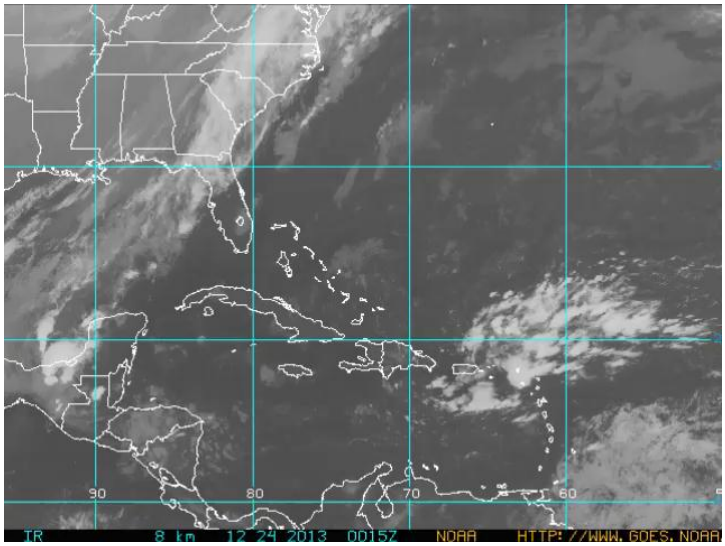


Rapid Damage and LossAssessment (DaLA)

December 24-25, 2013 Floods

A report by the Government of Saint Vincent and the Grenadines

January 16, 2014

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

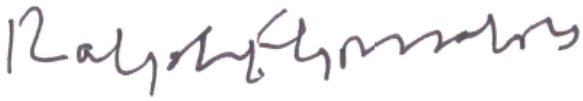
FOREWORD

On 24th and 25th December, 2013 a tropical trough system produced heavy rains in Saint Vincent and the Grenadines (SVG), which resulted in intense flooding across the island. The ensuing rapid and intense flash flooding resulted in widespread damage to road infrastructure, electricity and water infrastructure, housing as well as public and private buildings. On December 26, 2013, the Government of SVG (GoSVG) declared a National Level 2 Disaster in accordance with the National Emergency and Disaster Management Act, 2006. This declaration was considered of national proportions, but specifically declared the following disasters areas to be: 1) Vermont Valley to Buccament Bay; 2) Rose Bank and Dark View on the Leeward Side, 3) Chateaubelair, 4) Fitz-Hughes, 5) Richmond Vale, 6) Spring Village, 7) Gordon Village, 8) Cumberland, 9) Troumaca, 10) South Rivers, 11) O'Briens Valley, Georgetown, and 12) Spring Village, Georgetown.

We will never forget the people who lost their lives as a result of this disaster, and will use their deaths as a wake-up call for the entire nation that we are a country that is highly vulnerable to natural disasters and the impacts of climate variability.

This "Saint Vincent and the Grenadines (2014) Rapid Damage and Loss Assessment" report serves as a reminder and proof of the GoSVG's resolve and commitment to risk reduction as well as the well-being of our people. The GoSVG recognizes the necessity to better understand our climate and disaster risk context, and will do our best to reduce this risk and improve resilience across all sectors.

This report provides a rapid damage and loss assessment of the sectors affected – with a particular focus on infrastructure damage in order to inform the GoSVG's recovery, reconstruction and financial planning. It also includes short and medium term recommendations designed to further incorporate disaster risk reduction and management into land use and physical planning decision-making processes so that we continue to develop into a country that is more resilient to natural disasters and climate change.



DR. HONOURABLE RALPH E. GONSALVES
PRIME MINISTER AND MINISTER OF FINANCE

ACKNOWLEDGEMENTS

This report reflects the relief and recovery efforts of the GoSVG to lift the nation out of the economic setbacks, infrastructure destruction and social impact caused by the heavy rains on December 24th and 25th, 2013. The GoSVG wishes to extend its most profound gratitude to the World Bank for having rapidly sent a team of experts to conduct a "Rapid Damage and Loss Assessment", at the request of the Ambassador, in the immediate aftermath of the devastating floods.

The report is a joint collaboration of GoSVG and the World Bank. This report was produced under the guidance of Dr. Honourable Ralph Gonsalves, Prime Minister and Minister of Finance, Ms. Laura Anthony-Browne, Director of Planning, Mr. Howard Prince, Director of the National Emergency Management Office (NEMO) and Mr. Brent Bailey, Chief Engineer at the Ministry of Transport and Works. A World Bank team led by Justin Locke (Disaster Risk Management Specialist) and consisting of Marco Rodrigues (Senior Disaster Risk Management Specialist), Bishwa Pandey (Senior Data Management Specialist), Gerald Meier (Senior Technical Specialist) and Keren Charles (Disaster Risk Management Analyst) provided additional support.

The authors are grateful to Mr. Richard MacLeish and Mr. Cecil Harris from the Central Planning Division for their logistic support and for the members of SVG Cabinet for their invaluable comments on an earlier draft of this report.

Last but certainly not least is to acknowledge with much appreciation the crucial role of all individuals from the respective ministries, agencies and development organizations that have contributed during the preparation of this report.

The European Union (EU) has provided financial support for the Rapid Damage and Loss Assessment in the framework of the ACP-EU Natural Disaster Risk Reduction Program, managed by the Global Facility for Disaster Reduction and Recovery (GFDRR).

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ABBREVIATIONS

ACP	Africa, Caribbean and Pacific Group of States
CCRIF	Caribbean Catastrophe Risk Insurance Facility
CPA	Country Poverty Assessment
CPD	Central Planning Division of the Ministry of Finance and Economic Development
CWSA	Central Water and Sewage Authority
DaLA	Damage and Loss Assessment
EC	Eastern Caribbean
ECLAC	Economic Commission for Latin American and Caribbean
EU	European Union
FY	Fiscal Year
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Risk Reduction and Recovery
GoSVG	Government of Saint Vincent and the Grenadines
I&C	Industry and Commerce
MCMH	Milton Cato Memorial Hospital
mm	Millimeter
MoTW	Ministry of Transport and Works
NEMO	National Emergency Management Organization
No.	Number
OECS	Organization of Eastern Caribbean States
PAD	Project Appraisal Document
PAHO	Pan American Health Organization
RDVRP	Regional Disaster Vulnerability Reduction Project
RPS	Regional Partnership Strategy
SIDS	Small Island Development State
SitReps	Situation Reports
sq km	Square Kilometer
SVG	Saint Vincent and the Grenadines
UN-ECLAC	United Nations –Economic Commission for Latin American and the Caribbean
US	United States
VINLEC	Saint Vincent Electricity Services
WB	World Bank
W&S	Water and Sanitation

EXECUTIVE SUMMARY

On 24th and 25th December, 2013 a tropical trough system produced heavy rains in Saint Vincent and the Grenadines (SVG). Local rainfall stations reported between 200mm and 310mm in a matter of 2 – 3 hours on the north windward side of the island and up to 153.3mm in the north leeward side of the island, which resulted in intense flooding across the island.

