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**JAMAICA:**

**ASSESSMENT OF THE DAMAGE  
CAUSED BY FLOOD RAINS AND LANDSLIDES  
IN ASSOCIATION WITH HURRICANE MICHELLE, OCTOBER 2001**

*.... Implications for economic, social  
and environmental development*



ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN  
Subregional Headquarters for the Caribbean  
CARIBBEAN DEVELOPMENT AND COOPERATION COMMITTEE

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## PREFACE

This study was prepared for the Government of Jamaica following the significant physical damage and economic losses that the country sustained as a result of flood rains associated with the development of Hurricane Michelle. The Planning Institute of Jamaica (PIOJ) submitted a request for assistance in undertaking a social, environmental and economic impact assessment to the Economic Commission for Latin America and the Caribbean (ECLAC) on 14 November 2001. ECLAC responded with haste and modified its work plan to accommodate the request. A request for training in the use of the ECLAC Methodology to be delivered to personnel in Jamaica was deferred until the first quarter of 2002, as it was impossible to mount such an initiative at such short notice. This appraisal considers the consequences of the three instances of heavy rainfall that brought on the severe flooding and loss of property and livelihoods.

The study was prepared by three members of the ECLAC Natural Disaster Damage Assessment Team over a period of one week in order to comply with the request that it be presented to the Prime Minister on 3 December 2001. The team has endeavoured to complete a workload that would take two weeks with a team of 15 members working assiduously with data already prepared in preliminary form by the national emergency stakeholders. There is need for training in disaster assessment as evidenced by the data collected by the Jamaican officials engaged in the exercise. Their efforts in the future will be more focused and productive after they have received training in the use of the ECLAC Methodology. This study undertakes a sectoral analysis leading to an overall assessment of the damage. It appraises the macroeconomic and social effects and proposes some guidelines for action including mitigating actions subsequent to the devastation caused by the weather system.

The team is grateful for the efforts of the Office of Disaster Preparedness and Emergency Management (ODPEM), the associated government ministries and agencies, the Statistical Institute of Jamaica (STATIN), the Planning Institute of Jamaica and the Inter American Development Bank (IDB) for assistance rendered to the team. Indeed, it is the recommendation of the team that STATIN is poised to play a pivotal role in any disaster damage assessment and should be taken on board in that regard.

The direct and indirect damages have been assessed in accordance with the methodology developed by ECLAC<sup>1</sup>. The results presented are based on the mission's estimates. The study incorporates the information made available to the team and evidence collected in interviews and visits to affected locations. It is estimated that the magnitude of the losses exceeds the country's capacity to address reparations and mitigation without serious dislocation of its development trajectory. The government may wish to approach the international community for assistance in this regard.

This appraisal is therefore designed to provide the government and the international community with guidelines for setting national and regional priorities in rehabilitation and reconstruction or resettlement programmes. A purely economic conception of the problem would be limited. A more integrated approach would have a human face and consider the alleviation of human suffering in the affected areas while attending to the economic and fiscal fallout of the disaster. Questions of improved physical planning, watershed management, early warning, emergency response and structural

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<sup>1</sup> ECLAC/IDNDR, Manual for estimating the Socio-Economic Effects of Natural Disasters, May, 1999.

preparedness for evacuation and sheltering the vulnerable population are seen as important considerations for the post disaster phase. Special attention and priority should be placed on including sustainability and increased governance criteria in making social and productive investments, and on allocating resources to the reinforcing and retrofitting of vulnerable infrastructure, basic lifelines and services as part of the reconstruction and rehabilitation strategy.

The Jamaican society and government face the opportunity of undertaking action with the benefit of revised paradigms, embarking on institutional, legal and structural reforms to reduce economic, social and environmental vulnerability. The history of flood devastation in the very areas of Portland and St. Mary shows a recurrence of flooding. Accounts of flooding from the earliest recorded accounts pertaining to 1837 are available. Recurrences in 1937, 1940, 1943 and 2001 indicate an ever-present probability of recurrence of similar events. The Government may wish to consider the probable consequences of a part of its population living in flood plains and address its position vis-à-vis land use and the probability of yet another recurrence of flood rains.

## I. BACKGROUND

Natural disasters, whether climatic, seismic or volcanic, are frequent in the region. The scale of human and economic damage caused by natural disasters in Latin America and the Caribbean is remarkable when measured by any yardstick. Some estimates put the affected (directly and indirectly) population at 150 million. Between 1972 and 1999 alone the number of dead reached 108,000 and the total of those directly affected exceeded 12 million<sup>2</sup>.

The total damages covered by the assessments made by the ECLAC between 1972 and 1999 amounts to more than 50 billion dollars. The true figure for human and material damages is much greater because ECLAC has only assessed damages when governments have asked for assistance. The figure quoted is therefore only a fraction of the total damage wrought.

The Caribbean is subject to meteorological (hurricanes, floods and droughts) and geophysical (earthquakes, landslides, volcanoes) hazards. Depending on the degree of vulnerability of given States/territories, exposure to hazards may result in natural disasters that, in small islands and countries such as these, can have devastating economic, social and environmental effects. Even a small disaster in terms of monetary damage can have major economic implications in a small country. Table 1 presents an analysis of loss of life from natural disasters in the insular Caribbean and Belize.

**Table 1**  
**Loss of life from natural disasters in the insular Caribbean and Belize**

PERIOD	LOSS OF LIFE			
	TOTAL	Floods	Windstorms	Other
1990 – 1998	1966	155	1745	66
1980 – 1989	1640	925	584	131
1970 – 1979	1829	265	1561	3
1964 – 1969	953	0	953	0
<b>TOTAL</b>	<b>6388</b>	<b>1345</b>	<b>4843</b>	<b>200</b>

Source: EM-DAT: The OFDA/CRED International Database<sup>6</sup>, Universite Catholique de Louvain, Brussels, Belgium.

Haiti with 2,598 deaths and the Dominican Republic with 1,862 fatalities over the period 1964 to 1998 account for almost 70 percent of the death toll in the region. This is a reflection of social vulnerability caused by poverty, environmental degradation and in some instances, insufficient or inadequate mitigation and risk reduction policies. This high degree of vulnerability was highlighted in 1994, when rainfall, associated with tropical storm Gordon caused floods and mudslides which resulted in 1,122 fatalities in Haiti, even though the center of Gordon did not pass over that country. The Dominican Republic and Haiti are not alone in this vulnerability, as many of the characteristics are shared with other low-income countries or with the poor in higher –income countries.

<sup>2</sup> See ECLAC/IDB, A Matter of Development: How to Reduce Vulnerability in the Face of Natural Disasters, (LC/MEX/L.428), 7 March 2000.

Increasingly, fatalities caused during the passage of tropical cyclones are not wind related but stem from secondary disasters like flood or land and mud slides. This highlights the role of environmental degradation and policy failures as major factors that account for the loss of life. Whereas the team assessing the damage caused by the flood rains of October/November 2001 could not ascertain the cause of the significant slides, investigations should be made to determine whether or not the massive slide was promoted by human activity.

## **1. The mission**

The Government of Jamaica, at the recommendation of the Inter American Development Bank (IDB), requested ECLAC's technical assistance to undertake a rapid assessment of damage in the aftermath of a weather system associated with Hurricane Michelle in October/November 2001. ECLAC responded by fielding a small team of experts to carry out the evaluation.

The mission's work was facilitated with cooperation from the Office of Disaster Preparedness and Emergency Management (ODPEM), the associated government ministries and agencies, the Statistical Institute of Jamaica (STATIN), the Planning Institute of Jamaica, the Meteorological Office and the Inter American Development Bank (IDB) for any assistance rendered to the team. Indeed, it is the recommendation of the team that STATIN is poised to play a pivotal role in any disaster damage assessment and should be taken on board in that regard.

The mission visited Jamaica from 26 November to 4 December. The team included the following ECLAC officials and an external consultant:

- Len Ishmael, Director, ECLAC Subregional Headquarters for the Caribbean
- Lancelot Busby, Mission Coordinator and Macroeconomist
- Asha Kamboj, Social Affairs, including housing
- David Smith, Environmental and Infrastructure assessment

This document contains an independent and objective assessment of the disaster, which sets forth the overall magnitude of direct and indirect damages and their effects on the behaviour of the economy as a whole. It is intended to assist in drawing up proposals for reconstruction priorities and needs, one of which should be the explicit incorporation of measures to reduce the country's high vulnerability to severe flooding and increase Jamaica's sustainability for development.

## **2. Description of the event**

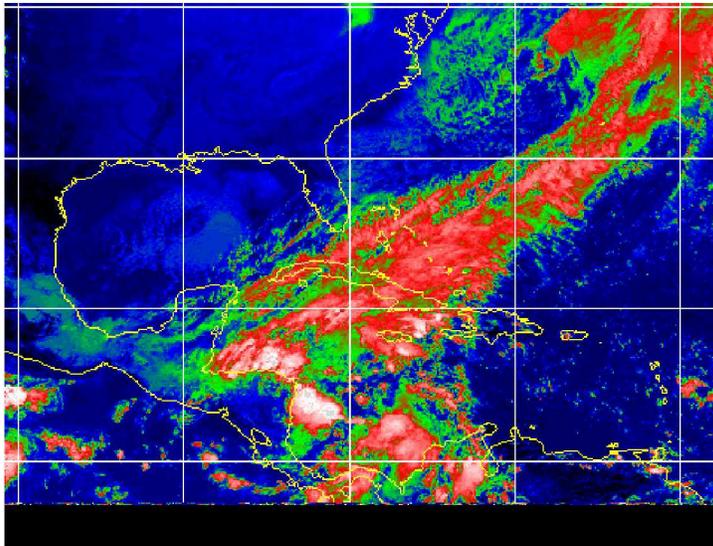
Between 28 October and 5 November 2001, heavy<sup>3</sup> –and at times violent- rains fell over Jamaica, particularly in its northeastern parishes. The heavy rainfall during this period was a direct result of the development of Hurricane Michelle. It is noteworthy that the majority of this rainfall fell during the early developmental stages of Hurricane Michelle, and not during its latter stages as it passed west of the island. In addition, it was during this period that the most intense rainfall fell across

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<sup>3</sup> Rainfall intensity: light- less than 2mm/h; moderate- 2 to 10 mm/h; heavy- more than 10mm/h; violent- more than 50mm/h.

the northeastern parishes. The following chronology of events summarizes the report prepared by the Meteorological Office, which gives an account of the recent heavy rains, and briefly explaining the reasons for such heavy flood rains, particularly over the northeastern parishes.

On 31 October 2001 Michelle became the thirteenth named Tropical Storm of the 2001 Atlantic Hurricane Season over the northwestern Caribbean Sea. The centre was then located near latitude 16.1 degrees north and longitude 83.2 degrees west, or about 550 kilometres southwest of Negril Point, Jamaica. However, prior to it being named, the tropical depression and low-pressure area (photo 1) from which it formed, produced disturbed weather across the western Caribbean (including Jamaica). At this time the 'low' was centered just off the east coast of Nicaragua (Photo 2). It is as a result of this area of disturbed weather that Jamaica –particularly northeast Jamaica- received heavy flood rains on the 28<sup>th</sup> and 29<sup>th</sup> October.



*Photo 1: Area of disturbed weather, October 28, 2001.*

On the night of 27 October showers had already begun affecting northeastern parishes. The parishes most affected by the heavy rainfall were Portland, St. Mary, St. Ann and to a lesser extent St. Andrew, St. Catherine and St. Thomas. Rainfall data gathered for nine stations of the 14 stations in St. Mary revealed a total of over 1000 millimetres of rainfall on both 28 and 29 October (Table 1). St. Ann received in excess of 700mm on 28 October and 1000mm on the 29<sup>th</sup>, while Portland received over 470mm on the 28<sup>th</sup> and over 1000mm on the 29<sup>th</sup>. Interestingly, although St. Mary received more rainfall than Portland for the period 28 October to 5 November, flooding and damages to infrastructure and agriculture were much more devastating in Portland.

By 1 November, rainfall amounts had decreased significantly across the island. Flooding however, continued in the northeastern parishes, as the floodwaters spilled over the banks of both natural and artificial waterways, which were not able to adequately contain the river flows. At this time the low had intensified into Tropical Storm Michelle, the centre of which was then located near latitude 17 degrees north, longitude 83.8 degrees west; or about 600km southwest of Negril Point,

Jamaica. Average rainfall over the period 27 October to 5 November was 1924mm for the collective parishes of Portland, St. Mary, St. Ann, St. Andrew, St. Catherine and St. Thomas.



