 million) is required to ensure economic recovery in all sectors that were affected, and represents 21 percent of total needs; SAT 279 million (US$122 million) is required to finance disaster-resilient reconstruction of assets that were destroyed, and represents 60 percent of total needs; and SAT 92.7 million (US$40.6 million) is required to finance DRR schemes, representing 19 percent of total needs. Table 58 shows the total and subtotals for recovery, reconstruction, and DRR needs.

An analysis of needs reveals that those for infrastructure sectors are the highest (SAT 220 million, or 46.8 percent of the total); needs for the social sectors are estimated as the second most important (SAT 102 million, or 21.8 percent); needs for productive sectors rank as third (SAT 86 million, or 18 percent); and needs for cross-sectoral activities (including the environment and DRR) amount to SAT 61.7 million, or 13 percent of the total.

A combination of domestic funding and international support would be required to meet these financial requirements.

Table 58. Summary of Recovery, Reconstruction, and Disaster Risk Reduction Needs

	Post-disaster needs (million SAT)			
	Recovery	Reconstruction	Disaster risk reduction	Total
Productive sectors	**26.6**	**58.7**	**1.0**	**86.3**
Agriculture	14.5	2.4	n.a.	16.8
Livestock	0.1	3.9	n.a	4.0
Fishery	-	2.2	n.a	2.2
Manufacturing	1.0	20.7	n.a	21.7
Commerce	3.4	1.9	n.a	5.3
Tourism	7.6	27.6	1.0	36.2
Social sectors	**18.6**	**60.9**	**22.9**	**102.4**
Education	0.6	8.7	n.a	9.3
Health	2.0	4.5	21.9	28.4
Housing	2.	47.7	n.a	49.9
Social needs	13.8	n.a	1.0	14.8
Infrastructure	**48.5**	**141.9**	**29.5**	**219.9**
Electricity	28.5	35.0	26.1	89.6
Water and sanitation	3.0	9.5	3.4	15.9
Transport	17.0	97.4	n.a	89.6
Cross-sectoral	**4.9**	**17.5**	**39.3**	**61.7**
Environment	4.9	17.5	28.5	50.9
DRM needs	n.a	n.a	10.8	10.8
Total	**98.6**	**279.0**	**92.7**	**470.3**

Source: Estimations by assessment teams on the basis of damage and loss.

Note: n.a. = not applicable; - = negligible.

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