SECTION II

DAMAGE ASSESSMENT

With respect to the damage assessment, some agencies had plans in place and were better able to respond to requests for damage assessments. Damage assessments would have been prepared earlier and in a more coherent fashion if arrangements had been made for the collection of assessment information prior to the disaster Many agencies indicated that their work could have been simplified if forms had been developed and made available prior to the event.

While many of the agencies produced credible disaster assessments, there were some areas where information was not collected in as detailed a manner as would have been required to inform decisions and recovery actions The area in which this was most apparent was in the assessment of damage to buildings While costs were indicated, the actual detailing of the damage which occurred was very general and did not indicate specific damage which occurred. Attempts were made to rectify this approach to the collection of data when detailed forms for damage assessment were prepared for allocation of funds for repair.

It is very evident that the agencies which had disaster plans in place recognised that they were responsible for the preparation of disaster assessments, and some of these agencies had begun preparation of their assessments before any requests were made for assessments. Like the territorial plans, however, the agency Disaster Plans emphasised response activity as opposed to post disaster activity, and mitigative measures
(SEE TABLE OVERLEAF).

AGENCY	DISASTER PLAN PREPARED		DISASTER ASSESSMENT PREPARED	
	YES	NO	YES	NO
Department of Education				
Health Department	✓		✓	
Department of Civil Aviation	✓		✓	
Ports and Marine		✓	✓	
Electricity Corporation	✓			✓
Department of Agriculture	✓		✓	
Department of Fisheries		✓	✓*	
Water and Sewerage Department	✓		✓	
Conservation Department		✓	✓	
Public Works Department		✓		
National Parks Trust		✓	✓	

*** Prepared as part of Department of Agriculture's Assessment**

DAMAGE ASSESSMENT

Types of Information Collected

It is very clear that a number of agencies recognised the need to collect and collate information after the hurricane This is evidenced by a number of reports which were prepared, particularly by Government Agencies What is very evident is that the motivating factor for the preparation of these reports was that they were required if aid was to be requested

The reports produced varied significantly in terms of content and estimates Some detailed information in a precise and objective manner Some were very subjective and information collected seemed to vary considerably.

The whole process and methodology for the collection of damage statistics, the collation of the information, as well as the verification of the accuracy of the data collected was developed as a response to the event and as a result the information collected was not standardised or as useful as it could have been

Some agencies viz Conservation Department and the Natural Resources Department experienced difficulty in the process of quantifying their losses This was mainly because there are no established techniques for quantifying certain environmental losses without long-term monitoring In addition for certain categories of losses, only qualitative assessments could be made

The following is a synopsis of the types of assessments made by the various agencies

AGRICULTURE

As with most agencies preliminary as well as final reports were prepared by the Department of Agriculture The preliminary assessment for agricultural losses was determined to be of $3,961,800.00 This estimate included damage to the Agricultural Station as well as structural damage to infrastructure - dams, feeder roads etc.

Subsequent to this a more comprehensive report was prepared by the department This report explained the methodology used, classified farmers by categories, and tabulated the information by zones. The estimated damage for all categories of farmers was $736,346 as opposed to the original loss estimate of approximately $2.9 million dollars The final report only dealt with losses to farmers and did not include structural damage or damage to the Agricultural Station. Neither report focused on the causes for the damage The Table below indicates the final figures provided by the Department of Agriculture for losses to farmers and backyard gardeners

CATEGORY	CROP FARMERS		LIVESTOCK FARMERS		POULTRY FARMERS		TOTAL	
	NO	VALUE	NO	VALUE	NO	VALUE	NO	VALUE
1	89	$396 046	23	$13,540	2	$16,400	114	$425 986
2	52	199,575	25	34,148	2	1,287	79	235,010
3	24	33,625	1	200	-	-	25	33 825
4	11	32,850	-	-	-	-	11	32,850
5	16	8 675	-	-	-	-	16	8,675
	192	$652,771	49	$47,888	4	$17,687	245	$736,346

Categories classify farmers based on their dependence on farming as a source of income and time spent on the farm All farmers reporting damages had been classified into the following five (5) categories.

Category 1:	Full time farmers and /or dependent to a large extent on farming as a source of income.
Category 2	Part time farmers but spend considerable amount of time on the farm. Farming is a subsidiary source of income.
Category 3	Very keen backyard gardeners Spend quite a bit of time in the garden Gardening substitutes food bill
Category 4	Backyard gardeners. Pursue gardening as a hobby.
Category 5	Negligible interest Have a few trees in the yard

The department expressed the view that there was some difficulty in verifying damage, as part of their approach was to request damages from farmers and then verify the information by field checks and interviews

FISHERIES

The Fisheries Division which fell under the aegis of the Department of Agriculture also prepared a damage assessment for Fisheries In this instance the final estimate which was $414,695 was less than the preliminary estimate by $78,000 The following Table indicates the losses in this area

FISHERIES DAMAGE ASSESSMENT

Boats Damaged/Lost	Engines Damaged/Lost	Pens/Pets Damaged/Lost	Fish Pots Lost
23	15	8	3402

Tortola experienced the most damage accounting for 52% of the losses Of the fish pots lost Tortola also recorded loss of 1876 pots which were more than 50% of those lost

Of the boats damaged or lost, 13 were located in Tortola, 5 were located in Virgin Gorda with the rest bei located on Anegada, Salt, Peter Island and Jost Van Dyke. Of the fish nets lost, 55% (1872) were located Tortola, 21% (731) were on Anegada

This report was restricted to cost assessment only, no assessment was made of causative factors This assessme indicated that the reason for the collection of the information was to assist in arriving at compensation which cou be given to fishermen.

The information was collected by telephone, interviews, visits and from district representatives.

CONSERVATION DEPARTMENT

The Conservation Department which was responsible for assessing environmental damage limited itself to dama assessments of Coastal Areas in Tortola and Beef Island Emphasis in this report was not placed on quantitati assessments It was reported that damage was sustained on all coasts of Tortola and Beef Island with the greate damage being experienced on the south coasts. Beaches had been eroded between 5 and 10 yards inland

It was also estimated that some 40% of the mangrove area has been wind damaged While mention was mac of the fact that some of the coral reefs had been damaged, no surveys had been carried out up to the time reporting The view was expressed that based upon experience from other islands, damage to the reefs cou have ramifications for coastal beach changes

This report did attempt to examine causative factors for the damage which occurred The major reasons cite for damage were sand mining, non protection of bulkheads and location of coastal roads, primarily Drakes Highwa

This report attempted to outline post disaster lessons and suggested some mitigative measures The significa measures recommended were as follows -

1 That the existing 50ft building reserve from high water mark was inadequate and that there should be revision of the setbacks
2 That the rebuilding of the Highway should be carefully studied and that Highway planning should take account of Mean Sea Level (MSL) rise
3 That individual reclamations should be reviewed as many of them were not completed within a short tim after approval
4 That predicted sea level rise has implications for new reclamations and the existing Land Development Control Authority Guidelines should be amended to reflect this development
5 Sand mining in back areas should be prohibited for beach conservation
6 That mangrove areas should be conserved

Subsequent correspondence indicated monetary estimates for some of the environmental damage These estimates were limited to costs for transportation, clearing and replanting projects as it was indicated that "it is impossible to place a monetary figure on most of the damage As regards most of the environmental damage it is best to let nature recover at her own speed" *