Figure 1: Track of Hurricane Michelle.

As a result of this, Flash Flood Warnings for Jamaica were continued until November 5, at which time the chain of rainfall events had been broken, as Hurricane Michelle moved further north over the Atlantic Ocean.

Table 1 which follows, presents a compilation of rainfall data from the Meteorological Station and from the Water Resources Agency (WRA), while Table 2 gives the 30-year mean rainfall amounts for the parishes that were most affected by this event. A review of the data shows that the rainfall actually received far exceeds the monthly averages for these parishes.

**Table 2: Preliminary Rainfall Report for October 27-30, 2001 (in mm).**

STATION	PARISH	OCTOBER			
		27	28	29	30
Orange River	St Mary	-	142.0	300.3	33.3
Brimmer Hall		-	107.8	208.4	13.7
Industry		9.8	96.0	230.0	32.0
Boscobel		39.4	96.5	162.8	38.1
Agualta Vale		-	47.4	345.9	19.6
Runaway Bay	St Ann	-	102.0	184.4	40.4
Laughlands		-	142.2	172.2	32.0
Discovery Bay		-	54.4	131.8	57.8
Fern Gully		-	171.0	238.3	20.9
Lawrence Tavern	St Andrew	-	79.5	58.0	3.0
Guys Hill	St Catherine	-	40.0	170.0	-
Damhead		-	23.5	9.0	-
Tulloch Estate		-	26.0	22.7	-
Enfield (United Estate)		-	124.0	37.5	-
Passley Gardens	Portland	-	19.6	137.7	49.9
Moore Town		0.0	186.6	300.1	31.3
Bellevue		29.0	11.0	622.0	36.0
West Retreat		16.0	11.0	217.0	40.0
Comfort Castle		0.0	244.8	277.1	55.4
Spring Garden		2.5	0.0	428.2	92.6
Port Antonio		0.0	20.0	62.0	12.4
Orange Valley	Trelawny	-	40.0	50.5	50.0

\* Figures represent amounts in millimetres.

**Table 3: 30-year (1951-80) Mean Parish Rainfall (millimetres)**

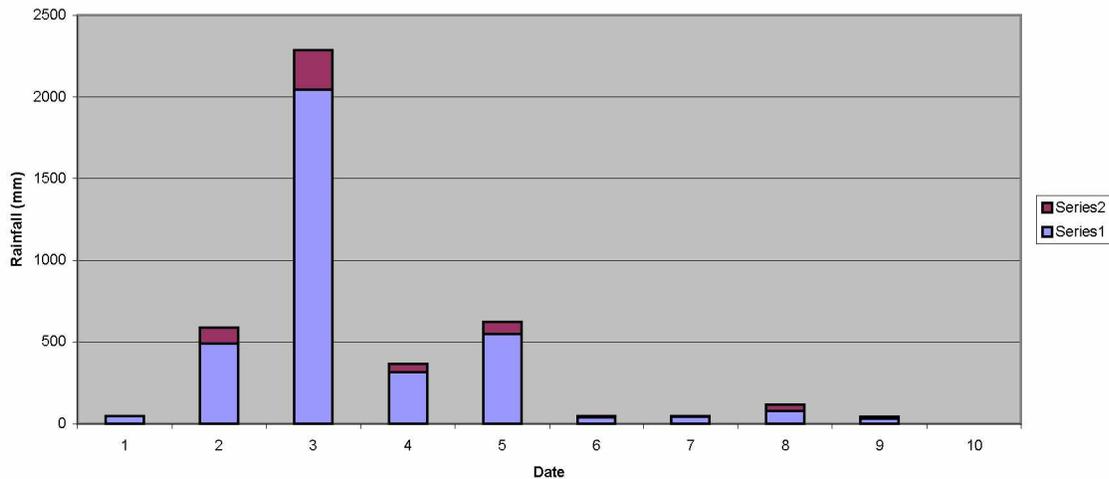
<i>Parish</i>	<i>Rainfall (mm)</i>	
	<i>October</i>	<i>November</i>
Portland	373	477
St Mary	209	263
St Ann	177	214
St Andrew	287	187
St Catherine	238	121
St Thomas	368	232

A comparison of Tables 2 and 3 shows that for some stations in St. Mary daily rainfall values (on October 29) exceeded the 30-year mean for October. Orange River, Brimmer Hall, Industry and Agualta Vale all surpassed the 1951 to 1980 average of 209mm. In Portland, Spring Garden and Bellevue both exceeded the 30-year mean on 29 October, by 55mm and 249mm respectively.

A simplified computation of rainfall rates, assuming uniformity throughout the respective days, would seem to imply accumulations of 10.2, 5.9 and 7.1 millimetres per hour (mm/hr) respectively for Portland, St. Mary and St. Ann on October 28, increasing to 17.8, 14.4 and 9.9 mm/hr on October 29.

A summary of these data for Portland is shown in the following graph of rainfall for all stations at which records were retrieved, for the period from 27 October to 5 November. The graph highlights the extreme nature of the rainfall that was experienced, when compared to the average values.

Preliminary Rainfall Data for Portland for October 27th to November 5th 2001



## Radar report

October 27 – Light showers started over sections of northeastern parishes in the morning but spread, while becoming heavier, to mostly western and central parishes during the afternoon.

October 28 – Showers affected most of the island. Light showers started over eastern sections of the country, becoming moderate and spreading to central parishes by mid-morning. By early afternoon, western parishes had also started to experience shower activity.

October 29 – Rainfall began early in the morning over most sections of the island. More intense activity detected over northern parishes for the majority of the day, occasionally spreading to sections of southern parishes where showers became more consistent during the afternoon. Concentration of showers reverted to northern parishes during the late evening.

October 30 – Showers were found to affect mostly northern and eastern parishes during the day, at times spreading to northern sections of southern parishes. This continued into the night.

October 31 – Northern and southeastern parishes were particularly affected by moderate to heavy showers. Rainfall was lighter for sections of south-central parishes starting in the mid-morning.

## Summary discussion

Several meteorological and physical factors were responsible for the heavy rains that ravaged northeastern parishes during the period 29 October to 5 November. Apart from the obvious presence of the low-pressure area and the eventual development of Hurricane Michelle over the Caribbean Sea, its location relative to Jamaica is of major significance. Photo 1 and Figure 1 show the location of the centre just off the Nicaraguan coast on the 28<sup>th</sup> of October. The counter clockwise wind-flow pattern into the centre of the system drew warm moist air from the eastern Pacific and southern Caribbean Sea into the Jamaica area.

Specific to Portland and St. Mary, is the presence of the Blue Mountain range (Figure 2). The mountain range acted as a barrier and zone of convergence to surface wind. In this case northeasterly winds along the north coast and near southerly winds along the south coast forced the warm moist air to rise, thereby producing relief rainfall in the process. In addition to this, with the presence of Hurricane Michelle, the southeasterly sea breeze was enhanced by the near southerly flow from the system. This meant that with stronger southerly winds, the northern side of the mountain range became the distinctive leeward side, setting up the development of a *leeward trough*. This is an elongated low-pressure area that forms on the leeward side of mountain ranges when the wind flow is nearly perpendicular to the ridge. Hence more rainfall occurred over northeastern parishes.

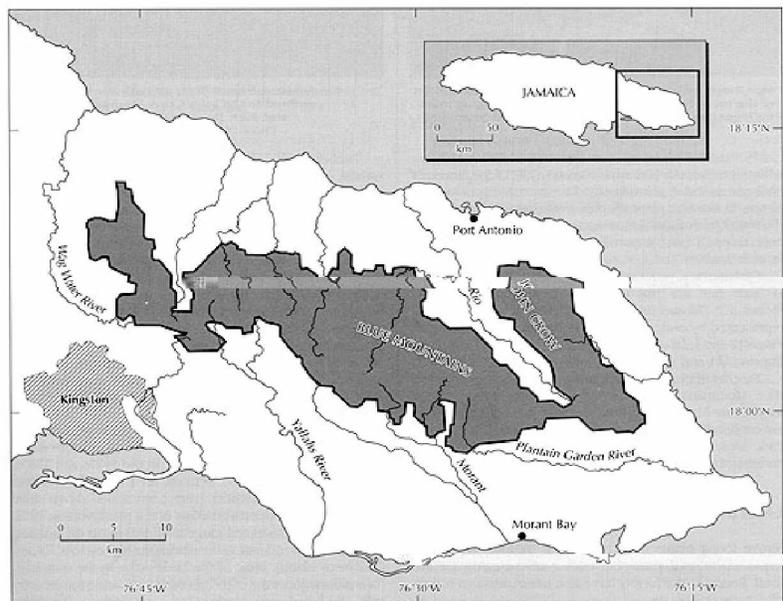


Figure 2: Location of Blue Mountain Range, Jamaica.

Another contributing factor to the heavy and abundant rainfall was the near stationary position of the 'low' during the formative stages of Hurricane Michelle. During the period October 27 to 30<sup>th</sup> there was very little movement of the low-pressure area. As a result there was a constant supply of moisture being drawn into the Jamaica area. Over the course of the 31 October to 3 November period, the system's forward speed did not exceed 9 km/h. At this time Michelle was a dangerous category 3 hurricane on the Saffir-Simpson scale, located near latitude 19.0 degrees north, longitude 84.2 degrees west, almost due west of Negril Point.

As Hurricane Michelle moved slowly in a general northward direction spiral bands from the cyclone extended across Jamaica. Although rainfall decreased significantly during the first 5 days of November, the fact that soil saturation levels were already at very high levels, additional rainfall during this period triggered more flooding in Portland and St. Mary.

## **Impacts on the affected areas**

### Physical damage

The worst affected areas were in the Spanish and Swift River watersheds. Site visits made to a number of these communities confirmed the type of damages that had occurred. On the coastal areas, the swollen rivers resulted in the severe erosion of the approach roads for three major highway bridges. These were the Spanish River Bridge, the Swift River Bridge and the Westmoreland Bridge. At the first of these three, the western approach was completely eroded, with the river breaking through the road and cutting off the access to the bridge. An unused railway bridge south of the vehicular bridge was also damaged, with the western abutment being undermined and the resulting failure of the structure (see Appendix A for photograph inventory).

At the Swift River Bridge, the western approach was eroded, but not totally broken through. This, however, rendered the bridge inaccessible to vehicular traffic, with the result that traffic had to be diverted unto a disused railway bridge located immediately to the north of the vehicular bridge. At the Westmoreland Bridge, the pier of the bridge itself was damaged, unlike the other two structures where the approach roads were washed away.

In the interior of the parish of Portland, the worst hit areas were: Bybrook, Ann's Delight, Claverty Cottage, Clifton Hill, Swift River, Bloomfield, Chelsea, Shrewsbury and Fruitful Vale. Although a significant amount of rain fell in the parish of St. Mary, the number of communities exposed to medium and long-term damage were not as great. The photographs shown in Appendix A provide a pictorial summary of the damage that occurred in some of these above-mentioned communities. In general, these interior communities were exposed to either landslide or to debris flow brought down by the river. In the case of Bybrook, debris (mud, sand, gravel and boulders) was brought down into the inhabited areas by landslide mechanism. It is estimated that approximately 200,000 cubic metres of material was deposited in this village by this landslide mechanism. Two roads leading out of Bybrook, to Carlton Gap and Ann's Delight, were also washed away. At the former, the road and culverts leading across a tributary were destroyed, while at the latter, the road section beside the river was washed out.

At Swift River, the Swift River deposited debris (primarily sand and gravel) that covered the houses of this village. It is believed that this material would have been eroded from the upper reaches of the watershed, and transported by the flood waters into the area of concern. Since the river enters a more gently sloped area in the vicinity of the Swift River community, it is not surprising that the previously eroded material would be deposited in this area. It is estimated that approximately 240,000 cubic metres of debris was deposited in this community. A pedestrian access way in Swift River was also washed away, along with the associated culverts.

Finally, a number of roads in the parish were badly damaged and will require resurfacing, river training and/or patching.

#### Population affected

The two main parishes which were affected following the heavy rains associated with hurricane Michelle were St. Mary and Portland, both of which are located on the northeast coast and account for some 4.6% and 3.3% of the total population of Jamaica, respectively. The low population rate in those parishes contained the social impact of the disaster.