The ensuing rapid and intense flash flooding resulted in severe damage and 9 confirmed deaths with 3 persons still missing. Additionally, there is widespread damage to road infrastructure, electricity and water infrastructure, housing as well as public and private buildings.

On December 26, 2013, the Government of SVG (GoSVG) declared a National Level 2 Disaster in accordance with the National Emergency and Disaster Management Act, 2006. This declaration was considered of national proportions, but specifically declared the following disasters areas to be in a state of emergency: 1) Vermont Valley to Buccament Bay; 2) Rose Bank and Dark View on the Leeward Side, 3) Chateaubelair, 4) Fitz-Hughes, 5) Richmond Vale, 6) Spring Village, 7) Gordon Village, 8) Cumberland, 9) Troumaca, 10) South Rivers, 11) O'Briens Valley, Georgetown, and 12) Spring Village, Georgetown.

According to the summary of the data reported from each affected sector, the December 24-25, 2013 flood event resulted in total damages and losses of US$108.4million (EC$291.4 million), equivalent to 15% of the country's gross domestic product (GDP). Most of the flood damage was sustained in the infrastructure sector (97%) - followed by the social (3%) and productive sectors (<1%). However, as in the case with any rapid assessment following a major event, re-construction/rehabilitation works contingencies – particularly in the transport sector, could potentially increase the total damages reflected in this report by up to 15%.

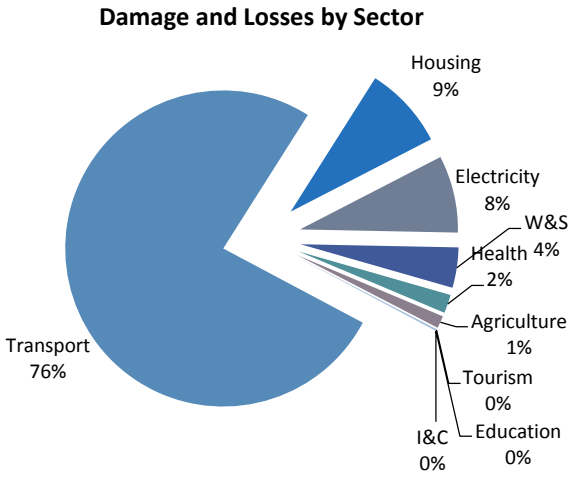
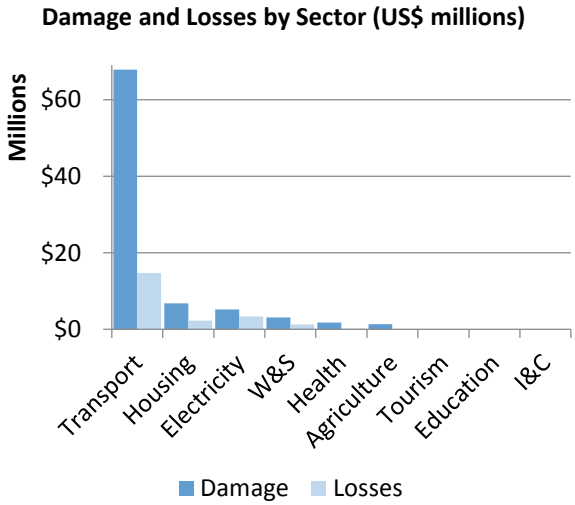


FIGURE 1: RATIO OF DAMAGE AND LOSSES BY SECTOR



W&S - Water & Sanitation; I&C - Industry & Commerce

FIGURE 2: DAMAGE AND LOSSES BY SECTOR (US$ MILLIONS)

TABLE 1: SUMMARY OF DAMAGE AND LOSSES BY SECTOR

	Disaster Effects (US$)				Disaster Effects (EC$)		
	Damage	**Losses**	**Total**	**%**	**Damage**	**Losses**	**Total**
Sector							
Infrastructure							
Transport	$67,868,392	$14,733,755	$82,602,147	76%	$182,443,811	$39,607,282	$222,051,092
Housing	$6,799,830	$2,339,169	$9,138,999	8%	$18,279,303	$6,288,154	$24,567,457
Electricity	$5,207,946	$3,347,965	$8,555,911	8%	$14,000,000	$9,000,000	$23,000,000
W&S	$3,148,999	$1,319,835	$4,468,834	4%	$8,465,140	$3,547,981	$12,013,121
Social							
Health	$1,830,965	$221,952	$2,052,917	2%	$4,922,000	$596,651	$5,518,651
Agriculture	$1,372,666	$0	$1,372,666	1%	$3,690,000	$0	$3,690,000
Productive							
Tourism	$118,739	$52,675	$171,414	0%	$319,195	$141,600	$460,795
Education	$0	$15,000	$15,000	0%	$0	$40,323	$40,323
I&C	$0	$6,000	$6,000	0%	$0	$16,129	$16,129
Total	**$86,347,537**	**$22,036,351**	**$108,383,888**	**100%**	**$232,119,449**	**$59,238,120**	**$291,357,568**
	80%	**20%**			**80%**	**20%**	

1. COUNTRY OVERVIEW

1.1 COUNTRY CONTEXT

Demographic. Saint Vincent and the Grenadines (SVG) is an archipelagic state in the Eastern Caribbean, comprising the main island, Saint Vincent, and a chain of 32 islands and cays. The total area of the country is 390 sq. km of which the main island is 344 sq. km. SVG is a small island developing state (SIDS) with an estimated population of 109,373 and a GDP per capita of US$6,515 in 2012[1].The country's population is split evenly with 50% female and 50% male. According to the last completed census (2010), 30% of the population lives below the national poverty line. Over the past two decades, the population has migrated from the rural areas to the urban areas, where 50% of the population now resides.

Economic. The GDP in 2012 was US$712 million with the tertiary sector accounting for 72.9% of the GDP, industry for 19.9% and the primary sector accounting for the remaining 7.3% of the GDP[2].In the past, SVG relied almost exclusively on agriculture, but within recent times, tourism and related services, construction and other sectors have become increasingly important as contributors to the national economy. Although commerce is becoming more decentralized, the main area of economic activity is Kingstown - the country's capital. Public external debt relative to GDP ratio was 70% in 2012[3], which results in SVG having limited capacity to manage the fiscal impacts of exogenous shocks. Table 2 shows select socio-economic statistics.

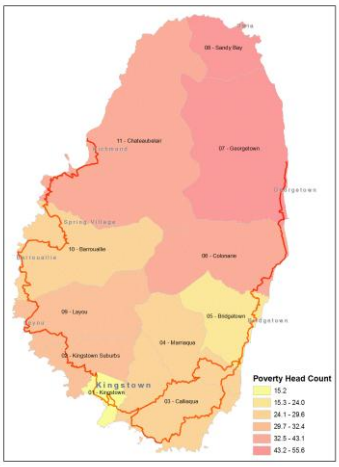


FIGURE 3: POVERTY HEADCOUNT

Poverty. According to the 2007 Country Poverty Assessment (CPA), 2.9% of the population lives in abject poverty, 30.2%is below the poverty line and 48.2% of the population is susceptible to poverty. The poverty distribution is geographically correlated with the highest poverty rates, 55.6% found at the northern end of the island – with the highest concentrations found in the villages of Sandy Bay and in Georgetown. Figure 3 shows the poverty by census district.

