



# Grenada

## NATIONAL HAZARD MITIGATION PLAN

Prepared for  
**THE CARIBBEAN DISASTER EMERGENCY  
RESPONSE AGENCY (CDERA)**

and

**THE CARIBBEAN DEVELOPMENT BANK (CDB)**

Consultant: JECO Caribbean Inc

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## **PLAN ADOPTION**

The Grenada National Hazard Mitigation Plan is the product of a participatory plan development process that lasted for over three years, from 2003 to 2006. Several workshops and consultations were conducted to review to determine the scope of hazard assessment, review outputs and achieve consensus on the action that must be taken to undertake effective natural hazard mitigation measures. This document therefore represents the views of community leaders, technicians, public and private sector agencies. It has received endorsement from the Caribbean Disaster Emergency Response Agency and the Caribbean Development Bank who provided funding for the project.

A national consultation was held to review and finalize the draft plan.

## ACKNOWLEDGEMENTS

The Caribbean Disaster Emergency Response Agency (CDERA), through its Caribbean Hazard Mitigation Capacity Building Programme (CHAMP), and the Caribbean Development Bank (CDB), through its Disaster Mitigation Facility for the Caribbean (DMFC), have collaborated to support the development of national hazard mitigation plans in Grenada.

CHAMP is a four-year project funded by the Canadian International Development Agency (CIDA), executed by the Organization of American States (OAS) and implemented by CDERA, which seeks to enhance regional capacity to reduce vulnerability to the effects of natural hazards. CHAMP initiatives include the development of national hazard mitigation policies and programmes, the promotion of the wider use of hazard information in development decisions, and the strengthening of safe building practices, training and certification.

The DMFC is financed by the United States Agency for International Development (USAID) and seeks to strengthen vulnerability reduction in CDB's Borrowing Member Countries (BMCs). The DMFC provides technical assistance to BMCs to implement disaster mitigation policies and practices, and strengthen CDB's institutional capacity for natural hazard risk management through the integration of disaster mitigation into all of its policies, programmes, and projects.

The plan development process was spearheaded by the Natural Hazard Mitigation Council. The staff of NaDMA performed an instrumental role in facilitating the work of consultants, coordinating the workshops, consultations and activities that were conducted to formulate the plan. The plan development committee was responsible for the outcome of this exercise, the plan herein contained.

The members of the committee are:

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## EXECUTIVE SUMMARY

### ***1 Introduction***

The Grenada Hazard Mitigation Plan presents a multi-sectoral and integrated planning framework to reduce the adverse impacts of natural and human-caused hazards to human safety, welfare and property. The Plan documents a collaborative planning effort by the national government and regional disaster management organizations with contributions from a broad range of government agencies, professional associations, community organizations and key stakeholders from the private sector. The planning process was initiated with the development of a National Hazard Mitigation Policy. The policy provides a clear national mandate for natural hazards risk reduction and creates the foundation for the many implementation mechanisms presented in this Plan.

Like the rest of the Caribbean, Grenada is vulnerable to several different types of natural and technological hazards. Although Grenada is on record as having the lowest natural disaster experience for the Eastern Caribbean, the island is not without frequent and continuous exposure to low intensity natural hazard events. These hazards include floods, landslides, tsunamis, storm surges, earthquakes, hurricanes, volcanoes and fires.

Implementing an effective hazard mitigation programme is a complex undertaking that will involve fundamental changes in the development process, multi-sectoral collaboration between government agencies, and the involvement of all facets of civil society. There will be the need to build consensus that hazard mitigation is both vital and feasible, traditional attitudes will need to change, and new organizational measures will be needed for the way in which development is carried out. This is a major challenge which will require education, training and creative thinking in order to be successful.

Finally, the national hazard mitigation plan must have a long-range focus because these changes will take time to integrate into everyday activities, yet it should also propose ambitious yet achievable short-range implementation steps. The Plan endeavors to balance these objectives by having a 10-year planning horizon for plan implementation, supplemented by annual action plans.

The priority and urgency for natural hazard mitigation planning was heightened by the devastating events since the passage of Hurricanes Ivan 2004 and Emily 2005. National reconstruction and development programs in Grenada thus provide the context for the present plan development process although it was initiated prior to the 2004 hurricane.

The Government of Grenada with assistance from several development partners has placed renewed emphasis on comprehensive disaster management in the post Ivan reconstruction period. The establishment of the Agency for Reconstruction and Development (ARD) provides a pathway and mechanism for coordination of policy responses across sectors and integration of hazard mitigation in development strategies. In addition to this plan development process which is being implemented by CDERA and CDB through the local National Disaster Management Agency (NaDMA), there are several other initiatives with relevance for hazard mitigation.

## **2      *The Planning Process***

Development and adoption of a national hazard mitigation policy at the onset of the planning process provides a critical framework and direction for the natural hazards risk reduction programme. This hazard mitigation plan is the implementation mechanism for the national policy. A hazard mitigation plan is a written statement of the Government of Grenada goals, objectives, and implementation measures necessary to reduce its current and future vulnerability to natural hazards. To support the practice of hazard mitigation planning in the Caribbean region, a hazard mitigation planning methodology was developed under the CHAMP programme.

There were seven elements to the planning process utilized in developing this Plan.

1. Hazard Mitigation Planning Introduction
2. Hazard Mapping and Vulnerability Assessment Prioritization
3. Common Digital Database Development
4. Hazard Mapping
5. Vulnerability Assessment
6. Legislative Review and Institutional Capability Assessment
7. Hazard Mitigation Plan Development

The mitigation plan development is the culmination of the hazard mitigation planning process. This planning element builds upon the national mitigation policy framework and was guided by the findings of the vulnerability and capability assessments. It involved four tasks: (1) development of hazard mitigation goals and objectives; (2) identification and prioritization of hazard mitigation actions; (3) preparation of an implementation strategy and action plan; and, (4) documentation of the hazard mitigation planning process. A model framework for the national hazard mitigation plan was developed by CDERA to facilitate mitigation plan development.

## **3      *Hazard Mapping and Vulnerability Assessment***

It was a prerequisite to the development of this Plan to prioritize hazard risk management interventions, so that the body of hazard maps, digital databases, and assessment findings can be used by government officials and the private sector to make better decisions about designing and locating new developments, settlements, infrastructure, and other investments. Hazard mapping can also inform preparedness and response functions by providing emergency management officials with accurate and high resolution data for communities that are located in hazard-prone areas.

A qualitative ranking methodology was used to determine which hazards deserved more detailed evaluation. Probability, magnitude, and spatial impact weighting factors were used to prioritize the hazards and guide the vulnerability assessment. For this, it was necessary to first complete a general list of acknowledged hazards followed by a refined list of hazards that were thought to be of importance to the country. The results of this first screening of top hazards are presented in the table below.

**Table 1. Prioritizing of hazards identified for Grenada**

	<b>Identified hazards</b>	<b>Prioritized hazards</b>
1	Coastal Erosion	Landslides
2	Floods	Coastal Erosion/Winds /Flooding
3	Landslides	Volcano
4	Volcano	Storm Surge
5	Tropical Storms/Hurricane winds	Rock fall/Earthquake/Tsunamis/ Expansive soils
6	Tsunamis	
7	Storm Surge	

Detailed description and mapping was performed for the top three priority hazards, landslides, coastal erosion and flooding. For each hazard the assessment was conducted island-wide and detailed mapping was done for three highly vulnerable locations:

1. Landslides Florida
2. Coastal Erosion St. George's (southwestern coast)
3. Flooding St. John's River Basin

Vulnerability assessments were conducted for critical facilities island-wide. The results of the hazard mapping and vulnerability assessment exercise are included as Annex I.

#### **4      *Capability assessment***

The capability assessment for hazard mitigation in Grenada was conducted within the framework of Post Ivan Reconstruction. There were two broad objectives: first, to determine the existing national capability for hazard mitigation through a review and assessment of legislation, agency mandates, policies, and activities; and second, to identify opportunities for the incorporation of mitigation policies and disaster risk reduction mechanisms in the post-Ivan programme being managed by the recently formed Agency for Reconstruction and Development (ARD).

Hazard mitigation in Grenada is fragmented across at least ten (10) agencies in Grenada without any sustained national coordination role mandated by legislation or appointed to any single agency. Hazard mitigation initiatives appear to have arisen as a part of the mandate of a few existing agencies in response to a recognition of specific needs.

Notwithstanding the foregoing, it is important to acknowledge the progress that the Government of Grenada (GOG) has made over the past five years in giving natural hazards risk reduction greater visibility as a national priority and creating formal and informal mechanisms to promote hazard mitigation initiatives. The GOG has endorsed the regional Comprehensive Disaster Management Strategy and has a standing National Hazard Mitigation Council to inform the National Disaster Management Agency (formerly NERO) and other government agencies on mitigation issues. As demonstrated by the name change from National Emergency Relief Organisation (NERO) to National Disaster Management Agency (NaDMA), there is increased awareness of and commitment to integrating natural hazard mitigation into the development planning process.

The implementation of the recently completed National Physical Development Plan can be an important mechanism for creating a more disaster resistant and sustainable future in Grenada. The Sustainable Development Council and a multi-sectorial Committee was instrumental in developing the recently adopted National Hazard Mitigation Policy.

As part of the capability assessment a review of existing regulations and policies was conducted. The following deductions were made:

1. About two thirds of the laws reviewed were enacted more than 15 years ago. These tend to be more sector or issue specific and relate more to emergency response or relief. These include, for example, the Police Act, the Fire Brigades Act, the Constitution, the National Disaster (Emergency Powers) Act and the Housing (Hurricane) Loans Act. There is no single piece of legislation that addresses hazard mitigation and natural hazards risk reduction.
2. There are a number of fairly modern pieces of legislation which make adequate provision to reduce or prevent the adverse impacts associated with natural hazard events.
3. Adequate environmental and natural resources management laws can assist in ensuring the proper management, protection and conservation of the environment and resource use, thereby maintaining or strengthening the natural resilience of ecosystems. Environmental degradation, pollution and loss of biodiversity may have significant adverse consequences on the quality of life. There are a number of existing laws that address specific environmental or natural resource use concerns. These laws, however, tend to be issue-driven and in some instances appear to be fragmented with overlaps and gaps.
4. Within the fragmented authorities related to water resources management, it is important to note that there is neither a clearly delineated ministerial role nor legislative mandate for floodplain management. Specifically, there are no regulations to control development within areas designated as being at risk to riverine or coastal flooding events, including storm surges associated with hurricanes.
5. There is an OECS Sub-regional Environmental Strategy and Action Plan in addition to a National Environmental Policy and Management Strategy for Grenada. This policy and strategy is supported by a comprehensive national Environmental Management Act which is presently in draft form and needs to be promulgated. In the past the absence of clear legislation resulted in institutional overlaps, duplication and omissions. It is envisaged that the proposed comprehensive legislation would encourage a coordinated and integrated approach to decision-making and that could avoid the inefficient use of limited resources (financial, human, technological, information).
6. There is no comprehensive disaster management legislation in Grenada that addresses the full range of issues that arise during the disaster management cycle; that is, preparedness, response, recovery and reconstruction. Hazard mitigation is relevant throughout all four phases. Although there is a national coordinating entity, the National Disaster Management Agency (NaDMA), an established National Hazard Mitigation Council, and an adopted

National Hazard Mitigation Policy, there is no clear legislative basis for supporting the functions of these entities or for the implementation of policy.

7. In the absence of specific legislation, it is apparent that the legal authority for disaster management is derived from a number of sources that include the: (1) Executive; (2) Constitutional, where the Constitution sets out a role for the Governor-General in proclaiming a state of emergency; and (3) weak legislation, for example the Emergency Powers Act and the National Disaster (Emergency Powers) Act. Neither of these pieces of legislation addresses hazard mitigation. The Emergency Powers Act is simply a response mechanism that is triggered in the event of an emergency, and the National Disaster (Emergency Powers) Act allows for the provision of relief, in particular the provision of essential supplies and services. In the absence of comprehensive disaster legislation these two Acts are currently used to fill this legal lacuna. Once an emergency, including a disaster, has been declared the respective government agencies must rely on their individual empowering Acts to undertake action.

There remains the need to change public perception held on disaster management so that it is viewed as an integral part of the mandate of all agencies and not only NaDMA. The impacts of Hurricanes Ivan and Emily provided a window of opportunity for concerted action and inclusion of natural hazard mitigation into the planning framework of all sectors. With time once the saliency of natural hazards to everyday life is removed, it will be necessary to reinforce the gains made through the work of a strong champion coordinating agency. At present the ARD is performing this role and it will be necessary to identify and develop an appropriate mechanism through the relationships that are presently emerging. From the above assessment of capability, it seems evident that NaDMA and the PPU will remain central to implementation of natural hazard mitigation activities in Grenada.

## **5 Mitigation Strategy**

### **Plan Vision**

*To develop a holistic national hazard mitigation culture to create social, economic and environmental sustainability*

### **Guiding Principles**

The guiding principles underlying the elaboration of the national hazard mitigation policy are as follows:

- A multi-sectoral and integrated approach to hazard risk management and development planning.
- The need for effective public education and public awareness programmes.
- The need for community mobilization and active civil society involvement.



- The need for environmental protection and reduction in social and economic vulnerabilities

**Plan Goal**

Given the recent disaster experiences, existing natural hazard vulnerability and national capacity for undertaking effective mitigation programs for the same, the goal that this hazard mitigation plan contributes towards is:

*Sustainable and livable communities, resilient to natural and technological hazards*

**Plan Objectives**

- To strengthen the policy framework for hazard risk reduction
- To empower the private sector, NGOs and individuals to participate effectively in the management of hazards
- To reduce vulnerability of the poor and high risk areas to the impacts of natural hazards

**Strategic Interventions**

To achieve each plan objective and thus make the goal of the hazard mitigation plan a reality, a series of necessary strategic interventions were identified. These interventions are consistent with the findings of the capability assessment. Specific actions were developed for implementation of each Strategic intervention. These are included in section 7 of this document and Annex III and IV which provide the ten year action plan and for Plan implementation.

**Objective 1:**

1. Integration of hazard risk reduction into national policy frameworks
2. Development, implementation and enforcement of appropriate legislation and regulation to support hazard risk reduction
3. Development and implementation of knowledge management and information sharing framework for hazard mitigation

**Objective 2**

1. Implementation of a programme for sensitization, public education and outreach and information sharing at all levels
2. Effective mechanisms for coordination, cooperation, collaboration and sustained involvement in risk reduction initiatives by Private sector and NGOs
3. Development and implementation of appropriate economic programmes for hazard risk reduction

**Objective 3**

1. Development of community-based initiatives to effectively manage hazard risks
2. Implement hazard mitigation measures to reduce vulnerability of critical facilities and infrastructure
3. Develop management plans for high vulnerable areas (HVA)

## 6 *Plan Implementation*

It is proposed that the Hazard Mitigation Council assume responsibility for spearheading the implementation of the 10 year plan. The terms of reference of the Hazard Mitigation Council should be revised to ensure consistency with this new role. The following are suggestions for the terms of reference:

- a. To utilize the Natural Hazard Mitigation Policy and Plan as the primary policy documents over the next 10 years (2007 – 2016).
- b. To promote the Natural Hazard Mitigation Framework among the public and private sectors and the community in general.
- c. To review mitigation plans and programmes implemented by lead agencies to ensure that they are in keeping with the Mitigation Action Plan.
- d. To assist implementation agencies with the development of projects as they relate to natural hazard mitigation and disaster management in general.
- e. To assist implementation agencies in preparing requests for technical assistance for the implementation of projects (when applicable).
- f. To monitor the implementation of plan proposals with a view to ensuring that they fulfill project objectives.
- g. To coordinate the implementation of mitigation projects which cross-cut several sectors.
- h. To ensure that implementation agencies coordinate their projects.
- i. To ensure that adequate resources are allocated for the implementation of programmes and projects.
- j. To review plan proposals on an annual basis and supervise the preparation of annual work plans.
- k. To ensure that lead agencies have the supporting resources such as appropriate finances, manpower and legislative framework.
- l. To provide a focal point for collaboration in mitigation activities with external agencies.

Day to day responsibility for the implementation of the annual action plans will be that of NaDMA. It is proposed that a position be created within the agency for a technical hazard mitigation officer whose job will be to facilitate the actual implementation of the action plan along with the various sectors. Effective implementation will require sustained interagency coordination and collaboration. Although the National Disaster Management Agency (NaDMA) must be actively involved with hazard mitigation initiatives, it serves as a coordinating agency for disaster management activities and is not a national planning and implementation agency.

Implementation responsibilities do not reside solely within the key line ministries that have a role to play in natural hazards risk reduction; a successful implementation programme must define the myriad ways that government agencies can collaborate with the private sector, NGOs, and local community organizations to affect meaningful change. The Plan provides an institutional framework for reducing future vulnerabilities, but implementation only occurs when it affects the

day-to-day activities of professionals in the private sector, those working on behalf of NGOs, and the general public.