Within the two main parishes, as expected, some districts were more severely affected than others. The affected districts were those of: Annotto Bay, Bangor Ridge, Belcares, Buff Bay, Bybrook, Claverty Cottage, Dumfries, Fellowship, Shrewsbury/Fruitful Vale, Skibo, and Swift River. Of these, the two extreme cases were to be found in the Bybrook and Swift River communities. These suffered from unusual amounts of debris and sediment having been deposited into the homes by the cascading rivers, Spanish River and Swift River, making the areas uninhabitable. Other areas, such as Claverty Cottage and Clifton Hill, became inaccessible due to flooding and road damage. They remained so six weeks after the event. Communities such as Annotto Bay and Buff Bay were flooded as they rested at the mouth of the Pencar River and the Buff bay River, respectively. In all (5) five persons lost their lives due to the devastation brought on by the flood rains associated with hurricane Michelle. Three persons died during the first downpour at the end of October and two on November 4<sup>th</sup> in Westmoreland. Some 4,000 people were immediately affected and another 12, 000 were at high risk for health impairment, see table 4. Altogether, this represents a little over 12% of the combined population of the two parishes.

**Table 4**

#### **Affected Population By Parish**

<b>Parish</b>	<b>Persons directly affected</b>	<b>Persons at high risk of health impairment</b>	<b>Persons affected</b>
St. Mary			N/A
Portland			6000
Totals	4,000	11,976	6000

Source: Mission estimates based on official data

More than 800 persons were evacuated, 350 were housed in shelters. At least 2000 were isolated due to the flooding, which caused extensive road damage and more than 40,000 were affected due to loss of electricity, collapse of waste disposal systems, and broken water mains resulting in limited or no access to potable water supplies.

The resulting damage, particularly of water mains and damaged and destroyed pit latrines (see table 7), are expected to aggravate an already tenuous health situation as the parishes have a history of malaria and typhoid. Excessive pools of stagnant water, uncollected garbage and the presence of raw

sewage in some areas have been identified as cause for concern, by the Ministry of Health. In addition, the country remains on the alert for the West Nile Virus, dengue and dengue haemorrhagic fevers.

The Ministry of Health has embarked on a public education campaign, initially to last for one month, encouraging people to literally “Make Water Safe”. The Ministry has also raised concerns about the water quality, even as the water supply is gradually being restored. The analysis of samples is limited by the lack of water quality testing kits.

The current situation, if not addressed could have an effect on the most vulnerable households and exacerbate the current rural to urban drift with its negative impact both on the capital city of Kingston and the already poor rural parishes.

The general socio-economic data for Portland and St. Mary Parishes reveals that the region is essentially rural and agricultural with a high rate of unemployment and an ageing population. Portland is the most northeast parish in Jamaica. Even today, it is considered the least accessible parish. It was and continues to be the home of Jamaica’s proud and independent Maroon communities who fled slavery and established outposts such as Nanny Town, Moore Town, and Charles Town. Resilience speaks to an individual’s entitlement, enfranchisement, empowerment and capabilities to withstand external shocks. The resilience of the people of the affected communities in Portland and St. Mary is threatened by the magnitude of this natural disaster. Their sense of isolation has been heightened by the localization of the flooding, the economic difficulties which they have experienced due to the loss of preferential markets for their banana crops, and the sluggish pace of tourist arrivals due to the events of September 11.

According to a socio economic study conducted by the Jamaica Forestry Department in April 2000, both Portland and St. Mary parishes were ranked as the poorest in Jamaica.<sup>4</sup>

Farming is the main occupation for a majority of households, but families tend to engage in marketing of farm products and wage labour in the agricultural sector, particularly on the coffee farms, and the cocoa and coconut plantations. Except for a few absentee landowners, most farmers work their own land, often with the help of family members. The majority of farmers use hired labour occasionally, particularly for coffee harvesting. However paid workers are a common feature on farms operated by single women, as they tend to rely much more on hired labour. Single women operate about one out of five farms nationally, but for the two parishes under consideration, it is one of out of ten. A study conducted in these communities in 1993<sup>5</sup>, observed however, an increasing trend in women operated farms. There is a small but significant fishing industry, which provides a fair livelihood for a number of households. Eco-tourism, mainly from day visits to the area for activities such as river rafting and hiking, provides some additional employment.

Despite these available forms of livelihoods, the unemployment rate for St. Mary, 20.5% and 30% for Portland, is higher than the national rate for Jamaica which stands at 16%, see table 5. This

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<sup>4</sup> Trees for Tomorrow Project: Buff Bay/Pencar Watershed pilot Area. **Socio Economic Study and Agro forestry baseline Survey April 2000**. Forestry Department/ Trees for Tomorrow project.

<sup>5</sup> Trees for Tomorrow Project. **Buff Bay/Pencar Watershed Socio-Economic Study**. Forestry and Soil Conservation Department, Ministry of Agriculture. July 1994

high unemployment rate, coupled with the pull of the cities and possible overseas travel, drives the able bodied 15 to 24 year olds out of the area in search of better opportunities, leaving the elderly and younger children behind, resulting in an average age for farmers in these parishes of 48.4 years. It has been noted as well, that 69.2% of the persons who migrated out of Portland in 1991 were females and in 1995, Portland experienced a net decline in its population due to migration.

**Table 5**  
**Selected Socio Economic Indicators For Affected Parishes**

<b>Socio Economic Indicators: Parishes of Portland and St. Mary</b>			
Social Indicators	Portland	St. Mary	All Jamaica (1991 census)
Population	75,000	107,502	2,380,666
Population density	93	176 (1991)	211
No. of persons per dwelling	3.74 (1997)	3.97(1997)	3.6
Rate of functional illiteracy	31.5% (1994)	33.1% (1994)	20.1
Access to electricity	N/A	N/A	64.8%
Access to piped water	N/A	N/A	80%
Public Hospitals	1	2	24
Health Centres	16	N/A	343
Rate of unemployment	30% (est. 1997)	20.5% (est. 1997)	16.10%
Number of households	20,512	27,955	588,340

Source: ECLAC based on official data

a. Vulnerability of women and children

Vulnerability refers to the risk that an individual, household or community will fail to withstand against external threats or shocks. Special groups, such as pregnant women, children under five, the elderly and persons with disability, during times of natural disasters may be at increased risk. The census data for 1991 pointed to 7% and 6% of the population in Portland and St. Mary respectively, suffering from at least one form of disability. The highest proportion was in the 65 years and over age group in both instances.

It is the capabilities, either of an economic, social or personal nature, which an individual/household may possess that increases their resilience to withstand the threats caused by an event such as the flooding witnessed in the affected communities.

Past experience has demonstrated that women whose responsibility it is, in the main - to mobilize family resources, provide clean drinking water, manage the family health, prepare the meals, ensure clean clothing for family members - during times of natural disaster, face greater challenges in managing the day-to-day operations of the household.

When their capabilities are reduced due to poverty, lack of education, poor health status, coupled with their status as single heads of households, their capacity to reduce the vulnerability of family members, particularly children is weakened. The Jamaica Survey of Living Conditions, Report

2000, indicates that households headed by women comprise some 42.1% of the households nationally and notes the significance of female headed households that “are more likely to be larger, have more children present and be in the lowest consumption quintile than those headed by men”<sup>6</sup>. Although the proportion of female headship is lower in rural communities than the average for all Jamaica, women do head many households and it is noted that the general acreage owned and accessed by women in the affected parishes, is in many cases smaller than the average household, thus further limiting their capacities to withstand external shocks.

According to data available since the event, which does not give gender disaggregated information, some 12,000 persons were directly affected, resulting in the dislocation of families and the disruption of the routines and normal life of families and their children.

b. Psycho social trauma

Disasters affect people in different ways, however the psycho-social impact of extensive flooding on the family and especially children, often remains invisible in disaster assessment studies. Yet disaster situations may mean loss of loved ones, family members or neighbours, loss of property and cherished belongings. Sometimes it means starting over with a new home or business.

Although only five people lost their lives, the emotional effects of material loss and social and family disruption may show up immediately or may surface many months later.

For the affected communities in Portland and St Mary, where relocation may become necessary, the cultural beliefs and practices of the affected communities will have to be taken into consideration if successful relocation is desired. One such practice has to do with the burial of the family members on family grounds or within close proximity to family grounds. In many circumstances, the living are reluctant to leave behind their dead when relocating.

Anecdotal reports were made of elderly persons requiring counseling services and families slipping into moments of despair. Counseling was provided mainly through members of the church and health care givers. The story of the disruption of burial sites, due to the disaster was often repeated, indicating the extent to which this caused discomfort.

The efficiency with which shelters are managed would reduce the negative psycho-social impacts of the disaster. The shelter in Buff Bay, located in the Community Centre, which housed 115 persons when visited some six weeks after the disaster, was an excellent example of the rich social capital that exists in rural Jamaica. It was managed by a young female school-teacher, with volunteer assistance from young men and women in the village. The shelter manager was quick to take note of the psychological condition of the elderly persons in her care and referred them to care givers as soon as she observed any unusual changes in their demeanor.

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<sup>6</sup> Jamaica Survey of Living Conditions Report 2000. A Joint Publication of the Planning Institute of Jamaica and the Statistical institute of Jamaica.

Much more attention needs to be paid to this aspect of mitigation and recovery to ensure that persons are enabled to fully participate in the future development of their communities and not become burdens of the state.

### **3. Emergency actions**

As early as Monday October 29 an emergency response was mounted out of the two affected Parishes, Portland and St. Mary. The Parish Council's Disaster coordinators and their Committees went into action immediately. Shelters were opened in both Parishes. The National Disaster Executive, consisting of the Chairman of the National Disaster Committee, the Right Honourable P.J. Patterson, Vice Chairman of the national Disaster Committee, the Honourable Dr. Karl Blythe, Director General of the ODPEM and senior Cabinet Ministers developed an action plan in response to the heavy rains associated with Hurricane Michelle. The National Emergency Operations Center (NEOC) was activated and staffed by ODPEM personnel. On Tuesday October 29<sup>th</sup> the first attempt of the Secretary General of the office of Disaster Preparedness and Emergency Management to reach Portland by helicopter was aborted due to severe weather conditions. A second attempt in the afternoon of the same day however, was successful. The first of many food drops and relief supplies began.

By Friday November 2, CDERA was sent a Situation Report.

Planning for the dispatch of Assessment teams began by Saturday 3 November. They went into action, via airlift into the isolated areas on Sunday November 4<sup>th</sup>. The initial assistance consisted of food and bedding, but relief efforts were hampered by inaccessibility of roads due to weather conditions.

A banana boxing plant in Shrewsbury was converted into a shelter, initially for some 50 persons, at the cost of \$75,000 dollars.

The international donor community, UNDP, USAID/OFDA and PAHO were approached for assistance.

The rains of November 4<sup>th</sup> resulted in new reports of damage to previously unaffected areas, such as Kingston, St. Andrew and St. Catherine requiring several rescues to be undertaken by the Fire Brigade, Red Cross and the JDF (Jamaica Defence Force). Infrastructure and coastal facilities damage was reported in St. James, Westmoreland where two of the five reported fatalities occurred. In a JDF Report dated 16 November, it was reported that some 11,000 pounds of food, medical supplies and water were delivered to date.

Human relief services provided to affected population by government staff and volunteers during the emergency, and the contribution of the JDF were instrumental in alleviating some of the more traumatic effects and tending to basic needs during the emergency. Table 6 details some of the expenses incurred.

**Table 6**  
**Jamaica: Emergency Costs (JS)**

<b>Emergency Costs</b>		
<b>Services</b>	<b>Quantity</b>	<b>Costs</b>
JDF		64,618
<b>Relief supplies</b>		
Foam pads Anti-Bacterial	175	367,500
Baby Blankets	30	18,000
Mattresses Double	110	312,080
Plastic Sheeting	1	5,188
Blankets	362	297,115
Water boots	1	540
Raincoats	4	2,416
Gas stove	4	9,846
Tarpaulin	20	9,884
Cooking pots	14	23,582
Sheets	12	5,640
Total	733	1,116,409

Source: ECLAC based on official data

## **II. ASSESSMENT OF THE DAMAGE**

This chapter contains an assessment of the damage caused by the flood rains associated with Hurricane Michelle as it impacted the social (housing, education, health), infrastructure (energy, transport and communications, water and sewerage) and production sectors (agriculture, fisheries, tourism, industry and services), and to the environment. The assessment was carried out on the basis of information available during the mission and incorporates aspects that became known soon afterwards.

Direct damages or effects were assessed, i.e. to physical infrastructure and the country's capital reserves. The indirect effects or damage, have included estimates such as lower production of goods and services and emergency outlays. Direct damages have been assessed on the basis of capital assets prior to the disaster; i.e. taking into account depreciation and normal use of capital goods.

