

## **INTRODUCTION**

### **The Meteorological Phenomenon**

A strong Tropical Wave entered the Caribbean on July 4, 2005, producing heavy showers over much of the Lesser Antilles as it moved westwards. The system developed a closed circulation during the evening and was named the fourth Tropical Depression of the 2005 Atlantic Hurricane Season at 10:00 that night. Its location was latitude 12.5° N, longitude 63.1° W, or about 160 kilometres west-northwest of Grenada, in the Windward Islands.

Further development of the system was rapid, prompting the issuance of a Hurricane Warning for the island on July 6 when it was upgraded to a Category 1 hurricane, with wind speeds of 130 km/h, at 5:00 p.m. The system further intensified to Category 2 status on July 7.

The path that Hurricane Dennis took was just as forecasted (see Figure 1), except for the rate of intensification and the speed of movement. Its centre was located approximately 60 kilometres east of Morant Point at 10:00 a.m. on July 7. Moving adjacent to the island's northeastern coastline, but remaining over the warm Caribbean waters, the centre was pinpointed at 50 kilometres northeast of Port Antonio at 1:00 p.m. and then 120 kilometres north of that town at 4:00 p.m. that day. The strengthening phase continued as Dennis became a Category 3 hurricane at 4:00 p.m. and reached Category 4 by 10:00 the same evening. By that time, it had started to move away from Jamaica and was located about 140 kilometres north of Falmouth. The Hurricane Warning was finally discontinued for the island at 5:00 a.m. on July 8, 2005.

## The Severe Weather Event

The Meteorological Service's Doppler radar first detected outer bands of showers and heavy thunderstorms during the morning of July 6, spreading from east to west across the island. There was some abatement during the afternoon; however, scattered showers and thunderstorms were again observed late that night and gradually increased in extent, duration and intensity on July 7. The hurricane continued to produce significant rainfall across sections of the island through July 8 and into July 9, 2005 (See Tables 1 and 2).

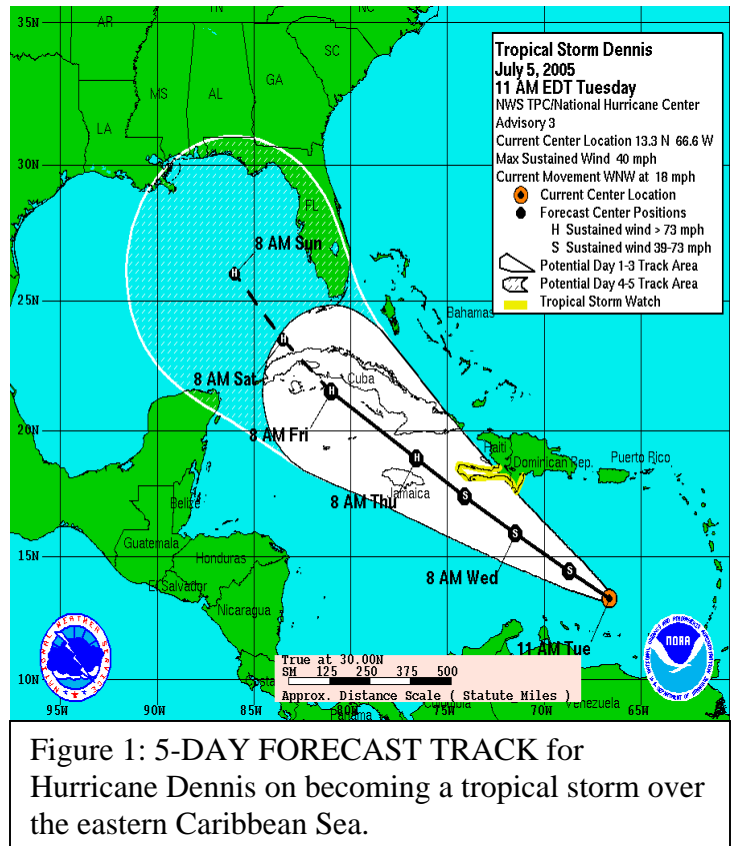


Figure 1: 5-DAY FORECAST TRACK for Hurricane Dennis on becoming a tropical storm over the eastern Caribbean Sea.