An estimate was made by this department with respect to the protection of Drakes Highway This estimate was for $4 million dollars for protection of the highway with a rock revetment 3 - 5 ton armour units over a stone filter

Subsequent to the damage assessment prepared, this department was allocated $29,000 for conservation damage and proposed a number of measures for the following activities -

- Monitoring of post hurricane activity
- Coastal revegetation
- Territory wide replanting programme
- Public awareness of environmental damage and the lessons to be learnt from the disaster

* **Correspondence from Conservation Officer to the Chief Physical Planning Officer dated September 27th, 1989.**

NATIONAL PARKS TRUST

The report of the National Parks Trust expressed the dilemma of assessing natural heritage and aesthetic value, but assessed structural damage to park sites and replacement value of mature trees and other vegetation It was indicated that Hugo disrupted programmes being carried out by the Trust

Of a total estimate of $371,175 some $325,375 were losses incurred on Virgin Gorda Of this, $315,000 was reported as lost real estate

Of note were the comments on the damage of the Wreck of the Rhone marine Park It was reported that the hurricane had shifted bottom sediments which revealed previously buried artifacts which were being removed from the park site Assessment of replacement value was deemed impossible It was suggested that quantifying the loss to the national parks system with respect of loss of biological productivity would require long-term monitoring and related resources which could cost $100,000

This was one of the few reports that considered damage to the smaller outer islands although at the time of reporting data was not available for four (4) of the islands

PORTS AND MARINE SERVICES

A comprehensive report was prepared on damage to ports and marine services The total cost of repairs and replacement amounted to $131,000, with all of the jetties on the island being damaged. Three (3) of the jetties needed replacement and in one instance, the Jost Van Dyke jetty, work had already started, but was aborted because of the storm surge damage.

In the case of the Port Purcell Mooring Post and the main jetty in Road Town, there were structural deficiencies in these jetties and Hugo caused them to be non functional It was therefore necessary to effect quick repairs to ensure service prior to carrying out extensive works on these facilities (See Table overleaf)

DAMAGE ASSESSMENT

Ports & Marine Services

FACILITY	LOCATION	DAMAGE	COST TO REPAIR/RE-PLACE	RECOVERY MEASURES INCL. MITIGATIVE MEASURES	REASON FOR DAMAGE
Main Dock	Port Purcell	Undermined and weakened by wave action	Temporary repairs $10,000.00	Mitigation measures included in Port redevelopment	Wave damage
Mooring Post	Port Purcell	Destruction of storebund coursing undermining	$5,000.00	Rebuilt with stronger specifications, e.g. bracing, anchoring and insitu cast concrete	Wave damage
Office Building	Port Purcell	Window & structure (wooden building)	$10,000.00	Restored to orig. condition. No mitigative measures	Structural stress from wind
Main Jetty	Road Town *	Undermining wharf docking collapsed	$15,000.00	Replacement of fill. No mitigative measures	Wave damage. Pile settlement and jetty sunk subsidence
Ferry Terminal	West End	Roof Damage	$5,000.00	Building restored	Wind damage
Jetty	Trellis Bay *	Piling undermined Wharf weakened	$10,000.00 for removal of old jetty	First dock wooden replaced by concrete pile and dock - restored.	Needed replacement prior to Hugo
Jetty	Anegada		$25,000.00		The bund was breached by excessive wave, sea and swell action
Jetty	Jost Van Dyke *		$5,000.00	None	Needed replacement prior to Hugo
Jetty	Salt Island *	Piling destroyed and Jetty carried away	$36,000.00	Jetty replaced	Needed replacement prior to Hugo
Navigational Aids		Buoys dislodged - dragged from position and beached	$10,000.00		

* Major works were subsequently carried out on these jetties with some being completely rebuilt.

Office buildings related to jetty use and one warehouse at the port were damaged. Most of the damage wer to roofs, and much of this damage occurred because the structures were not designed to withstand hurricane forc winds.

DAMAGE ASSESSMENT

Electricity Corporation

LOCATION	DAMAGE	COST TO REPAIR/RE-PLACE	RECOVERY MEASURES INCL. MITIGA-TIVE MEASURES	REASON FOR DAMAGE
Tortola and Virgin Gorda	Damage to transmission lines	$1,000,000.00	Replacement of damaged distribu-tion and transmis-sion system.	Wind velocity

ELECTRICITY

The electrical distribution system suffered severe damage with a final cost of $1 million dollars worth of damage This figure does not include loss of revenue during the period of disruption by the hurricane. The original estimate: of damage were approximately $650,000.00 for damage to equipment, lines, replacement of poles and labour costs The areas which experienced most damage were Doty and along Ridge Road. These areas are some of the mos exposed hillside areas in the B.V.I. Although there was no detailed written plan for post disaster operations thi department operated efficiently and effectively and was able to restore power to the entire territory within twc (2) weeks.

One major problem experienced by the electricity department in its recovery measures was that after intensive work its linesmen were suffering from exhaustion and replacements were needed. The replacement workers had to be recruited from other Caribbean Islands.

WATER AND SEWERAGE

The total loss incurred by the Water and Sewerage Department was $121,870.00. The losses recorded for actual repairs to water and sewerage facilities amounted to $36,870.00. Much of the cost of damage was for repair of access roads to reservoirs with $55,000 of the total damages being allocated to this use. The major losses recorded with respect to water lines were in areas located along the coast line. In one instance a 70 foot section of 6" cast iron water line along Blackburne Highway between Beach Club Terrace and the Fisheries Company was washed out by the sea and broken. The main reason for this was because of poor construction techniques as well as inadequate location of the pipelines. *(See Table on Page 21).*

One major factor in the delay in the assessment of the Water Department was the lack of electricity as some of the systems required electrical power for their operations. Some assessments of damage could not be made until power was returned. Since that event, the Water and Sewerage Department has tried to make their operations independent of electricity during disaster through the installation of a generator.

Although a damage assessment report was prepared by the Water and Sewerage Department it did not address factors which could mitigate against damage in the event of hurricanes. The Department does recognise the need for mitigative action and has indicated that proper location of its facilities could reduce the impact of future hurricanes on them.

DAMAGE ASSESSMENT

Water & Sewerage Department

FACILITY	LOCATION	DAMAGE	COST TO REPAIR/REPLACE	RECOVERY MEASURES INCL. MITIGATIVE MEASURES	REASON FOR DAMAGE
Access Road to Reservoir	Carrot Bay	Road surface destroyed	$50,000.00	Upgraded and repaved	Did not have
Access Road to Reservoir	Long Bush	Road surface destroyed	$5,000.00	None	Unpaved
Sewerage trenches	Huntum's Ghut, Purcell	Water damage and debris	$30,000.00		Project was in progress when Hugo struck
Pipeline cover	East End Maya Cove	Lines washed out	$6,000.00	Pipes anchored in reconstruction	Poor construction and inadequate location
Repeater Communication System	Peter Island	Blown down	$870.00	A different repeater station is being used now	Inadequate location
			$121,870.00		

TELECOMMUNICATIONS

Cable and Wireless West Indies Ltd. provided estimates of expenditure to return their system to pre hurricane conditions with their total estimate being $1,152,000.00 Of the total amount 26% of the estimated cost was for replacement of external line plant, such as cables and poles. *(See Table below)*

The other major expenditure associated with the replacement of telecommunications facilities were related to damage to ongoing capital projects, in this instance the repairs to the Telephone Engineering Centre (TEC) site at Palestina, and damage to buildings.