In keeping with the ECLAC methodology, the loss of crops, either about to be harvested or stored for distribution is calculated as direct damage, and damages to inventories and production under way in the industrial sector are classified as direct costs.

The cost of rebuilding damaged assets has also been calculated. If the aim were to return to the situation prior to the hurricane, the value would be the same as the direct cost according to the methodology. However, for the purpose of a reconstruction programme, the assessment should also take into account the value of improved replacement, including disaster prevention and mitigation criteria, such as better technology and quality and more resistant structures. The country now has an

opportunity to rebuild on sounder economic, social and environmental bases while simultaneously reducing its vulnerability to natural disasters.

The ECLAC mission interviewed representatives of the government, the private sector, and affected persons and made use of the information that was supplied.

The figures used in this chapter were calculated in local currency and in United States dollars, based on the exchange rate of J\$47 per US dollar.

## 1. Social sectors

### a. Housing

Some 500 houses have been so completely damaged by the flooding in association with Hurricane Michelle that they require complete replacement for families to be able to occupy them once again. In addition, many of these houses have to be placed in different locations from where the damage was originally done. Some 561 houses have been otherwise damaged.

Table 7

#### SUMMARY OF DAMAGES TO HOUSES IN AFFECTED DISTRICTS

Summary status of all districts						
Affected Districts	Affected Population	Houses	Houses damaged	Houses destroyed	Pit Latrines damaged	Pit Latrines destroyed
All districts	11,976	3061	305	500	203	147

Source: Mission estimate based on official data

Data from the 1991 census supports the observations made regarding the quality of the housing stock in the two affected parishes, which was that of a good quality. Approximately 21% of the housing stock in Portland and 23% in St. Mary are about 20 years old. A little over 40% of the housing units in both parishes were built before 1970. Almost 98% had zinc sheeting as roofs and some 40% were built of wood and concrete in both parishes.

Because of the good quality of the housing stock, many were not completely washed away; rather they were filled with debris and silt. See photographs in Annex showing houses covered with silt located in the Bybrook and Swift River districts in the Parish of Portland.

A significant proportion of the houses in the affected parishes were privately owned, 63% and 61%, for Portland and St. Mary respectively. The Ministry of Water and Housing estimates that relocation costs will be in the vicinity of \$225,000,000. Table 8 provides details of costs of relocation. It is intended that lot development will have to include the provision of roadway, light and water. The housing units being considered are 12x24 timber units with an outside bathroom and toilet facility.

**Table 8****Costs Of Relocation (JS)**

<b>Costs of relocation</b>			
<b>Item</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Total Cost</b>
Land Development	500 lots	190,000	95,000,000
Housing Units	500	260,000	130,000,000
Land acquisition			10,000,000
<b>Total</b>			<b>235,000,000.</b>

Source: ECLAC from data collected from the Ministry of Water and Housing

Table 9 provides a summary of the effects on the housing sector, which amounts to \$225,357,000 dollars. Many families are still housed in shelters or accommodated by friends and families. In most instances, repairs to homes or relocation have not yet got underway. The indirect costs include the cost of running shelters and refurbishing a building in order to make it habitable as a shelter.

**Table 9**  
**Summary Effects On The Housing Sector**

<b>Summary Effects on the Housing Sector</b>		
		Thousands of JA dollars
<b>Total</b>		<b>225,375,000</b>
Direct Effects		225,000,000
Reparation of damaged houses		NA
ii. Replacement of lost houses		225,000,000
Imported Component		135,000,000
Indirect effects		375,000

Source: Mission estimate based on official data

## **b. Education**

Education is considered the engine of sustainable development and economic growth and therefore any event that results in student disruption is of considerable concern. School life for many had not returned to normal, some six weeks after the natural disaster. Eighteen schools in the two worst affected parishes suffered considerable damage as a result of the flooding. Damage occurred to the roofing, the electrical facilities, retaining walls – resulting in land slippage - and in at least five cases, the waste disposal systems were damaged. This situation threatens the health and safety of the children and teachers in attendance. Table 10 presents the details of damage to schools.

One Basic school, located in Swift River, which was built at the expense of the community, and provides stimulation, socialization and school readiness skills to children at preschool ages 2,3 and 4 was, although still standing, unusable due to silt and debris, which covered at least one third of the

school. Despite the poverty of the community, the well-constructed school demonstrates the commitment of the community to the education of its children.

**Table 10**  
**Schools Damaged In The Two Affected Parishes**

Parish	Schools Affected	Type of damage	Cost of repairs
Portland	Belvedere All Age	Electrical	500,000
	Buff bay Primary	Roofing and electrical	1,500,000
	Nonesuch All Age	Latrines	300,000
	Windsor Forest	Latrines	600,000
	Windsor Castle All Age	Latrines and roofing	1,500,000
St Mary	Annotto Bay Primary	Sewage disposal/roofing	1,000,000
	Brainard All Age	Land slippage/retaining wall	1,200,000
	Bromley primary	Roofing	200,000
	Islington High	Roofing	900,000
	Ramble All Age	Roofing	400,000
	Robins Bay all Age	Roofing	900,000
	Rose bank Primary	Roofing	300
	St. Mary High	Sewage disposal/retaining wall	5,000,000
	Woodside all age	Roofing	600,000
Total			14,600,300

Source: ECLAC based on official data supplied by ministry of Education

The cost of repairs to damaged schools amounts to some \$14.6 million. Some schools were damaged when used as shelters. Table 11 provides the details. The Ministry of Education moved as quickly as possible to seek alternative accommodation for families who were housed in school premises in order to reduce the extent of damage.

Despite their best efforts six schools suffered damages due to use as shelters. Table 11 details the schools. This indirect cost of \$3,500,000 increased the overall cost of damage to the education sector, resulting in a total of some \$20,700,000.

**Table 11**  
**SCHOOLS DAMAGED FROM USE AS SHELTERS**

Schools damaged from use as shelters		
Parish	School	Cost of repair – J\$
St. Mary	Annotto Bay Primary	300,000
Portland	Bloomfield All Age	200,000
	Buff Bay All Age	500,000
	Fairfield all Age	200,000
	Fruitful Vale all Age	300,000
St. Andrew	Edith-Dalton James High	2,000,000
Total		3,500,000

Source: Mission estimate based on official data supplied by the Ministry of Education

Table 12 summarizes the direct and indirect costs of damages to the education sector, which amounts to some \$20,700,000 dollars. Reconstruction and reinforcement of existing structures in order to reduce vulnerability and exposure to risk associated with climatic phenomena could increase costs considerably. This figure will depend on the Government's and the communities' decisions in respect of the mitigation process.

**Table 12**  
**SUMMARY EFFECTS ON THE EDUCATION SECTOR**  
(Jamaican dollars)

<b>Total</b>	<b>20,700,000</b>
<b>Direct effects</b>	17,200,000
i. Reparation of schools without improvement	14,900,000
ii. Replacement of school materials and furnishings	2,000,000
iii. Damages to libraries	300,000
Imported Component	0
<b>Indirect effects</b>	3,500,000
i. Damages for use as shelters	3,500,000

Source: ECLAC based on official data

### c. Health

i) Health infrastructure. The main damages to the health infrastructure were reported to be leaking roofs at the Falmouth hospital, in Trelawny, flooding on one ward at the May Pen hospital in Clarendon and inaccessibility of health facilities in the two affected parishes due to flooded roadways. The Ministry reported that flooding occurred at 15% of health facilities.

The Ministry of Health reported that service delivery was not significantly affected, as health care providers made every extra effort to maintain services, including flying into inaccessible areas.

**Table 13**  
**DAMAGES TO HEALTH INFRASTRUCTURE**  
(J\$)

Districts	Type of facility	Type of damage	Repair cost	Replacement cost
Swift River	Health Centre	Silt and debris		4,034,400
Portland	Health Centre	Silt and debris	150,000	0
KSA	Health Centre	Fence damaged from falling tree	NA	0

Source: Mission estimate based on official data<sup>7</sup>

Table 13 provides the reparation costs and replacement costs to the health infrastructure. Table 14 details the cost of the repair of health infrastructure caused due to use as shelters. Minor damage was reported to facilities that were used as shelters. Sanitizing and minor repairs are required.

<sup>7</sup> Note on Health Centre cost of construction

**Table 14**  
**Damages To Health Infrastructure**  
**Caused By Use As Shelters**

District	Type of facility	Cost of repair
Fruitful Vale	Health Centre	40,000
Annotto Bay	Hospital	60,000
Total		100,000

Source: ECLAC based on official data

ii) Epidemiological and environmental health issues. The main concern of the Ministry of Health were the environmental health issues particularly the lack of potable water and the destroyed waste water disposal facilities in areas of Portland and St. Mary. The Ministry of Health reported on November 11<sup>th</sup> that “wide scale destruction and damage to water supplies, houses and pit latrines, inadequate solid waste management, pooling of water and the lack of road access to some communities, place the affected populations at high risk for diseases and illness”. The Ministry stepped up its surveillance activities in all parishes.

**Table 15**  
**JAMAICA: HEALTH SERVICES REQUIRED JS**

<b>Water quality</b>		
Item	Unit cost	Total cost
30 water quality kits	3,600.00	108,000
30 Patho Screen Kits	2,300.00	69,000.00
<b>Waste Water</b>		
100 standard latrines	35,000.00	3,500,000
400sealed double vault pit latrines	100,000	40,000,000
50 latrines and shower	135,000	6,750,000
<b>Vector Control</b>		
Reduce source	1 month	100,000
Twelve fogging machines	60,000	720,000
Protective equipment		130,000
Malathion 20 drums	70,000	1,400,000
A-bate	50x25kgt bags	390,000
<b>Public Education</b>		
Make water safe campaign		
Environmental health,		
Waste disposal/vector control		400,000
Total cost		53,567,000

Source: ECLAC based on official data provided

1. Construction JA2,500 per square foot
2. Assumed size of centre is 150 square meters; 50x30 ft

Vector control is constrained by the lack of an ongoing comprehensive programme, and by the reduced road access caused by flood and excessive debris. The parishes affected have a history of typhoid and malaria and with the country on the alert for the West Nile Virus and the dengue and

dengue haemorrhagic fevers; the risk of health impairment is high in the affected areas. Table 15 presents the details of the costs to meet the health requirements of the emergency.

Table 16 summarizes the direct and indirect damages experienced in the health sector. Reconstruction costs are included and an indication of import components.

**Table 16**  
**Jamaica: Summary Damage To Health Sector**  
(J\$)

Summary Damages to the Health Sector					
				Reconstruction	Imported
		Damage		Costs	Component
	Total	Direct	Indirect		
<b>Total</b>	<b>14,184,4000</b>	<b>7,184,400</b>	<b>7,000,000</b>	<b>53,567,000</b>	<b>3,590,640</b>
Partial damage to health infrastructure	5,984,400	4,184,400	1,800,000		3,590,640
Health community educational material	200,000		200,000	400,000	
Increased cost of medical care	2,000,000		2,000,000		
Extra spending on drugs and medication					
Vector control environmental sanitation	6,000,000	3,000,000	3,000,000	2,740,000	
Damages in rural water supply				177,000,	
Damages in rural sanitation systems				50,250,000	

Source: ECLAC based on official Ministry of Health Reports

## 2. Damage in the productive sectors

This section includes estimates of damage to the agricultural, fisheries, tourism and other productive and services sectors. The extremely severe weather conditions caused disruptions to life. Some were very brief and included the cuts in basic services that were quickly restored. Others will have more serious implications. The impact on tourism is broken into two aspects:

1. Damages to the infrastructure, which will be repaired and replaced promptly, and
2. The number of visitors. Tourist arrivals may be adversely affected in the early part of the high season.

In the case of agriculture and fisheries, the effects will be somewhat more lasting, given the seasonal nature of their production and the persevering negative physical conditions associated with slowly receding waters and mud and boulder deposits. Crops tend to be the most affected due to excess water, and crop damage depends on various factors, which are described below.

Apart from losses of infrastructure and capital goods (tractors, combine harvesters, etc.), direct damage in the farming sector includes lost harvests and stored produce. The effect of the floods on future farming output is considered indirect damage, whereas in the industrial sector (namely sugar processing, rice husking, citrus concentrate), inventories and goods in process are counted as direct damage.