**Table 1: Comparison of Dennis' Cumulative Point Rainfall (July 6-8, 2005) with Climatological Mean**

Station/Parish	Dennis Rainfall (mm)				30-yr Mean	% of Mean
	6 <sup>th</sup>	7 <sup>th</sup>	8 <sup>th</sup>	3-day Total		
<b>St. Mary</b>						
Castleton Gardens	320.0			320.0	118	271
Brandon Hill	21.8	306.6	8.8	337.2	109	309
Industry	26.4	95.7	45.6	167.7	-	-
Long Road	31.6	332.2	6.0	369.8	-	-
<b>Portland</b>						
Comfort Castle	-	357.6	2.3	359.9	-	-
Moore Town	-	258.4	40.5	298.9	395	76
Plantain Garden	54.8	197.8	0.4	253.0	166	152
Shirley Castle	-	408.0	108.0	516	85	607
Spring Garden	-	159.2	11.0	170.2	131	130
<b>St. Thomas</b>						
Amity Hall	2.7	298.4	61.3	362.4	160	227
Morant Bay	16.0	261.4	21.0	298.4	137	218
Norris	40.3	343.5	6.9	390.7	-	-
Ramble	28.6	325.0	0.0	353.6	196	180
<b>Kingston/St. Andrew</b>						
Constant Spring	24.0	370.0	0.0	394	108	365
Golden Spring	41.2	393.1	0.0	434.3	-	-
Lawrence Tavern	30.0	287.0	7.5	324.5	147	221
Mavis Bank	84.0	497.6	41.6	623.2	62	1005
Mona	61.7	280.0	19.0	360.7	57	633
Norbrook	27.1	340.4	14.2	381.7	-	-
N. Manley Int'l Airport	11.9	296.6	3.4	311.9	40	780
Rose Hill	75.0	367.8	17.6	460.4	128	360
<b>St. Catherine</b>						
Bybrook	8.0	155.5	36.0	199.5	152	131
New Works	14.0	222.0	22.5	258.5	178	145
Swansea	11.1	230.2	67.0	308.3	121	255
Worthy Park Estate	10.0	140.0	50.0	200.0	118	169
<b>Clarendon</b>						
Beckford Kraal	9.0	218.0	17.1	244.1	124	197
Rock River	20.3	265.2	23.4	308.9	107	289
Thompson Town	5.2	224.0	62.0	291.2	154	189
Trout Hall	254.0		0.0	254.0	138	184

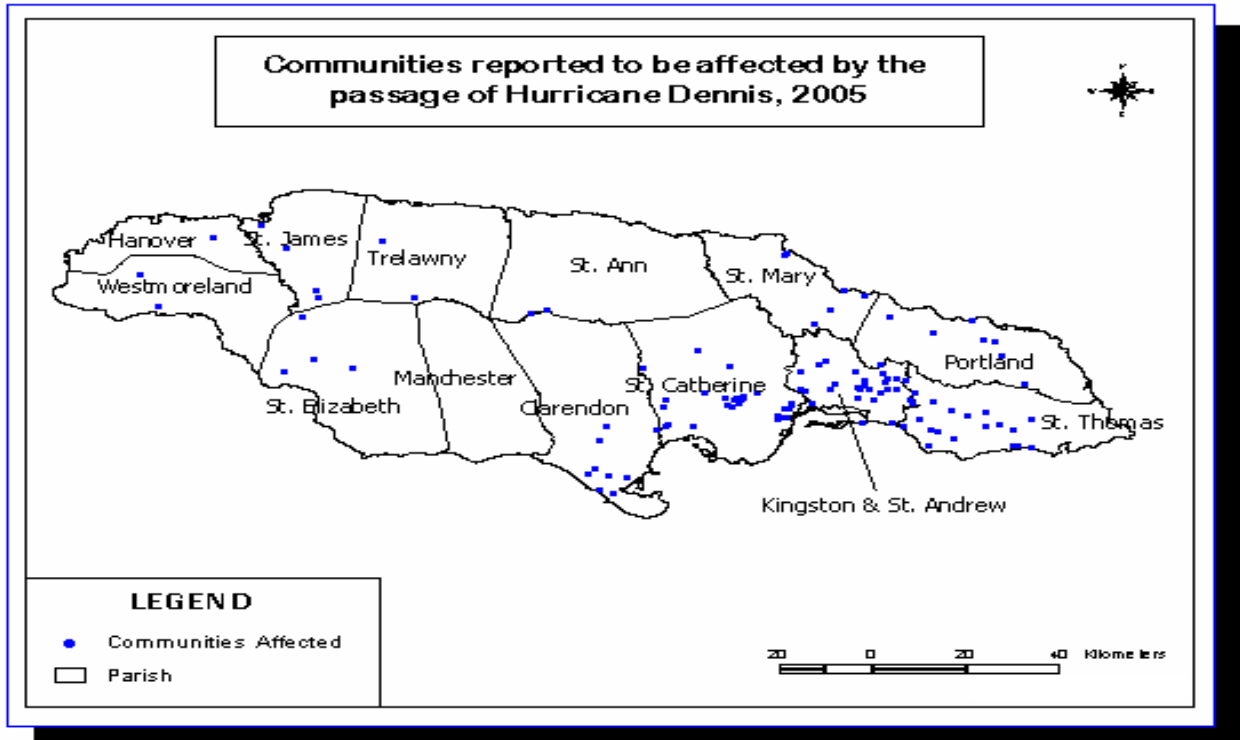
**Table 2: Comparison of Highest One-Day Rainfall Totals (mm) on July 7, 2005 with Climatological Return Periods for Selected Parishes**