A number of government agencies have already been involved in developing the national hazard mitigation policy, as well as in the implementation of specific hazard mitigation projects. However, there is still the need for further enhancement of these activities, particularly in the ability of the national government to execute and implement hazard mitigation measures through formal or informal multi-agency collaborative actions. The plan also identifies mechanisms for achieving synergy between related policies and programmes that can help create a more sustainable future for Grenada. The implementation plan is meant to serve as a catalyst for change in the way in which development is carried out, so that hazard mitigation measures become a part of the everyday activities of all facets of civil society.

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## GLOSSARY

**CAPABILITY ASSESSMENT** – Evaluates the past and future performance of agencies to carry out the stated objectives of policies, plans or programmes. It also considers the ability of the government to effectively coordinate implementation programmes between agencies and work in a collaborative fashion with the private and non-profit sectors.

**CHEMICAL SPILL** – Accidental release occurring during the production, transportation, or handling of hazardous chemical substances.

**CRITICAL FACILITY** – Buildings or improvements important to public health and welfare, including facilities that serve emergency response functions, such as shelter, police and fire protection, or buildings that may be essential to continuity of government operations, or facilities that provide essential public services, such as water, wastewater treatment, transportation, and electric power.

**CLIMATIC CHANGE** – Change observed in the climate on a global, regional, or sub-regional scale caused by natural processes and/or human activity. In making the linkage to natural hazards risk reduction, climatic change should be considered a slow onset natural hazard.

**DISASTER** – A serious disruption of the functioning of a community or a society, causing widespread human, material, economic, or environmental losses which exceed the ability of the affected community/society to cope using only its own resources. Disasters may be natural or human-caused.

**DISASTER MANAGEMENT** – A collective term encompassing all aspects of planning for and responding to natural or human-caused disasters including pre- and post-event activities. It refers to both the management of the risk and the consequences of an event.

**HAZARD** – A potentially damaging physical event, phenomenon and or human activity, which may cause injury or loss of life, property damage, social and economic disruption, or environmental degradation.

**HAZARD MITIGATION** – Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation, and technological hazards. In climate change terminology, hazard mitigation is synonymous with adaptation to some degree. Climate change adaptation is an adjustment in natural or human systems in response to actual or expected climatic *stimuli* or their effects, which moderates harm or exploits beneficial opportunities.

**HAZARD RISK MANAGEMENT** – The systematic management of administrative decisions, organization, operational skills and responsibilities to apply policies, strategies, and practices for hazard risk reduction.

**HAZARD RISK REDUCTION** – The development and application of policies, procedures, and capacities by the society and communities to lessen the negative impacts of possible natural

hazards and related environmental and technological disasters. This includes structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse impact of hazards, as well as the development of coping capabilities.

**MITIGATION** – In the context of natural hazards risk reduction, mitigation refers to sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.

**NATURAL HAZARD** – Natural processes or phenomena occurring in the biosphere that may constitute a damaging event.

**NON-STRUCTURAL MITIGATION MEASURES** – Non-physical preventative measures implemented to avoid or lessen the impact of natural hazards. Examples include physical planning, development review, zoning, coastal and riverine setbacks and preservation of environmentally sensitive areas

**PREPAREDNESS** – Measures taken to reduce, to the minimum level possible, the loss of human life and damage to property, through organizing effective measures which will ensure timely and appropriate responses to a given hazard.

**PREVENTION** – Measures taken to prevent natural or human-caused phenomena from causing property damages or other emergency situations.

**RECONSTRUCTION** – The long-term process of rebuilding a community's destroyed or damaged housing stock, commercial and industrial buildings, public facilities, and other structures. This process is sometimes referred to as long-term recovery.

**RECOVERY** – In the aftermath of a disaster, recovery refers to the transition from emergency response functions to restoration of basic services and the initial repair of physical, social, and economic damages.

**RESPONSE** – Actions carried out immediately before, during, and immediately following a disaster event which are aimed at saving lives, reducing economic losses, and alleviating suffering.

**RISK** – The measure of the expected losses due to a hazard event of a particular magnitude occurring in a given area over a specific time period.

**STAKEHOLDERS** – Person or entity holding grants, concessions, or any other type of value or interest that would be affected by a particular action or policy.

**STRUCTURAL MITIGATION MEASURES** – Physical measures that modify the environment to lessen the impact of natural hazards. Examples include flood control impoundments, channel modifications, storm sewers and drainage, groins and other coastal erosion structures.

**SUSTAINABLE DEVELOPMENT** – Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development maintains or enhances economic opportunity and community well-being while respecting, protecting, and restoring the natural environment upon which people and economies depend. Disaster resilience should be considered an essential element of sustainable development.

**TECHNOLOGICAL HAZARDS (HUMAN-CAUSED HAZARDS)** – Danger originating from technological or industrial accidents, dangerous procedures, infrastructure failures, or certain human activities, which may cause the injury or loss of life, property damage, social and economic disruption or environmental degradation.

**VULNERABILITY** – The extent to which a community, structure, service, or geographic region is likely to be damaged or disrupted by the impact of a particular hazard.



## ACRONYMS AND ABBREVIATIONS

APA	American Planning Association
ARD	Agency for Reconstruction and Development
ART	Agency for Rural Transformation
BMCs	Borrowing Member Countries
BVI	British Virgin Islands
CARICOM	Caribbean Community
CBO	Community Based Organisation
CDB	Caribbean Development Bank
CDERA	Caribbean Disaster Emergency Response Agency
CDD	Common Digital Database
CDM	Comprehensive Disaster Management
CDMP	Caribbean Disaster Management Program
CGCED	Caribbean Group for Cooperation in Economic Development
CHAMP	Caribbean Hazard Mitigation Capacity Building Programme
CIDA	Canadian International Development Agency
CIPA	Council of Information and Planning Alternatives
CPACC	Caribbean Planning for Adaptation to Global Climate Change
CPC	Country Plan Coordinator
CRIS	Coastal Resources Information System
DMFC	Disaster Mitigation Facility for the Caribbean
ESDU	Environment and Sustainable Development Unit
FEMA	U.S. Federal Emergency Management Agency
GDP	Gross Domestic Product
GIS	Geographic Information System
GOG	Government of Grenada
GRN	Grenada
HMVA	Hazard Mapping and Vulnerability Assessment
HVA	Highly Vulnerable Area
IR	Intermediate Result
ISDR	International Strategy for Disaster Reduction
kph	kilometers per hour
MACC	Mainstreaming Adaptation to Climate Change
MEA	Multi-lateral Environmental Agreement
mph	miles per hour

NaDMA	National Disaster Management Agency
NAO	Network Administration Organisation
NPDC	National Policy Development Committee
NERO	National Emergency Relief Organisation
NGO	Non-Governmental Organisation
OAS	Organization of American States
OECS	Organisation of Eastern Caribbean States
PDC	Plan Development Committee
PEC	Plan Enhancement Committee
SIDS	Small Island Developing States
SNC	Second National Communication
TCG	Thematic Cooperating Group
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
USAID	United States Agency for International Development
VITEMA	Virgin Islands Territorial Emergency Management Agency

## **SECTION 1.0 INTRODUCTION**

The Grenada Hazard Mitigation Plan presents a multi-sectoral and integrated planning framework to reduce the adverse impacts of natural and human-caused hazards to human safety, welfare and property. The Plan documents a collaborative planning effort by the national government and regional disaster management organizations with contributions from a broad range of government agencies, professional associations, community organizations and key stakeholders from the private sector. The planning process was initiated with the development of a National Hazard Mitigation Policy. The policy provides a clear national mandate for natural hazards risk reduction and creates the foundation for the many implementation mechanisms presented in this Plan.

### **1.1 The Rationale**

Natural hazards are part of the world around us and are inevitable. The occurrence of these natural phenomena cannot be accurately predicted nor controlled. The Caribbean region is especially prone to a wide range of natural hazards including hurricanes, landslide, drought, volcanic eruptions, earthquakes and flooding. While the natural environment has evolved over time to have considerable recuperative powers and has shown remarkable resiliency to natural hazards, the consequences of natural disasters to our country's economic activities, property and human welfare can be devastating.

It is when natural hazards intersects with the human-made environment that a disaster event results. These events in the Caribbean have greatly affected the productive sectors of the economy such as tourism and agriculture, not to mention the severe impacts on communities. Limited resources, land ownership, and tenure patterns can drive the poor to settle in hazard-prone areas. Recovery from disaster events can be extremely difficult for the most vulnerable elements of the population – the poor, elderly, and single female heads of households. On average, at least one major hurricane and numerous tropical storms impact small developing island states in the Caribbean each year. Within the region, individual countries have incurred losses from a single hurricane event that has exceeded the annual Gross Domestic Product (GDP) (CGCED, 2002).

Unfortunately, the magnitude of disaster damages has been rising at an alarming rate, not necessarily because natural hazards have become more frequent (although there is growing evidence that global warming is contributing to more frequent and intense events), but because of increased population pressures and individual decisions that place businesses and homes at greater risk. Too often, new development occurs along the coast and in other areas subject to repeated flooding or other natural hazards, with little or no attention to the need for sound building practices or land use policies. As a result, the magnitude of disaster damages has grown exponentially.

Recent experience in countries such as Jamaica, the Dominican Republic, and the Organisation of Eastern Caribbean States (OECS) countries confirms that economic recovery from a natural disaster is an exceedingly slow process (CGCED, 2002). Disasters directly impact the foreign exchange earnings just at the time when extra

resources are required to pay for the range of imports critical to the recovery of the agricultural, tourism and manufacturing sectors. Successive natural disasters can push countries into a downward spiral, where losses outweigh any economic development progress recently made. If sustainable development is to be achieved in the Caribbean region, countries will have to take effective measures to manage these natural hazard risks.

The impacts of natural disasters are fundamentally an issue of development. Each natural disaster leaves in its wake an overwhelming volume of evidence of how planning and investment decisions contribute to vulnerability and the consequent risk of further disasters (CGCED, 2002). Since reducing vulnerability is closely linked to the manner in which development occurs, and because reducing the vulnerability associated with future development is by far the most cost effective approach, it is essential that hazard considerations are incorporated more systematically in development review and physical planning functions.

While we cannot prevent natural hazards, there are a range of tools, techniques, and strategic interventions that, when put into effect in a timely fashion, can minimize the economic, social, and environmental impacts of future disaster events. By managing the type, construction, and location of future development, by improving management of our natural resources, and by incorporating hazard mitigation measures in existing homes, essential public facilities and infrastructure, we can significantly reduce our vulnerability to natural hazards.

This Plan serves as a guide to decision-makers, government agencies, developers and contractors, design professionals and citizens on the tools and techniques that can be employed to decrease our vulnerability to future hazards. It charts a path forward that will require substantial changes to our legislative and institutional frameworks, and will require the sustained and collaborative effort of all facets of civil society to achieve a more sustainable future for our country.

## **1.2 Background**

Like the rest of the Caribbean, Grenada is vulnerable to several different types of natural and technological hazards. Although Grenada is on record as having the lowest natural disaster experience for the Eastern Caribbean, the island is not without frequent and continuous exposure to low intensity natural hazard events. These hazards include floods, landslides, tsunamis, storm surges, earthquakes, hurricanes, volcanoes and fires.

Two major earthquakes were experienced in 1997 recording 5.7 and 5.9 on the Richter scale. The last recorded tsunamis activity was in 1867. A particular hazard is Kick 'em Jenny, which is an active submarine volcano located approximately nine (9) kilometers off the north coast of Grenada and between the Islands of Grenada and Carriacou. Kick 'em Jenny is the most active volcano in the Eastern Caribbean having erupted at least twelve times since its discovery in 1939. Kick 'em Jenny lies approximately 180 meters below sea level, and the last recorded major activity was in 2001.

Grenada's location in the south Caribbean, about 2° north of the 10° north latitude where most North Atlantic hurricanes are generated means that by the time most cyclones develop into hurricanes they are already well past the island. Analysis of storm tracks from the 120-year database for the North Atlantic reveals that between the periods 1885 - 2005 twenty-three hurricanes and tropical storms affected the country but only three made direct landfall in the last fifty years. The most recent hurricanes to landfall are category five Hurricane Janet in 1955, category five Hurricane Ivan in 2004 and category 1 Hurricane Emily in 2005.

In general coastal regions are most vulnerable due to their exposure to wave erosion, wind damage and flooding from inland regions. Threats of sea level rise and the probability of tsunamis from the eruption of kick-em-jenny volcano also place coastal areas at high risk. The Eastern seaboard receives the most intense wind and wave erosion as a result of the constant prevailing North-east Trade Winds, and turbulent waters of the Atlantic Ocean. Due to this intense erosion of the landscape the distance to the 100m contour is furthest on the eastern insular shelf. On the western coasts gentler waves from the Caribbean Sea results in slower erosion rates, however winter sea swells are known to produce high wave action and storm surges. The indented submerged coastline in the South is subject to constant basal erosion at the headlands leading to the formation of features such as caves, arches, blow holes and stacks. The inner bays are fairly sheltered and form many harbours, but are also affected by storm surges caused by tropical cyclones.

Flooding and landslides are the two common hazards experienced in inland areas. The change in gradient from the interior to the coast is very sudden and due to the short distance between the mountain and the sea the effects of heavy rains are readily felt in low-lying areas. Grenada experienced major fires in 1990, 2000 and 2002. The cultural perception on natural hazards favors preparedness for hurricanes due to the annual hurricane season which lasts from June to November and concentration of disaster management initiatives around that time.

### **1.3 The Challenges**

Hazard mitigation is a major element in comprehensive disaster management, yet it is the least understood, the most complex, and often the most controversial. Hazard mitigation refers to a wide range of actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects. It includes structural measures such as the construction of flood control impoundments, retrofitting buildings to withstand high wind damages or constructing sea defense mechanisms. In addition, it includes non-structural measures that address a range of preventive measures such as land management and development controls, building code enforcement, and public outreach programmes. Hence, implementing an effective hazard mitigation programme is a challenge in that it must address all sectors of the economy and requires a sustained multi-agency collaborative effort to succeed.

Hazard mitigation measures are normally implemented prior to a disaster event but the concept has application in all four phases of the disaster management cycle, comprised of preparedness, response, recovery, and reconstruction. A definition of each phase of the disaster cycle and a brief discussion on how hazard mitigation can be addressed at each phase follows:

- **Preparedness** – Measures taken, to reduce to the minimum level possible, the loss of human life and damage to property, through the organisation of effective measures which will ensure timely and appropriate responses to a given hazard. Preparedness traditionally refers to improving the capacity of governments to undertake emergency response functions immediately following a disaster event, but preparedness can also include pre-disaster planning for incorporating hazard mitigation measures in long-term recovery and reconstruction.
- **Response** – Actions carried out immediately before, during, and immediately following a disaster event which are aimed at saving lives, reducing economic losses, and alleviating suffering. Retrofitting or “hardening” critical facilities is an example of applying hazard mitigation in an effort to improve response capabilities.
- **Recovery** – In the aftermath of a disaster, recovery refers to the transition from emergency response functions to restoration of basic services and the initial repair of physical, social, and economic damages. Hazard mitigation considerations should come into play when evaluating options to restore, temporarily repair, or permanently replace essential public buildings, bridges, or infrastructure.
- **Reconstruction** – The long-term process of rebuilding a community’s destroyed or damaged housing stock, commercial, and industrial buildings, public facilities, and other structures. The post-disaster environment provides a tremendous opportunity to ensure that hazard mitigation measures are incorporated in the design and construction of damaged or destroyed buildings and infrastructure. Mainstreaming disaster risk reduction in the reconstruction process poses many challenges as political and societal pressures to return to normalcy and the prevailing pre-disaster conditions work against taking advantage of these opportunities.

Another challenge is that low-income populations and communities are disproportionately affected by natural hazards. Given the close link between environmental degradation and poverty, unsustainable natural resource use associated with poverty can exacerbate existing vulnerabilities. In the assessment, planning, and programming stages of recovery, gender sensitivity requires the national government to pay particular attention to the needs of the poor, especially female single heads of households. This sensitivity applies equally well when designing public outreach efforts and determining eligibility for safe housing programmes before disasters strike.

There is growing awareness in the Caribbean of the challenge that must be faced in adapting to changes in the global climate. Grenada does not have a policy on climate change or on any of the major issues within the climate change framework – energy, adaptation, systematic observation, technology development, public awareness and education. No attempt has been made to develop a National Strategy on Climate Change.

Grenada's First National Communication (FNC) was implemented from March 1999 to November 2000 – during the same period that the CPACC project was being implemented. The FNC was done in fulfillment of Grenada's reporting obligation to the UNFCCC and was presented at COP 6 in November 2000 and formally submitted to the UNFCCC at the same time. The two projects were managed by one coordinating committee in order to ensure that they were implemented synergistically.