**a. Agriculture, livestock and fisheries**

In a number of areas, some six weeks after the event, some basic services have not been restored. In the case of agriculture and fisheries, the effects were more severe with crops and livestock experiencing damage of approximately J\$541.3 million. Of this figure, some J\$ 492.1 million represented direct damage. Some 1,911 hectares of crop farmlands were damaged, the most severely hit areas being St. Elizabeth, Portland and St. Andrew. Other damage can be examined in table 17 that presents damage data. An estimate of direct damage (loss) of livestock puts the figure at J\$ 30.8 million. The estimate of indirect damage is of the order of J\$3 million. No damage to fisheries has been reported.

i. Crop analysis

Coffee: This is a major commodity used in the manufacture of some of the world's best coffee beverages and a prized blending agent with coffees from other parts of the world. About 120 hectares in the Portland parish were damaged, with an approximate value of J\$ 12.6 million. Damage to coffee in the St. Andrew parish was of the order of J\$ 90 million, bringing the total damage to coffee to an estimated value of J\$102.6 million. Some of this would no doubt have been for the export market. The foreign exchange earning capacity of the economy would therefore have been impaired.

Bananas: Approximately 200 hectares in the parishes of Portland, St. Thomas, St. Andrew and St. James were damaged and losses of bananas amounted to some J\$ 18.2 million. The recuperation of the crop will rest on decisions that must be taken on future location of human settlements and access to the devastated lands for farming purposes.

Plantains: Damage to the extent of an estimated J\$22 million was recorded countrywide for this crop. Much of this output was geared for domestic consumption. This loss puts additional strain on the ability to feed a portion of the population. If market forces intervene, the price of this item will rise.

The effect of the damage to the agriculture sector will continue to be felt into the year 2002 as autonomous rehabilitation takes place and as Government intervention by way of provision of new planting material and land allocation work themselves through the system.

ii. Livestock

Major damage occurred in grazing lands as can be inferred from the data provided by government officials. A total damage figure of J\$ 30.8 million is estimated. Table 17 below provides details.

**Table 17**  
**AGRICULTURE**  
**Direct & Indirect damage estimates**  
**(JS Million)**

Parish/crops	Hectares	Direct Damage	Indirect Damage	TOTAL DAMAGE	Of which Imports
<b>Crops</b>	<b>1911</b>	<b>461.3</b>	<b>46.13</b>	<b>507.43</b>	<b>25.3715</b>
Portland	355	38.8	3.88	42.68	2.134
St. Mary	103.1	43.6	4.36	47.96	2.398
St. Catherine	51	5	0.5	5.5	0.275
St. Ann	86.4	9.4	0.94	10.34	0.517
St. Thomas	140.8	15.2	1.52	16.72	0.836
St. Andrew	267	241.3	24.13	265.43	13.2715
Clarendon	62.5	13.1	1.31	14.41	0.7205
Westmoreland	79.5	12.9	1.29	14.19	0.7095
Hanover	67	11.2	1.12	12.32	0.616
St. Elizabeth	516.8	55.2	5.52	60.72	3.036
Manchester	34.7	1.6	0.16	1.76	0.088
St. James	83	1.8	0.18	1.98	0.099
Trelawny	64.2	12.2	1.22	13.42	0.671
<b>Livestock</b>		<b>30.8</b>	<b>3.08</b>	<b>33.88</b>	<b>1.694</b>
Portland		18.3	1.83	20.13	1.0065
St. Mary		2.9	0.29	3.19	0.1595
St. Catherine		0.5	0.05	0.55	0.0275
St. Ann		0.2	0.02	0.22	0.011
St. Thomas		1.1	0.11	1.21	0.0605
St. Andrew		1.1	0.11	1.21	0.0605
Clarendon		0.8	0.08	0.88	0.044
Westmoreland		0	0	0	0
Hanover		1.4	0.14	1.54	0.077
St. Elizabeth		1.3	0.13	1.43	0.0715
Manchester		1.6	0.16	1.76	0.088
St. James		1	0.1	1.1	0.055
Trelawny		0.6	0.06	0.66	0.033
<b>TOTAL CROPS PLUS LIVESTOCK</b>		<b>492.1</b>	<b>49.21</b>	<b>541.31</b>	<b>27.0655</b>

Source: Data supplied by Ministry of Finance and RADA and mission estimates.

## b. Tourism

Damage to the tourism sector as a result of the flood rains is estimated to be relatively insignificant. The major damage to the sector had already been done as a consequence of the events of September 11 2001. A significant reduction in tourist arrivals ensued and to a great extent has continued. A slow increase in arrivals is beginning to take place as tourists and Americans in

particular attempt to continue to live in their accustomed manner. About one hundred rafts were lost in the Rio Grande, thus depriving their owners of a livelihood that was made from tourism activities. Inaccessibility by land has in addition temporarily curtailed this aspect of tourism activity and earnings.

### c. Industry and Commerce

The damage to industry and commerce caused by the flood rains was less severe than in agriculture. Manufacturing comprises some 14.4 percent of GDP and Commerce accounts for 21.4 percent. The manufacture of agro-industrial products will be adversely affected by the losses in agricultural production and by difficulties in transporting produce to the factories. The production of sugar has not been adversely affected as that activity preceded the rains. It is possible that the next cycle of production will feel some effect resulting from flooded sugar cane lands. No adverse effects to commerce have been reported.

## 3. Infrastructure

### Transport

Total direct damages in the transport sector are summarized in Table 18 following. These primarily encompass damages to roads and bridge structures (including culverts). Note that no damage was reported to any port infrastructure or to the local airport/aerodrome.

**Table 18:**  
**Total Direct damage in the Transport sector – J\$**

Sub-sector	Direct Cost	Of which Labour	Of which National	Of which Foreign
Total	1,570,774,250	250,564,500	806,865,150	513,083,600
Bridges	143,774,250	19,964,500	115,065,150	8,483,600
Roads/River Training	1,427,000,000	230,600,000	691,800,000	504,600,000

Source:

The primary cause of damage to the transport network would have been as a result of the inadequacy of the river channels to convey the flow of water that resulted from the excessive rains. An additional factor that compounded the problem was due to the fact that the rivers brought down significant quantities of sand and gravel, which had the effect of reducing the conveyance waterway areas.

As a result of the damages sustained to the road network, several communities were isolated immediately after the event. In fact, there are still two communities that remain inaccessible - Claverty Cottage and Clifton Hill.

Indirect costs to the transportation sector are summarized in the following table. It should be noted here that while direct costs are borne mainly by the public sector, indirect costs would be reflected primarily by the users and operators, who are mostly private.

**Table 19**  
**Total Indirect Cost for Highways**  
**(JS)**

Sub-sector	Total Cost	Government	Private users and operators
Total indirect cost	6,660,000	1,332,000	5,328,000
Highways			
Erosion of roads	540,000	108,000	432,000
Use of alternative roads	2,520,000	504,000	2,016,000
Roads condition	3,600,000	720,000	2,880,000

### Main highways direct damage

Damage was done to two main sections of highway, at the Spanish River Bridge and at the Swift River Bridge. As a result of this damage, there was significant disruption to these two communities, as residents had to be ferried across the rivers by boats in the days immediately following the flooding. Damage to these sections of roadway occurred as a result of the rivers exceeding their normal bank levels and flowing in sections of adjacent river bank that had previously been dry. In each case, the river washed out a 50-100 metre long section of approach roadway. For the Spanish River, this washout was complete, with the floodwaters flowing past the damaged section and out to the sea. For the Swift River, the approach road was eroded, but not washed out completely.

The National Works Agency reports that 440 roads were damaged island wide, as a result of the flood rains. Estimates were also received from the Ministry of Local Government and Community Development for damage to parochial roads, while estimates were received from RADA for the farm roads. For the parochial roads, the rehabilitation focus will be on drainage, retaining walls and road resurfacing, while for the farm roads, the focus will be on patching and minor resurfacing. The following tables summarize the costs developed for the varying transport components.

**Table 20**  
**Direct Cost of Damage – Bridges**  
**(JS)**

Bridge	Length (m)	Activity	Unit	Quantity	Price (\$)	Labour	National	Foreign	Total
Spanish River	100	Fill	m <sup>3</sup>	25,000	1570		39,250,000		<b>39,250,000</b>
		Gabions	m	200	3100			620,000	<b>620,000</b>
		Surface	m <sup>2</sup>	750	1550		1,162,500		<b>1,162,500</b>
		Training	m <sup>3</sup>	100,000	500		50,000,000		<b>50,000,000</b>
Swift River	50	Fill	m <sup>3</sup>	7000	1570		10,990,000		<b>10,990,000</b>
		Gabions	m	60	3100		186,000		<b>186,000</b>
		Surface	m <sup>2</sup>	365	1550		565,750		<b>565,750</b>
		Training	m <sup>3</sup>	50,000	500		25,000,000		<b>25,000,000</b>
Westmoreland		Bridge Repair	LS	1			8,000,000	8,000,000	<b>16,000,000</b>
Total Bridges									<b>143,774,250</b>

**Table 21**  
**Direct Cost of Damage – Main Roads/Parochial Roads/Farm Roads; River Training Works**  
**(JS)**

	<b>Length (km)</b>	<b>Labour</b>	<b>National</b>	<b>Foreign</b>	<b>Total</b>
Main Roads	440 affected roads	83,825,000	251,475,000	143,700,000	479,000,000 <sup>8</sup>
Parochial Roads	122	98,525,000	295,575,000	168,900,000	563,000,000
Farm Roads	400	22,750,000	68,250,000	39,000,000	130,000,000 <sup>9</sup>
River Training		25,500,000	76,500,000	153,000,000	255,000,000
Total		230,600,000	691,800,000	504,600,000	1,427,000,000

### **Main highways indirect damage**

Three sources for indirect costs in the ground transportation system were identified as a result of damages to highways and roads. These are:

- Inconvenience to users of buses and light vehicles as a result of roads being cut off, as some of these users had to seek alternative methods of transport.
- Increase of vehicle operational cost and time expenses as a result of vehicles having to make alternative and longer trips.
- Increase of vehicle operational costs as a result of vehicles having to use roads having poorer condition of pavement.

For the first category, the developed cost is based on the fact that local fishermen, at each of the bridges in question, were ferrying people across the respective rivers. At each river, and based on news reports, approximately 10 people, including school children, would have been carried per trip. Assuming an average of five trips per hour, between the hours of 8:00 a.m. and 6:00 p.m. the estimated total number of people ferried across the river each day equals 500. This went on for a period of approximately two weeks (12 days). In total therefore, and for all three rivers, approximately 18,000 people would have been ferried in the weeks following the roads being cut off. At a trip that is analogous to the bus fare, \$30, this gives a total amount of \$540,000.

For the second category, it is necessary to estimate the average daily traffic at each of the affected locations. Based on personal observations made at the Spanish and Swift Rivers, approximately three cars pass every five minutes where access is not seriously restricted. Assuming that this rate of traffic flow is maintained between the hours of 7:00 a.m and 7:00 p.m, and reduced to one car every five minutes between 7:00 p.m and midnight, then the total number of cars passing each location would be approximately 500 per day. The distance that was added to travel time, as a result of the roads being cut off, was estimated to be approximately 30 km. This is based on the trip distance between Kingston and Port Antonio. This distance would have added on average, 4.2 litres of fuel per vehicle, for each trip. Based on the prevailing rates of gasoline in Jamaica at this time, this would have added a cost of \$84 per trip. The main roads referred to were impassable for a period of approximately three weeks (20 days). For each location therefore, this translates to a cost of \$840,000, or for all three locations, a cost of \$2,520,000.

<sup>8</sup> Estimate supplied by National Works Agency

<sup>9</sup> Estimates supplied by RADA

For the final category, the additional wear and tear on the vehicles is calculated as follows:

- A set of tyres may be expected to last for 15,000 km. The additional travel time and the poor condition of the alternative roads would have contributed on average 1% of the replacement cost of tyres, or \$120 per car.
- Additional damage to suspension parts has been assumed to be included in the above estimate.
- For all three locations, these assumptions lead to a cost estimate of \$3,600,000.

### Energy

In general, a significant area of the island's electrical supply system was affected by the passage of the storm. However, the transmission and lateral distribution lines suffered the most impact, with cable cuts and washing out of poles. Fortunately, there was no damage to distribution trunk lines or to sub-stations. Areas spanning from Discovery Bay to Port Antonio experienced loss of electricity as a result of the damage, with the most severely affected areas being in Portland. These included the Rio Grande, Buff Bay and Hope Bay Valleys, and the Craigmill to Bellevue district. Of particular note was the Swift River community, where service has still not been restored.