<b>Parish/Station</b>	<b>Highest 24-hour Total</b>	<b>2-yr</b>	<b>5-yr</b>	<b>10-yr</b>	<b>25-yr</b>	<b>50-yr</b>	<b>100-yr</b>
<b>St. Mary</b>							
Castleton	306.6	175	270	335	415	475	535
<b>Portland</b>							
Moore Town	258.4	232	340	412	502	569	635
Shirley Castle	408.0	269	381	455	548	618	687
<b>St. Thomas</b>							
Morant Bay	261.4	158	225	270	326	368	409
Ramble	325.0	148	249	317	402	465	527
<b>Kingston/St. Andrew</b>							
Constant Spring	370.0	137	221	279	351	404	460
Mavis Bank	497.6	139	242	313	400	465	529
<b>St. Catherine</b>							
New Works	222.0	133	185	234	296	342	388
Worthy Park	140.0	118	187	233	291	334	376
<b>Clarendon</b>							
Rock River	265.2	129	176	220	276	318	358
Thompson Town	224.0	135	177	218	269	307	345

## **EMERGENCY ACTIONS**

The Emergency Operations Center of the Office of Disaster Preparedness and Emergency Management began search and rescue operation on July 7 for sections of the island which were under threat from rising waters, covering communities in Clarendon, St. Thomas, St. Andrew, St. Catherine and Kingston. In the days following, four medical evacuations and aerial reconnaissance damage assessment flights were also undertaken. Welfare items were delivered by trucks to the parishes of St. Thomas, Portland and St.

Catherine and the Jamaica Defense Force assisted with food drops to marooned communities in the parishes of St. Andrew and St. Thomas.



By 11 July, 5 days after the disaster occurred, six shelters remained open in four parishes and housed approximately 299 persons, down from 66 shelters housing three thousand and fourteen (3 014) persons on July 8, 2005. Approximately 70% of persons housed were located in the parish of St. Thomas. The Ministry of Health (MOH) reports that a 35 year old male was washed away and drowned due to flooding in Georgia, St. Thomas.