TABLE 2: SELECTED SUMMARY STATISTICS

	2007	2008	2009	2010	2011	2012
Demographic						
Population	109,045	109,158	109,249	109,316	109,357	109,373
Population Density (persons per sq km)	280	280	280	280	280	280
Female, % of Total	49	49	49	50	50	50
Rural, % of Total	52	52	51	51	51	50
Urban, % of Total	48	48	49	49	49	50
Economic						
GDP (US$)	684,691,915	699,004,421	672,342,406	674,762,009	687,993,793	712,588,889
GDP per Capita (US$)	6,279	6,404	6,154	6,173	6,291	6,515
GDP Growth (annual %)	3	1	(2)	(3)	0	2
Agriculture (% of GDP)	6	7	7	7	6	7
Industry (% of GDP)	21	20	20	19	20	20
Services (% of GDP)	73	74	73	73	74	73
Inflation	7	10	0	1	3	3

[1] Figures from the World Bank Development Indicators as of January 13, 2014.
[2] Figures from the World Bank Development Indicators as of January 13, 2014.
[3] IMF, World Economic Outlook Database, October 2013.

Geographic						
Land area (sq km)	390	390	390	390	390	390
Agricultural land area (%)	26	26	26	26	26	26
Total road network (km of road)	829	829	829	829	829	829

Source: World Bank Development Indicators

1.2 GENERAL SITUATION

Extraordinarily heavy rains experienced in Saint Vincent Island on the evening of December 24, 2013 provoked rapid and intense flash flooding that directly affected over 50% of the population. Flood damages and landslides resulted in significant damage to infrastructure - particularly in the water, electricity and transport sector. Numerous private homes were lost and 9 persons are confirmed to have lost their lives with 3 person still missing. As a result of the event, 225 persons were evacuated to national disaster shelters and schools were closed for an extra week of Christmas vacation while emergency stabilization operations continued.

Particularly critical was the damage experienced in the transport, electricity, and water sectors. Floods destroyed bridges and undermined roadways, two hydropower-generating facilities were disabled, and water services were cut to more than 50% of the population due to losses of transmission pipes throughout the country.

Initial emergency response operations have restored most transport communication and water services through a patchwork of emergency interventions and most landslips have been cleared from affected roadways. However, the two hydropower plants remain offline and are not expected to be restored for several months. These plants represent 12% of the national generating capacity.

1.3 VULNERABILITY TO NATURAL HAZARDS

SVG is exposed to high levels of risk to meteorological and geophysical hazards[4], which have significant negative impacts to SVG's economic and fiscal stability. It has more than 40 rivers and tributaries, which originate in the central mountains and discharge to the Caribbean Sea or the Atlantic Ocean[5]. Often villages and towns are located along those rivers, especially near the coast in the flatter areas that leads to increased debris flow and flood risk. As a result of its volcanic origin, steep slopes dominate the island's landscape and tilted volcanic layers define the geology and soils[6]. In combination with high temperatures and abundant rainfall, this leads to slope instabilities and the potential for landslides. De Graaf identified in 1988 about 475 landslides, covering about 1% of the country's surface. The most common type of landslides in SVG are debris flows. These are defined as rapid movements of a mass of soil, water and air, posing a significant threat to human lives since they can travel long distances, approach fast and exhibit a considerable destructive force. Volcanic eruptions have affected the country in 1789, 1812, 1902, 1971 and 1979[7]. SVG is located in the Atlantic hurricane belt and has suffered periodic damages from past events e.g. from Hurricane Allen (1980), Hurricane Lenny (1999), and Hurricane Tomas (2010).

Studies show that natural hazards are being exacerbated by the adverse impacts of climate change, which are putting increased stress on water availability, coastal investments, national infrastructure

[4]Meteorological: High wind/excess rainfall/hurricanes and drought.Geophysical: Seismic/volcanic/tsunami.
[5]DLN Consultants (2006) Island wide flood risk assessment study
[6]De Graff(1988) Landslide hazard on St. Vincent, West Indies – Final report. Department of Regional Development, Organization of American States
[7]National Emergency Management Organisation (2005) St. Vincent and the Grenadines – National Disaster Plan

and livelihoods. In the past decade, damages from major natural disasters in SVG were approximately US$41 million, which was more than the accumulative sum of damages from 1961 – 2000[8].

1.4 Overview of December 24 and 25 Disaster

On December 24 through the early morning of December 25, 2013, extraordinarily heavy rains associated with a tropical trough system, passed through the Eastern Caribbean affecting the islands of Dominica, St. Lucia and St. Vincent. While meteorological services were observing the trough system, regional forecasts provided indicated that the system was associated with moderately heavy rainfall activity but did not indicate the potential for severe weather. Extracted from the forecast outlook issued from Barbados Meteorological Services, the outlook for December 24 was "*This feature [the trough] will continue to advect copious amounts of moisture and showers particularly over the north-eastern portions of the Lesser Antilles with most of the deep convection and thunderstorm activity being concentrated in the vicinity of Dominica, Martinique and Guadeloupe and St. Vincent to a lesser extent for at least another 12 to 24 hours*."

Along the northern portion of the island, 308.6 mm of rainfall was recorded over the 24-hour period, but more importantly, 278 mm fell over a 3-hour period from 9 pm to 12 am. While rainfall curves are unavailable for St. Vincent, a review of curves available for Puerto Rico and St. Lucia coupled with interviews with affected persons and staff at the national meteorological office strongly suggest the 3 hour rainfall intensity is in excess of a 1 in 100 year event. Additionally, previous normal rainfall had already saturated the surface soils creating optimum conditions for maximum surface runoff. Witnesses reported unusual lightning and thunder activity associated with the storm and, some areas, hail during the peak rainfall event, further confirming the system was unusually intense. Rainfall was largely focused on the northern portion of the island where the topography is mountainous and includes the highest elevations on the island, namely the Soufriere volcano. Storm interaction with the island topography in this area likely contributed to the high rainfall rates experienced. Most of the rainfall was experience over the central mountain range where eastern and western watersheds converge. Rainfall was unevenly distributed during the storm and the northern and central portions of the island received disproportionately higher intensities than the southern portions where the rain gauge at the Arnos vale airport reported heavy but not extraordinary precipitation rates and levels.