Temporary and long-term repairs were conducted very quickly after the passage of the storm in order to restore electricity in most of the communities affected. Poles and cables were replaced, and fallen trees (on cables) were removed within two weeks of the event. For Swift River, once the roads are cleared, then the Jamaica Public Service crews will be able to go in and effect repairs.

The estimated direct cost of the emergency works is approximately J\$6.2 million. Indirect costs for this sector include the losses of profit for the month of November, for the various affected communities. Reports from the JPS indicate that at least twenty-four communities in Portland and St. Mary were affected by power loss. At an average of approximately 25 to 50 houses and commercial properties in each community, and at a monthly power cost of \$2,000 per property, and assuming profits of 8% of revenue, an indirect cost of approximately \$190,000 is estimated.

### Water and sanitation

The National Water Commission sustained damage to both pumping equipment and pipelines, affecting approximately 70 distribution systems throughout the island. The heavy rainfall and the associated landslides resulted in several systems having blocked intakes, heavy siltation and high turbidity.

Damage to water supply systems was seen in several parishes including Portland, St. Mary, St. Ann, Kingston, St. Thomas, Clarendon, St. Catherine, Trelawny, St. James, Hanover and Westmoreland. However, most of the damage was seen in Portland, where approximately 17 water supply systems were affected. Significant damage was also seen along the 'Yallahs Pipeline' leading from St. Thomas to Kingston, where there was the dislocation of a major trunk line, which affected the inflow of water into the main metropolitan reservoir, the Mona Dam.

Most of the emergency repairs were effected within two weeks of the rain events. However, restoration of water supply to many areas was hampered by the inability to access the pipelines as a result of the severely damaged roads.

The wastewater treatment plants in Portland (Anchovy) and Spanish Town also experienced significant damage as a result of the storm.

The estimated costs of repair for the system in Portland alone was J\$64 million, and for the entire island was J\$96 million. A further breakdown obtained from the National Water Commission was:

- \$3 million allocated for minor repairs to pipelines (outside of Portland).
- \$1 million for the repair of the Woodstock plant.
- \$3 million for the repair of damage to infrastructure in St. Catherine.
- \$25 million for repairs to the Yallahs pipeline.

Indirect costs associated with this sector may be obtained from an evaluation of costs associated with water transportation, increase of chemical treatment, emergency power supply, etc. These costs were not provided, and so cannot be included in this analysis.

### Telecommunications

The main infrastructure damage that was reported was the washing away of underground ducts/cable at the Yallahs fording. In addition, minor damage was reported in Portland, St. Mary, St. Thomas and Trelawny. Following is a summary of the reported direct costs:

- Repair to cable at the Yallahs fording is \$3,700,000.
- Repairs spent to date in other parishes are \$1,800,000.
- The estimate of rehabilitation efforts for short-term remediation is \$1,400,000.
- 

Indirect costs for this sector may be attributable to the loss of profits for the month of November 2001.

### **Effects on the environment**

The excessive rains and flooding that ensued, resulted in the following primary effects to the environment:

- Loss in water quality.
- Destruction to habitat.
- Changes in watercourse paths.
- Geological changes to mountainous regions.
- Beach erosion and shoreline infrastructure damage in the towns of Negril and Montego Bay

Following are summaries of some of the factors that led to the damages that occurred, as well as suggested mitigation strategies and plans that should be adopted in order to minimize the vulnerability of the areas that were affected.

### **Factors influencing massive flooding and landslides in Portland Watersheds**

The recent extensive flooding and land slippage that took place in Portland can be attributed to a combination of factors. The heavy rains caused by Hurricane Michelle, in association with the steep slopes, highly erodable soils, and numerous geological faults, which were compounded by human activities that have resulted in improper land use and deforestation, all contributed to the destruction in Portland.

### **Factors influencing shoreline infrastructure damage in resort towns**

Extensive damage occurred to sections of the shorelines in Negril and Montego Bay. This damage occurred as a result of high waves, spun off from Hurricane Michelle, reached the northwestern coastline of Jamaica. In both resort areas, observers have indicated that waves were as high as 3-5 metres at the shoreline.

### **Flood and landslide mitigation measures**

In order to minimize the potential for such drastic flooding and erosion during future storm events, certain measures need to be taken. These mitigation measures are primarily aimed at reducing soil exposure to sunlight, heavy rain, and high velocity water, and involve soil conservation/erosion control practices as well as slope and riverbank protection practices. In addition, it is strongly recommended that both flood hazard mapping and geohazard mapping be undertaken, so that the planning process may be properly accommodated.

#### **1. Soil conservation**

The practices that need to be adopted in order to promote soil conservation include:

- Minimizing the removal of trees, in particular young trees, on steep slopes (> 40 degrees).
- Halting the use of fire as a means to clear lands for agricultural purposes.
- Promoting the planting/retaining of vegetation, especially on steep slopes.
- Alternating between tree crops and grass along slopes, and in keeping with the natural land contours.
- Constructing, where appropriate, slope and diversion drainage channels made out of earth or wood.
- Planting low growing crops to increase the soil cover under the canopy.
- Mulching crops.

## **2. Slope protection and geohazard mapping**

The practices that need to be adopted in order to protect the steep slopes of the area are very similar to those needed to control erosion, and include:

- Limiting the exposure of topsoil on slopes by planting crops or grass.
- Adopting 'no-tilling' farming practices.
- Planting vegetation known to have deep roots.
- Constructing minor engineering structures such as spillways, check dams and waterways.
- Diverting water from existing landslides.
- Planting fast growing tree species within and adjacent to landslides.
- Mulching and composting.
- Avoiding construction on steep slopes.

In addition, it is recommended that geohazard mapping be carried out, whereby the susceptibility of mountainous areas to landslide are determined. This type of investigation should be used by the Planning Institute and the NEPA, to regulate habitation areas, and by the Office of Disaster Preparedness to fine-tune evacuation plans for the most threatened communities.

## **3. River bank protection and flood hazard mapping**

Much of the soil that was carried down by the rivers during the floods came from the riverbanks. Measures to protect the soil along river banks includes:

- Retaining the vegetation on gully and stream banks.
- Ceasing the mining of gravel and sand from the upper reaches of riverbeds.
- Planting fruit and forest trees along gully and river areas when possible.
- Constructing minor river training works to prevent undercutting of developed areas.
- Clearing river and tributary channels of excess debris.
- Stabilising any material removed from channels with stones or vegetation (if stored near to the channel).
- Conserving wetlands by not dredging, dumping up or cutting down trees.
- Preventing the grazing of animals in gullies.
- Promoting and enforcing proper development planning, so that development does not take place on riverbanks. In order to facilitate this objective, a number of investigative steps must be carried out. The Water Resources Authority (WRA) has proposed a program to improve the development planning process that includes: flood hazard mapping, which is a necessary and fundamental tool in disaster preparedness; improved data collection and management, through the implementation of additional intensity rain gauges and water level recorders for Portland; adoption of regulation guidelines for flood plain usage; preparation of technical guidelines illustrating appropriate standards and criteria relating to the siting and dimensioning of buildings and hydraulic structures.

- Planting crops that require and can utilize large amounts of water (e.g. banana and cane) on floodplains.

Direct costs can be developed for the strategies described above, and for the required remediation activities. These are summarized in the table below. However, the following points should be noted:

- Repair to tourism infrastructure in Negril is estimated to be \$5,000,000. This amount is attributable to the private sector.
- Repair to the damaged shoreline in Montego Bay is estimated to be \$7,000,000. This amount will be attributable to the public sector.

**Table 22**  
**Direct Costs in Tourism Sector**  
**(JS)**

<b>Mitigative Intervention</b>	<b>Labour</b>	<b>National</b>	<b>Foreign</b>	<b>Total</b>
Repairs to Negril infrastructure	900,000	3,600,000	500,000	5,000,000
Repairs to Montego Bay infrastructure	1,260,000	5,040,000	700,000	7,000,000
Flood Hazard Mapping	300,000	200,000	500,000	1,000,000
Data Collection/Management	1,000,000	1,200,000	1,000,000	3,200,000
Technical Training		60,000	240,000	300,000
Geohazard Mapping	2,000,000	8,000,000	2,000,000	12,000,000
Public Awareness Programme	500,000	3,500,000	1,000,000	5,000,000
<b>Total</b>	<b>5,960,000</b>	<b>21,600,000</b>	<b>5,940,000</b>	<b>33,500,000</b>

Source: Mission estimates

### **III. MACROECONOMIC EFFECTS**

#### **1. Summary of damage**

The totals of direct and indirect damage assessments of the sectors affected are presented in table 23. It is clear that damage to housing, infrastructure, especially transport, and agriculture must be addressed with urgency. Much of the damage, although devastating in money terms, was even more so when one considers the loss of livelihoods and the trauma that was produced by the event. The onus is on the country to re-build (in cases where re-building is recommended) with mitigation. The decision to re-locate communities is a delicate one and should take into account all aspects surrounding the trauma of removing persons from the spot where their forefathers are buried. Another pressing need is evidenced in the recognition and immediate work being done to protect the approaches to the bridges that sustained damage. The re-training of the respective rivers is necessary. In housing and settlements, it is fortuitous that such a low death toll could be reported in the aftermath of millions of tons of debris that overtook human settlements. The damage done to agriculture was great but could have been worse if extremely sophisticated farming methods were in use.

Table 23

## Assessment of Total Direct and Indirect Damage – J\$ Million

	Direct Damage	Indirect Damage	Total Damage
<b>Social Sector</b>	<b>249.4</b>	<b>10.9</b>	<b>260.3</b>
Housing	225.0	0.4	225.4
Health	7.2	7.0	14.2
Education	17.2	3.5	20.7
<b>Infrastructure</b>	<b>1679.9</b>	<b>6.9</b>	<b>1686.8</b>
Water and Sewerage	96.0	-	96.0
Telecommunication	6.9	-	6.9
Transport	1570.8	6.7	1577.5
Energy & Electricity	6.2	0.2	6.4
<b>Economic Sectors</b>	<b>525.6</b>	<b>49.2</b>	<b>574.8</b>
Tourism	33.5	-	33.5
Agriculture, livestock & fisheries	492.1	49.2	541.3
Industry & Commerce	-	-	-
<b>TOTAL</b>	<b>2454.9</b>	<b>67.0</b>	<b>2521.0</b>

The summary data on direct and indirect damage indicates that the most affected sectors were the infrastructure, the social sector and the economic sectors, especially agriculture. A socio-economic mapping of the disaster to the geography of the country shows that the settlements most severely affected were the poorest communities. This makes a solution all the more urgent.

In the table that follows, a number of ratios are presented to complete the appreciation of the damage. The ratios analyze damage with GDP, domestic exports, Total Government Revenue and Grants and Value of Agricultural Exports in 2000.

**Table 24**  
Selected ratios to put the damage in perspective

Total Damage As % of GDP 2000	0.8%
Total damage as % of Exports 2000	201.1%
Total damage as % of Govt. Revenue & Grants FY 1999/ 2000	2.8%
Indirect damage as % of Agricultural Exports 2000	23.4%

It is clear that the damage was severe but not enough to cause massive dislocation to the macroeconomic variables. The Fiscal Account seems the most threatened as Government must treat this as a matter of urgent social concern.

## 2. The pre-disaster situation

### a. Overview<sup>10</sup>

#### Gross Domestic Product (GDP)

During the third quarter of 2001, GDP increased by an estimated 3.4 percent compared with the corresponding period of 2000 as output in the Mining industry made a recovery to normal levels of output after the Gramercy accident<sup>11</sup>. All of the other major sectors with the exception of Electricity and Water and Miscellaneous Services<sup>12</sup> recorded increases. At the end of September, the inflation rate for the period January to June was of the order of 5.7 percent. Central Government operations resulted in a fiscal deficit of \$2.6 billion.

Construction and Installation and Financial services recorded significant increases in activity as residential construction was fostered by public sector activity in housing and water. Non-residential construction activity reflected Central Government capital works and refurbishing work in the private sector.

Increases in real GDP in Agriculture, Forestry and Fishing, Manufacturing and Transport, Storage and Communication were noted when compared with the period July to September 2000. Growth rates have, however slowed down in these industries in the third quarter when compared with performance in the first half of 2001. A reduced level of real output in Electricity and Water responds to lower levels of electricity generation resulting from problems at the generating plants. Lower growth rates for miscellaneous services reflect reduced output in Hotels, Restaurants and Clubs segment as tourist arrivals declined.

Table 25 presents GDP estimates and tentative forecasts.

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<sup>10</sup> The present description of main aspects of the Jamaican economy was prepared from the third quarter analysis as presented by the Planning Institute of Jamaica.