While the estimates did provide costs for management and wages, it did not take into account lost revenue resulting from hurricane damage. Although there was damage to the telecommunications system, the telephone system functioned very well during Hugo This was largely because the Company had installed underground cables one year before the hurricane.

TELECOMMUNICATIONS - CABLE & WIRELESS W.I. LTD.

FACILITY	LOCATION	TYPE OF DAMAGE (1)	COST TO REPAIR/ REPLACE	RECOVERY MEASURES INCLUDING MITIGATION MEASURES (2)	REASONS FOR DAMAGE
External Line Plant	Entire territory	Downed & damaged poles: Broken cables	$307,000.00	Most lines now underground	Wind
Customer Apparatus (Telephones, PBX's etc.)	Entire territory	Electrical & Mechanical damage	$20,000.00	Replacement	Lightning & Water
Incomplete Capital Project TEC	Palestina	Flooded basement	$60,000.00	Flood mitigation measures instituted	Flood hazard
Equipment, Towers Bldgs.	Chalwell	Damage microwave disks & towers	$130,000.00	Replaced and repaired	Wind exposure
Damage to buildings	Georges Yard Brandywine	Roof and general site damage	$150,000.00	Roof replacement strengthening	Wind and water
Damage to boats & vehicles		Water and wind blown missiles	$50,000.00	Replaced and repaired	Wind and Water
Damage to Power Plant		Water damage	$50,000.00	Repaired	Water
	Entire territory	NA		Increased hurricane awareness to staff	NA
		TOTAL	$1,152,000.00		

DAMAGE ASSESSMENT

Health

FACILITY	LOCATION	DAMAGE	COST TO REPAIR/RE-PLACE	RECOVERY MEASURES INCL. MITIGATIVE MEASURES	REASON FOR DAMAGE
Peebles Hospital	Road Town	Awning destroyed	$5,000.00	Replacement with wood & galvanise, designed to withstand hurricane	Inadequate structure
Peebles Hospital	Road Town	Air-conditioning duct	$4,000.00	Replaced with metal duct	
Peebles Hospital	Road Town	Wall damage - wind blast damage	$12,000.00	Aluminium roll-down hurricane shutter installed - $85,000	No protective features in place
Cane Garden Bay Clinic	Cane Garden Bay	Damage to glass windows	$4,500.00	Glass louvres replaced with aluminium windows	Inappropriate material
Long Look Clinic	Long Look	Damage to roof overhang	$150,000.00	Replaced and appropriately secured	
			$175,500.00		

HEALTH

The Health Department recorded damage to the Peebles Hospital as well as two (2) clinics, one at Cane Garden Bay and the other at Long Look Clinic The damages to Long Look Clinic which was to the roof amounted to some 90% of the total damage to the health facilities

The total damages recorded to health facilities were $165,000 00 It is to be noted that much of the damage to the health structures was because no protective features were in place Several mitigative measures have since been taken to secure the hospital as well as to repair the clinics *(See Table on Page 23)*

While the Environmental Health Department did not carry out a specific damage assessment they indicated that the major environmental health problems were those associated with mosquitoes because of flooding, as well as overflowing and seepage from septic tanks and pit latrines It was indicated that the latter problem was related to poor design standards and the view was expressed that there was a need for design standards for cisterns, septic tanks and pit latrines in order to prevent contamination of water and spread of disease

AVIATION

The Civil Aviation Department recorded damages of a little over $15,000 00 00 The major costs incurred were because of damage to navigational aids This was primarily due to wind speed Since Hugo, nylon ropes are used to secure these aids It is expected that these ropes will withstand hurricane force winds

Buildings such as the Airport Terminal Building and the Airport Freight Shed experienced damage to their roofs. This was largely because of poor design standards. Damage to the Airport Control Tower and its equipment was largely because of poor maintenance practices in that some glass panes of the Tower were cracked prior to Hurricane Hugo While there was a disaster plan for the Airport, this was a limited plan which emphasised procedures for the shut down of the Airport The plan is presently being revised so that it could include all aspects of disaster management including the use of mitigative measures *(See Table on Page 25)*

DAMAGE ASSESSMENT

Civil Aviation Department

FACILITY	LOCATION	DAMAGE	COST TO REPAIR/RE-PLACE	RECOVERY MEASURES INCL. MITIGA-TIVE MEASURES	REASON FOR DAMAGE
Airport	Beef Island	Navigational Aids	$9,165.00	Use of nylon ropes to secure Aids	Wind
Airport Terminal Building	Beef Island	Damaged roof and ceiling tiles	$1,918.12 +$1,056.00	Repairs to roof. Replacement of tiles	Type of structure
Airport Control Tower	Beef Island	Damage to Tower and equipment	$1,800.00	Repairs to Tower and equipment	Cracked panes in Tower
Airport Freight Shed	Beef Island	Roof Removed	$1,394.00	Replacement of roof	Old structure not in good condition
			Total cost $15,333.12		

HOTELS

Total estimated damage to hotels in the B V I amounted to some $12,000,000 with damage to one of the hotels on an outer island (Peter Island) estimated at some $8,000,000 dollars The damage to hotels amounted to 30% of the total damage estimated for built development from Hurricane Hugo in the B V.I The major impact on hotels with the exception of that on Peter Island, occurred on Tortola with the hotels located on the coastal areas experiencing the most damage The hotel on Peter Island was so severely damaged that it remained closed for a period of fifteen months In carrying out restorative works on Peter Island it was pointed out that the beaches presented the greatest problem It was necessary to install gabion baskets in key positions in order to hold the sand It is to be noted that the hotel on Peter Island now has a Disaster Plan in place which was prepared in collaboration with the Office of Disaster Preparedness.
Insurance claims for hotels ranged from $14m dollars to $200,000 The highest paid claim for hotels was $8,000,000.

The major reasons which were given for the damage experienced by the hotels were:-

1 Location of development in relation to the path of the hurricane
2 Poor construction standards in some instances
3 Locational criteria with respect to one hotel located on an outer island

Roof damage was extensive in a number of hotels While there was concern with damage to hotels and a tourism consultant co-ordinated the collection of information with respect to the impact of the hurricane on the Tourism Industry there did not seem to be any mechanisms in place prior to Hugo to carry out this kind of assessment

DAMAGE TO HOUSING

When Hugo occurred there were 3,200 dwelling units on Tortola. It was estimated that 30% (960) of all of the units were damaged with 10% (96) of these dwelling units experiencing severe damage, that is damage of $80,000, 40% (384) experienced moderate damage, that is, damage of $15,000 and 15% (480) suffered minor damages, i e $2,500 or lower The total damage estimated for the dwelling units was $14,640,000

One noticeable feature of the assessment prepared for this area was that 75% of the damage which occurred was to the roofs of the buildings The report of this group provided some analysis with respect to the concentration of damage and noted that concentration of damage was evident at West End/Long Bay area extending in an easterly direction to Cane Garden Bay and on higher slopes, crests and low lying areas

The report also recommended that future planning and development guidelines consider property damage risks in relation to the siting of buildings in exposed areas and indicated that residential structures on higher hillsides, ridges and low-lying beach areas are particularly vulnerable

The report further suggested that construction and building codes should be examined with a view of minimising future damage

DAMAGE TO COMMERCIAL DEVELOPMENT *

Damage to commercial buildings amounted to $1 5million dollars These damages included damage to buildings with consideration being taken of interior water damage where visual roof damage gave cause for interior losses. This figure does not include loss of revenue from closure of businesses while reconstruction work was taking place