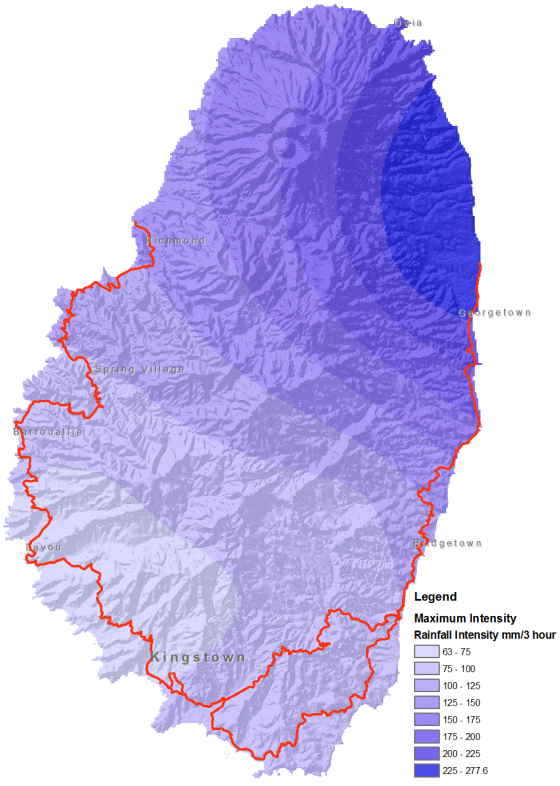


FIGURE 4: PRECIPITATION DISTRIBUTION

The intense rainfall converted rapidly to a major flash flood event for most of the streams on the northeast and northwest portions of the islands and provoked major landslides. Kingstown experienced flooding originating in the upper watersheds and flood intensity increased to the north. Consequently, the northern portion of the island suffered major flooding along

[8]EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.be – Universitécatholique de Louvain – Brussels – Belgium.

principal rivers and tributaries, which severely damaged or destroyed public and private infrastructure. Floods particularly affected roadways, bridges, drinking water and power generation facilities. Landslips in the north blocked most major roadways. Numerous houses were damaged and 9 persons lost their lives with 3 additional persons missing. Bridges were severely damaged or destroyed, cars were swept away and numerous landslips closed much of the principal road system. It is fortunate that the storm occurred in the evening of Christmas Eve and traffic was at a minimum, which undoubtedly contributed to the relatively low loss of life.

TABLE 3: SUMMARY OF PERSONS AFFECTED

Locations	Impacted Population[9]	%	Poverty Ratio (2008)[10]	Main Economic Activity[11]
Spring Village, Rose Bank and Dark View on the Leeward Side (including the villages of Pitit Bordel, Chateaubelair, Fitz-Hughes, Richmond Vale, Spring Village, Gordon Village, Cumberland, and Troumaca)	5,731	34%	43.1%	Agriculture and Fishing
The Vermont Valley, all the way down to Buccament Bay (including the villages of Francois, Retreat, Vermont, Dubois, Hog Hole, Cave Vale, and Pembroke).	4,684	28%	32.4%	Agriculture and Fishing, Construction and Services
Sandy Bay, Owia, Fancy	3,856	23%	55.6%	Agriculture and Fishing
O'Briens Valley and Spring Village Georgetown	1,401	8%	55.6%	Agriculture and Fishing
South Rivers	1,213	7%	40.2%	Agriculture and Fishing
Total Number of Impacted Persons	**16,885**	**100%**		

The impact was concentrated in zones where the economic activities focus on agriculture, fishing and services, areas with high levels of poverty, such as Georgetown 55.6% and Sandy Bay 55.6%. Approximately 15% of the population was directly affected and the total population will be affected by the medium and long-term effects. With respect to of the people affected, around 44.0 % are classified as living in poverty. A more detailed social assessment on the impact of gender would be required in order to determine the full social impact of the disaster.

1.5 The Immediate Response

Advisories and Warnings. On the evening of December 24, intense rainfall developed in St. Vincent without significant advanced warning as presented in this extract from the synopsis issued by the Meteorological Service of St. Vincent "*the weather changed so rapidly between 6:00 and 8:00 pm on the 24th December that is would have been very difficult to predict and then issue a severe weather bulletin/flood warning with any significant lead time to alert the populace. The officer on duty however did manage to issue a severe/special weather bulletin for the country based on her observations of what was taking place between 7:00 and 8:30 pm. that evening. This bulletin went out at 9:20 pm and verbal contact was made with NEMO….*"

Activation of the National Disaster Plan. In accordance with the National Disaster Response Plan of the GoSVG, the National Emergency Management Organization (NEMO) – as mandated by the National Emergency and Disaster Management Act, 2006 - led the preliminary Damage and Needs Assessment. The report generated from the initial assessment provides information relative to the nature and scope of destruction to public and private sectors. Based on the information contained within the report, the Acting Prime Minister, Girlyn Miguel – as Chair of the National Emergency Council – declared a Level 2 Disaster on December 26, 2013. This announcement was via a formal announcement via National broadcast, which was later published in the local newspapers.

[9] Ibid.
[10] Saint Vincent and the Grenadines, Country Poverty Assessment 2007/2008.
[11] Provided by the Statistical Office of the Central Planning Division.

Immediate emergency response focused on rescue, clearing of landslips, restoration of water and electricity as well as preparation of diversions around damaged and lost bridges. Levels of infrastructure loss were significant due to the flash flooding and efforts to restore services are ongoing.

Following the initial damage assessment report, several sectoral reports were produced by key agencies of the GoSVG Damage and Needs Assessment Committee. Subsequently, the GoSVG activated the National Disaster Plan, which requires the specific identification and prioritization of critical recovery and reconstruction activities - including critical imports.

1.6 The Damage and Loss (DaLA) Approach

DaLA Preparation. After the initial assessment of damages by the government, it was concluded that the infrastructure had been severely impacted. On December 31, the GoSVG Ambassador to the United States requested the technical assistance of the World Bank (WB) to conduct a Rapid Damage and Loss Assessment (DaLA) and to support reconstruction efforts in the country. In response to the government's request, the WB deployed a team of experts to conduct the rapid DaLA, which arrived in the country on January 7, 2014. The team worked jointly with the national authorities, visited the affected areas, gathered information and analyzed the results. The information in this report reflects the results of the assessment and information available as of January 16, 2014.

DaLA Methodology. The DaLA methodology calculates the damage and losses as well as the social, economic, and environmental impacts of a disaster. This report provides -based on the available information- a close approximation of damages to assets and losses to the economic flows, and provide the some inputs to summarizes total macroeconomic impacts.

The DaLA methodology uses the country's system of national accounts and involves all macroeconomic sectors including productive (agriculture, tourism, commerce, and industries), infrastructure (transportation, electricity, and water supply and sanitation), social (housing, education, and health), as well as crosscutting issues (e.g., the environment and gender).