<sup>11</sup> Refers to an accident at a smelter plant in Louisiana, U.S.A.

<sup>12</sup> Includes Tourism

**Table 25**  
**Real GDP estimates and tentative forecasts – JS million**

	1999	2000	2001 est Jan- Sept	2001 est Jan – Dec before floods	2001 est Jan – Dec after floods
GOODS-PRODUCING SECTORS					
Agriculture, Forestry & Fishing	1539.5	1367.7	1504.5	...	...
Mining & Quarrying	1774.3	1746.0	2035.8	...	...
Manufacturing	3015.2	3035.9	3111.8	...	...
Construction & Installation	1454.6	1456.2	1506.9	...	...
SERVICE SECTORS	15416.3	16089.9	16455.2	...	...
Electricity & Water	1020.2	1054.0	1045.6	...	...
Transport, Storage & Communication	3002.0	3273.3	3433.7	...	...
OTHER SERVICES					
Distribution	3792.0	3829.0	3852.0	...	...
Financial Institutions	2588.9	2863.5	2955.1	...	...
Real Estate & Business Services	1683.0	1688.1	1708.4	...	...
Producers of Gov't. Services	1243.5	1227.6	1237.4	...	...
Miscellaneous Services	1998.6	2103.8	2126.9	...	...
Household Services	88.1	86.7	86.1	...	...
Less Imputed service charge	-4196.2	-4541.8	-4759.8	...	...
TOTAL GDP	19003.6	19154.3	19844.4	20737.4	19920.5

Source: Official data and ECLAC estimates

## Production

### Agriculture

During the third quarter of 2001, the gross value of agricultural output was estimated at \$8522.4 million, some 19.1 percent higher than the figure for the corresponding period of 2000. This is due to an almost five-fold increase in the volume and value of sugar cane produced. The value of sugar cane increased to \$1167.92 million from \$203.6 million in July-September 2000. Agricultural production as measured by PIOJ's Agricultural Production Index had shown a 10.3 percent increase in the January to September period of 2001 over the corresponding period of 2000. The floods would have eroded that increase. The forecast is therefore that production will remain at the 2000 level in 2001.

The increased production of **sugar cane** was primarily responsible for the improved performance in the Export Crops sub-index. The increased production came about as a consequence of deferred milling operations that influenced the accounting. This is not likely to recur in the coming year and a return to normal levels of operation is expected. For the crop year November 2000 to September 2001, some 2,230,606 tonnes of sugar cane were milled, yielding 204,478 tonnes of sugar.

Partly responsible for this output was the yield in terms of tonnes of cane to tonnes of sugar (the highest since 1965) - no doubt due to the sucrose content of the canes.

### Mining

The **Mining** Sector continued to recover as bauxite and alumina production increased compared with the July – September 2000 level of production. Alumina production increased by 5.4 percent and crude bauxite production increased by 168.0 percent. Total bauxite production increased by 26.6 percent.

### Construction and installation

Construction and Installation continued to record significant increases. Residential construction increased largely in response to Government's Settlement Upgrading Programme. Activity in non-residential construction was propelled by major infrastructure projects by the Ministry of Transport and Works.

### **Services**

In the **Services** sector, Tourism recorded lower levels of growth when compared with the first half of 2000 and the first quarter of 2001. This reflected a continued reduction in cruise ship visitor arrivals and a slowdown in the rate of growth of stopover visitors as the slowdown in the American economy continued and as negative reports on safety in the country were carried on major news networks. There has within more recent days been some indication of increased activity.

### **Financial services**

Financial services continued to record a significant increase. Growth in the sector was attributed to continued recovery in the banking and insurance industries.

In the **Basic Services**, although there continued to be growth in sales and generation in the Electricity, Light and Power sub-sector, the rate of increase has slowed down as a consequence of the generation problems of the Jamaica Public Service Company. Water production fell by 3.4 percent when compared with the corresponding period in 2000. The recovery in the Financial Services sector was fuelled by:

- Improved supply conditions in the credit market,
- Increased demand for insurance related products as evidenced by more policies being sold,
- The continued recovery in the Stock market.

Government consumption expenditure is estimated to have increased by less than 1 percent in real terms, reflecting in part higher wages.

Events towards and after the end of the quarter have compromised the ability of the economy to achieve a growth rate of 4.5 percent for 2001. Given the need for immediate Government response, a

different pattern of expenditure and economic activity is expected in the fourth quarter of 2001, resulting in an estimated increase in total GDP of some 4 percent over the 2000 total. The drop in tourist arrivals in the wake of the September 11 attack on the United States has resulted in hotel occupancy rates of some 11 percent – less than one-third of normal occupancy rates as an immediate response. Information is that occupancy rates are on the increase and some increase in arrivals is expected in the last month of the year. A decline in tourist cruise ship calls has led to reduced performance in that industry. The devastation of the flood rains in the Portland and St. Mary areas have put additional pressure on the productive and service sectors to meet the target of 4.5 percent growth in 2001.

The two unexpected events as described above have put pressure on Government expenditure as emergency financial support to victims of the flooding in the affected areas of Portland and St. Mary. A fiscal deficit is therefore forecast for 2001 as Government responds to the event.

### **Manufacturing**

For the period January to September 2001, overall performance in the Manufacturing sector increased by 2.5 percent compared with the corresponding nine months of 2000. A significant factor behind this performance was the return to normal operations at the Petrojam refinery, leading to a 27.3 percent increase in petroleum production.

### **Money and inflation**

The monetary base of the Bank of Jamaica declined by 2.2 percent in the third quarter of 2001 as compared with a 2.0 percent fall in July to September of 2000. This resulted from a 0.2 percent decrease in the value of the Net International Reserves, together with a 1.4 percent fall in the Net Domestic Assets (NDA). The fall in the NDA was influenced by an increase in Open Market Operations to the extent of 4.5 percent. Net claims on the Public Sector at the Bank of Jamaica increased by 8.0 percent in the third quarter of 2001. The Central Government's balance at the Bank continued to reduce, the balance falling by 22.1 percent compared with the level observed in the corresponding quarter of 2000. For the twelve-month period to July 2001, Narrow Money increased by 11.7 percent, compared with the 9.6 percent increase recorded for the twelve-month period ending in July 2000. Quasi-Money grew at a rate of 10.4 percent. Growth in Time Deposits continued to outstrip the expansion in Savings Deposits, as investors moved into higher interest-bearing accounts. Total M2 increased by 10.8 percent on an annual basis, compared with an 11.8 percent growth rate in the preceding year.

Inflation was 2.8 percent during the third quarter of 2001, following on a 2.9 percent rate recorded in the second quarter of 2001. The relatively strong rate of inflation reflected cost-push effects as well as seasonal increases in domestic food crop prices. For the calendar year to September, the rate of inflation was 7.5 percent, which represented the highest rate in three years.

## Fiscal operations

Central Government's **fiscal operations** generated a fiscal deficit of \$2.6 billion during the third quarter of 2001. This contrasted sharply with a surplus of \$333 million in the corresponding quarter of 2000. The fiscal outturn was somewhat better than the programmed deficit of \$3.4 billion as government curtailed its expenditure on capital projects and programmes by 49.5 percent and 23.3 percent, respectively. There was also a re-allocation of funds in an effort to attain the fiscal targets while dealing with a measure of social unrest in July 2001. Total expenditure stood at \$28 billion and was 4.3 percent less than budgeted for the period. When compared with the outturn for the similar period of fiscal year 2000/01, Total Expenditure for the quarter was 14.1 percent greater. This stemmed from an increase in Recurrent Expenditure of some 16.8 percent as Government's wage bill increased by \$11.2 billion. Table 26 presents a summary of fiscal operations.

**Table 26**  
**A Summary of Fiscal Operations**  
**(J\$ Million)**

Categories	Budget Jul-Sep 2001	Revised Jul-Sep 2000	Provisional Apr-Sep 2001	Budget Apr-Sep 2001
Fiscal Surplus/Deficit <sup>a</sup>	-3387.4	333.4	-11838.8	-12816.2
Recurrent Surplus/Deficit	-1011.5	1380.2	-9096.0	-9310.7
Primary Surplus/Deficit <sup>b</sup>	8165.1	10525.0	12515	12837.9
Overall Surplus/Deficit <sup>c</sup>	2797.2	7088.5	-7210.0	5951.0
<sup>a</sup> Fiscal deficit refers to total revenue and grants less total expenditure (excluding amortization) <sup>b</sup> Primary deficit refers to the fiscal deficit plus interest payments <sup>c</sup> Overall deficit refers to the fiscal deficit plus loan receipts less amortization payments				
Source: Ministry of Finance and Planning				

## Trade and balance of payments

The **Balance of Payments** position improved in the January to July 2001 period with a build up in the Net International Reserves of US\$556 million. This compared with US\$338.5 million in the corresponding period of 2000. The positive balance of payments outturn was due to large inflows on the Financial Account and reflected increases in both official and private investment. Official investment increased by US\$ 345.7 million to a figure of US\$ 423.9 million, as Government received US\$ 400.0 million from a Euro bond issue. Private investment increased by 4.3 percent as Government received the final payment from the sale of the Jamaica Public Service Company Limited. The Capital Account moved from a surplus of US\$ 2.8 million to a deficit of US\$ 8.4 million.

The Current Account registered a deficit of US\$ 224.7 million for the January to July period of 2001, as the Current Account position weakened when compared with the corresponding period of 2000 and 1999. The trade deficit increased by 18.5 percent as the value of imports increased and that of exports declined.

The export performance of the Agricultural and Manufacturing Sectors is captured in the following table 27.

**Table 27**  
**Value of exports from the Manufacturing Sector**  
**(US \$Million)**

	Jan-Jul 1999	Jan-Jul 2000	Jan-Jul 2001	% Change Jan-July 2001 /Jan- July 2000
Sugar	81.8	83.3	70.5	-15.4
Other Food Products	5.8	6.0	3.5	-42.2
Rum	16.2	13.9	15.8	13.4
Processed Foods	22.6	24.4	30.1	23.2
Beverages & Tobacco	22.6	17.8	18.0	1.5
Crude Materials	16.7	1.4	1.5	5.1
Mineral Fuels	1.1	1.9	4.6	146.8
Animal & Vegetable oils & fats	0.03	0.04	0.06	47.4
Chemicals & Chemical products	22.4	32.0	26.4	-17.7
Manufactured Goods	3.5	3.8	4.2	9.7
Machinery/ Transport Equipment	1.1	0.7	1.9	148.1
Miscellaneous Manufactures	97.0	92.7	52.4	-43.5
<b>TOTAL EXPORTS</b>	<b>290.9</b>	<b>278.0</b>	<b>228.8</b>	<b>-17.7</b>

Source: PIOJ on the basis of data received

The Income Account deteriorated from the figure of the corresponding periods in 1999 and 2000 as multi-national corporations increased profit remittances. The Services and Current Transfers Accounts continued to be positive. The improved position in the Services Account was due to the travel account and reflected increased earnings from the tourism sector up to the end of July 2001.

**Table 28**  
**Balance of Payments Account**  
**January – July 1999 – 2001**  
**(\$US million)**

	Jan Jul 1999	Jan-Jul 2000	Jan-Jul 2001	Change % 2001 / 2000
Current Account	33.0	-93.3	-224.7	-140.8
Goods Balance	-610.3	-742.6	-880.1	-18.5
Services Balance	451.3	400.8	424.8	6.0
Income	-189.8	-235.6	-275.5	-16.9
Current Transfers	381.8	484.1	506.1	4.5
Capital & Financial Accounts	-33.0	93.3	224.7	140.8
Capital Account	7.7	2.8	-8.4	-400.0
Financial Account	-40.7	90.5	233.1	157.6
Reserves (minus equals increase)	95.0	-338.5	-556.6	64.4

Source: PIOJ on basis of data compiled from Bank of Jamaica.

### 3. Economic forecast and outturn during 2002

Gross domestic Product estimates and projections to the year 2002 were made on the basis of a number of assumptions as are presented in the text below.

The assumptions are simple in nature and represent a great likelihood of outcome based on the expected behaviour of the economy in the year to come. An assumption that may not be unlikely is that the projection is based on a set of inter-industry relationships that fairly fixed in the short term and is not expected to change drastically in the coming year. This extrapolation assumes that the Manufacturing sector will not be deranged by the event, since its major effects were highly localized and are located away from the area of operation of the sector. Table 29 presents an extrapolation of current priced GDP to the year 2002.