Grenada has recently initiated work on activities related to the preparation of its Second National Communication (SNC). These activities involve an assessment of the FNC process and the development of a project proposal for the preparation of the SNC. This proposal is to be submitted to the UNDP for funding. Grenada has been involved in a number of climate change activities since 1997. It is important to note that all the climate change programming to date has been largely project-driven and externally funded.

Given that much of our development is concentrated in coastal areas, global climate change has serious implications, including increased frequency and magnitude of tropical storms and hurricanes, sea level rise, and potential for salt water intrusion into public water supplies. One of the challenges of the national hazard mitigation plan is to emphasize the close linkage between the climate change and hazard mitigation and to design implementation mechanisms that can address both issues.

Implementing an effective hazard mitigation programme is a complex undertaking that will involve fundamental changes in the development process, multi-sectoral collaboration between government agencies, and the involvement of all facets of civil society. There will be the need to build consensus that hazard mitigation is both vital and feasible, traditional attitudes will need to change, and new organizational measures will be needed for the way in which development is carried out. This is a major challenge which will require education, training and creative thinking in order to be successful.

Finally, the national hazard mitigation plan must have a long-range focus because these changes will take time to integrate into everyday activities, yet it should also propose ambitious yet achievable short-range implementation steps. The Plan endeavors to balance these objectives by having a 10-year planning horizon for plan implementation, supplemented by annual action plans.

## **1.4 Plan Context**

The priority and urgency for natural hazard mitigation planning was heightened by the devastating events since the passage of Hurricanes Ivan 2004 and Emily 2005. National reconstruction and development programs in Grenada thus provide the context for the present plan development process although it was initiated prior to the 2004 hurricane.



The Government of Grenada with assistance from several development partners has placed renewed emphasis on comprehensive disaster management in the post Ivan reconstruction period. The establishment of the Agency for Reconstruction and Development (ARD) provides a pathway and mechanism for coordination of policy responses across sectors and integration of hazard mitigation in development strategies. In addition to this plan development process which is being implemented by CDERA and CDB through the local National Disaster Management Agency (NaDMA), there are several initiatives with relevance for hazard mitigation. Among them are:

- The establishment of a Human Settlement Task Force by ARD with the aim of preparing a National Human Settlement Policy.
- Strengthening of the Physical Planning and Land Use Units as part of the development of a National Land Registry. This includes improving the GIS capability of these two units.
- Development of a National Land and Land Use Policy.
- Implementation of demonstration projects under the United Nations Environment Programme (UNEP)/Caribbean Environmental Health Institute (CEHI) Sustainable Land Management Project.
- Implementation of an Integrated Watershed and Coastal Area Management Project.
- Implementation of demonstration projects under the OECS Protected Areas and Associated Livelihoods Project.
- National Self Capacity Assessment on implementation of the Multilateral Environmental Agreements (MEAs) for Climate Change, Land Degradation and Biodiversity including cross cutting issues such as natural hazard mitigation.
- National Public Education and Environmental Awareness Program
- Development of an Environmental Information System.



## **SECTION 2.0 PLANNING PROCESS**

An effective hazard mitigation plan must be designed and implemented within the context of an integrated development planning framework. By its very nature, it must be a multi-sector effort, requiring strategic interventions in government, the private and non-profit sectors, and with the involvement of the broader public. It must also be cross-cutting, in that effective implementation will require the active involvement of a number of line ministries, departments, and authorities. Natural hazards risk reduction initiatives require a strong commitment and coordination across sectors, many of which have not traditionally been involved directly in disaster management activities.

This section describes the comprehensive hazard mitigation planning process that led to the development of this Plan. It was a collaborative effort involving CDERA and the Caribbean Development Bank (CDB), working in concert with the Government of Grenada. The hazard mitigation planning approach used included two major phases: (1) development of the national hazard mitigation policy; and (2) development of the national hazard mitigation plan. A comprehensive government policy in support of hazard vulnerability reduction, combined with an appropriate implementation strategy contained within the national hazard mitigation plan, provides the necessary planning framework for successful implementation.

### **2.1 National Hazard Mitigation Policy Development**

Development and adoption of a national hazard mitigation policy at the onset of the planning process provides a critical framework and direction for the natural hazards risk reduction programme. A Model National Hazard Mitigation Policy and Adaptation Guide have been developed through the collaboration of CDERA and the CDB to provide a template for national hazard mitigation policy development. The adaptation of the model policy at the national level was facilitated using a multi-sectoral stakeholder review process. A series of workshops was held emphasizing integration with existing national policies, plans, and programmes. At the introductory workshop, the model policy was presented and issues were identified that needed to be addressed in adapting the policy to country-specific conditions. The workshop also included an introduction to the hazard mitigation planning process, which was used throughout the rest of the project. The national hazard mitigation policy provides the mandate and framework for the project's hazard mitigation planning activities.

### **2.2 National Hazard Mitigation Plan Development**

This hazard mitigation plan is the implementation mechanism for the national policy. A hazard mitigation plan is a written statement of the Government of Grenada goals, objectives, and implementation measures necessary to reduce its current and future vulnerability to natural hazards. To support the practice of hazard mitigation planning in the Caribbean region, a hazard mitigation planning methodology was developed under the CHAMP programme. The hazard mitigation planning approach described in the Comprehensive Disaster Management Project (CDMP) document, Planning to Mitigate

the Impacts of Natural Hazards in the Caribbean, provided an integrated planning framework for the development of the national plan (USAID/OAS, 1997).

The following seven elements provide a brief overview to the planning process utilized in developing this Plan.

### 2.2.1 Introductory Hazard Mitigation Planning Workshop

The Plan development process was initiated by a three-day Introduction to Hazard Mitigation Planning Workshop held in Grenada, January 20 – 22, 2004, at the Coyaba Beach Resort. The workshop objectives were:

- To increase the understanding of participants with respect to hazard mitigation; To familiarize participants with the hazard mitigation planning process;
- To outline an approach to hazard mitigation planning at the national level;
- To develop a work programme for the completion of national hazard mitigation plans.

The introductory workshop on hazard mitigation was structured to provide a balance of lecture presentations and small group activities. Plenary and working group discussions permitted extensive interactions between workshop participants. The workshop was attended by a total of 34 persons with excellent representation from a wide cross section of government ministries and agencies including Health and the Environment, Police, Tourism, Finance, Physical Planning, and Works. There was more limited representation from the private sector and NGOs with a broader representation from utilities and infrastructure including solid waste, public water and sewer, electrical, communications and the port authority. Media involvement and coverage of the workshop was superb with attendance throughout the workshop by print and film media representatives and extensive media coverage of the workshop was provided.

The major themes of the workshop were to present natural hazard risk management as an issue of development and to emphasize the planning process necessary to effectively implement a hazard mitigation plan. The basic method involved lecture presentations on the sequential steps in the hazard mitigation planning process followed by small group brainstorming sessions to create a national mitigation planning framework.

Outcomes included a greater understanding of natural hazards risk reduction, opportunities and constraints to implementing hazard mitigation, strategies for promoting linkages between key stakeholder groups and consensus on a work programme for completion of the national hazard mitigation plan.

### 2.2.2 Hazard Mapping and Vulnerability Assessment Prioritization Workshop

A second, one-day workshop quickly followed the introductory workshop and was intended to sensitize participants to the characteristics and impacts of the prevalent hazards and to provide stakeholders with a basic understanding of the mechanism and

applications of hazard mapping and vulnerability assessments. The Hazard Mapping and Vulnerability Assessment (HMVA) Prioritization Workshop was held in Grenada at the Coyaba Beach Resort, Grand Anse, on March 9<sup>th</sup>, 2004.

Sectors represented at the workshop included: the National Emergency Relief Organisation (NERO; now NaDMA); National Water and Sewerage Authority; the Solid Waste Management Authority; Ministry of Health; Ministry of Agriculture – Land Use Division; Ministry of Finance – Physical Planning; Ministry of Works; and a local engineering representative. The attendees therefore represented a good mix of public, quasi-government and private sector agencies.

The workshop included a discussion on the status of national hazard mapping and plenary discussions focused on identification of any gaps or shortcomings in the existing hazard maps or analysis. Other outcomes of the HMVA Workshop included the selection of priority hazards to be included in the national plan and the identification of the types of critical facilities that would be evaluated in the vulnerability assessment.

### 2.2.3 Common Digital Database Development

The development of a common digital database was the initial task in conducting the Hazard Mapping and Vulnerability Assessment (HMVA). The accurate identification, evaluation, and mapping of natural hazards for this Plan were dependent upon a consistent set of Geographic Information System (GIS) data. The CDERA/CDB Collaboration supported the development of a common digital database for undertaking the HVMV phase of the Plan development process. The requirements of the common digital database were that it:

- build upon GIS data currently available;
- be compatible with and able to be easily integrated into the existing national GIS databases;
- have the necessary accuracy to support hazard mapping and vulnerability assessment applications; and,
- be able to support HMVA evaluations across multiple sectors and localized mapping applications.

### 2.2.4 Hazard Mapping

Prior to formulating the hazard mitigation plan, those hazards that affect Grenada were identified and the threats posed by the hazards evaluated. The hazard identification and mapping task involves determining what natural hazards affect the region, the frequency or the probability of occurrence of each of those hazards, the magnitude of those hazards, where effects are most likely to cause the greatest harm to people and property, and the impacts of each of the natural hazards evaluated. The outputs from the Introduction to Hazard Mitigation Planning Workshop informed this hazard mitigation planning element by providing a prioritized list of natural hazards for consideration in the HMVA and also

identified specific data gaps that needed to be addressed in understanding and mapping natural hazards.

Regional risk assessment experts worked closely with the HMVA Subcommittee to compile country-specific hazard information, address data gaps or shortcomings in existing national databases, and build national capacity for carrying out hazard mapping and vulnerability assessment tasks. The HMVA Subcommittee reviewed all of the outputs of the regional risk assessment experts to ensure accuracy and applicability to the national hazard mitigation planning process.

#### 2.2.5 Vulnerability Assessment

Vulnerability assessments are systematic evaluations of buildings, facilities, population groups, or sectors of the economy that are susceptible to damages from the effects of natural hazards. Vulnerability to a natural hazard can be defined as the extent to which people will experience harm and property will be damaged from that hazard. Vulnerability is determined not only by a facility's geographic location and susceptibility to prevalent natural hazards but also by the structure's characteristics (design, materials, and quality of construction). Vulnerability can be estimated for individual structures, for specific sectors, or for selected geographic areas, such as high hazard zones. The results of a vulnerability assessment are then used to prioritize mitigation actions and can help inform disaster recovery, mitigation, and response planning.

Most vulnerability assessments estimate the potential property damages that would occur to existing development; for example, if a natural disaster of a particular magnitude were to occur today. However, the degree of vulnerability will change in the future as a region experiences greater development. Hence, risk management specialists speak of both present and future vulnerability. The future vulnerability of a region will be strongly influenced by the amount, type, and location of new development and infrastructure. Development review, physical planning, and hazard mitigation are the keys to successfully managing future hazard vulnerability.

The HMVA Subcommittee, supported by regional consultants and informed by the output of the initial HMVA workshop, developed an inventory and spatial database of critical facilities throughout the country. Critical facilities are those structures important to the general health and welfare of public, particularly following a natural disaster event. These facilities may serve important emergency response functions, such as shelter, fire, rescue, and medical services, they may be essential to the continuity of government operations, or be important in rapidly restoring key infrastructure and public services such as potable water, wastewater, and electric power following a disaster event.

The findings of the regional consultants were documented in a Draft Vulnerability Assessment of Critical Facilities Report. The draft report was reviewed by the HMVA Subcommittee, comments were addressed by the consultant team, and the final report was approved for use in developing the mitigation plan.

### 2.2.6 Legislative Review and Institutional Capability Assessment

An effective natural hazards risk reduction programme requires a solid understanding of the existing opportunities and constraints for reducing vulnerability across all sectors of the economy. Regional experts conducted a review of existing legislation and authorities for disaster and hazard mitigation related activities and a review of the institutional capabilities of key agencies and organizations.

The capability assessment addressed not only traditional disaster management legislation and response functions but also evaluated the full range of institutional roles and authorities that can affect future land use decisions such as development review, physical planning, and environmental impact assessment. The capability assessment revealed gaps in existing capabilities and identified areas to build upon existing strengths.

The legislative review and institutional capability assessment consultancy included the following tasks:

- review of existing laws, regulations, and subsidiary legislation that govern, either directly or indirectly, hazard mitigation activities;
- semi-structured interviews and questionnaires with agency personnel and key stakeholders which were used to evaluate institutional capabilities to implement a natural hazards risk reduction programme; and,
- preparation of a final report on the capability assessment.

The Grenada Capability Assessment Report was provided to the members of the Plan Development Committee prior to a one-day workshop where the findings of the capability assessment were presented and discussed through working group and plenary sessions. The Capability Assessment Workshop, held on October 13, 2005 at the Grenada Grand Beach Resort, permitted the Plan Development Committee to reach consensus on the challenges facing the national government in implementing hazard mitigation activities.

The capability assessment, summarized in Section 4, describes the existing institutional framework for hazard mitigation and includes subsections on the legal, institutional, fiscal, and technical capabilities in Grenada. The capability assessment served an important function in informing the Committee on the direction needed to develop an effective implementation plan.

### 2.2.7 Hazard Mitigation Plan Development

The mitigation plan development is the culmination of the hazard mitigation planning process. This planning element builds upon the national mitigation policy framework and was guided by the findings of the vulnerability and capability assessment. It involved four tasks: (1) development of hazard mitigation goals and objectives; (2) identification and prioritization of hazard mitigation actions; (3) preparation of an implementation strategy and action plan; and, (4) documentation of the hazard mitigation planning

process. A model framework for the national hazard mitigation plan was developed by CDERA to facilitate mitigation plan development.

The goals and objectives contained in the Grenada National Hazard Mitigation Policy were the starting point for developing the Plan's goals and objectives. Working sessions conducted during the Capability Assessment Workshop refined the policy goals and objectives for incorporation into the national hazard mitigation plan.

A separate workshop focused on identifying and prioritizing mitigation actions to achieve Plan goals and objectives. The Hazard Mitigation Plan Actions Development Workshop was held June 19<sup>th</sup> and 20<sup>th</sup>, 2006 and utilized working group and plenary sessions to finalize a set of immediate, short-term, and long-term mitigation actions.

Additional working sessions of the Plan Development Committee were necessary to develop the implementation strategy and draft the implementation plan. The Committee agreed to 10-year planning horizon for the implementation strategy, with Annual Action Plans that would identify specific implementation steps. The Annual Action Plans provide a mechanism to address the critical need to monitor, evaluate, and, where necessary, modify the implementation strategy over time. The Committee also decided that the national hazard mitigation plan should be updated and revised on a 5-year planning cycle.

The Government of Grenada worked diligently to involve a broad range of stakeholders in the development of the Plan throughout the hazard mitigation planning process. Representatives from disaster relief organizations, community and professional organizations, and from the private sector participated on many of the various policy and plan development committees. A special consultation was undertaken July 25<sup>th</sup> 2006 with NGOs and district coordinators to incorporate the needs and concerns for disaster mitigation at the community level. In addition, the draft Plan was made available for public review and comment.



## SECTION 3.0 HAZARD MAPPING AND VULNERABILITY ASSESSMENT

This section presents the findings of the hazard mapping and vulnerability assessment that was conducted to inform the national hazard mitigation planning process. A detailed evaluation of hazard risk gives individuals, communities, businesses, and our government the power to choose, within our means, the level of hazard risk we are willing to accept.

Not only was it a prerequisite to the development of this Plan by helping to prioritize hazard risk management interventions, the body of hazard maps, digital databases, and assessment findings can be used by government officials and the private sector to make better decisions about designing and locating new developments, settlements, infrastructure, and other investments. Hazard mapping can also inform preparedness and response functions by providing emergency management officials with accurate and high resolution data for communities that are located in hazard-prone areas.

At this point in the introduction to this section, it is important to provide more technical definitions for hazard, vulnerability, and risk. These terms are often used interchangeably but have very different meanings when applied in the specialized field of risk management.

- **Hazard** – A potentially damaging physical event, phenomenon or human activity, which may cause injury or loss of life, property damage, social and economic disruption, or environmental degradation. A natural hazard cannot become a disaster until it affects the vulnerable built environment.
- **Vulnerability** – The extent to which a community, structure, service or geographic region is likely to be damaged or disrupted by the impact of a particular hazard. Although vulnerability does include the potential for injury or loss of life, most vulnerability assessments evaluate potential property damages in strictly economic terms.
- **Risk** – The measure of the expected losses due to a hazard event of a particular magnitude in a given area over a specific time period. The magnitude of a specific hazard is directly related to its probability or frequency of occurrence. Risk can be conceptualized by a simple equation – risk equals hazard multiplied by vulnerability.