> ***Damage*** *is defined as the monetary value of fully or partially destroyed assets. It is initially assumed that assets will be replaced to the same condition— in quantity and quality—that they had prior to the disaster.*
>
> ***Losses*** *are defined as the changes in the flows of goods and services that will not be forthcoming in the affected area until full economic recovery and reconstruction has been achieved. They include production of goods and services that will not be obtained or provided, higher costs of operation and production, and the cost of the humanitarian/emergency assistance activities. Losses are expressed in current values.*

2. DAMAGE AND LOSSES ASSESSMENT

2.1 DAMAGE AND LOSS SUMMARY

According to the summary of the data reported from each affected sector, the December 24 and 25, 2013 flood event resulted in total damages and losses of US$103.9 million (EC$279.3 million), equivalent to 15% of the country's gross domestic product (GDP). Most of the flood damage was sustained in the infrastructure sector (97%) - followed by the social (3%) and productive sectors (<1%).

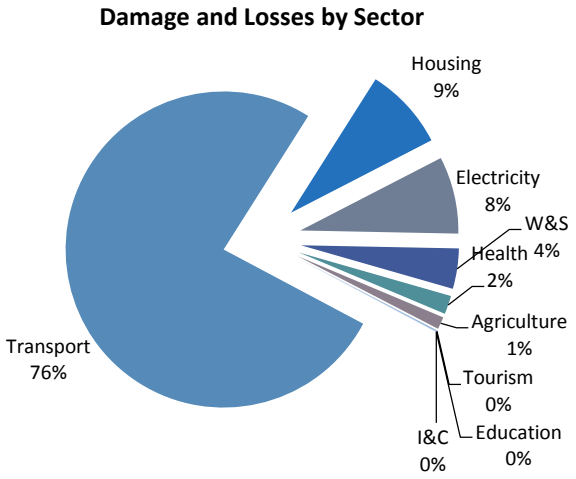
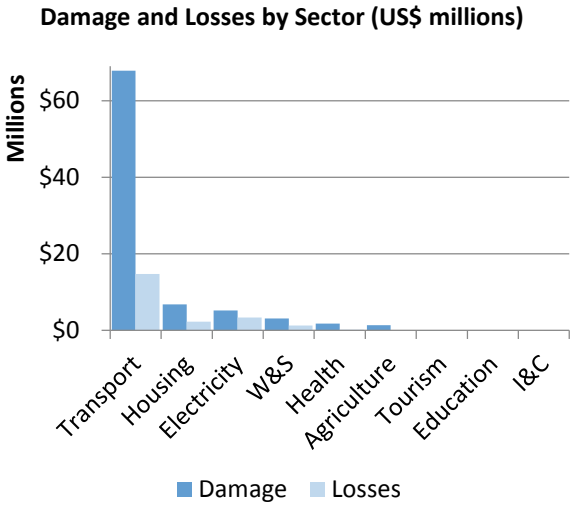


FIGURE 5: RATIO OF DAMAGES AND LOSSES BY SECTOR



W&S - Water & Sanitation; I&C - Industry & Commerce

FIGURE 6: DAMAGES AND LOSSES BY SECTOR (US$ MILLIONS)

TABLE 4: SUMMARY OF DAMAGES AND LOSSES BY SECTOR

	Disaster Effects (US$)				Disaster Effects (EC$)		
Sector	Damage	Losses	Total	%	Damage	Losses	Total
Infrastructure							
Transport	$67,868,392	$14,733,755	$82,602,147	76%	$182,443,811	$39,607,282	$222,051,092
Housing	$6,799,830	$2,339,169	$9,138,999	8%	$18,279,303	$6,288,154	$24,567,457
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Health	$1,830,965	$221,952	$2,052,917	2%	$4,922,000	$596,651	$5,518,651
Agriculture	$1,372,666	$0	$1,372,666	1%	$3,690,000	$0	$3,690,000
Productive							
Tourism	$118,739	$52,675	$171,414	0%	$319,195	$141,600	$460,795
Education	$0	$15,000	$15,000	0%	$0	$40,323	$40,323
I&C	$0	$6,000	$6,000	0%	$0	$16,129	$16,129
Total	**$86,347,537**	**$22,036,351**	**$108,383,888**	**100%**	**$232,119,449**	**$59,238,120**	**$291,357,568**
	80%	**20%**			**80%**	**20%**	

**All Ministries and agencies are still in the process of analyzing and quantifying their losses; as a result total losses are expected to increase in each sector.*

2.2 DAMAGE AND LOSSES BY SECTOR

The following report is based on estimates from national authorities in each sector following the same template and the same DaLA methodology. It is presented by sectors under categories of Infrastructure, Productive Sectors, Social Sectors, and Cross-Cutting Sectors.

2.2.1 TRANSPORT INFRASTRUCTURE

The impacts to the transportation system focused mainly on the main roads, bridges and riverbank stability from floods and landslips. A single major road rings the island connecting all communities to the island's principal center of commerce, Kingstown, and hospital. This road provides access services for the entire population and is key to all sectors of the national economy.

During the storm, the country's international airport suffered temporary flooding of the runway resulting in closure of the airport facility for several hours however; no significant damages were identified with the airport reopening on December 25, 2013. The country's principal port facilities were not affected; however, a small pier facility on the northwest coast was destroyed. The pier in this area is classified as lifeline infrastructure as it serves the fishing community but represents the only access point to supply the community in the event of a major road blockage. Access to this region is highly susceptible to landslip activity.

24 bridges (13% of all bridges) were damaged and 14 were completely destroyed (8% of all bridges)– for a total of 21% of affected bridges. Additionally, 31 km of roads (representing 4% of total road network) were damaged or destroyed. Estimated damage to bridges and roadways is approximately US$67.9 million (EC$182.5 million) - representing approximately 12% of the GDP.

TABLE 5: DAMAGES AND LOSSES TO THE TRANSPORTATION SECTOR

	Windward	Leeward	Total
Damages			
Roads and Bridges	$30,377,169	$37,491,222	**$67,868,391**
Losses			
Roads & Bridges			$8,144,207
Temporary Structures			$1,562,384
Cost of Clean up			$1,673,983
Cost of new cars			$24,000
Value of increased time on the roads due to damaged infrastructure			$460,934
Increased maintenance costs			$108,462
Hydrology and hydraulic studies			$2,000,000
Total Losses			**$14,733,755**
Total	**$30,377,169**	**$37,491,222**	**$82,602,147**

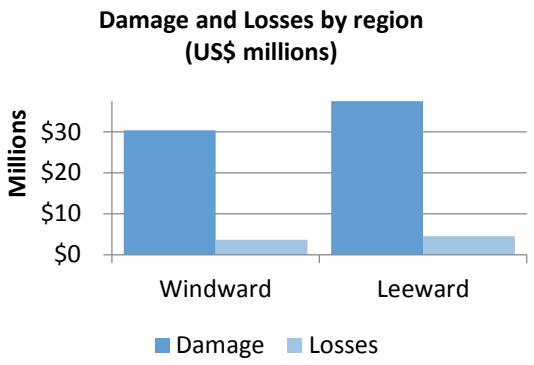

FIGURE 7: DAMAGE AND LOSSES TO THE TRANSPORT SECTOR BY REGION

Assumptions. The damages and losses represented in table 5, include main roads (primary and secondary), feeder roads (tertiary), and bridges. In order to calculate the estimated damages, all estimates used market unit rates in accordance with an established database housed within the Ministry of Transport and Works. This calculation also considered a cumulative rehabilitation/reconstruction contingency of 15% and a nationally established value added tax (VAT) rate of 15%.