**table 29**  
**Gross domestic product in producers' values at current prices**  
**J\$ million**

	1998	1999	2000	2001 Forecast before Floods	2002 Forecast
<b>I. GOODS</b>	90913.8	98541.8	108420.8	117484.8	128025.5
Agriculture, Forestry & Fishing	20203.5	20044.6	20765.5	22501.5	24520.3
Export Agriculture	3211.4	3503.6	3744.5	4057.5	4419.5
Domestic Agriculture	12761.1	12001.1	12273.5	13299.6	14485.9
Livestock & Hunting	2789.6	2978.5	3056.3	3311.8	3607.2
Forestry & Logging	232.1	245.5	276.2	299.3	326.0
Fishing	1209.3	1315.9	1414.8	1533.1	1669.8
Mining & Quarrying	11241.7	12013	13826.6	14982.5	16318.9
Bauxite & Alumina	10923.4	11607.1	13372.9	14490.9	15783.5
Quarrying	318.3	405.9	453.8	491.7	535.6
Manufacturing	36232.3	38817.2	42903.8	46490.6	50637.5
Construction & Installation	23236.3	27666.9	30924.9	33510.2	36499.3
<b>II. SERVICES</b>	171329	190002.4	210759.8	228379.3	248750.8
Basic services	34104.3	39185.5	44581.6	48308.6	52617.8
Electricity & Water	8104.5	10246.4	12877.3	13953.8	15198.5
Transport, Storage & Communications	25998.8	28939.1	31704.3	34354.8	37419.2
Other Services	137224.7	150816.9	166178.2	180070.7	196133.0
Distribution	54974.2	57771.3	63941.4	69286.9	75467.3
Financial Institutions	17645.5	21792.1	24574.5	26628.9	29004.2
Real Estate & Business Services	15029	16583.8	18182.4	19702.4	21459.9
Government Services	31059	34045.4	36326.7	39363.6	42874.8
Miscellaneous Services	17113.1	18966.9	21143.3	22910.9	24954.5
Household & Private Non-Profit	1403.8	1657.3	2009.9	2177.9	2372.2
<b>III. IMPUTED BANK SERVICES CHARGES</b>	-16163	-20383.3	-20497.9	-22211.5	-24192.8
<b>IV. TOTAL GDP</b>	<b>246079.8</b>	<b>268160.9</b>	<b>298682.6</b>	<b>323652.5</b>	<b>352522.3</b>

The mission's forecast is that the economy will not be unduly set back in the attainment of its growth target for the year. It was already set back in September and will fall a bit short of its targeted growth rate of 4.5 percent. GDP in current prices is forecast to be slightly less than the 2001 forecast of J\$ 323652.5 million for 2001.

#### **4. Fiscal policy and the central government's finances**

During the third quarter of 2001, Central Government's fiscal deficit was \$2.6 billion. The outturn was better than the programmed deficit of \$3.4 billion as government curtailed its expenditure on capital projects and Programmes by 49.5 percent and 23.3 percent, respectively. As a result, Total Expenditure was J\$28 billion, which was some 4.3 percent less than budgeted for the period.

Taxes from Production and Consumption as well as International Trade grew by 13.8 percent and 10.3 percent, respectively above the figures for the corresponding period of the previous year.

The fiscal situation has not given cause for alarm, but in the aftermath of the flood rains, there emerges the need for urgent Government expenditure. In the final two months of the year, the immediate expenditure required is expected to result in a deficit far larger than had been programmed and foreseen. No indication of the magnitude of this deficit was made available to the team, as disbursements must be a function of absorptive capacity. A measure of cash flow planning must therefore be employed. Clearly, the budget for the current Fiscal Year may have to be revisited.

#### **5. Effects on population's income**

The effect of the rains has taken away the livelihoods of those affected in the major disaster areas. To the extent that the damage was not sustained in the Kingston area or in the industrial area, the effect of the damage did not affect the main macroeconomic variables. The observation was made that the areas affected tended to be poor areas. The inhabitants are more vulnerable to natural disasters by virtue of the location of their settlements and not resourceful in terms of having financial resources to take themselves out of their predicament. Whereas the earnings of the affected people fell and approached zero, they look towards the Government to assist them. Government has little choice but to respond in a meaningful way. The disbursement of aid will most probably come from the treasury as a matter of urgency. Government has one of two options to finance the response. They must increase taxes or they must seek international aid. If the first approach to the solution were taken, increased taxes would mean a loss in personal disposable income for all taxpayers in the country. The second approach seems the more advisable.

## 6. External sector and prices

The rains have doubtless impacted on economic activity and production in a serious manner. They have further impoverished the affected families and deprived them of their homes and income from the sale of their harvests. It has reduced the food supply available to the domestic economy and has resulted in a loss of foreign exchange. A temporary increase in prices is expected to ensue, as the market mechanism settles the new price of the foodstuffs now in short supply. In the case of the rafters of the Rio Grande, new rafts will merely put them back to the status that they had before the floods – waiting for the patronage of tourists who cannot now access their services because of broken road communications. In addition much of their market comprises tourists who have chosen to stay away for some time until the American people become comfortable again and resume travel. Loss of foreign exchange has resulted from the events of September 11 as well as a prolongation of the decision to refrain from air travel to tourist destinations. This will reduce benefits to be gained by the country on the transportation account of the balance of payments. The foreign content of damage that will have to be restored is significant. This will result in an increase in imports and widen the visible trade balance. The lack of insurance on the part of the homeowners means that the individuals will bear the brunt of the loss if assistance is not forthcoming from a third source.

## 7. Effect on rate of savings and investment

Depending on Government's package of assistance to the affected families, considerable construction activity is likely to take place in the New Year. Capital formation will take place but the Net position may not change much as some of the new construction will be replacements for destroyed houses. The rate of savings as well as of investment will remain relatively intact for this reason.

**Table 30**  
**A summary of the effects of the damage in terms of time horizons**

<b>Type of Damage</b>	<b>Short term effect</b>	<b>Medium term effect</b>	<b>Long term effect</b>
Crops and livestock	Price increase Loss of livelihoods	Economic hardship in period of recuperation	Some of the affected farmers will drop out of agriculture and migrate to the city or tourist centers to be employed in the services sector
Housing	Trauma on part of individuals at loss of housing and assets Displacement Loss of self-esteem	Economic and opportunity cost of rebuilding or re-location. Start over costs will be high.	Re-organization of lives and livelihoods as communities are re-located, hopefully with a human face.
Social damage	Devastation of families Great effect on fiscal account	Continuing fiscal pressure	Accommodation in fiscal account. Depends on how help was delivered or sourced.
Infrastructure	Reparation and construction cost are at expense of Central govt.	Linked to fiscal account	Linked to Fiscal Account

#### **IV. GUIDELINES FOR A REHABILITATION AND RECONSTRUCTION PROGRAMME**

Different emphasis is required in each country depending on the type of damage and the vulnerability existing prior to the disaster. The reconstruction effort after the event should not return the country or part thereof to the same level of vulnerability that existed before the event. Programming of the intended re-construction effort should, however, ensure that the community could absorb the financial and technical resources being brought to bear on the effort. It would be important, therefore, to set priorities and consider the time frame and the necessary changes to design, construction and land use regulations in keeping with the situation in each country.

Poverty factors and unequal distribution both of resources and income aggravate the country's structural vulnerability and it will only be through a combined effort of government, local authorities, private sector entrepreneurs and society at large that a new approach to development can take place. Physical fragility, health risks, environmental hazards, income differential and social dynamics all combine to determine a country's development pattern.

Occasionally an event such as the recent rains and their accompanying floods and landslides occur without major loss of life. This provides an opportunity for the country to be proactive in changing policy in an effort to avoid preserving levels of vulnerability that derive from life styles. The economic and social setback of the October floods has been great among the affected communities but it should serve to accelerate new thinking and action on the vulnerability of a number of human settlements, most of which are inhabited by the poor.

Reconstruction efforts must be guided by mitigation that must be built in from the ground up. In the case of Jamaica in October 2001, a major question surrounds the decision of whether the villagers of ByBrook or Swift River should be re-located or allowed to rebuild in the same flood plain. The content, priorities and scope of such programmes must necessarily be a national, sovereign decision of the country. Such a decision must respond as much to the magnitude of the damages as to a country's pre-existing conditions and economic and social policy criteria. Its foreign debt commitments and stabilization policies must also be taken into account on determining the content, scope and scheduling of the programmes.

Not all the effects of a major natural event are totally disastrous. Earth movements can change the resources of a location and bring with them possibilities of other economic activities. In this vein, one would have to consider the economic cost versus the benefit of moving the deposit of silt and boulders that descended on Swift River and environs or considering the material deposited as a valuable input into Construction.

In the course of interviews the team discovered that it is possible to plant on relatively steep slopes in a manner that retains the soil when similar slopes without the preparation used would fall away. A soil-retentive grass may be planted in a manner to deliver the retention discussed. It would be in the ultimate interest of the Government to seek funding to introduce this technique to a wider community of farmers. Government may wish to conceive of a pilot project that would demonstrate to farmers the usefulness of that approach.

## **1. Project generation**

The main aims of the proposed projects are to attend to victims of the disaster, rebuild and improve destroyed and damaged assets, re-establish productive and export processes, and in general help to reactivate the process of economic and social development.

The initiatives presented here are a list of investment project ideas that may be developed as project profiles that may address activities aimed at developing some aspect of the national vulnerability. Each profile will subsequently be analysed in depth in order to draw up definitive projects and prioritize them so as to design repair and reconstruction programmes. This will make it possible firstly to improve the living conditions of disaster victims and recover the material and economic losses stemming from the October landslides and floods: secondly to enhance the design standards in use prior to the disaster, and thirdly, to carry out works and establish mechanisms to control and mitigate the enormous damage caused by hurricanes and floods.

It should be mentioned that in regard to the main physical damage caused by the rains, was to infrastructure and agriculture and livestock production facilities. The after effects are not limited to such losses, however, since the initial damages unleashed a multiplier effect with serious economic and social consequences; rural populations lost their housing, livelihoods and access to public services and were subjected to other equally serious hardships stemming from environmental and sanitary crises, in addition to food shortages.

As a result, many victims that were already poor prior to the floods were left in a worse condition of poverty, not to mention trauma. The support of Government and the International community may very well focus on addressing the social and economic problems as described above and in preceding chapters.

To carry out the projects efficiently once they have been definitively assessed and ranked, it will be necessary to develop execution programmes so as to match resources with needs. A rehabilitation programme will have to be drawn up to deal with the emergency situations facing disaster victims, followed by a reconstruction programme to overcome economic and social adversities, restore and improve infrastructure and production facilities and prevent or reduce the effects of similar events.

## **2. Rehabilitation stage**

This initial phase will focus on normalizing the living conditions of victims, while also continuing to reactivate economic activity in the areas affected. Vital needs must be met and basic services delivered. The victims' food, health care and employment needs should take priority and should be met expeditiously through the following actions:

- Provision of food
- Provision of potable water
- Medical attention to those at risk

- Control and prevention of diseases, especially contagious diseases
- Housing repair
- Establishment of improved sanitation services
- Generation of productive jobs
- Provisional repair of access roads to affected areas
- Supply of seeds and basic inputs into farming for small and medium-scale farmers, along with soft loans and other financial support
- Repair of affected infrastructure

The suggested rehabilitation programme should be implemented as swiftly as possible, partly to meet vital and basic needs that are an ethical imperative, and partly due to the need to control and check the spread of diseases and epidemics in order to prevent hardships from becoming more acute.

### **3. Reconstruction stage**

This is the most crucial stage in economic and social terms, since it will lead to the full re-establishment of normal living conditions and the country's economic and social development momentum prior to the adverse weather conditions of October.

This phase will bring about the implementation of specific projects that are matched to resources and that can be assimilated. The main aim of the reconstruction stage and the projects thereof is to effectively overcome the direct and indirect problems stemming from the flood rains, while mitigation against a recurrence of the event takes place. For example, the approaches to bridges have been exposed as being vulnerable to the type of water that descended on them. River defenses may very well begin as a preemptive strategy in rivers identified as being vulnerable to the type of damage that was sustained.

Moreover, on designing the reconstruction programme it will be important to take into account macroeconomic principles so as to prevent the undesirable consequences of overly ambitious reconstruction programmes. These include inflation, dislocations in the exchange rate or in the supply and demand of certain resources such as labour and building materials or undesired and disorderly migration.

### **4. A list of projects suggested for consideration**

What follows is a list of projects suggested for funding. They arise from the discussions as raised in the document.

#### IV. Project Profiles

V.