### 3.1 Hazard Identification and Prioritization

The Hazard Mapping and Vulnerability Assessment Prioritization Workshop, conducted on March 9<sup>th</sup> 2004 at the Cobaya Beach Resort, served to initiate the HMVA planning process in Grenada. The participants reviewed existing data on hazards, discussed data gaps and shortcomings, and then generated a list of natural and human-caused hazards that should be considered for detailed evaluation in the HMVA. A qualitative ranking methodology was used to determine which hazards deserved more detailed evaluation.

Probability, magnitude, and spatial impact weighting factors were used to prioritize the hazards and guide the vulnerability assessment. For this, it was necessary to first complete a general list of acknowledged hazards followed by a refined list of hazards that were thought to be of importance to the country. The results of this first screening of top hazards are presented in the table below.

**Table 1. Prioritizing of hazards identified for Grenada**

	<b>Identified hazards</b>	<b>Prioritized hazards</b>
1	Coastal Erosion	Landslides
2	Floods	Coastal Erosion/Winds /Flooding
3	Landslides	Volcano
4	Volcano	Storm Surge
5	Tropical Storms/Hurricane winds	Rock fall/Earthquake/Tsunamis/ Expansive soils
6	Tsunamis	
7	Storm Surge	

This first-cut assessment of hazard priority was then followed by the implementation of a Relative Priority Matrix, where:

Hazard Priority Score (HPS) = (Probability of occurrence + Area of Impact + Frequency of Occurrence) x Potential Magnitude of Damage

$$\text{HPS} = (\text{P} + \text{A} + \text{F}) \times \text{M}$$

All prioritized hazards were then subjected to the Relative Priority Matrix and evaluated, based on the experience of the participants, on a scale from 1 (lowest) to 5 (highest). The results of this analysis are given in Table 2 following.

**Table 2 Relative Priority Matrix**

<b>Hazard</b>	<b>P</b>	<b>A</b>	<b>F</b>	<b>M</b>	<b>HPS</b>
Coastal erosion	4	3	3	4	40
Floods	4	2	3	4	36
Landslides	5	2	4	3	33
Volcano	2	5	1	4	32
Hurricane winds	3	4	3	3	30
Tsunami	2	4	1	4	28
Storm surge	1	3	1	5	25
Earthquakes	3	4	3	2	20

Based on those priority hazards, the following areas of Grenada were identified as being vulnerable:



**Coastal Erosion**

SW - Point Salines to Fontenoy  
 SSE - Point Salines to Petit Trou  
 NE –Marquis to Antoine

**Flooding**

Grenville  
 Town of St. George  
 Beausejour (river)  
 Madeys

**Landslides & rock falls**

Vincennes  
 Concord  
 Palmiste  
 White Gate  
 Grand Etang

In addition, two areas in Grenada were identified as being important candidates for multi-hazard mapping as follows:

- i) Grenville (Coastal Erosion/Floods)
- ii) St. George's (Coastal Erosion/Floods)

**Table 3 Critical Facilities in Multi-Hazard Zones**

<b>St. George's (Point Salines to Fontenoy)</b>	<b>Grenville (wider area–Marquis to Antoine Bay)</b>
<ul style="list-style-type: none"> <li>• Police/Fire/Rescue</li> <li>• Port Facilities (Air &amp; Sea) – jetty, customs etc.</li> <li>• Roadways &amp; transport infrastructure</li> <li>• Electrical generation</li> <li>• Water distribution</li> <li>• Commercial Centre</li> <li>• Hospital</li> <li>• Government buildings</li> <li>• Sewerage</li> <li>• Historic monuments</li> <li>• Grand Anse – Tourism infrastructure</li> <li>• Oil storage</li> </ul>	<ul style="list-style-type: none"> <li>• Police Station – Fire/rescue</li> <li>• Port Facilities – jetty, customs etc.</li> <li>• Roadways &amp; transport infrastructure</li> <li>• Utilities</li> <li>• Schools</li> <li>• Commercial Centre</li> <li>• Government buildings</li> </ul>

## 3.2 Hazard Description and Mapping

Detailed description and mapping was performed for the top three priority hazards in Table 2 above. Prior to the specific characterization of these hazards for the Grenada case, a general definition for all the hazards identified is presented below:

### **Tropical Storms and Hurricanes**

Starting out as tropical depressions, these storms become a hurricane when the maximum sustained surface wind speed exceeds 74 miles per hour (mph) (119 kilometers per hour [kph]) and are characterized by winds directed inward in a spiraling pattern toward the hurricane's eye. They are generated over warm ocean water at low latitudes and are particularly dangerous due to their destructive potential, large zone of influence, and erratic movement. The hazard phenomena associated with hurricanes include: direct impacts from hurricane-strength winds and damages from wind-borne objects; coastal flooding from storm surge; inland flooding from intense rainfall that often precedes and follows the hurricane's passage; and rain-fall induced landslides.

### **Tsunami**

A tsunami (pronounced "suu-nah-mee") is an ocean wave or series of waves caused by an abrupt disturbance of the ocean floor that displaces a large volume of water. The crests of these long-period waves can exceed heights of 25 meters upon reaching shallow waters. The characteristics of tsunamis (high velocity and small crests in deep waters) make their detection, monitoring, and warning difficult. Tsunamis can be caused by earthquakes, volcanic activity, or undersea landslides. Coastal flooding caused by tsunamis are similar to storm surges but can be much more severe and can extend further landward.

### **Volcanic Eruption**

Volcanoes are openings in the earth's crust through which molten rock and gasses escape to the surface. Volcanic hazards stem from two classes of eruptions: explosive eruptions which occur in the rapid dissolution and expansion of gas from the molten rock as it nears the earth's surface; and effusive eruptions where material flow is the major hazard. Hazards associated with volcanic eruptions include lava flow, falling ash and projectiles, mudflows, and toxic gases.

**Landslide**

The term includes landslides, rock falls, and mud or debris flows. The three major causes of landslides are: rainfall-induced, where soils are saturated by heavy rains and move down slope; earthquakes due to ground-shaking effects; and mudflows associated with volcanic eruptions. Rainfall-induced landslides are the most common and often occur along road sections where the cut and fill slopes have not been adequately designed or stabilized. In most cases, landslides are a localized hazard; however, a mudflow associated with a volcanic eruption can have a destructive impact over a large area.

**Flood**

Two types of flooding can be distinguished: inland flooding along streams and rivers; and coastal flooding caused by storm surges, which is often exacerbated by storm water run-off from the upper reaches of the watershed.

Inland flooding is a natural phenomenon that occurs when excessive run-off from heavy rains exceeds the normal capacity of a river or stream channel to move water safely down gradient. Flooding can be exacerbated when land use changes occur in the watershed without providing adequate storm water management for new development. Inappropriate development of the floodplain and inattention to flood-proofing are the major factors leading to flood-related damages from inland flooding.

Storm surges are an abnormal rise in sea water level associated with hurricanes and other storms at sea. Surges result from strong on-shore winds and/or intense low pressure cells and ocean storms. Damages associated with storm surges can be extensive owing to the immense forces associated with direct wave impact, hydrostatic forces on fixed structures, and the effects of water lifting and carrying objects landward. The combination of storm surges associated with hurricanes occurring during periods of high tide can be particularly destructive.

**Earthquake**

The sudden release of slowly accumulated energy along a fault in the earth's crust causes earthquakes. They occur most commonly at the collision zone between tectonic plates. Earthquakes represent a particularly severe threat due to the irregular intervals between events, lack of adequate predictive models, and the hazards associated with these destructive events, such as:

- Ground shaking is a direct hazard to any structure located near the earthquake's center. The severity of an earthquake increases with the amount of energy released and decreases with the distance from its location. Structural failure can lead to extensive loss of life in densely populated areas;
- Vertical or horizontal fault movements along fractures in the earth's crust;
- Landslides due to ground shaking in areas of steep topography and poor slope stability;
- Liquefaction is a phenomenon that amplifies ground shaking effects in areas of unconsolidated materials with high water tables. The soils lose their strength and

act more like a viscous fluid when subjected to earthquake ground shaking. It can be the most destructive hazard associated with earthquake activity.

- Subsidence and tsunamis are two other hazards that may be associated with earthquakes.

Given its mandate and active role in development planning and control it is proposed that the Physical Planning Unit within the Ministry of Finance will serve as the repository for the hard copies of the hazard maps. The PPU can use the information to guide private sector agencies, development professionals and developers when seeking approvals for undertaking projects. The electronic database should be shared by both the PPU and NaDMA. NaDMA should make the data available to non-profit and organizations who work at the community level. It will be the responsibility of NaDMA to disseminate the information to public sector agencies.

The results of the hazard mapping and vulnerability assessment exercises are included in Annex I. Explanatory notes on the hazard mapping methodology are provided below along with information on volcanic hazards which are excerpt from the Lesser Antilles Volcanic Hazard Atlas.

### **3.2.1 Coastal Hazard Map for Grenada**

An initial mission to the country was undertaken in order to collect necessary field data for the erosion analysis; meet the key stakeholders and to become familiar with the study area. At the initial meeting, key stakeholders agreed that the 100-year return period event and the 20-year shelf life would be the main modeling parameters for the erosion analysis. It was also decided to duly consider long-term trends, which are not a part of the original terms of reference set out for this consultancy.

During this initial visit, the importance of conducting erosion studies at the selected bays was highlighted for various reasons, including recreational purposes, industrial and social infrastructure, tourism interests and fishing purposes. Grand Anse was thought to be aptly chosen for the high-resolution scaling owing to its high importance to the country's tourist industry, popularity amongst locals and the infrastructure along its shoreline. Visual evidence of past erosive events, such as exposed tree roots and structural damage to buildings were seen at many of the bays.

#### ***Data Collection***

Bathymetric and topographic surveys were undertaken in order to supplement the existing available maps and charts, which offered little site-specific nearshore data within each bay and shoreline. This survey data, in addition to digitized information from IKONOS imagery, the common digital database (CDD) for Grenada, available topographic maps and bathymetric charts were combined to create a digital database for the study bays with the most current data. This database allowed for a better understanding of the physical features, such as reefs, offshore islands and headlands that characterize each bay and subsequently provided data for the nearshore wave modeling and the determination of beach profiles for input into the erosion model.

Sand samples were collected from the beach area at each bay in order to determine the median grain sizes, an important input parameter to the erosion model. This was done by means of cumulative sand grain size analysis and this revealed that sand sizes ranged from 0.22 to 2.73 mm for all bays studied, thus from fine sand to granules. Grand Anse was observed to have coarse sand.

Anecdotal evidence was collected by means of conducting interviews at each bay. This revealed that the magnitude of erosion experienced as a result of past category 3 and 4 storms with waves comparable to the 20 to 75 year-return period waves generally ranged from 10 to 50 metres, with the exception of Milet Bay which was said to have had 100 meters of erosion. Sand mining was observed to take place at South Great River Bay on Grenada's eastern coastline.

### ***Wave Climate***

A statistical investigation of a historical hurricane database was conducted in order to define the hurricane wave climate that each bay is subject to. This analysis revealed that each bay exists in varying hurricane wave climates. The worst 100-year return period wave had a height of 13.16 metres, period of 17.8 seconds and originated from the southeast at the north northeastern tip of island. Grand Anse was seen to have experienced a number of category 4 and 5 hurricanes within 500 km of the bay and the most severe waves associated with a 100-year event came from the northwest and north with heights of 6.18 and 6.77 respectively. In addition, the worst northerly 100-year return period wave occurs most frequently at this location.

Near-shore hurricane wave modeling revealed that the majority of study bays had incident wave heights of less than 1 metre for the waves considered. However, beaches such as Bathway, Magazin and Meadow and Sauteurs Bay had wave heights reaching 2.5 metres at the shoreline. The southern half of Grand Anse was observed to be more vulnerable to wave energy (wave heights between 1 and 2 metres) than the northern half (wave heights do not exceed 1 metre).

### ***Storm-Induced Erosion Modeling***

The erosion model utilized for the purposes of this study is the Storm-induced Beach Change model (SBEACH) as it is a well known numerical simulation model that predicts beach-profile changes in response to varying wave conditions. Important input parameters to the model included three (3) equally spaced bathymetric profiles for each bay and eight (8) for Grand Anse (obtained from digital database) and associated median sand grain size, tidal characteristics and wind conditions.

The model was firstly calibrated using waves originating from Hurricane Lenny (1999) and Ivan (2004) and the erosion noted to have occurred as a result of these storms from the interview exercise. Once this step was complete, the model was run using the two worst design 100-year return period waves for each bay obtained from the hurricane wave climate investigations.

These waves were the design storm waves utilized for each bay for the purposes of this study and are all comparable to waves originating from category 4 and 5 hurricanes. Global sea level rise of 0.2 metres for the shelf period time of 20 years and inverse barometric pressure rise were additional considerations for these design model runs. Erosion was defined to be that distance from the pre-storm mean sea level position to the landward extent of the erosion scarp, thus to the landward extent at which a person would observe eroded beach material.

Short-term erosion results for Grand Anse Bay range from 22.5 to 48.7 metres for the northerly 100-year return period wave of 6.8 metres and from 25.8 to 41.7 metres for the 6.2 metre northwesterly wave. Morne Rouge was seen to have the least erosion estimates of less than 20 metres. Erosion was predicted to be greater than 100 metres at Bathway Beach and erosion in the magnitude of 100 metres may therefore be expected at this beach. For the remainder of bays predicted beach erosion from the initial shoreline to the landward extent of the erosion scarp was predicted to be between 20 and 90 metres.

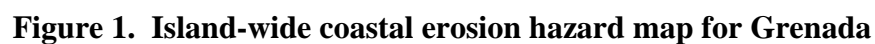
### ***Long-Term Erosion Trends***

As mentioned previously, long-term erosion trends were duly considered for the study. These trends were estimated by means of the Bruun model and a conservative sea level rise figure of 10mm/year was utilized for this exercise so as to be in line with a previous CPACC erosion study done for Grenada. Predicted shoreline retreat generally ranged from 3 to 10 metres, with the exception of Grenville and Meadow having erosion greater than 20 metres and Pink Gin less than 3 metres. At Grand Anse, the shoreline was seen to retreat by approximately 4 metres in 20 years, similar to that estimated by CPACC erosion study. Short-term erosion with a 100-year return period wave was predicted to have a far greater impact on the shoreline than long-term erosion at all bays considered.

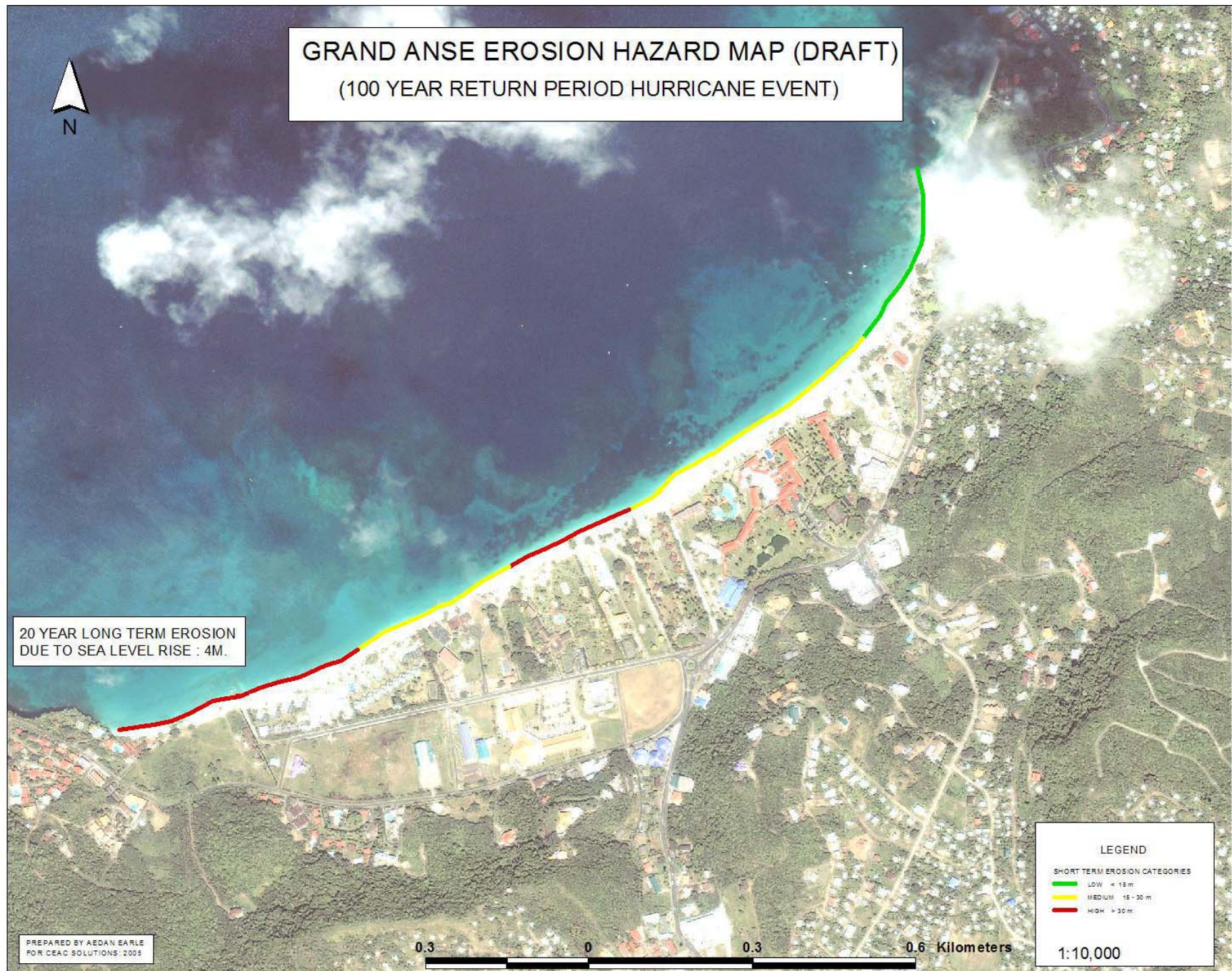
### ***GIS Hazard Mapping***

Both the worst predicted storm-induced erosion and the long-term erosion trends were mapped using Geographical Information System (GIS) technologies. The short-term trends were classified into three (3) categories and mapped with a colour-coded line. The two worst 100-year return period waves for each bay were also incorporated on the island wide map.