Losses calculated for the transport sector include costs of: i) improved reinforced infrastructure for roads and bridges; ii) construction of temporary structures while construction is taking place; iii) clean-up(US$1.7 million); cost of vehicle replacements (US$24,000); and the opportunity cost associated with increased transit times (US$460,934).The loss calculation also included a combined design (6%) and supervision (9%) cost of 15%(US$8.9 million) for all rehabilitation/reconstruction works activities. In addition, in order to support the rehabilitation and redesign of damaged or destroyed civil works, the loss calculation considered the conducting of pre-engineering studies – more specifically, hydrology and hydraulic studies for 8 affected watersheds (Richmond, Buccament,

Colonaire, Troumaca, Petit Bordel, Sandy Bay, Fancy and Chateaubelair) for total of US$2 million (EC$5.3 million). The assessment also considered the increase in cost of maintenance ($108,661 for 1 year) of affected infrastructure. Total transportation losses, as of January 15, 2014, is US$8.9 million (EC$21.9 million); however, this number is expected to increase by 2% as additional losses are realized over time.

These losses consider the value of increase the time to transit and do not include isolation of population, increase in the prices of agricultural goods in market (affecting food security), increase in the time and cost of transport, reduction in the export of agricultural goods, reduction in the income of farm owners and possible reduction in the income from tourism.

2.2.2 HOUSING

Damage to housing stock on the east side of the island was significant. Areas particularly hit hard were Vermont, Troumaca, Spring Village and Cumberland villages. Table 6 below presents the Housing Infrastructure affected by the storm.

TABLE 6: HOUSING INFRASTRUCTURE AFFECTED

Level	No. of Houses	Description
1	396	No signification damage – structure is useable and can be occupied. Repairs required are minimal
2	144	Minor damage – structure is useable and can be occupied after urgent temporary measures are taken. Owner will probably need assistance with repairs
3	61	Structure is not useable and cannot be occupied until after repairs are done.
4	61	Structure is not useable and cannot be repaired must be rebuilt
Total	**662**	

The GoSVG organized emergency assistance and established temporary shelters. On January 7, 2014 there were 225 people occupying 7 shelters. Losses include the cost of shelter operation for one month, the cost of vulnerability analysis to be conducted and estimated land acquisitions required for relocation of vulnerable families. Table 7 presents the detailed calculations of the damage and losses.

TABLE 7: HOUSING - CALCULATION OF DAMAGES AND LOSSES

		Disaster Effects		
		Damage	**Losses**	**Total**
Estimation of Damage				
a) Houses Fully Destroyed				
	Number of houses	122		
b) Houses Partially Destroyed				
	Number of houses	540		
Damages Total		**$6,799,830**		**$6,799,830**
Estimation of Losses				
a) Cost of Temporary Housing Scheme - Emergency Shelters				
	Number of persons in shelters		225	
	Number of shelters		7	
	Weekly cost of Operating Shelter		$9,635	
	Number of weeks in operation		4	
	Estimated loss (1 month)		**$38,539**	
b) Cost of Relocation				
	Study and other agreements		$10,000	
	Infrastructure		$0	
	Access to roads		$0	
	Access to utilities		$0	
	Land value (1=1000sq ft)+utilities		$8,000	
	Contingencies		$1,686,880	
	Cost of replacement furniture		$408,452	
	Number of households		21	
	Cost of Land		$195,298	
	Total Cost of relocation		**$130,000**	
Losses Total			**$2,339,169**	**$2,339,169**

Total	**$9,138,999**

2.2.3 WATER AND SANITATION

Water. Drinking water transmission services provided by of the Central Water and Sewage Authority (CWSA) were interrupted with 8 of the 11 distribution networks suffering major damages to transmission pipes caused by the extensive flooding. As many as 30 major rivers island-wide suffered major flooding many of which are traversed by the CWSA's transmission and distribution lines. Raw water intakes were affected with two weirs completely destroyed. Sandbags have been put in place to temporarily restored services from these locations. As a result of damages to the system, approximately 70% of the country was left without piped water. Through a program of temporary emergency repairs, this number was reduced to 40% after one week and subsequently 30% after two weeks. Piped water access was fully restored to normal service levels by three weeks after the event. As of January 13, 2014, 30% of the water infrastructure remains in a highly vulnerable condition owing to the temporary nature of the emergency interventions.

Sanitation. Solid waste services were suspended to several communities as CWSA collection trucks could not access communities due to the severe damages to transport infrastructure. Over the three weeks period after the storm, CWSA worked with the affected communities to devise a means to remove the solid waste.

Temporary Water Distribution. While emergency construction progressed to restore piped water services, CWSA reverted to the use of water trucks to distribute water to affected communities. This practice continued until services were restored.

Reconstruction. An estimated 2 to 3 months will be required to replace weir structures along the two affected raw water intakes. An estimated 1 to 2 years will be required to rehabilitate the distribution network replacing temporary repairs with permanent infrastructure. Based on the experience from the flood event, CWSA plans to conduct studies to determine new pipeline routes and designs for more resilient pipelines at river crossings as well as other areas in the system. These studies will evaluate the impact of the current river conditions such as widening and/or rerouting caused by the flood event.

Financial. The combined damage and losses to water and sanitation was approximately US$4.5million (EC$12million).

2.2.4 ELECTRICITY

In SVG, 83% of the electricity is generated using imported fuels; approximately 17% is produced by 3 hydroelectric facilities. Power transmission is accomplished through a unified grid network with all generator connected to same grid. Floods affected the system primarily through damage to all three hydro facilities - taking them off line. This represents approximately 17% of the generating capacity for the system that will be replaced through the increase in fuel based generation systems. The need for increased reliance on imported fuels will likely result in an increase in the consumer fuel service fee collected by VINLEC - affecting all sectors.

VINLEC expects to see an increase in the cost of electricity as the lost Hydropower generation will be replaced by diesel generation. Electricity bills primarily consist of a base rate plus a fuel surcharge, which is used to recover the cost of fuel. Without Hydropower generation, VINLEC will use more fuel requiring an increase in the fuel surcharge. The Hydropower generation plants produce between

two and three million units of electricity monthly. Hydropower generation in SVG results in costs savings over fossil fuel plants of approximately EC $1.5 million (US$ 557.994) monthly in fuel costs.

No significant damages were noted in the transmission system and minor localized damages were experienced in the distribution system.

2.2.5 HEALTH

The Ministry of Health and the Pan American Health Organization (PAHO) has conducted an Initial Damage Assessment focused on the Milton Cato Memorial Hospital (MCMH). This assessment revealed that a number of records and essential pieces of equipment were damaged. Additionally damage from flooding to the maternity and pediatrics wards was significant. Initial replacement/repair costs are estimated at US$1.8 million (EC$4.9 million). Annex 3 as the list of equipment needed.