*** Commercial Development is defined as bars, shops, restaurants, offices.**

EDUCATION

Eight (8) schools in the territory experienced damage during the hurricane Of these, seven (7) were located on Tortola and one on Virgin Gorda. Two (2) primary schools on Tortola experienced such severe damage that one was required to be rebuilt at a cost of $300,000 and another required approximately $260,000 Two (2) schools, the BVI High School and the Bragado Flax Educational Centre needed repairs prior to the hurricane Further to this, many of the schools had not been maintained or were poorly constructed and as a result could not withstand the impact of Hugo One school, the Enis Adams Primary School, in addition to being old and not constructed to withstand hurricanes was located on an exposed slope and was completely destroyed *(See Table on Page 28).*

Four (4) schools had to be relocated until major repairs were carried out on them. This meant that alternate sites had to be found for these schools and while rents were not charged for these facilities it was felt that some consideration should be granted to agencies which allowed their facilities to be used on a temporary basis Some $8,600 were granted for the use of the facilities

Further costs were incurred because of the dislocation of schools as extra transportation costs had to be paid because of the temporary relocation of two (2) schools

Work on minor repairs to schools started shortly after the event, however, rebuilding of schools which required substantial funding had to be deferred until arrangements for funding could be made

DAMAGE ASSESSMENT

Department of Education

FACILITY	LOCATION	DAMAGE	COST TO REPAIR/RE-PLACE	RECOVERY MEASURES INCL. MITIGA-TIVE MEASURES	REASON FOR DAMAGE
Alexandria Maduro Primary School	Alexandria Maduro Primary School	Partial roof damage	$23 000 00	Reconstruction Reinforcement to hurricane status	Inadequate construction
B V I High School	Road Town	Damage to roof	$65,000 00	Remedial work done	Repairs needed prior to Hugo
Ebenezer Thomas Primary School	Sea Cow's Bay	Partial roof damage	$18,000 00	Reconstruction reinforcement to hurricane status	Inadequate construction
Ivan Dawson Primary School	Cane Garden Bay	Partial roof damage	$6 000 00	Immediate repairs carried out Reinforcement since carried out	Inadequate construction
Inis Adams Primary School	Meyers	Totally destroyed	$300,000 00	Reconstruction with appropriate building design standards	Old building roof not well con-structed Located on exposed slope
Leonora Delville Primary School	Capoons Bay	Building partially destroyed	$260 000 00	Reconstruction with appropriate building design standards	Inadequate construction
Bellevue Primary School	Bellevue	Minor ceiling damage	$900 00		Minor damage associated with wind velocity
Bregado Flax Primary School	Virgin Gorda	Roof and ceiling damage	$45,000 00	Since upgraded	Inappropriate construction
All schools			$120,000 00	Replacement of equipment / books	Water damage
TOTAL			$837,900 00		

ROADS

Several roads were damaged, however the most impacted area by the hurricane was the area in the vicinity of Drakes Highway The Works Department carried out detailed studies on this area immediately after the hurricane See Appendix III This study assessed the damage and estimated materials required

Some pavement maintenance had to be carried out in this area to restore accessibility to the West End area In many areas roadways were affected by aftermath rains These areas were between Sea View and Fort Burt, Sea Cow's Bay and Huntum's Ghut In the Sea View area the Works Department reported that the subgrade had failed indicating that the road may not have been developed to the required standard Although preliminary figures estimated at $4 million dollars were given for repairs to sea defence works along Drakes Highway, no figure was given for overall repairs to the Highway

The Public Works Department carried out restoration works in many areas as part of their on-going work and in many instances these costs were taken as departmental spending and not related to the cost of damage from Hugo

LANDSLIDES

Two (2) major Landslides were reported by the Ministry of Works, one at Carrot Bay and one at Ballast Bay At Carrot Bay it was determined that a retaining wall costing $60,000 would be required to be built in order to rectify damage from the landslide

GOVERNMENT DEPARTMENTS

Most agencies reported on damage to their buildings The impact on Government Offices did not appear to be very great However, most noted that water and other damage to offices was because of poor maintenance

PRIVATE MARINAS AND BOATS

It was estimated that damage to Marinas and boats amounted to approximately $3,000,000 The reason which was given for damage to boats was that adequate systems were not put in place for securing them

When action was finally taken to remove and secure the boats, the methods used were so haphazard that boats were not properly secured and caused damage to adjacent vessels

The view was expressed by persons interviewed that no arrangements had been made for the marine community Given that yacht chartering is a major part of the tourist industry there is the need to develop comprehensive disaster plans for the marine community, including the identification of safe harbours for all categories of boats

IMPACT ON EMPLOYMENT

The only record of loss of employment that is available is that with reference to hotels. Immediately after the hurricane, two hundred and thirty-one (231) employees of some four hotels were reported to have lost their jobs. The largest loss of employment was sustained at Peter Island Hotel where one hundred and forty-nine (149) persons were out of work because of extensive damage to the hotel By October the number of jobs lost by hotels works had been lessened when one hotel recalled some 48 employees Although efforts were made to obtain unemployment figures, no emphasis was placed on the collection of this type of data

While there was a loss of job through damage to places of employment, there was an increase of jobs in construction activity related to repair and restoration of built development

INSURANCE

After hurricane Hugo three issues emerged in the area of insurance These were:-

1. A number of damaged properties were underinsured

2. Claims were not paid by some companies

3 There was no mechanism in place for the assessment of insurance companies in the BVI Further to the above in the aftermath of Hugo these Insurance Companies went bankrupt leaving a number of unpaid claims The result of the impact of Hugo was that measures have been put in place for the scrutiny of all Insurance Companies and standards for their operations are being drawn up.

REVIEW OF ASSESSMENT PROCEDURES

The co-ordination of the damage assessment of post Hugo was handled by the Chief Minister's Office for the National Emergency Advisory Council This was in keeping with proposals in the Emergency Management Plan for Disaster Relief Assistance. This office also provided strong leadership and was well aware of the information required in order to inform the recovery process

The process adopted was to request Government agencies to prepare damage assessment reports These reports were requested so that estimates could be prepared for requests for aid, as well as to determine priorities for action Preliminary reports were produced within three (3) days of the event. Many of the estimates of damage produced were subsequently reduced when more detailed assessments were made

ASSESSMENT PROCESS

While Government departments were asked to provide reports on damage to their individual departments, a group called the "Private Sector Survey Team" was set up to carry out an inspection tour of storm damage to the private sector of Tortola This team was also required to estimate value damage to structures including water craft The team comprised the Chief Town Planner, an Attorney and a Real Estate expert.

This survey team interviewed people, visited sites and compiled a comprehensive list of properties, provided description of the damages and estimated costs for the damages incurred Properties with extensive damage were photographed, although the whereabouts of these photographs could not be ascertained when investigations were carried out for this report.

The group assessed damages for private residences, hotels, boats, commercial properties, boatyards, agricultural holdings, docks, as well as for some government property The assessment made by this group covered so many areas that there was overlap in the collection of the data.