Figure 1 illustrates the coastal erosion hazard for the entire island of Grenada. As seen in this map, storm-induced erosion is not uniform with the majority of bays being vulnerable to erosion distances greater than 30 metres. Figure 2 shows the high-resolution study area, Grand Anse Bay and clearly depicts the most vulnerable section to storm-induced erosion to be situated to the south. Coarser sand samples at this section, in addition to relatively high energies support this finding.









### *Additional Considerations*

It is important to note that beach profile changes owing to sea level rise, beach nourishment and sand mining may greatly alter the beach characteristics used within the analysis, and thus the predicted erosion trends. It is therefore strongly recommended that a detailed study of the anthropogenic activities, specifically beach nourishment and sand mining be undertaken. In addition, exploring possible beach protection works for the most critical areas should be done in order to lessen the effects of future erosion events. Vulnerability and risk assessments would be an ideal tool in identifying these critical areas.

### **3.2.2 Landslide Hazard Map for Grenada**

The landslide mapping project was initiated by project inception meetings and field reconnaissance in Grenada. The consultant project team met with the HMVA Subcommittee to discuss the technical approach to developing the landslide susceptibility maps. The HMVA Subcommittee requested that the consultant project team include in the final report recommendations on best management practices to reduce the frequency and severity of landslide events.

The major study area covers the entire island of Grenada but does not include the adjacent island of Carriacou, which also falls under the jurisdiction of the Government of Grenada. The Terms of Reference for this landslide mapping project also included a Pilot Study Area. In consultation with CDB and the Government of Grenada, the area surrounding the community of Florida which is very susceptible to landslides and landslips was selected for the pilot study. It was agreed on that the output scale for map for Grenada would be:

- Island-wide map at a 1:25,000 scale<sup>1</sup>; and,
- High-resolution maps at a 1:10,000 scale of Florida.

The field reconnaissance occurred over five days in early September of 2005 and was conducted by an engineering geologist, environmental planner and geographer, in addition to local government representatives who had intimate knowledge of the islands and helped locate recent and historical landslide events. Once landslides were located, the field reconnaissance team would take a Geographical Positioning System (GPS) reading and then evaluate the physiographic, geologic and human influences that may have played a role in causing the landslide. The field reconnaissance, review of previous technical studies and evaluation of the spatial distribution of landslide events led the consultant project team to identify five factors that were most important in causing landslides. They included:

- **Slope** – the steepness of the hillslope, expressed as a percentage
- **Slope Aspect** – the orientation of the hillslope to the prevailing winds
- **Elevation** – used as a surrogate for the influence of rainfall intensity

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<sup>1</sup> Please note that base map data used for production of maps was at a scale of 1:25,000; however, final map was plotted at 1:30,000 scale in ArcGIS.

- **Geology** – the underlying bedrock units from geologic surveys
- **Soils** – soil mapping units from soil surveys

A geographic information System (ArcGIS), a computer-driven geographic mapping program, was used to overlay and combine the physical, geologic and soils data necessary to create the landslide susceptibility maps. The hazard mapping methodology utilized in this study systematically combines several factors in a GIS model to provide insight into landslide susceptibility. The mapping methodology developed in this study can be divided into four (4) steps:

**Step One – Landslide Inventory Map.** Landslide occurrences were mapped and observations were noted of landslide type, location along hillslope, slope angle, depth of landslide whether shallow or deep seated, and the nature of the bedrock including rock type and degree of weathering. This inventory was provided in both hard copy and digital formats to provide a landslide chronology that can be updated over time.

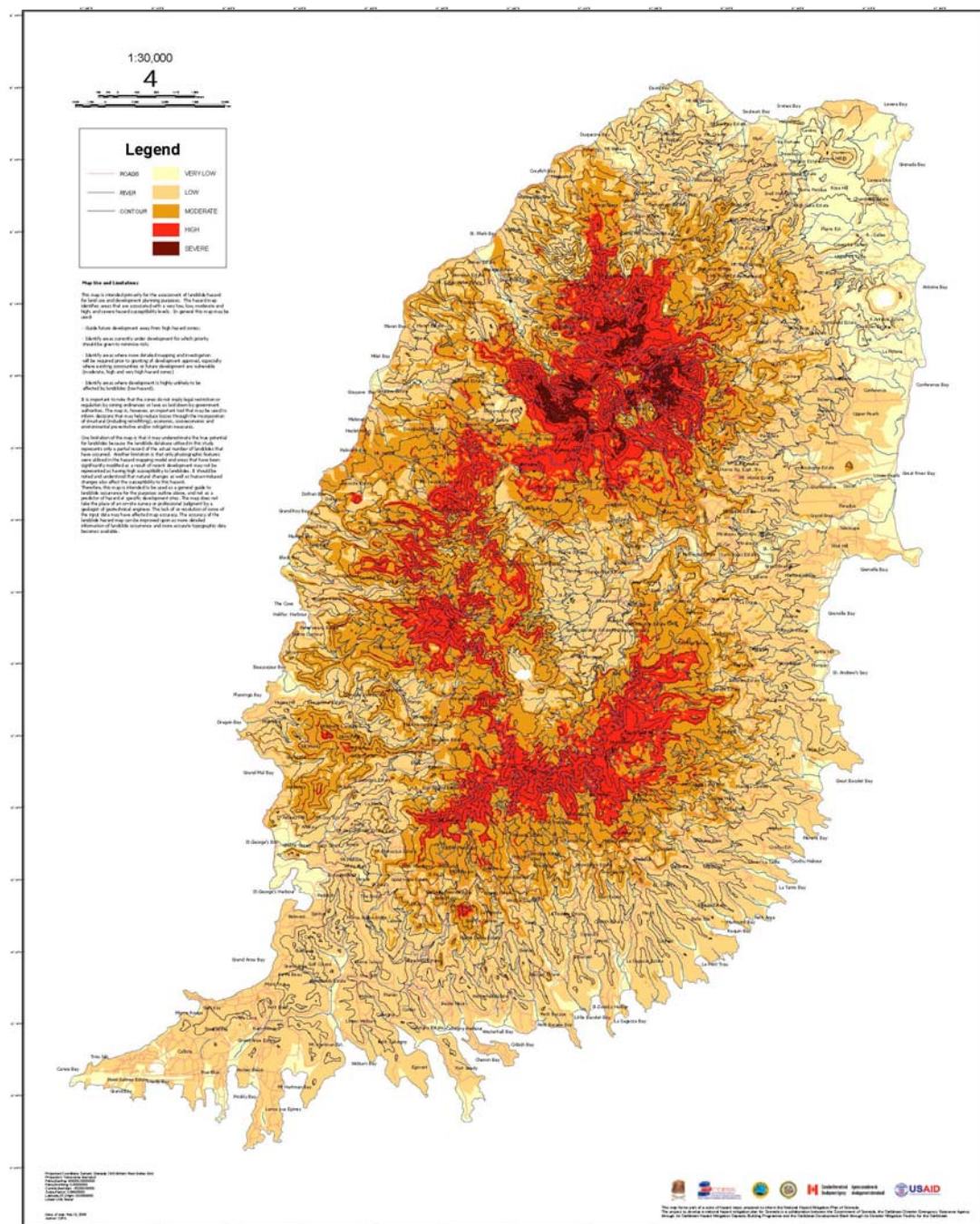
**Step Two – Base Map Preparation.** A series of base maps related to the five factors noted above were compiled from the Common Digital Database (CDD), prepared under a previous CDERA/CDB consultancy. The base maps were converted to particular formats to facilitate analysis at the proper map resolution.

**Step Three – Base Map Classification and Factor Map Development.** The landslide inventories allowed the project team to determine the frequency of landslide events that occurred within different geologic and soil mapping units, in addition to selected categories of elevation, slope angle and slope aspect. The project team was able to query the database to determine the number of landslides within each category, calculate the percentage of landslides within that category, determine the total area of a category and, finally the percentage of area for that category compared to the total area of the study area. These calculations allow an estimation of relative landslide susceptibility based on a ratio comparing percentage of the land in a specific category and relates it to the percentage of landslides mapped in that same category. This ratio provided the project team with a map for each factor influencing landslide susceptibility and quantitative means to rank the relative importance of each factor.

**Step Four – Hazard Model and Susceptibility Map Development.** A susceptibility mapping model was prepared that reflected the varying influences of slope, elevation, aspect, geology and soils. The model used a simple mathematical overlay process that adds the susceptibility ranking for the corresponding cells of each factor map together. The output of the model was reclassified into five susceptibility categories: *Very Low, Low, Moderate, High, and Severe*. These five categories provide an indicator of landslide susceptibility throughout Grenada.

The landslide susceptibility maps for Grenada were distributed to the respective government agencies in several different formats. Digital and hard copy formats will be provided at 1:25,000 for the island-wide map and at 1:10,000 for the Pilot Study Area surrounding the village of Florida.

## Landslide Hazard Map of Grenada, West Indies



There are several limitations that must be considered in utilizing the landslide susceptibility maps for Grenada. The five categories represent the potential for landslide events not their actual occurrence. Study limitations included the time available for the field work and field evaluations were constrained by road access to landslide sites. For major road and infrastructure projects, site-specific geologic investigations are recommended. That being said, the landslide susceptibility maps provide an important tool for development review and physical planning functions. The maps are an important input to any vulnerability assessment, provide an understanding of landslide hazard and contribute to the development of national hazard mitigation plans.

The landslide hazard map for Grenada is intended as a development planning guide for major projects. For minor projects site specific landslide analysis may be required as part of the Physical Planning Unit approval process. The full Landslide Hazard report for Grenada provides a series of recommendations on utilizing the landslide susceptibility maps and best management practices for minimizing the potential for man-caused landslide events. They include development planning considerations, general site planning considerations and specific recommendations for reducing landslides alongside roadside cut and fill slopes.

### **3.2.3 Flood Hazard Map for Grenada**

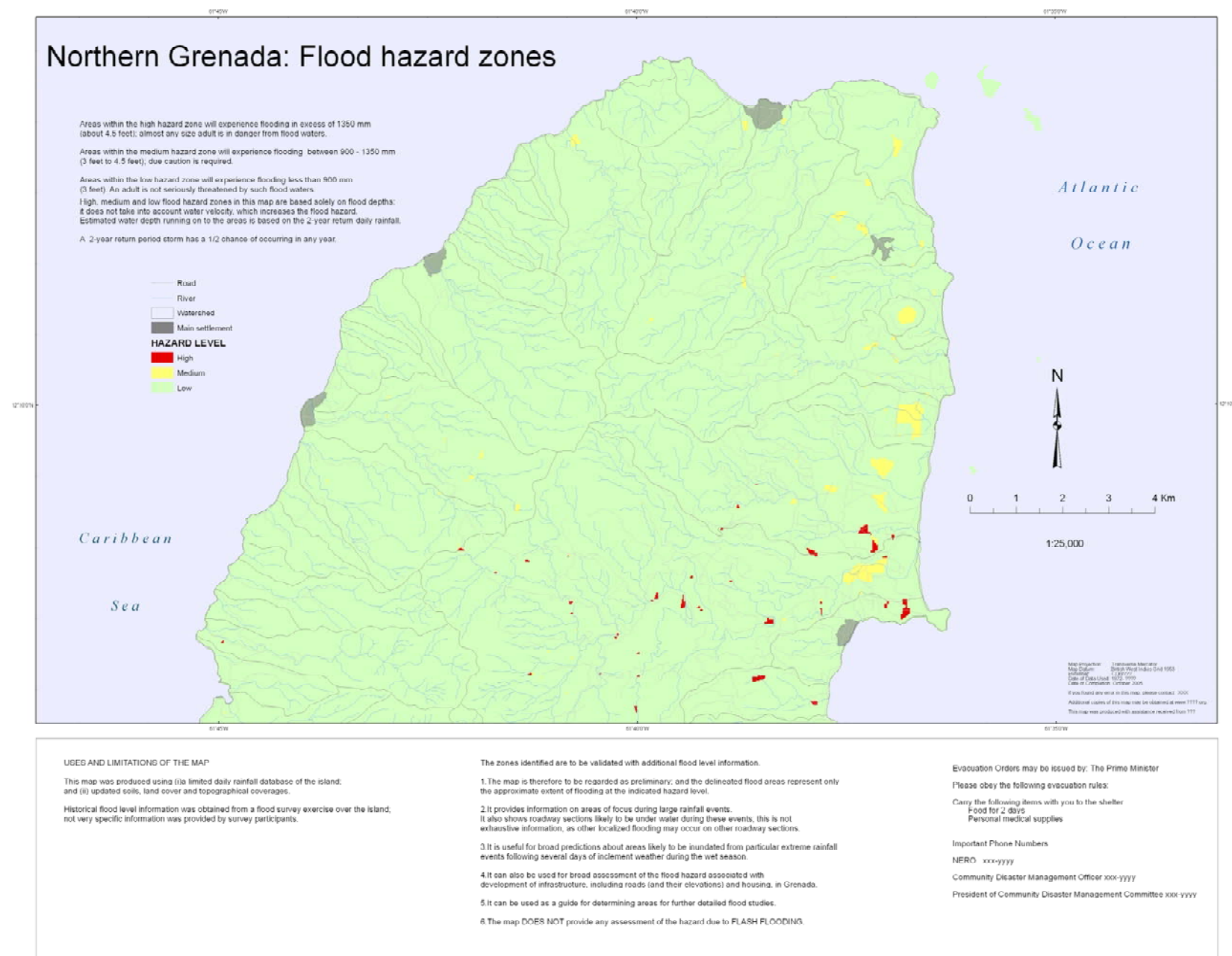
The Flood Hazard assessment and mapping processing for Grenada was undertaken at two levels, island-wide and for the St. John's River Basin which floods frequently.