The Ministry of Health reported, all the district clinics is functioned (only one clinic in leeward has no water), the water tasted equipment was been provide, and improve the fogging program to reduce the risk of dengue and the health psychologist program to assist the affected population.

The losses include the expenditures to treatment to injures, the higher expenditures on patients referred to other facilities, loss revenue and the cost of surveillance, information campaign and vector control in flooding areas.

2.2.6 AGRICULTURE

The agriculture sector was impacted by the flooding, primarily resulting from the interruption of transport access services. The agricultural production in the northern affected areas, such as Georgetown and Sandy Bay, comprises primarily banana, root crops and vegetables. Particularly affected are low-income families whose agricultural production is primarily for personal consumption and local sales (i.e. farmers markets). It is estimated that approximately 3% of total population affected are farmers.

Total damages in the agricultural sector are estimated to be US$1.4 million(EC$3.69 million). 1,115 farmers were affected and 170 acres of land (equivalent 0.688 sq km). This amount represents 3% of the total value of agriculture (WB 2012). The Agriculture sector represents 7% of the GDP (WB 2012). At the moment, the Ministry of Agriculture is in the process of determining the total damage to the forestry sector and estimated costs of reforestation.

It is expected that the environmental damage and losses will be minimal, and therefore were not quantified as part of this assessment.

2.2.7 TOURISM

Damages. Key tourist sites were located in the areas that suffered the most damage from the storm. These include popular locations such as Troumaca and Vermont areas. Damage to Tourism infrastructure includes the Botanic Gardens, Black Point Historic and Recreational Park, Dark View Falls and the Wallilabou Heritage Park. Direct damages to the Tourism infrastructure are estimated at US$118,739 (EC$319,195).

Losses. The major impact of the storm on the Toursim sector will be experienced due to the loss or limitation of access to key tourism sites resulting from damages to the Transportation infrastructure.

The following section estimates the potential loss to the Tourism sector for the national's parks (6): Walllilabou Heritage Park, Black Point Historic and Recreation Park, Dark View Falls, Layou Petroglyph Park, Vermont Nature Trails, and La Soufriere Cross Country Trail. According to National Parks, Rivers and Beach Authority, 75,502 people visit the national parks per year and pay on average US$2 (EC$5) to enter. Assuming that it would take 3 months to restore the sites to partial capacity and 6 months to fully restore the sites, the total amount lost in the tourism sector would be US$52,675 (EC$470,795).

This does not include expenditures souvenirs, incidentals or food. In total, the damage and losses for the tourism sector, to date, is approximately US$171,414 (EC$460,795).

2.2.8 Education

The education infrastructure was not directly affected; however, five of the eight emergency shelters activated were elementary schools. These may need repairs once the shelters are closed cost of repairs coupled with some furniture replacement is estimated at US$15,000 (EC$ 43,323).

2.2.9 Industry and Commerce

The GoSVG conducted an assessment of minor commerce, in general the losses are US$6,000 (EC$16,129).

2.3 Macroeconomic Impact

The macroeconomic impact of the floods and landslides will take longer to become apparent. In the Balance of Payments (BOP), the possible impact considered the increase of the imports; foods and agriculture supplies, W&S supplies, rehabilitations roads and bridges and reconstruction the houses and medical equipment.

In the Fiscal Sector, the possible impact considers the increase of the budget of public expenses and reassignment of public investment budget resources. The increased expenditures were accommodated by making use of the government's budget framework - as no allocation with respect to natural calamities was made to the budgeted contingency fund. This represents approximately the 7% of the total budget of expenses (2011). The needs for reconstruction represent proximally the 39% of the public investment budget (2011).

The GoSVG will need to further assess the impact to BOP, Fiscal Sector and poverty level after the conclusion of the DaLA process.

2.4 Recovery and Reconstruction Plan

The late December floods offer an important window of opportunity to address difficult development issues. More importantly, this event provides a strong impetus to better understand the localized relationship between rainfall rates and run-off volumes and the system response with respect to flood and landslide events within watersheds. Improving this understanding will be useful in the application of more advanced hazard and risk modeling methodologies to inform the future investment activities.

A robust recovery and reconstruction framework is proposed to provide a sequenced, prioritized, programmatic, yet flexible action plan to guide the recovery and reconstruction process that is anchored in disaster risk management – in particular flood risk management.

Short-Term Actions (1 year)

- Repair and clean up damaged houses and infrastructure - including roads, river protection works, drainage, schools and recover agriculture production

- Conduct a detailed post disaster needs assessment (PDNA) focused on livelihoods

- Conduct a technical inspection of damaged infrastructure – including a technical assessment of existing transportation and power, water and sanitation infrastructure.

- Develop or update the river basin flood risk maps and watershed calibration curves from CWSA data collected since 2009

- Update the landslide susceptibility maps to include other interacting risks (i.e. flood, rockslide, mudslide, change of river course, etc) with particular attention to areas left unstable after the flood event

- Evaluate and ensure the effectiveness of operation and maintenance (and in some cases immediate improvement) of drainage network, as well as efficient coordination between agencies

- Establish a standing parliamentary committee to investigate and develop risk transfer options with respect to government assets and private sector losses in order to prepare for dealing with future disaster loss events. Considerations should include activities such as setting aside a capital reserve, (government self-insurance), purchase of insurances, insurance requirements for the private sector, formal support systems for low income citizens. Recommend this begin with a comprehensive multi-sectoral fiscal vulnerability analysis and an analysis of needs for periodic rehabilitation of public infrastructure in order to mitigate direct budget impacts of recurrent disaster events in the future

Medium- to Long-Term Actions (1–5 years)

- Address critical data gaps needed to generate hazard and risk assessment particularly with respect to hydromet monitoring systems

- Advance findings under risk transfer analysis to policy and/or legislation

- Formalize the national hydromet data management system and improve data collection (including telemetric reporting systems for all rainfall and stream gauges) building on the current system managed by CWSA developed under the GOSVG/EU water resources project. Improve interagency data sharing and archiving and formalize the establishment of a national hydromet center of expertise

- Identify and map annual, 10 year, 25 year, 50 year and 100 year flood plains

- Develop a land-use/land-cover map using criteria required as inputs to watershed and runoff modeling systems

- Incorporate watershed and flood risk management in the national land-use planning process
- Identify and act on the development of required legislation to manage land-use in high risk areas particularly in recurrent floodplain zones
- Adopt a watershed management legal framework
- Invest in transportation infrastructure and preventive maintenance and establish formal requirements for new infrastructure design with respect to expected service life and disaster resilience requirements (e.g. survives 100, 200, 500 wind, flood, seismic event)
- Advance and adopt risk reduction-based building codes and strengthen training and enforcement
- Identify capacity gaps and provide tailored training for staff in key ministries in disaster risk management and response
- Install additional meteorological and stream gauging stations at a density to accommodate engineering scale analysis for design and planning
- Strengthen disaster monitoring and early warning systems
- Continue and expand public education with respect to hazard avoidance, particularly with respect to flood awareness
- Provide engineering and non-engineering solutions for vulnerable embankments in the upper watershed