It would appear that apart from agencies with specific responsibilities, some assessment groups were not clear as to the areas for which they were responsible Some of this uncertainty was created because of the urgency with which the information was required It would therefore have been more efficient if all of the damage assessment groups could have been briefed at the same time. One benefit of the overlapping information though was that it was able to provide some limited verification of the information provided Further to this, processes had not been elaborated prior to the event and in the circumstances there were some inefficiencies in the collection of information

OBSERVATIONS FROM ASSESSMENTS

Several agencies prepared reports in which facilities which had been damaged during Hugo had been entirely replaced In some instances such as Trellis bay and Jost Van Dyke jetties, it was the intention to replace these jetties prior to Hugo. There was no separation of the costs from damage by Hugo and the replacement cost

Many of the reports documented dollar loss but made no attempt at determining the cause of the damage The only assessment groups which attempted to identify reasons for damage were the Conservation and Fisheries Department and the group which assessed built development

DEVELOPMENT STANDARDS

Many of the persons interviewed indicated that poor development standards and lack of maintenance, especially for Government properties were the major causative factors in terms of damage to infrastructure and built development Given the type of damage to buildings, i e. a great deal of roof damage, the fact that in rebuilding some public as well as private buildings, account was taken of the need to put in additional reinforcement. This assessment would appear to be correct

Several persons made the observation that many of the houses and buildings which experienced substantial damage were those which were more recently constructed, while the older ones withstood the impact of the hurricane with minimal damage. The reasons expressed for this were that the older buildings were designed with hurricane impacts in mind and that many persons who engaged in the design of buildings were not accustomed to designing buildings for hurricane territories like the B.V.I., and therefore did not understand the requirements for designs which could withstand hurricane impacts. It was also expressed by several agencies/persons that there was a lack of information on the required standards and that building construction was being undertaken by persons who did not have the necessary training nor experience in building construction techniques.

PREPARATION OF DAMAGE ASSESSMENT REPORT

In order to derive long term mitigation measures as a result of the impact of Hurricane Hugo, it was necessary to look at actual damage and reasons for such damage. This assessment was carried out four years after the event, and while the event itself is remembered, in some instances the agency memory was not as comprehensive as it could have been. There were a number of reasons for this. These were:-

1. Actual responsibility at the time of the event.
2. Changes made in key positions in departments.
3. Lack of availability of records.
4. Lack of participation in meetings
5. Relative unimportance in people's minds of the event after a period of four years.

The above sectors indicate the need for ongoing work on assessments immediately after the basic recovery period and the allocation of responsibility for the preparation of a final report on the event. With a Disaster Co-ordinator now appointed, the responsibility for this function should rest with this officer

SIGNIFICANTLY IMPACTED AREAS

Poor development standards did not appear to be the only reason for some of the damage which was sustained The areas in which damage was sustained appeared to be a factor in terms of the extent and type of damage which occurred The most obvious area which was heavily impacted was the coastal area which suffered widespread damage to physical infrastructure, beaches, water front property, mangrove as well as flooding and erosion.

The coastal areas are predictable impact areas. While poor construction standards would serve to exacerbate damage, the fact of being in vulnerable locations would create the conditions for damage in the first instance. In an island with limited land space options for development may have to be considered in areas which are not optimally located for development, however, stringent mitigative measures may be required for development located in such areas. It would appear that although development was located in areas that were considered vulnerable, no great attention had been paid to the measures which would make development less exposed to severe impacts. As a result some contributing factors to damage in coastal areas were because of extreme location to the sea and because of lack of observance of even minimal requirements for building lines.

RIDGE DEVELOPMENT

Impact on development in ridge areas was quite severe particularly in areas located on cliff faces. While it may be debated that the standard of development of the buildings in these areas were not such, that they could withstand wind speeds generated by Hugo, none the less, location on ridges and exposed cliff faces would make these developments more vulnerable.

PUBLIC RELATIONS

The B.V.I. is located in close proximity to the United States Virgin Islands which experienced substantial damage as well as a breakdown in law and order post Hugo. It was felt that there was no differentiation between the B.V.I. and the U.S.V.I. when events in the U.S.V.I. were reported and this impacted negatively on the return to normalcy of the tourism industry in the B.V.I. This matter was subsequently attended to, but however indicated the need for urgent elaboration of a Public Relations strategy after Hurricane Hugo, for dealing with conditions in the B.V.I.

RESPONSE TO HURRICANE HAZARDS

In response to the impact of Hurricane Hugo, the Government and some private companies in the B.V.I. have already taken a number of actions towards the introduction of mitigative measures in various projects. The range of projects and activities, especially those directed at training indicate serious commitment to a mitigation programme. The Disaster Preparedness Office needs financial and technical support in carrying out all of these activities.

The Projects are -

1. **Drakes Highway Sea Defence project** which involved the construction of a rip-rap type seawall along a portion of a south coastal road in Tortola which experienced severe damage during Hugo.

2. **A Study of Climate Vulnerability of OECS Sea Ports.** This is a study of the vulnerability of the OECS ports including those in the BVI to determine what magnitude of wave impact port structures can stand. The study will also provide information relating to the cost of upgrading facilities to withstand a 50 year or a 100 year hurricane. It is hoped that the information regarding cost and the nature of the required retrofit works that funding can be obtained for these works through donor agencies or amortization of the costs by tariffs. It is the view that insurance rates for port facilities will decrease once the additional protection is put in place.

   This study is being undertaken as a Regional Technical Assistance Project in OECS countries and the BVI. Phases 1 and 2 of this study have now been completed.

The following is the type of information which will be available upon completion of this project.-

- development hazard catalogues,
- an analysis of the geography of each port,
- scenario mapping,
- assessments of emergency/relief significance, and
- recommendations for design standards for each location

3 **Road Improvement and Maintenance Project**

This project has two (2) major mitigation components. These are:-

1 The strengthening of the sea wall to improve coastal protection
2 The development of a drainage system for the highway, to reduce coastal flooding

4 **Fish Bay Improvement Project**

This project which has already been completed involved the redesign and elevation of a portion of Blackburne highway in order to reduce flooding

Hazard and Risk Assessment Study

A project proposal has been formulated for determining the hazard risks and vulnerability of the public and private sector capital stock, economic activity and housing areas from the effects of natural and man-induced hazards Upon completion the project will provide an assessment of the risk posed by natural hazards to the British Virgin Islands' development, the formulation of a Loss Reduction Programme and the implementation of Loss Reduction Mitigation strategies

9 **Telephone company Mitigative Measures**

As part of their hurricane hazard mitigation project, the Telephone Company has engaged in the following activities -

1 All large capacity copper cables and fibre optic plants are being placed underground with pressurised ducts to keep water out during flooding
2 All junction routes are diversified as far as possible.
3 Small capacity pole routes are being designed for better wind survival.
4 The Head Office has been designed to hurricane standards.
5 All towers and dishes are built to survive 200 mile per hour winds

10. **The Electricity Corporation**

The Electricity Corporation has erected a new power station after Hugo, which can withstand windspeeds of 150mph

The above ground distribution and transmission systems have been built to withstand 120mph winds

11 **Training**

An interagency mitigative building techniques seminar involving a number of government agencies, professional and private groups was held to introduce professionals to Mitigative Building Techniques with special reference to wind and earthquake resistance

SECTION III

THE IMPACT OF HURRICANE HUGO ON MAJOR DEVELOPMENTAL AREAS IN THE B.V.I.