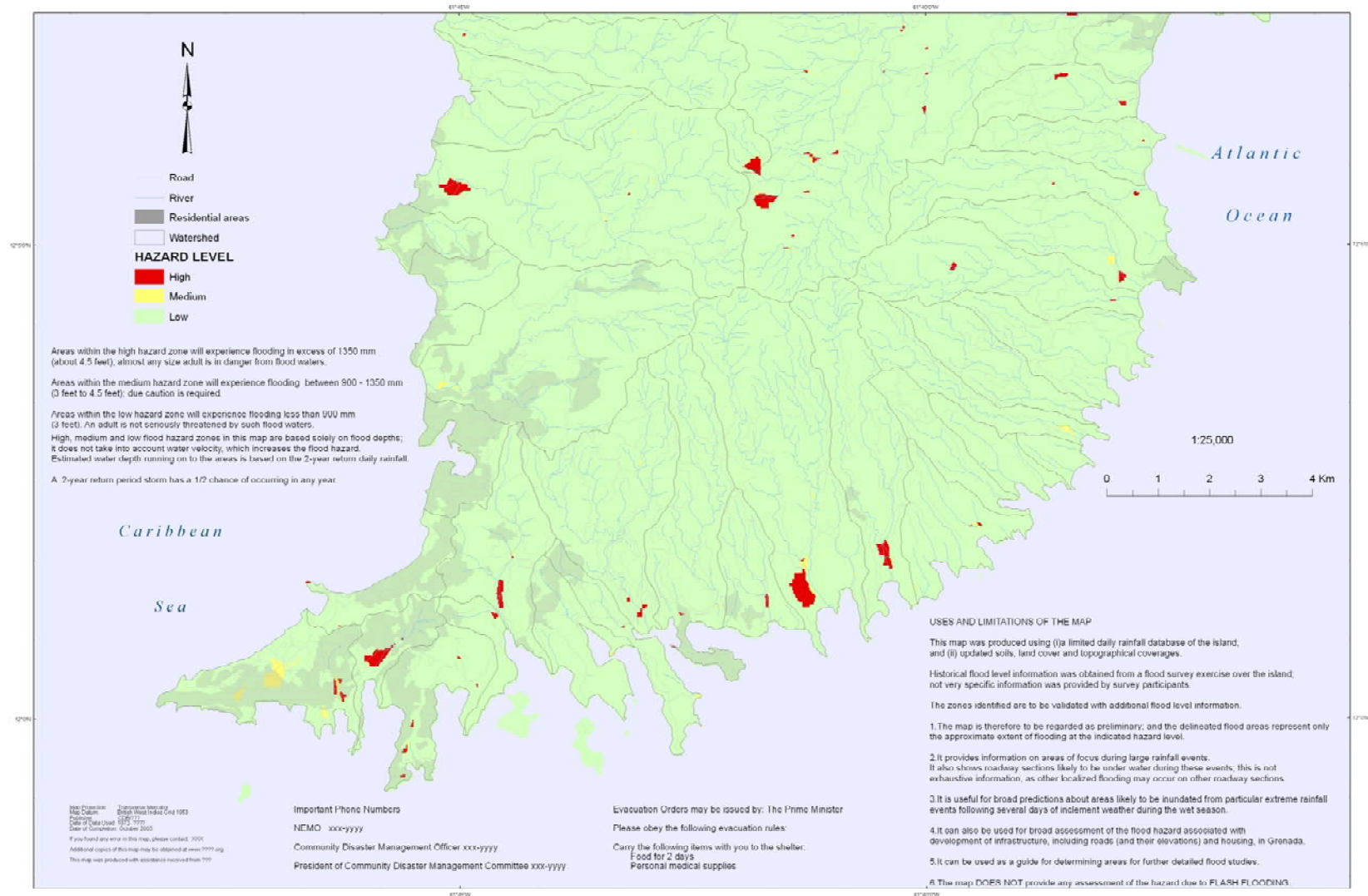
#### **Island-Wide Map**

The model used to generate the island-wide map is based on the ranking and interaction of the major contributing factors that determine the extent and frequency of flooding, namely, land cover and soil hydrologic characteristics of the upper catchment, extreme daily rainfall, and the slope of the floodplain. The combination of the land cover and soil hydrologic characteristics are quantified using the empirical curve number approach of the Natural Resources Conservation Service (NRCS, formerly Soil Conservation Service) that rank runoff potential of lands on a scale of 1 to 100, lands with 100 having the highest runoff potential. The ranges chosen for this criterion were based on the expected fraction of runoff from the 2.33-year return period daily rainfall event but these values should be finalized by calibration using reported flood levels from flood surveys. The 2.33-year return period is the return period of the arithmetic mean of the extreme rainfall values. Rainfall for such an analysis cannot be mean annual rainfall, as has been suggested in other places because such a parameter does not capture the fact that flooding is caused by extreme rainfall event over short time intervals. It is more appropriate to use the mean daily value of extreme rainfall events for assessment.

There are two sections in the island-wide flood hazard map for Grenada, one showing the location of the hazard zones, the other section providing information about the map and its use. The map defines three hazard zones, high, medium, low, on the basis of the danger posed to an average human being as a result of floodwater depths.







## Southern Grenada: Flood hazard zones

The map, which is at a scale of 1:25000, shows the important settlements, the road network and the catchments contributing runoff to the hazard zones. The other section provides explanations of the procedure for producing the map, the required assumptions and approximations and the limitations and use to which the map could be placed.

As would be expected for steep terrain such as is the island of Grenada, few areas are prone to flooding and so most of the island falls in the “low” hazard category. But it should be remembered that this category does not cover “flash flooding” that might be experienced in several places over the island. Several areas are designated as high because they have very small mean slopes, are downstream of runoff contributing areas with high Curve Number (CN) values and the ratio of the area of the contributing areas to their area is large.

### **St. John’s River**

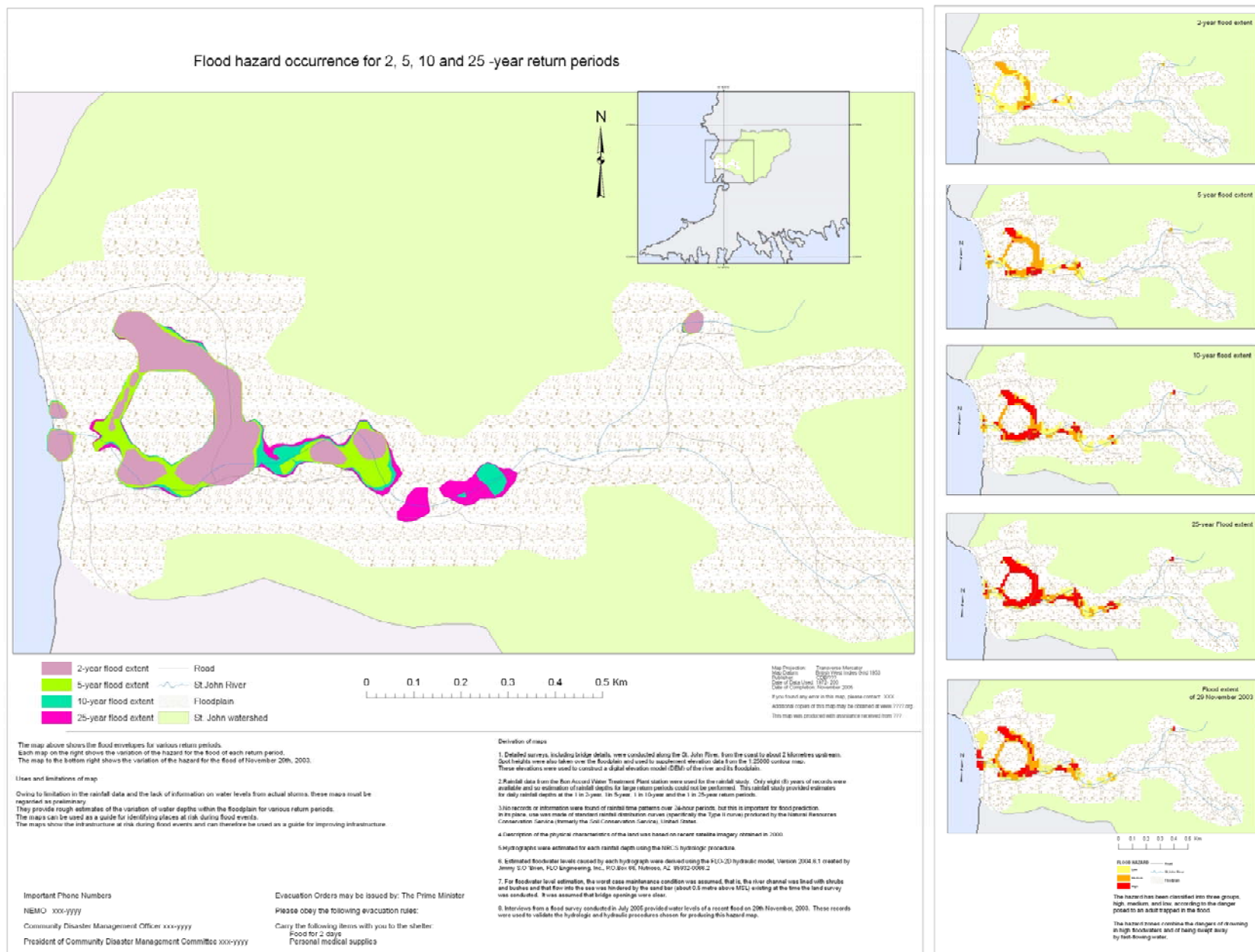
A hydrologic analysis was performed on the St. John River Catchment using the NRCS hydrologic procedure. This procedure is empirical and, as mentioned above, is based on rating the runoff potential of lands within the catchment on a numerical scale varying between 1 and 100, 100 representing lands of highest runoff potential. This CN number, depends on the land cover and the soil type. Values for a wide range of soils and land cover are available from standard tables and the user is required to match descriptions in the table to the land cover of the catchment under study. The physical characteristics of the catchment were derived from digital maps from which input parameters for completing the description of the catchment were obtained. Extreme daily rainfall depths were obtained from the database available and the depths were distributed in time using the Type II distribution from the NRCS procedure. This curve was used because of the unavailability of actual time-depth distributions from at least one storm. It is acceptable procedure to choose at least one significant storm falling within or in close proximity of the catchment, failing the availability of long-term temporal distribution. Only recently has continuous recording stations been installed on the island which can provide the much needed information on time-depth relations on the island. When these instruments have been fully established then the use of the Type II curves will no longer be required and this will perhaps reduce uncertainty in the results from the hydrologic analysis.

The detailed flood hazard map for the St. John River Floodplain has three sections with three major pieces of information. The major section, which is at a 1:2500 scale, describes the spatial extent of floodwaters at various rainfall return periods that are distinguished by colour. It shows important features on the floodplain and thus informs on the likelihood of flooding of these features. There is not significant variation in the spatial extent of the flood owing to the steep sides on the fringes of the floodplain, but the floods differ in their depth. This cannot be well represented on such a map.

The map suggests that flooding occurs along the reach of the St. Jon River on the floodplain. Most vulnerable appears to be the area in the vicinity of the two sharp bends, and around the stadium by the Humpback Bridge, both of which flood even for the frequent 2-year return period rainfall. The reason in both cases is due to inadequacies in the drainage channel.



## Flood hazard occurrence for selected return periods, St. John River, Grenada



The two sharp bends always will pose a problem, but this unfavourable alignment is compounded by the poor maintenance of the river. The flooding is further aggravated by the presence of the sandbar at the river mouth and siltation from around the Humpback Bridge.

The danger posed by flooding from the 2-year rainfall event generally is low to medium except in one area around the Humpback Bridge where it is high. For the 5-year rainfall event, the danger increases with a substantial portion of the inundated area designated as high. For the higher rainfall events, the 10-year and the 25-year rainfall events, persons should avoid almost all of the inundated area as there is strong threat to life.

The removal of vegetation is likely to make some impact, but if possible, consideration should be given to river training works, including lining with concrete and realigning at the bends, of course if such an option is favoured by the necessary environmental and social impact assessments. Flood mitigation measures must include debris traps, especially in the upper catchment, to minimize the occasions of blockages at the bridges by logs, as this would further exacerbate flooding.

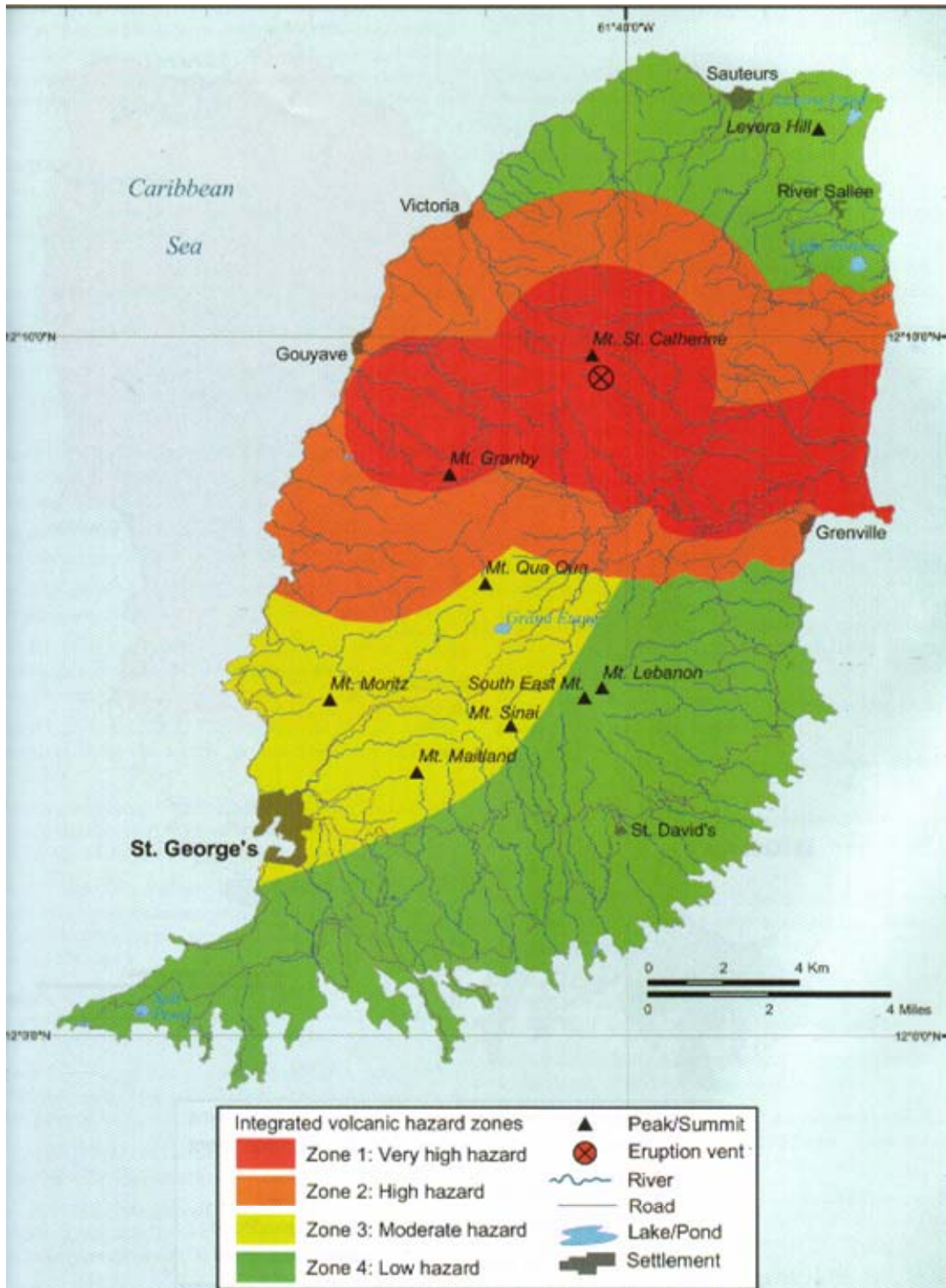
### **3.2.4 Volcanic Hazard Map for Grenada**

Data on volcanic hazard for Grenada is taken from the Volcanic Hazard Atlas for the Lesser Antilles (UWI, 2005).

Mt. St. Catherine is the only live volcano on Grenada. “Based on the geologic record, future eruptions on Grenada may involve activity at Mt. St. Catherine or single explosive eruptions from monogenetic volcanic centers similar to those found at Grand Etang and Lake Antoine. There appears to be a roughly linear trend in the location of the existing explosion craters and it is most likely that future activity of this type will follow this trend.

It should be noted that the potential distribution of future explosion craters extends from Sauteurs in the North of St. George’s in the south of Grenada. Specific hazard maps for these types of eruptions cannot be drafted before the actual onset of eruptive activity since the future vent location of a monogenetic explosion crater cannot be predicted prior to the onset of precursory activity.”

Three likely scenarios have been inferred for Mt. St. Catherine. It is possible that these may occur as single independent events or they may simply be different stages in the evolution of a given crisis. An integrated volcanic hazard zone map has been developed for Grenada based on the three scenarios for future volcanic eruptions from Mt. St. Catherine. These zones attempt to give an indication of the overall hazard in different parts of the island so as to enable disaster officials to better prepare for future activity (including assessment of volcanic risk).



**Figure 3-1 Integrated Volcanic Hazard Zones for Grenada – Based on Eruption of Mt. St. Catherine**

### 3.3 Vulnerability Assessment

As part of the plan development process a national vulnerability assessment was conducted for Grenada. The assessment approach was developed using simple procedures for risk scoring, based on a methodology developed by the United States National Oceanographic and Atmospheric Administration (NOAA). Their “Community Vulnerability Assessment Technique” was expanded and modified to focus only on critical facilities. The approach comprises of three measures of risk:

1. Hazard Scores. This involves performing overlays of critical facilities on hazard maps. The result of this step is to develop a hazard score for each critical facility that corresponds to the location of the facility within designated hazard risk areas.
2. Exposure Rating. This involves developing a critical facility rating on several attributes collected during field reconnaissance. The critical facilities were classified according to economic factor (dollar value or replacement cost of the facility) and an importance factor (criticality of use or importance following a disaster event). This allows the facility to be assessed on two important elements of vulnerability (i.e. economic versus operational vulnerability).
3. Combined Vulnerability Score. This step combines the data and analysis developed under previous steps to understand the hazard/exposure combination for each critical facility. Once the vulnerability scores have been assigned they will be cumulatively added to determine the combined vulnerability for each facility.