## SUMMARY OF PRELIMINARY ESTIMATES OF DAMAGE AND LOSSES CAUSED BY HURRICANE DENNIS

Based on preliminary assessment, the impact of Hurricane Dennis on Jamaica amounted to \$2 128.60 million dollars or US\$34.50 million. Of this total, \$1 586.03 million refers to direct losses while \$542.58 million refers to indirect losses. A summary of preliminary costs is shown in the table below:

**Table 3: Preliminary Costs of Damage and Losses caused by Hurricane Dennis (J\$ Million)**

Sector and Sub-sector	J\$ million		
	Direct	Indirect	Total
<b>Total</b>	<b>1 586.03</b>	<b>542.58</b>	<b>2 128.60</b>
<b>Social</b>			
Housing	180.10	n/a	180.10
Education and Culture	n/a	n/a	n/a
Health	27.60	21.90	49.50
<b>Productive</b>			
Agriculture and Livestock <sup>1</sup>	450.00	n/a	450.00
Mining	n/a	n/a	n/a
Tourism	n/a	n/a	n/a
Manufacturing - Cement	18.30	30.40	48.70
<b>Infrastructure</b>			
Electricity	20.00	50.00	70.00
Water Supply and Sanitation	140.00	n/a	140.00
Transport/Roads and Bridges	704.40	379.00	1083.40
Telecommunications	30.20	n/a	30.20
Airports <sup>2</sup>	0.43	0.13	0.55
<b>Environment</b>			
Forestry	15.00	n/a	15.00
Waste Management	n/a	45.00	45.40
<b>Emergency Operations</b>	n/a	15.75	15.75

n/a: not available

**1 – Includes some indirect costs which we are not yet able to disaggregate.**

**2 - Donald Sangster International Airport only**

## **SOCIAL SECTORS**

### ***Education***

The Ministry of Education, Youth and Culture has not yet completed an assessment of the damages sustained. However, the Ministry has reported that the Content Gap All Age School has suffered roof damage. There were no other reports of significant damage to school buildings, however many reported leaking.

### ***Housing***

Some 121 communities island-wide, many of which are located in St. Thomas, St. Catherine, Clarendon, Kingston and St. Andrew, were affected by flooding and landslides. To date, approximately 6 000 households were reportedly in need of housing assistance. Using the average household size of 3.7 persons (Population Census 2001), it can be seen that there are approximately 22 200 such persons needing assistance.

### ***Health***

Approximately \$49.5 million of damage and losses was incurred by the health sector 56.0 per cent of which is categorized as direct damage. Some \$3.2 million related to damage to health infrastructure and equipment while the estimated cost of latrine replacement was \$17.0 million. Importantly, there was no loss of vaccines or pharmaceuticals.

## **PRODUCTIVE SECTORS**

### ***Agriculture***

This sector has the second highest level of reported damage which was set at \$450.0 million. Domestic crop (vegetables, roots and tubers) accounted for the bulk of the loss. Also included in this amount is \$60 million in damage to banana plantations; \$153.0 million for coffee; and \$30 million for cocoa.

## **Sugar**

No estimate of damage has yet been received for sugar cane. Hurricane Dennis is however likely to have limited impact on the sugar industry because the areas most severely affected account for a relatively small portion of the island's sugar cane production.

## **Citrus**

No estimates of damage are yet available. While the hurricane affected some citrus growing areas, the largest growing areas were not in the path of the storm.

## **Livestock, Dairy, and Poultry**

No estimates of damage for livestock and dairy are available but the main poultry producers report inconsequential damage.

## ***Mining & Quarrying***

The Jamaica Bauxite Institute has reported that there was no direct damage to the bauxite/alumina sub-sector as a result of Hurricane Dennis. WINDALCO, however, reported lost output of about 10 000 tonnes due to flooding at some of its facilities. There is no detailed assessment of damage to Quarrying activities.

## ***Tourism***

No estimate of direct damage to hotel infrastructure was reported. There were reports of damage to the Berrydale Rafting Attraction (loss of bamboo rafts and flooding of beaches) in Portland. However, no estimates of the direct or indirect damage cost to this facility have so far been compiled. Indirect cost might have been incurred by some hotels as stay was extended for some visitors at reduced or no costs. Damage to road network resulted in inaccessibility to some hotels and villas.



### ***Manufacturing***

In the manufacturing sector, the report of damage related only to cement production. The total estimated cost of damage to the firm was \$48.7 million. This is comprised of \$18.3 million direct costs.

- Desilting - \$14 million
- Community Cleanup - \$3 million
- Cleanup on Plant & Quarry - \$300,000

The indirect costs of \$30.4 million represented foregone production of cement, clinker and gypsum.