2.4.1 Financing Needs

TABLE 8: FINANCING NEEDS AND SOURCES

		Financing needs (US$)	Financing available (US$)	Financing Gap (US$)	Source
	Sector				
Infrastructure					
	Transport	$82,602,147	$1,400,000	$81,202,147	WB
	Housing	$9,138,999	$0	$9,138,999	
	Electricity	$8,555,911	$0	$8,555,911	
	W&S	$4,468,834	$500,000	$3,968,834	WB
Social					
	Health	$2,052,917	$0	$2,052,917	
	Agriculture	$1,372,666	$0	$1,372,666	
Productive					
	Tourism	$171,414	$0	$171,414	
	Education	$15,000	$0	$15,000	
	I&C	$6,000	$0	$6,000	
Total		**$108,383,888**	**$1,900,000**	**$106,483,888**	

Key: W&S – Water and Sanitation; I&C – Industry and Commerce

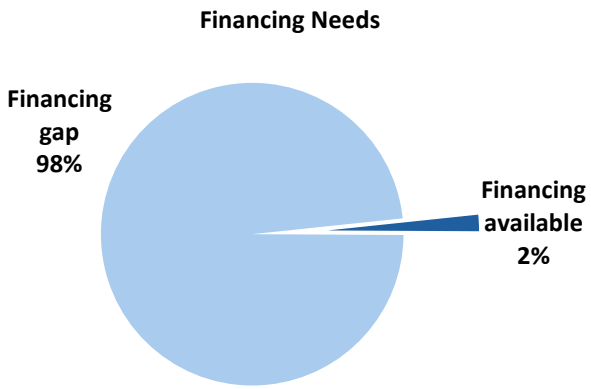

FIGURE 8: FINANCING GAP

ANNEXES

ANNEX 1 – LIST OF PEOPLE MET

TABLE 9: LIST OF PEOPLE MET

Name	Title
Ralph Gonsalves	Prime Minister and Minister of Finance
Central Planning Division, Ministry of Finance and Economic Planning	
Laura Anthony-Browne	Director of Planning
Richard MacLeish	Project Coordinator
Trelson Mapp	Economist
Sekai Chiaka Bowman	Procurement Officer
Janelle Quow	Engineer
Cecil Harris	Senior Project Engineer
Shervone Alexander	Statistician
Patrick Rodrigues	Project Engineer
Ministry of Transport and Works (MoTW)	
Brent Bailey	Chief Engineer
Ministry of Housing, Informal Human Settlement, Lands & Survey and Physical Planning	
Kathleen Jack	Senior Cartographer
Anthony Bowman	Chief Technical Officer
Dornet Hull	GIS Officer
National Emergency Management Office (NEMO)	
Howard Prince	Director
Michelle Forbes	Deputy Director
Central Water and Sewage Authority (CWSA)	
Garth Sanders	General Manager
Danroy Ballantyne	Senior Engineer/Hydrologist
Meteorological Office (MET)	
Corsel Robertson	Director of Airports

ANNEX 2 - SUMMARY OF DALA

TABLE 10: SUMMARY OF DALA AS WELL AS THE IMPACT ON BALANCE OF PAYMENTS AND THE FISCAL SECTOR

	Disaster Effects (US$)				Ownership by Sector		Effects on:	
	Damage	Losses	Total	%	Public	Private	BOP*	Fiscal Sector**
Sector								
Infrastructure								
Transport	$67,868,392	$14,733,755	$82,602,147	76%	$82,141,214	$460,934	yes	yes
Housing	$6,799,830	$2,339,169	$9,138,999	8%	$2,339,169	$6,799,830	yes	yes
Electricity	$5,207,946	$3,347,965	$8,555,911	8%	$8,555,911			yes
W&S	$3,148,999	$1,319,835	$4,468,834	4%	$4,468,834		yes	yes
Social								
Health	$1,830,965	$221,952	$2,052,917	2%	$2,034,917	$18,000		yes
Agriculture	$1,372,666	$0	$1,372,666	1%		$1,372,666	yes	
Productive								
Tourism	$118,739	$52,675	$171,414	0%	$118,739	$ 52,675		yes
Education	$0	$15,000	$15,000	0%	$15,000			yes
I&C		$6,000	$6,000	0%		$ 6,000		yes
Total	**$86,347,537**	**$22,036,351**	**$108,383,888**	**100%**	**$99,673,784**	**$8,710,104**		
	80%	**20%**			**92%**	**8%**		

ANNEX 3 - HEALTH

TABLE 11: HEALTH - SUMMARY OF MILTON CATO MEMORIAL HOSPITAL NEEDS

SER	QTY	PART #	ITEM DESCRIPTION
1	1		CT MACHINE
2	12		DAPTONE/ FETAL MONITOR – HUNTLEIGH
3	5		EASY FOLD WHEELED STRETCHER
4	3		DIATHERMY MACHINE
5	6		JUNKIN FLOTATION STRETCHER COLLAR
6	15	DS410-690	ADULT REUSABLE SPO2 SENSOR WITH 3 METER CABLE
7	12		LAERDAL SPEEDBLOCK HEAD IMMOBILIZER
8	10	DS810-690	NEONATAL REUSABLE SPO2 SENSOR WITH 3 METER CABLE
9	12		FERNO PROFLEXX STRETCHER 35-X
10	20		ADULT REUSABLE SPO2 MACHINE OR PULSE OXIMETER
11	12		LAERDAL V-VAC MANUAL SUCTION UNIT
12	3	M1110872	PANDA WARMER WITH ADJUSTABLE BASE
13	12		FERNATRAC TRACTION SPLINT ADULT
14	6		JUNKIN PLASTIC SPLINT STRETCHER
15	3		GE PORTABLE ULTRASOUND MACHINE
16	6		ALLIED GOMCO ASPIRATOR MODEL 405
17	10		LAKESIDE HOMED PREFERRED MEDICATION CARTS
18	10		LIFELINE EMERGENCY CART
19	3		HUNTLEIGH BIRTHRIGHT BED- ELECTRIC – 17000EL
20	12		INVACARE AEROSOL THERAPY PRODUCTS PORTABLE SUCTION
21	3		GE BILIBLANKET PLUS PHOTOTHERAPY SYSTEM
22	5		UNIMAC 60LBS CAPACITY WASHER -9 CYCLE 8 SEGMENT 380/400-415V 50HZ 3PH
23	3		UNIMAC 60LBS CAPACITY WASHER SPARE PARTS
24	5		UNIMAC 75LBS DRYER
25	3		UNIMAC 75LBS DRYER ELECTRICALLY HEATED 380/400-415V 50HZ 3PH – SPARE PARTS
26	75		METAL SHELVES

Source: Situation Report 7, January 7, 2014.