The methodology is designed around simple databases or spreadsheets and maps generated by Geographic Information Systems (GIS) software. GIS maps delineate the designated hazard areas and locations of critical facilities. The resultant tabular reports include:

- 1 Hazard Score Table: Provides vulnerability score based on simple GIS overlay procedures (susceptibility levels). Also provided in this table will be a cumulative hazard score (all hazards) and an average hazard score (# hazards/cumulative hazard score).
- 2 Exposure Score Table: Provides exposure scores based on attribution of economic value and criticality.
- 3 Combined Vulnerability Score Table: Average Hazard Score (each facility) \* Exposure Score (each facility).

The results of this analysis inform hazard mitigation planning by identifying critical facilities that are vulnerable to priority natural hazards and their degree of vulnerability – i.e. those located in high-risk areas, of high economic value, and of importance to emergency response and disaster management. The scoring methodology provides a tool for prioritizing actions to reduce the vulnerability of critical facilities.



The hazard, exposure and vulnerability scores are all valuable inputs to hazard mitigation planning for Grenada. The hazard mapping presented in the previous section provides valuable information for physical planning and development review for future development in the study region. The ranking of exposure alerts emergency management officials to the potential for monetary damages to critical facilities. When the hazard and exposure scores are combined it provides a powerful tool for hazard mitigation planning, by providing a ranking of the vulnerability of critical facilities in a particular location. Scarce financial resources can then be effectively targeted to retrofitting only the most vulnerable critical facilities.

### 3.3.1 Inland Flood Hazard Score

The Inland flood hazard scores ranged from 0 to 3.00. The facilities with the highest inland flood hazard scores are presented in the table below.

Facility_ID	Name	Flood Score
137	La Taste Community Centre	3
184	Woburn Medical Station	3

### 3.3.2 Coastal Erosion Hazard Score

The coastal erosion average hazard scores ranged from 0 to 2.00. The facilities with the highest coastal erosion hazard scores are presented in the table below.

Facility_ID	Name	Erosion Score
7	Boca Secondary	2
44	L'Esterre Pre School	2
64	St.Giles Anglican School	2
92	St. Andrew's Anglican Primary	2
123	Union Pre School	2
328	Grand Roy Plant	2

### 3.3.3 Landslide Hazard Score

The average hazard scores ranged from 0 to 3.00. The facilities with the highest average hazard scores are presented in the table below.

Facility_ID	Name	Landslide Score
137	La Taste Community Centre	3
16	Cable & Wireless	3
27	C & W Mt Royal Antenna An	3
36	Committee Center	3

58	Community Center	3
59	Clozier Community Centre	3
106	Texaco Service Station	3
326	Dougaliston Plant	3

### 3.3.4 Average Hazard Score

The average hazard scores ranged from 0 to 2.3. The facilities with the highest average hazard scores are presented in the table below.

Facility_ID	Facility Name	Average Hazard Score
137	La Taste Community Centre	2.333

### 3.3.5 Exposure Score

The exposure score ranged from 0 to 6.5. The facilities with the highest combined exposure score included in the table.

Facility_ID	Name	Exposure Score
164	SSU	6.5
190	Princess Alice Hospital	6.5
194	General Hospital	6.5

### 3.3.6 Combined Vulnerability Score

The combined vulnerability score ranged from 0 – 8.00. The facilities with the highest combined vulnerability score included in the table below.

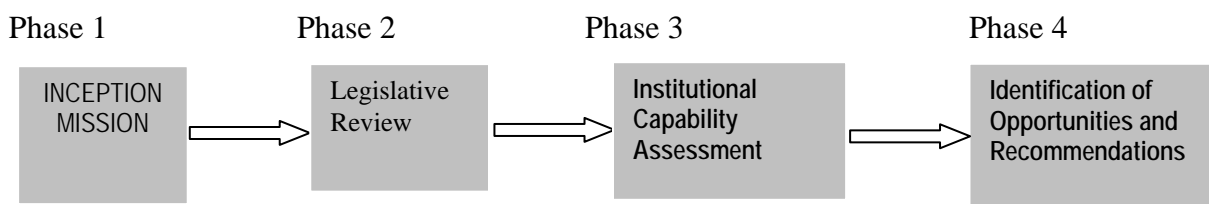
Facility_ID	Name	Cumulative Vulnerability Score
31	Lauriston Airport	8.0
106	Texaco Service Station	8.0
127	Ministry of Health Sauteurs	8.0

The maps showing the island vulnerability assessment are attached in Annex I of this report which also includes the detailed assessment for all critical facilities in Grenada.

## SECTION 4.0 CAPABILITY ASSESSMENT

The capability assessment for hazard mitigation in Grenada was conducted within the framework of Post Ivan Reconstruction. There were two broad objectives: first, to determine the existing national capability for hazard mitigation through a review and assessment of legislation, agency mandates, policies, and activities; and second, to identify opportunities for the incorporation of mitigation policies and disaster risk reduction mechanisms in the post-Ivan programme being managed by the recently formed Agency for Reconstruction and Development (ARD).

The assessment, completed in July 2005, was conducted in four (4) broad phases inclusive of an inception mission (see Figure 1).



**Figure 1. The Assessment Process**

A one-day capability assessment workshop was held in October 2005 to discuss the findings of the assessment and reach consensus on the impediments to implementing effective hazard mitigation programs in Grenada.

### 4.1 Existing Institutional Framework for Hazard Mitigation

Hazard mitigation in Grenada is fragmented across at least ten (10) agencies in Grenada without any sustained national coordination role mandated by legislation or appointed to any single agency. Hazard mitigation initiatives appear to have arisen as a part of the mandate of a few existing agencies in response to a recognition of specific needs. Those agencies involved in hazard mitigation pre-Ivan are a mixture of government, private, non-governmental and quasi-government institutions. A summary of the institutional structures that have had a pre-disaster hazard mitigation role and participate in mainstreaming disaster risk reduction in the Post-Ivan reconstruction programme are presented in Table 1.



**Table 1: Administrative Arrangements for Hazard Mitigation**

HAZARD MITIGATION		
Pre-Ivan	Post-Ivan	Activities
National Emergency Relief Organisation (NERO)		Collaboration with other agencies undertaking hazard mitigation initiatives
Agency for Rural Transformation (ART) Ltd.		Community-based disaster preparedness, vulnerability assessments and hazard mitigation activities
Grenada Red Cross Society		Community-based disaster preparedness programmes and vulnerability capacity assessments. Community-based disaster facilitators' training
Physical Planning Unit, Ministry of Finance		Preparation and implementation of National Physical Development Plan. Enforcement of development control regulations and building code/ guidelines
Land Use Division, Ministry of Agriculture		Technical assistance to NERO for policy formulation
Grenada Ports Authority		Internal procedures and simulations
Project Coordination unit, Ministry of Finance		Implementation of retrofitting and civil works projects
Sustainable Development Council		Participation in development of National Hazard Mitigation Policy
National Hazard Mitigation Council		Informs NERO and line ministries on mitigation issues
	Agency for Reconstruction and Development (ARD)	Committed to the appointment of a hazard mitigation specialist. Focus on incorporating hazard mitigation into the recovery efforts.
	National Advisory Council for Reconstruction and Development	Council informs ARD on reconstruction issues
	Grenada Electrical Services Ltd.	Development of a comprehensive disaster management plan (85% completed)
	Emergency Housing Committee	Construction of low-cost housing that meets minimum building code standards

Notwithstanding the foregoing, it is important to acknowledge the progress that the Government of Grenada (GOG) has made over the past five years in giving natural hazards risk reduction greater visibility as a national priority and creating formal and informal mechanisms to promote hazard mitigation initiatives. The GOG has endorsed the regional Comprehensive Disaster Management Strategy and has a standing National Hazard Mitigation Council to inform the National Disaster Management Agency (formerly NERO) and other government agencies on mitigation issues. As demonstrated by the name change from National Emergency Relief Organisation (NERO) to National Disaster Management Agency (NaDMA), there is increased awareness off and commitment to integrating natural hazard mitigation into the development planning process.

The implementation of the recently completed National Physical Development Plan can be an important mechanism for creating a more disaster resistant and sustainable future in Grenada. The Sustainable Development Council and a multi-sectorial Committee was instrumental in developing the recently adopted National Hazard Mitigation Policy.

Post-Ivan reconstruction presents a unique opportunity for the introduction of new approaches that will help reduce risk of future disasters and to achieve more sustainable development. The GOG worked closely with the Caribbean Development Bank (CDB) and the United Nations Development Programme (UNDP) to prepare the Policy and Operational Framework for Mainstreaming Disaster Risk Reduction into the Post-Hurricane Ivan Reconstruction Process in Grenada (CDB/UNDP 2004). Two new institutional structures were created by GOG to lead and inform the Post-Ivan long term recovery and reconstruction process; the Agency for Reconstruction and Development (ARD) and the National Advisory Council for Reconstruction and Development (NACRD). Both of these newly created corporate bodies have the potential to further the institutionalization of hazard mitigation.

The key institutional structures and a description of their activities are summarized below:

#### **4.1.2 Pre- Ivan Arrangements**

With respect to the pre-disaster period, the Physical Planning Unit has the legislative mandate to support a range of hazard mitigation activities through the implementation of its National Physical Development Plan and the enforcement of development control regulations. However, the Agency had neither the technical nor human resources required to be effective in the reduction of long-term vulnerabilities to natural and technological hazards. The Land Use Division of the Ministry of Agriculture has technological tools such as a geographic information system that could be utilized in the mitigation of hazards, but this agency is also short of staff to allow for sustained collaboration with other agencies in the implementation of a national programme.

It is also noteworthy that the work at the community level by the Agency for Rural Transformation, a Non-Governmental Organization (NGO), and the Grenada Red Cross

Society, with whom it works closely, is not well known among the government agencies interviewed during this consultancy. Also, NERO was significantly under-resourced prior to Ivan, and unable to extend itself to collaborate with the wide range of agencies required to be involved in a nationally coordinated hazard mitigation initiative.

The work of the Grenada Ports Authority more or less stands alone and details of it are relatively unknown to GOG's line ministries or the NGO community. Similarly, the Project Unit has a relationship only with those agencies benefiting from project funding such as the Ministries of Education and Health, and their job is often to impose minimum building standards that have been set by regional or international funding agencies.

In summary, despite the strategic policy focus given to hazard mitigation through the development of a policy under CHAMP/DMFC in 2003, at the time of writing this report there was no national coordinated framework within which to implement this type of policy initiative. Nonetheless, an important process of institutional building was started through the involvement of the Sustainable Development Council (SDC) in the development of the national hazard mitigation policy. The SDC is a quasi-governmental organization of private and public sector organizations and individuals that provides a framework for inter-agency information sharing and collaboration. In the pre-Ivan period, the work of the SDC had not yet witnessed the organizational changes required to support hazard mitigation in Grenada.

#### **4.2.2 Post –Ivan Arrangements**

The gog decided, very early on in the recovery process, to create a redevelopment authority, the agency for reconstruction and development (ard), to facilitate the reconstruction process. The establishment of the ard provided an excellent opportunity to ensure the implementation of hazard risk reduction in the reconstruction programme. The creation of any new institutional framework, such as the ard, takes time and the agency was just officially launched on March 15, 2005 at its new headquarters. A press release, posted March 27, 2005 on the Grenada emergency relief website ([www.grenadaemergency.com](http://www.grenadaemergency.com)), describes the functions of the ard, as follows:

- Ensure focus and direction for the national reconstruction effort;
- Coordinate the activities among Government Ministries;
- Coordinate and integrate private sector and civil society inputs and contributions;
- Coordinate international efforts and financial contributions;
- Ensure the optimal implementation of project activities;
- Track the impact on affected people, villages and communities;
- Evaluate and adjust response strategies and tactics; and,
- Account and report to the national and international communities.

It is anticipated that the ARD will serve as a vehicle for the effective coordination of hazard mitigation initiatives. This agency is well placed to incorporate the work of private agencies such as the Grenada Electrical Company and specialist committees such as the Emergency Housing Committee, both of which are showing a strong awareness of

the need to incorporate vulnerability reduction into development choices. In addition, full use should be made of the Sustainable Development Council to promote hazard mitigation across several sectors of the society.

The National Advisory Council for Reconstruction and Development (NACRD) was established to provide oversight and inform the ARD on problems and opportunities arising during the reconstruction programme. The ARD includes representation from a broad range of public, private and non-profit stakeholders. The NACRD provides a potentially effective mechanism to inform the ARD and the Cabinet on reconstruction priorities, especially the need to maintain vigilance in mainstreaming disaster risk reduction in GOG and donor community redevelopment projects.

The Policy and Operational Framework for Mainstreaming Disaster Risk Reduction (DRR) into the Post-Hurricane Ivan Reconstruction Process in Grenada provides a set of guiding principles, goals, objectives and an operational framework for incorporating hazard mitigation in reconstruction (CDB/UNDP 2004). GOG has included the mainstreaming of DRR in the reconstruction process as one of the strategic objectives of the ARD and has already moved to incorporate elements of the DRR operational framework and the National Hazard Mitigation Policy into the ARD Strategic Plan.

The GOG held a national consultation entitled *Towards Sustainable Recovery* on December 7-8, 2004. The national consultation was led by the ARD and NACRD and was supported by the United Nations Development Programme (UNDP). Over 140 people participated in the two-day consultation. The objective of the consultation was to generate a shared understanding of the challenges that confront Grenada in the aftermath of Hurricane Ivan and a process of general consensus building to define recovery strategies that could ensure a more sustainable future for Grenada. The consultation was built around nine (9) sectoral roundtables that sought to analyze and define the challenges, outline implementation steps in preparing a recovery plan, as well as identify coordination and monitoring mechanisms. The outcomes from this important consultative effort were described in a final report and made available to the consultant team.

## **4.2 Legal Capability**

The Revised Laws of Grenada (1990), rules, codes, guidelines, and international conventions was reviewed to determine their relevance to hazard mitigation and mainstreaming disaster risk reduction in the post-Hurricane Ivan reconstruction process. Some thirty-one pieces of legislation were found to be relevant for the purpose of this study based on either the overall objective of the legislation or on specific provisions within the law. A description of each Act or subsidiary legislation, its overall purpose, major provisions, and a fuller treatment of its relevance to hazard mitigation is provided in Annex 1.

The specific objective of this review was to evaluate the existing legal framework to identify the strengths, weaknesses and gaps as they relate to hazard mitigation. For ease of assessment, the laws have been clustered and divided into the following categories depending on the subject matter or issues addressed by the legislation:

1. Disaster
2. Constitutional
3. Civil Defence
4. Physical Planning/ Development
5. Environmental/Natural Resources Management, Conservation and Protection
6. Health
7. Public Works/ Infrastructural
8. Marine Pollution
9. Tourism

Table 2 gives a summary description of the laws. Comments describe the relevance of the legislation to hazard mitigation. Relevance is further defined as being: (1) directly relevant (the objective of hazard mitigation or disaster risk reduction is explicitly or implicitly addressed in the legislation's purpose or provisions); (2) indirectly relevant (the legislation addresses other aspects of the disaster management cycle, or does not specifically address hazard management but implementation or enforcement of the legislative mandate would benefit hazard mitigation objectives; and, (3) high potential for synergy (a special category of relevance where the legislative objectives and provisions of the Act, while not specifically directed towards hazard mitigation, would provide significant societal and environmental benefits if linked in a mutually supportive fashion to a hazard mitigation programme).

**Table 2: Summary of the Relevant Legal Instruments**

<b>Issue/ Focal Area</b>	<b>Legislation</b>	<b>Description and Mitigation Provisions</b>	<b>Comments</b>
Disaster	The Emergency Powers Act	The Act provides the legal basis for a declaration of an emergency. There are no mitigation provisions.	This law serves only as a triggering mechanism to commence action during a state of emergency. Indirect relevance to hazard mitigation.
	National Disaster (Emergency Powers) Act	The main purpose is to provide for the maintenance of essential supplies and services. There are no mitigation provisions.	This law relates to response/ relief activity after a disaster has occurred in respect of essential supplies and services like food, water, electricity, gas, etc. Indirect relevance to hazard mitigation.
	Housing (Hurricane damage) Loans Act	This law is aimed at providing loans for repair and reconstruction of houses damaged by a hurricane. There are no mitigation provisions.	This law is very limited in scope and relates only to the provision of relief for the housing sector. The Act is limited to availability of low interest loans for home repair. Directly relevant to hazard mitigation.
Constitutional	The 1973 Constitution	s. 17 sets out one of the Constitutional functions of the Governor-General. It provides for the declaration of a State of Emergency.	This provision is a constitutional mechanism for triggering a State of Emergency. It does not assist with mitigation of hazards. Indirect relevance.
Civil Defence	Police Act	s.23 imposes a statutory duty on the Police to preserve the peace and to assist in the protection of life and property in cases of fire, hurricane, earthquake, flood and other disasters.	This provision does not address mitigation of hazards. It focuses on emergency response functions. Indirectly relevant.