Feedback from some manufacturing companies indicated that they activated disaster management plans in their organizations and so minimized damaged.

## **Infrastructure**

Based on the preliminary assessments, infrastructure suffered the greatest level of damage. This was most noticeable with respect to roads and bridges.

### ***Public Utility Systems***

Prior to the arrival of Hurricane Dennis, the Jamaica Public Service Company announced that, given the magnitude of the hurricane, it would not have been necessary to disconnect power supplies. The company however responded to developments during the storm as was necessary to prevent danger to life and property. Most communities retained power supplies during and after the event. Water supplies also remained in tact in most areas.

### *Electricity*

The Jamaica Public Service Co. estimated damage at approximately \$70.0 million, \$20.0 million of which was categorized as direct costs and were associated with the damage to the electricity generation, transmission and distribution facilities.

Approximately 100 000 customers lost electricity supply island-wide. The most affected areas are shown on Table 4.

**Table 4: Areas Most Badly Affected by Loss of Electricity**

<b>Parish</b>	<b>Number of Customers Affected</b>
Kingston & St. Andrew	41 000
East Kingston & St. Thomas	25 000
Portland	17 500
St. James	6 000

As at Tuesday July 12, 2005, electricity was restored to approximately 95 000 customers.

### *Water Supply and Sanitation*

Most water supply systems in the National Water Commission's Eastern Division (St. Mary, Portland, St. Thomas, Kingston, St. Andrew, St. Catherine and Clarendon) were either damaged or disrupted as a result of Hurricane Dennis. The Western Division fared much better as fewer systems in this region were affected. Preliminary estimates of damage sustained by NWC's systems amounted to \$140 million.

### *Telecommunications*

Cable and Wireless has set preliminary estimates of damage caused by the hurricane at \$30.2 million. The breakdown is shown in Table 5.

**Table 5: Damage to Telecommunications**

<b>Nature of Damage</b>	<b>Amount (J\$ million)</b>
Telephone Network	8.5
Radio Equipment	11.5
Transmission & Distribution	10.2

The company reported that it is still unable to gain access to a few remote locations. No reports of damage or loss were received from the other service providers.

### *Transport, Roads and Bridges*

Severe flooding resulted in major damage to roads and drains across the island. Estimates of damage for parochial roads in 11 parishes amounted to \$704.8 million. While the actual cost of damage to major roads and bridges under the control of the National Works Agency are not yet available, an amount of \$379 million is required for reopening and temporary restoration of roads and bridges in 13 affected parishes.

### *Airport, Ports, and Industrial Facilities*

No estimates of damage have been received for the **Norman Manley International Airport**. However, preliminary estimates for the **Donald Sangster International Airport** are put at \$0.55 million. This amount is comprised of approximately \$0.42 million in Direct Damage to airfield/approach, lightening facilities and air conditioning equipment caused by high winds and heavy rainfall. Indirect costs were estimated at \$0.13 million. These were incurred primarily to cover labour used to protect assets prior to the storm and post-hurricane clean-up activities.

The **Port Authority of Jamaica** reported that an island-wide survey revealed that there was no damage to its property, plant and equipment

## **ENVIRONMENT**

Estimates of damage and losses to the environment are still being calculated. Some details of damage and losses sustained include landslides and debris flow, destruction of sewage treatment plants in Yallahs; destruction of pit latrines, and an oil spill in the Kingston Harbour.

### *Forestry*

Preliminary estimate of damage to forests amounted \$15 million. Loss related mainly to damage to infrastructure due to failure of retaining structures, and damage to plantations including breaking and toppling of timber stock and newly established stands.

## **CONCLUSION**

The data presented above do not reflect the full extent of the damage occasioned by the hurricane. The assessment is limited by the inability of some agencies to gain access to some of the most affected areas particularly in St. Thomas, Portland and parts of St. Andrew which remain impassable due to severe landslides and breakaways. Despite this, the early indication is that physical infrastructure, namely roads and bridges took the brunt of the damage. Because of the relatively quick restoration of the utilities in most of the country, dislocation of the general population was minimized. However, the population in the most affected areas continues to be inconvenienced.