IMPACTS

In order to foster sustainable development it is necessary to ensure that economic, social and physical development take place in such a manner that fundamental options for future growth and development are ensured. In terms of disasters, frequently the attitude is that it is futile to put in place measures to mitigate against disasters as costs may be too high for a disaster that may not happen With recent frequency of occurrence of disaster events in the Caribbean, this attitude towards mitigation of hazards is changing However, this change is not reflected as part of an integral change in the approach to planning or the development process. Further to this, while there has been recognition of the need for integrated planning which would bring together the social, environmental and economic facets of development, such a process is at an early stage of development and although efforts are being made to change the traditional modes of the planning process, various agencies are at different phases of development.

In the B V I some steps have been taken in the direction of integrating mitigative measures in the development process, these are largely mitigative programmes designed by the Office of Disaster Preparedness, as well as proposals for the preparation of a Spatial Development Plan by the Town and Country Planning Department. However, this is largely based on individual departmental initiatives and is not part of an overall cohesive policy on disaster mitigation Like any other aspect of planning, disaster planning here meaning mitigation, should not be viewed as a separate chapter or sector but should form an integral part of all levels of the planning process which can inform policies and projects It is important that the existing activities be acknowledged, built upon and expanded in order to build an effective mitigation programme

The British Virgin Islands which consist of a number of small islands with varying physiological features present a development dilemma which is common to all small island states with limited land and fragile natural resources, that is, where can development take place and whether it is possible to locate development in such a manner that these resources are not made vulnerable to long term damage

Events such as Hurricane Hugo bring study of such factors to the forefront in the consideration of developmental alternatives. The major physical damage experienced in the B V I was to physical and social infrastructure, coastal areas including tourist attractions, hotels, housing, agriculture and fisheries These are all key activities in the B V.I. Any effect on them will impact adversely on economic development Although the B V.I was not as severely impacted by Hurricane Hugo as many other neighbouring countries, there were impacts on the development of the territory

While the B V I was experiencing growth in its economy there were setbacks in that moneys which could have been spent on additional development had to be diverted to restorative works In the area of electricity and telecommunications, losses of over $2 million dollars were recorded, while insurance did cover some of these losses, moneys had to be found to make up the shortfall

The tourist industry experienced some losses although this was not quantified in the damage assessments. The numbers of visitors declined significantly in the period following the hurricane While it may be argued that September and October are slow months for visitor arrivals, June and July which are off season months indicated visitor numbers in excess of October and November 1989, June with a total visitor arrival of 12,217 and July with arrivals of 16,478 while for October and November the arrivals were 7,943 and 11,139 respectively

Although some sea defence work was carried out on Drakes Highway work on the road had not been completed (Detailed studies are now being carried out to inform the redesign of this road) In the damage assessment carried out by the Department of Works on this highway with respect to a heavily impacted area (Area 6 on Appendix III) the assessment was as follows -

> "This section is one of the most severely affected sections This section is exposed to wave action, secondly water depth is relatively deep, and thirdly much of the armour protection which existed in the past had been dislodged by previous storms leaving this section relatively unprotected "

While some damage may have taken place if mitigative action had been taken, the damage may not have been as extensive With reference to damage to buildings most people interviewed indicated that damage was because of poor building techniques both in terms of design as well as structural strength This was especially so with reference to schools

Much damage was experienced in coastal areas This was related to poor development standards especially with respect to bulk heading and incomplete reclamation activity, sand mining on beaches and lack of observance of appropriate building line distances

Many Government agencies reported that their buildings suffered damage largely because of the lack of maintenance Costs of damage may have been reduced if regular maintenance activity had been carried out on these buildings

In terms of location of development on exposed mountainsides and cliffs, while there is some debate as to whether damage would have been less if developments had not been sited in these areas, more attention needs to be placed to site planning in these areas so that buildings are located on sites less exposed to hurricane force winds

Given present attention to roof design it would seem that the population at large has learnt from the experience of Hugo There is still the need however to emphasise the use of adequate building standards, as well as to ensure that mechanisms are put in place to ensure compliance with required development standards

CONCLUSIONS

The general view expressed was that attention to maintenance of facilities would have resulted in less damage This is so to some extent, but will require the persons responsible for maintenance to be aware of the need and the skills necessary for mitigative action This awareness, the information required to inform measures, the requisite skills and staffing required for mitigative action are not completely in place This is more so with respect to Government Departments as both the Electricity Corporation and the Telecommunications Company have put in place mitigative measures to ensure that their operations are protected

The damage to schools amounted to over $500,000 With adequate maintenance or with careful attention to structural details in construction some of this damage may have been lessened

While the Drakes Highway may have been the optimum route selection when it was laid down, it being the traditional route to the West End of the island, if attention were paid to its protection, the areas in which severe damage occurred may have been lessened

Location of development was not considered a major factor in relation to damage, however, this view was not supported by any data In addition adequate programmes for land management are not in place to support informed decision making

Further to this there are many problems associated with coastal development such as lack of enforcement of coastal set back requirements, sand mining on a number of beaches resulting in the removal of protective coastal mechanisms

SECTION IV

THE INTEGRATION OF DISASTER MITIGATION INTO THE DEVELOPMENT PROCESS AND MITIGATION MEASURES FOR INTRODUCTION INTO THE B.V.I.'s DEVELOPMENT TRENDS FOR THE FUTURE

Given the information and observations made in the previous sections, the following approaches are recommended for the integration of mitigation measures in the development trends for the B V I for the future

An overview of the approach to the implementation of mitigative action is elaborated and specific recommendations are then made.

Mitigation is a major component of emergency management, yet it is the least understood, most complex and controversial of all measures Unlike other aspects of disaster management it occurs when no event is occurring and should form part of the everyday ongoing activities of many agencies and departments Any mitigation programme must have as its focus the attainment of sustainable development, so that mistakes of the past are not repeated, and the potential for a more secure future is not sacrificed

Some of the components of an effective mitigation programme already exist in the B V I These however, need to be strengthened, supported and become part of the mainstream planning and development for the B.V I There are a number of fronts in which action must be taken in order to ensure sustainable development The following are major areas by which a comprehensive approach to mitigation may be taken in the B V I

THE INTEGRATION OF DISASTER MITIGATION INTO THE DEVELOPMENT PROCESS

Hurricane Hugo impacted on the development process in the BVI in that there had to be rehabilitation of existing systems such as communications, power, roads, water supply, airport, ports, schools and the tourism plant before the territory could return to its normal activities

In the case of the BVI this period was not very prolonged, however, there were costs associated with the damage which highlights the need for taking into account the effect of disasters in order to effect long-term sustainability of development as disasters can and do impact on programmes and projects which form part of overall long-term policies

At present the Office of Disaster Preparedness in the BVI has shown that it possesses an effective disaster management capability, however, to be more effective there is the need to build upon the existing systems particularly those which involve the use of mitigative techniques, and to have them incorporated into comprehensive planning policies for the territory which will in turn facilitate the achievement of sustainable development

There are a number of mechanisms which can be used for achieving greater integration of mitigative measures into the planning process

- Provision for the inclusion of disaster mitigation strategies in development planning at all levels
- Inclusion of disaster managers in policy planning teams which contribute to the development of integrated plans
- Involvement of Disaster Managers in project and plan approval decisions.
- Provision for the inclusion of mitigation costs in the consideration of budgetary measures

This would mean fundamental changes to existing approaches to the planning process which would be considerably strengthened through the involvement of all actors in the process plan Preparation should require the participation of all of the agencies in the process rather than agencies attempting to produce individual plans without a context Approach to planning would be integrated with both formal and informal systems for managing the integration process The responsibility for the development of this type of process falls both within the purview of the policy makers as well as the Disaster Agency

The responsibility for the overall linking of disaster mitigation into the national development process ultimately lies with the policy makers as it is only at the national level that all embracing strategies can be developed. The first step in the process of creating linkages is placing responsibility for these linkages at the highest levels This could start with changes in the structure of the management board by creating a sub-committee under the Chairmanship of a policy maker at the highest level with responsibility for all mitigation matters. The Terms of Reference of such a committee should be -

(i) Responsibility for the elaboration of mitigation policies for the entire territory

(ii) Responsibility for ensuring that these mitigation measures are incorporated into all aspects of the national development process.

(iii) Responsibility for the training of senior administrators and policy makers in disaster mitigation.

The Office of Disaster Preparedness will have to influence the decision making process by interventions of its own through the following measures -

(i) the provision of data which can be used by budgeting, financing, environmental and physical planning agencies

(ii) providing information to approval agencies about disaster requirements

(iii) changing the image of the Disaster Agencies from that of Response Agency to that of Response and Mitigation Agency through seminars, workshops and one on one meetings with other agencies departments While a number of actions have been taken by the Office of Disaster Preparedness in this direction there is still the perception that its responsibility is that of response A concerted programme of action by this agency will have to be developed in order to change this perception.

iv) The Hazard and Risk Assessment proposal as outlined by the Office for Disaster Preparedness should be treated as a priority project for the BVI and the necessary resources should be made available for the carrying out of the project as well as ensuring that there is adequate counterpart staff assigned to the project so that the skills necessary for carrying out further work on projects of this nature remain with staff employed by the BVI Government This programme should form some part of the wider Geographic Information system which is being developed in the BVI

LEGISLATION

The use of mitigative measures is the responsibility of several agencies Legislation in some areas is lacking or has not been updated to include mitigative approaches It is therefore necessary to determine as early as possible whether the legal basis for the implementing of mitigation measures are in place This would indicate the need for a review of and co-ordination of the Disaster Legislation, the Town Planning Legislation, Environmental Legislation, the Public Health Legislation as well as the Building Legislation In the use of mitigative measures some consideration could be placed upon the use of incentives For example this could be related to insurance with special benefits given for the development with adequate standards

PLANNING, ENVIRONMENTAL AND REGULATORY MEASURES

Of the approaches to mitigation in the B V I , the options which are available for mitigation against hurricanes are through the use of the following -

1 Land use controls (non structural measures)
2 Environmental controls (non structural measures)
3 Use of building codes (non structural measures)
4 Use of engineering solutions

LAND USE CONTROLS

While Land Use Controls can limit the location of development and people in hazardous areas in islands such as the B V I , the use of such mechanisms for control of development may be constrained because of the limited land space The limits to which such methods can be used would need to be explored to their fullest This would require concerted technical approaches to determining these boundaries to development

Work in this area has already begun in the B V I with the preparation of the National Spatial Development Plan, which is being prepared in consultation with a number of agencies including the Office of Disaster Preparedness The plan will include a policy base for the preparation and implementation of a hazard mitigation programme

However, in order to formulate appropriate policies and to recommend specific hazard mitigation measures it will be necessary to carry out a number of technical studies The following information will be necessary in order to inform plan proposals -

1 Delineation of areas which are vulnerable to hurricane events

2 Quantification of the costs of and benefits to be derived from the use of alternative structural measures

In order to effectively inform plans for the future, technical agencies, developers and the public at large need to know the nature of the risks associated with hurricanes as well as the areas which will experience the highest risks This can only be done with systematic collection and analysis of information. The Office of Disaster Preparedness has prepared a proposal for a BVI Hazard and Risk Assessment which will involve an assessment of the risk posed by natural hazards to the British Virgin Islands' development, the formulation of a Loss Reduction Programme and the implementation of Loss Reduction Programme and the implementation of Loss Reduction Mitigation Strategies.

This proposal should be treated as a priority project and the necessary resources for the carrying out of the required studies should be made available for the early implementation of the project The type of study proposed will aid in the production of more rigour into the development plan process.

Further to this the database from this project should form an integral part of the wider database which is being developed in the British Virgin Islands

LAND AND BUILDING USE REVIEW PROCESS

While in a general sense the effects of hazards may be taken into account in dealing with projects submitted for consideration by the Development Control Authority or other agencies which may consider development applications, there are no hazard related guidelines for use by agencies with the responsibility for reviewing applications There is the need to develop hazard guidelines in order to inform the review process

While in a general sense the effects of hazards may be taken into account in dealing with projects submitted for consideration by the Development Control Authority or other agencies which may consider development applications, there are no hazard related guidelines for use by agencies with the responsibility for reviewing applications There is the need to develop hazard guidelines in order to inform the review process

Subdivision regulations can also be used to address mitigation concerns by requiring storm drains, sea defence mechanisms and placement of facilities relative to the risk. These need to be developed in a comprehensive manner taking into account hurricane and other hazard related measures

In addition special attention needs to be paid to site planning and other development works on steep, exposed hillside slopes.

At present Government projects do not need planning permission and in some instances rigour is not applied to their assessment particularly in terms of mitigation In the interest of progressive development these projects should also be subject to review which should include assessment of hazard mitigation measures

ENVIRONMENTAL CONTROLS

Environmental Regulations are usually used to protect sensitive natural areas These regulations can therefore aid in reducing hazards by preserving mangroves, seagrass, etc , there is the need to review existing environmental controls and develop regulations relevant to the B V.I , taking into account their mitigative aspects

PROJECT REVIEW

In order to ensure the qualitative improvement of projects it will be necessary to devise and implement them efficiently This will involve attention to a more comprehensive analysis of costs and benefits, that take into account environmental impacts thereby minimising the danger of pursuing growth which may have adverse impacts on the environment with resultant long-term impacts on development options

This is particularly relevant in an island which places so much emphasis on the utilisation of its coastal resources

USE OF BUILDING CODES

Much of the damage caused by Hugo was because of inadequate structural design There is therefore the need for regulatory measures such as the introduction of a building code in order to reduce the vulnerability of people and property

ENGINEERING SOLUTIONS

Given the size of the B V I. as well as its reliance on the coastal zone for its tourism industry, many uses will have to be located in vulnerable areas In these cases engineering solutions will have to be relied upon. This will mean construction of protective facilities such as bulkheads, revetments, seawalls etc., to standards which can resist the impacts of hurricanes

TRAINING

Concomitant with the introduction of any change to an existing system is the need for training and development of staff Most training in the past has been in coping with disasters as opposed to preventing them. While coping with disasters is important, it is necessary to upgrade and develop skills in disaster mitigation

It was previously indicated that the agencies which had responsibility for environmental matters as well as National Parks had serious difficulty in quantifying damage. While some aspects of environmental damage cannot be easily assessed, there is the need for the elaboration of criteria for evaluating losses, including environmental losses, and methods of conducting surveys for disaster assessments

Losses should be evaluated in such a manner that it can be demonstrated that savings might occur through the use of mitigative measures.

PUBLIC EDUCATION AND COMMUNITY PARTICIPATION

Any programme for disaster mitigation cannot be implemented without the support of the community which will be affected by the disaster While some public education programmes have been developed by the Office of Disaster Preparedness there is still need to develop a range of public education programmes which will target different age and interest groups

It is also necessary that the community be involved in the development of strategies for ensuring sustainable development as it is the community which will be affected by disasters and it should understand the impacts of the actions and what is necessary to negate such impacts

RECOMMENDATIONS

DEVELOPMENT OF MITIGATION POLICIES

A sub-committee of the disaster management board should be created under the chairmanship of a policy maker at the highest with responsibility for

(i) the elaboration of mitigation policies
(ii) the integration of such policies into the national development process
(iii) the training of Senior Administrators and policy makers in disaster mitigation

LEGISLATION

1 Existing Disaster, Town Planning, Environmental, Public Health and Building Legislation should be reviewed with a view to incorporating mitigative measures

2 Legislation pertaining to environmental and planning controls need to be reviewed to reflect requirements for mitigation measures In the review of the legislation, consideration should be given to the use of incentive legislation

3 Regulations need to be developed for construction standards for wharfs and jetties

PLANNING

4 The Hazard and Risk Assessment proposal as outlined by the Office of Disaster Preparedness should be treated as a priority project for the BVI and the necessary resources should be made available for the carrying out of the project as well as ensuring that there is adequate counterpart staff assigned to the project so that the skills necessary for carrying out further work on projects of this nature remain with staff employed by the BVI Government The project should inform of the wider Geographic Information System which is being developed in the BVI

5. The Disaster Agency should be consulted and form part of the plan formulation process especially with reference to policy on the use of hazard information for economic, environmental and spatial development

6 The Conservation and Fisheries Department, the Office of Disaster Preparedness and the Town and Country Planning Department should collaborate in the development of mitigative environmental policies These policies should be elaborated in the territorial spatial development plans Once these policies have been accepted by Government, major variations should be the subject of public consultation and review The development of these policies are particularly relevant in coastal and hillside areas

7 Disaster mitigation focal points should be established in all agencies/departments/Ministries They should be responsible for the co-ordination and development of mitigation policies and programmes for their respective departments Their work should be used to inform territorial policy which should be co-ordinated by the Office of Disaster Preparedness

8. Detailed plans for marine areas need to be developed These should incorporate response activities as well as disaster mitigative programmes

9. One of the first exercises for policy elaboration should be in the area of reclamation activity A moratorium should be placed on all reclamation for a period to be determined by the relevant agencies, until appropriate studies are carried out to determine

   i) The least vulnerable sites for development
   ii) Appropriate standards for reclamation activity

   These studies will require to be funded and should be carried out by the Conservation and Fisheries Department, the Town and Country Planning Department and the Office of Disaster Preparedness.

10 Special emphasis needs to be placed on site planning and road development in hillside areas

REGULATORY MEASURES

11 There is the need for the adoption of a Building Code as the standards for development are not very clear. Several codes have been prepared in the Caribbean - these are the Caribbean Uniform Building Code and the OECS Building Code. These codes have already been assessed in the B V I and they still need to be accepted It is to be noted however that the Building Codes cannot be introduced without reform of the administrative mechanisms for review and compliance It is therefore necessary that the level and quality of staff required to service any new building code be reviewed and put in place prior to the introduction of the code These changes can be made on an incremental basis dependent upon technical and financial resources

12 Public buildings and infrastructural works should be the subject of rigorous examination by approving agencies

13 Environmental Impact Assessments should be mandatory for certain categories of projects for the public as well as the private sector

14 The budgeting agency should ensure that prescriptions for mitigative measures are taken into account prior to the approval of funds for construction/development works for all major social and physical infrastructural works

15 Hazard guidelines should be drawn up by relevant agencies for reviewing applications This could be a two stage process whereby first phase guidelines based on existing information can be drawn up As information becomes available these guidelines would be updated

AGENCY MITIGATION ACTION

16 Departments should identify mitigation action needed to be taken by them and should make allocations in their budget towards mitigative measures Funds should only be released with the sanctioning of the particular project/ work/study by the office of Disaster Preparedness

MAINTENANCE AND PREVENTATIVE MEASURES

17 Regular maintenance programmes should be carried out for public buildings and infrastructure works in order to prevent major damage

18 All public buildings should be assessed with a view to determining whether they can withstand hurricanes Priorities for retrofitting should be determined based upon these assessments

19 Ghuts and water courses should be cleared regularly in order to prevent additional flooding from heavy rainfall during a hurricane

20 Certain categories of physical infrastructure especially water and sewage lines should be located as far as possible from the coastline

ASSESSMENT MEASURES

21 Appropriate forms should be designed for gathering of post disaster assessment information. It is to be noted that the Office of Disaster Preparedness is presently carrying out work in this area with forms being designed using the Caribbean Disaster Emergency Response Agency (CDERA) format.

22 Special attention should be paid to the selection of disaster assessment teams which should be comprised of competent professionals from the public and private sectors with training and experience in building assessments as well as local district representatives

23 That a comprehensive assessment of any hurricane event be prepared within a period of 6 - 12 months after the event This report should be lodged with theOffice of Disaster Preparedness and the Library

24. Damage assessments need to be co-ordinated by one department and the collection of information should be standardised and provision made for their computerisation A committee co-ordinated by the Office of Disaster Preparedness has already been formed to develop forms appropriate for the BVI.

Further to this the Office of Disaster Preparedness is collaborating with international and regional agencies with regard to training in damage assessments

TRAINING

25 Training needs to be carried out at a number of levels

1 There is the need for professional and technical training in disaster management and mitigation techniques

2 Focus for training in mitigation planning should be the Office for Disaster Preparedness, the Town Planning Department and the Development Planning Unit, the Public Works Department and the Water and Sewerage Department

26 Training should be carried out in conducting damage assessment and should include (a) criteria for evaluating losses, including environmental losses, and (b) methods of conducting surveys

27 Specialised programmes should be developed and training workshops should be carried out on an ongoing basis for all agencies of government and private enterprise Specific programmes should be developed for senior administrator and policy makers This is necessary as senior administrators tend to relegate this type of training to technical staff This will help in ensuring an understanding of mitigation at all levels in agencies The Sub-committee of the management board as proposed above should be responsible for the administration of the programmes for the Senior Administrators and policy makers in order to ensure their participation and understanding of mitigative issues

28 Although a number of mitigation programmes have been started in collaboration with the Community College, there is the need for additional and continued development of programmes in mitigation techniques should be developed at the Community College in collaboration with the UWI and other selected specialist agencies

COMMUNITY ACTION

29 There is the need for enhanced community participation in ensuring sustainable development This can be fostered by the development of community management strategies to improve existing natural resource management practices with reference to the following :-

- Forest reservations
- Ground cover controls
- Drainage
- Maintenance and clearance of drains
- Coastal management

STRENGTHENING OF THE OFFICE OF DISASTER PREPAREDNESS

30 The existing programmes of the Office of Disaster Preparedness need to be supported with adequate financial resources

31 The staff of the Office of Disaster Preparedness needs to be strengthened by the creation of additional professional posts

REVIEW OF DISASTER PLANS

32 All departmental disaster plans should be reviewed to ensure that they contain appropriate plans for mitigation

PUBLIC EDUCATION

33 While a number of public education programmes have already been started by the Office of Disaster Preparedness there is the need for a comprehensive public education programme on the implications of the use of mitigation measures involving planning and environmental concerns These programmes should be developed by the relevant agencies in collaboration with the Office for Disaster Preparedness

14 *PUBLIC RELATIONS*

A public relations strategy should be developed prior to any incident