Issue/ Focal Area	Legislation	Description and Mitigation Provisions	Comments
	Fire Brigade Act	The scope of this Act is limited to fire hazards. It spells out roles of firemen, police and volunteers to protect life and property from fire.	This law does not address hazard mitigation but focuses on response to fire hazards. Indirectly relevant.
Physical Planning/ Development	Physical Planning & Development Act	This is a modern piece of legislation and provides an adequate framework for physical planning. Effective implementation of this Act can strengthen the resilience of communities and hazard mitigation capabilities.	This law provides modern tools to prevent and/or reduce impacts of hazards (development controls, EIA, national physical plans, enforcement/ compliance, and consultative and integrated decision-making process). Directly relevant with high potential for synergy with mitigation programme.
	The Grenada Building Code	The current building code reflects 1992 OECS model standards. A Committee has been working to incorporate country-specific standards since 2001. Post-Ivan there have been calls for adding more stringent disaster resistance standards and adopting the new code quickly. Many provisions of the code address hazard mitigation.	Adopting and enforcing the new code requirements are priorities. This law should be implemented in a collaborative and integrated framework. Staffing and training inspectors are a concern and adequate implementation of code requirements could provide greater disaster resistance and improve safety. Directly relevant.
	The Grenada Building Guidelines	This instrument provides rules and standards for the design and construction of simple buildings. Provisions address hazard mitigation.	This instrument will complement the Building Code. See notes above on Grenada Building Code.
	Land Settlement Act	This is a very old act that addresses small holdings. There are no mitigation provisions.	Indirectly relevant.
	National Trust Act	This Act establishes the Grenada National Trust and describes the Trust's objects. There are no mitigation provisions.	Preservation of scenic landscapes that are hazard prone would benefit GOG mitigation objectives. Indirectly relevant.



Issue/ Focal Area	Legislation	Description and Mitigation Provisions	Comments
	Crown Lands Forest Produce Rules	This subsidiary legislation sets out the procedures for harvesting trees on Government or Crown lands. There are no mitigation provisions.	Sound management of forests on Government or Crown lands is a sound flood management principle. Indirectly relevant.
Environmental/ Natural Resources Management, Conservation & Protection	National Parks and Protected Areas	This Act provides for the designation and maintenance of protected areas including the prevention of landslips, soil erosion, etc. Hazard mitigation provisions for reducing severity and frequency of flooding and landslides.	The preparation and implementation of Management Plans provide a valuable tool for preventing or reducing the impacts of hazards. Directly relevant with high potential for synergy with hazard mitigation initiatives.
	National Heritage Protection Act	This Act provides for the protection of certain art work and artifacts. There are no mitigation provisions.	Indirectly relevant.
	Beach Protection Act	This Act prohibits the unauthorized removal of coastal materials like sand, stone, gravel, shingle, etc. Removal of coastal shore and near shore materials will worsen coastal and storm surge flooding. This Act can be considered a mitigation provision.	This Act is limited in scope and does not provide an adequate framework for integrated coastal zone management which may be used to strengthen the resilience of coastal and marine ecosystems. Directly relevant to mitigation.
	Birds and Other Wildlife (Protection) Act	This Act seeks to protect wild birds and other wildlife including fish, lobster, turtle and oysters. There are no mitigation provisions.	Preservation of the biotic and abiotic environments maintains disaster resilience. The process of harvesting wildlife may have adverse impacts. Indirectly relevant.

Issue/ Focal Area	Legislation	Description and Mitigation Provisions	Comments
	Forest Soil and Water Conservation	This law makes provision for the conservation of forest soil, water and natural resources. The Act requires the preparation of a forest policy. There are no specific mitigation provisions.	The development and implementation of a Forest Policy ensures the proper management, conservation and protection of biodiversity and strengthening related ecosystems. Indirectly relevant but with high potential for synergy with mitigation programme.
	National Water and Sewerage Authority Act	This law provides a comprehensive framework for the management of water resources and the proper treatment and disposal of sewage. The Act gives NWASA full authority over surface and groundwater resources. The Act is oriented towards ensuring adequate and quality public water supplies. Except for protection of catchment areas, the Act does not specifically address flooding issues. Limited mitigation provisions.	The law requires a national water and sewerage policy on water supply, distribution, conservation and augmentation. Consideration must also be given to flood plain management and comprehensive watershed protection. This will require a coordinated approach within the National Parks system, on Government and Crown lands, and with forestry and agriculture stakeholders for private lands. The existing legal framework does not provide a clearly delineated role for floodplain management.
	Pesticides Control Act	This Act regulates the importation, sale and use of pesticides. There are no mitigation provisions.	The proper implementation of this Act should support natural resources management objectives. The Act's mandate might be enlarged to provide a comprehensive framework for the management of hazardous and toxic substances. Indirectly relevant.

Issue/ Focal Area	Legislation	Description and Mitigation Provisions	Comments
	Plant Protection Act	This Act provides for the control of pests injurious to plants and to prevent the importation of plants and materials harmful to agriculture. There are no mitigation provisions.	The implementation of this act should improve the management and conservation of the environment and the building of ecosystem resilience. Indirectly relevant.
	Fisheries Act	This Act provides for the proper management of fishery resources. It allows for the creation and management of marine reserves.	The implementation of this act should improve the management and conservation of living and non-living marine resources. Indirectly relevant.
	Environmental Levy Act	This act imposes a levy on certain goods and services.	Indirectly relevant.
Health	Public Health Act	This is an old piece of legislation of wide scope including environmental health, drainage, nuisances, etc. It provides for the regulation of persons affected with any epidemic, endemic or infectious disease. Limited mitigation provisions.	The proper implementation of this act could assist in building the resilience of the social and economic sectors and or reducing socio-economic vulnerabilities. In addition, the Act promotes proper drainage in unhealthy areas to avoid public health and nuisance issues. Indirectly relevant.
	Waste Management Planning Act	This Act provides for management of solid wastes through use of best environmental practices. It requires the preparation of a Waste Management Strategy. Limited mitigation provisions to address potential of flooding at solid waste sites.	This law provides a comprehensive framework for the prevention, reduction and management of solid wastes. Depositing of plant and construction materials following major disaster events is a serious issue for small island states. Indirectly relevant.
Public Works/ Infrastructural	Roads Act	This Act governs the construction and maintenance of roads and the regulation of traffic. It also relates to maintenance of bridges, aqueducts, and drainage structures. Limited mitigation provisions.	This law provides a useful mechanism for ensuring the proper control, maintenance, protection and drainage along roads and water crossings. Indirectly relevant.

Issue/ Focal Area	Legislation	Description and Mitigation Provisions	Comments
	Ports Authority Act	Establishes the Port Authority with power to provide, manage and maintain efficient port facilities and services. Also general power to provide fire services within the Authority's jurisdiction. Limited mitigation provisions.	The Authority with fairly wide jurisdiction over matters relating to the provision of port services e.g. removal of any wreck or obstruction, control over the foreshore and entrance to ports. Ports are considered critical facilities and should be a high priority for mitigation. Indirectly relevant.
Marine Pollution	Civil Liability for Oil Pollution Damage Act	Enacted in 1988 response to International Convention. Act makes ship owners responsible for the release of oil and liable for damages. Provision addresses a human caused hazard.	The accidental release of oil from ships is much more likely to occur during natural hazard events. Directly relevant.
	Oil in Navigable Waters Act	Prescribes penalties for discharge of oil from vessels to waters under the Act's jurisdiction. There are no specific mitigation provisions.	Financial penalties are a strong incentive for minimizing the potential for hazard materials releases. See note above on relationship to natural hazards. Directly relevant.
	Oil Pollution Damage Compensation Fund Act	This Act implements a 1992 International Convention by requiring contributions to a fund to cover damages from discharges or accidental releases. No specific mitigation provisions.	The compensation fund facilitates the environmental and economic recovery from major oil spills. Indirectly relevant.
	Territorial Sea and Marine Boundaries Act	This Act defines the jurisdiction of GOG over the surrounding territorial waters. Limited provision noting pollution as a prejudicial act.	Indirectly relevant.
Tourism	Tourism Board Act	Establishes a Board of Tourism to promote the tourist industry. There are no mitigation provisions.	By its very nature, many of the hotels supporting tourism are located in hazard prone areas. Indirectly relevant.

Based on the review criteria described previously, the following key conclusions can be made on the existing legal framework for natural hazard mitigation in Grenada:

1. About two thirds of the laws reviewed were enacted more than 15 years ago. These tend to be more sector or issue specific and relate more to emergency response or relief. These include, for example, the Police Act, the Fire Brigades Act, the Constitution, the National Disaster (Emergency Powers) Act and the Housing (Hurricane) Loans Act. There is no single piece of legislation that addresses hazard mitigation and natural hazards risk reduction.
2. There are a number of fairly modern pieces of legislation which make adequate provision to reduce or prevent the adverse impacts associated with natural hazard events. The new Physical Planning and Development Control Act, once implemented, will be beneficial and presents great potential for synergy with national hazard mitigation objectives. This Act ensures the proper and orderly development of the land. This Act contains modern methods and tools that could assist in ensuring and maintaining adequate development standards such as Environmental Impact Assessment (EIA), development control, physical plans, and enforcement and compliance provisions. The Grenada Building Code and the Grenada Building Guidelines complement the new Physical Development Act and will further ensure that new building developments satisfy specified minimum standards for incorporating disaster resistance in new construction, major repairs and renovations.
3. Adequate environmental and natural resources management laws can assist in ensuring the proper management, protection and conservation of the environment and resource use, thereby maintaining or strengthening the natural resilience of ecosystems. Environmental degradation, pollution and loss of biodiversity may have significant adverse consequences on the quality of life. There are a number of existing laws that address specific environmental or natural resource use concerns. These laws, however, tend to be issue-driven and in some instances appear to be fragmented with overlaps and gaps. For example, there are three principal acts that seek to regulate aspects of water resources management: (1) the National Parks and Protected Areas Act affects critical watershed areas; (2) the Forest Soil and Water Conservation Act regulates some aspects of water especially as it relates to forests and the agricultural sector, and (3) the National Water and Sewerage Act has the overall mandate for water resources management.
4. Within the fragmented authorities related to water resources management, it is important to note that there is neither a clearly delineated ministerial role nor legislative mandate for floodplain management. The NWASA has full authority over surface and groundwater resources but its orientation is more towards ensuring an adequate public water supply. Specifically, there are no regulations to control development within areas designated as being at risk to riverine or coastal flooding events, including storm surges associated with hurricanes.

5. There is an OECS Sub-regional Environmental Strategy and Action Plan in addition to a National Environmental Policy and Management Strategy for Grenada. This policy and strategy is supported by a comprehensive national Environmental Management Act which is presently in draft form and needs to be promulgated. In the past the absence of clear legislation resulted in institutional overlaps, duplication and omissions. It is envisaged that the proposed comprehensive legislation would encourage a coordinated and integrated approach to decision-making and that could avoid the inefficient use of limited resources (financial, human, technological, information).
6. There is no comprehensive disaster management legislation in Grenada that addresses the full range of issues that arise during the disaster management cycle; that is, preparedness, response, recovery and reconstruction. Hazard mitigation is relevant throughout all four phases. Although there is a national coordinating entity, the National Disaster Management Agency (NaDMA), an established National Hazard Mitigation Council, and an adopted National Hazard Mitigation Policy, there is no clear legislative basis for supporting the functions of these entities or for the implementation of policy.
7. In the absence of specific legislation, it is apparent that the legal authority for disaster management is derived from a number of sources that include the: (1) Executive; (2) Constitutional, where the Constitution sets out a role for the Governor-General in proclaiming a state of emergency; and (3) weak legislation, for example the Emergency Powers Act and the National Disaster (Emergency Powers) Act. Neither of these pieces of legislation addresses hazard mitigation. The Emergency Powers Act is simply a response mechanism that is triggered in the event of an emergency, and the National Disaster (Emergency Powers) Act allows for the provision of relief, in particular the provision of essential supplies and services. In the absence of comprehensive disaster legislation these two Acts are currently used to fill this legal lacuna. Once an emergency, including a disaster, has been declared the respective government agencies must rely on their individual empowering Acts to undertake action.

### 4.3 Institutional Capability

This section comprises the identification and assessment of national policies, programmes and plans that relate to hazard mitigation, directly or indirectly, and an assessment of those institutions involved in hazard mitigation through legislation or custom. The assessment focuses primarily on those institutions and agencies involved in the recovery and reconstruction efforts.

For the purposes of this report the following definitions will be used<sup>2</sup>:

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<sup>2</sup> Some of the definitions have been adapted from FEMA (2004), United States Virgin Islands: Draft Territorial Hazard Mitigation Plan.

Policies – are statements that express the vision or intent of the country to support hazard mitigation.

Plans – are documents that provide a framework for the implementation of policy action in conjunction with a set of specific strategic objectives.

Programmes – are related, coordinated activities by one or more agencies that have a distinct focus or purpose. Programmess are often developed in direct response to policy and are enabled by the corresponding legislation or executive order.

Capability - describes the past and future potential performance of agencies to carry out the stated objectives of plans or programmes.

#### **4.3.1 Policies, Plans and Programmes**

Grenada has a few policies, programs and plans in place that explicitly support pre- and post-disaster hazard mitigation or have the potential to do so. With a focus on those agencies spearheading the long term recovery and reconstruction efforts, those policy documents and plans reviewed by the consulting team are listed as follows:

- Policy and Operational Framework for Mainstreaming Disaster Risk Reduction into the Post-Hurricane Ivan Reconstruction Process in Grenada – December 2004
- Grenada National Hazard Mitigation Policy – June 2003
- National Physical Development Plan: Grenada-Carriacou-Petite Martinique – August 2003
- National Environmental Policy and Management Strategy – December 2004
- National Environmental Policy and Management Strategy: Implementation Plan – February 2005
- National Disaster Plan (1995 Revision)
- Master Plan for the Tourism Sector: Final Report – February 1997

#### ***Grenada National Hazard Mitigation Policy***

##### *Description:*

This is a concise policy document that sets an overall framework for the development of a hazard mitigation plan for the country and a number of strategic interventions. The goals of this policy are explicitly:

1. To achieve sustainable development through the reduction of social, economic and environmental vulnerabilities to natural and technological hazards; and
2. To incorporate hazard risk reduction as part of the custom of the entire society.



The four guiding principles underlying the policy are:

- A multi-sectoral and integrated approach to hazard risk management and development planning
- The need for effective public education and public awareness programmes
- The need for community mobilization and active civil society involvement
- The need for environmental protection and reduction in social and economic vulnerabilities

Assessment:

This policy document was prepared by the National Hazard Mitigation Policy Development Committee that engaged in a consultative process with a number of key line ministries of Government and the National Sustainable Development Council (SDC). The SDC works through multiple agencies to provide an integrated, collaborative approach to national policy issues that could support sustainable development objectives. Against this backdrop, there is an understanding that a wide cross section of agencies, government, quasi-government, non-governmental and private agencies, have taken ownership of the policy and will incorporate its guiding principles into their own activities. However, the policy has no legislative basis and this may become problematic at a later stage when it comes to the implementation of essential plans and programmes that emanate from this policy.

***National Physical Development Plan for Grenada, Carriacou and Petite Martinique***

Description:

This is essentially a broad-based, spatial development strategy for land use developments across the country. It is a medium to long-range plan document with a time frame from 2004 to 2021. The intent of the plan is stated as the provision of a context for making strategic land use and investment decisions, and to facilitate the achievement of a higher quality of life for the national community through sustainable development and management of the physical environment. The plan sets out a strategic vision, a strategy, and policies and proposals. Strategic policies and proposals are presented both with respect to specific sectors such as agriculture and industrial development, as well as with respect to integrated activities such the national settlement pattern and hazard management.

The policy regarding hazard management is stated as follows:

“Policy regarding hazard management involves the application of preventative and mitigation measures to protect population and development activity from environmental hazards. Key activities in this regard involve preparation of hazard maps and enforcement of land use requirements and building construction standards for disaster mitigation.”<sup>3</sup>

The plan outlines the concerns and issues surrounding the islands’ vulnerability to natural hazards and articulates a distinct policy with respect to hazard mitigation. The Plan objective and policies for hazard mitigation are presented as follows<sup>4</sup>:

*Objective D:*

*Protect natural resources, population, housing, economic activity, and infrastructure facilities from natural hazards and the impacts of climate change.*

*Policies:*

*D.1 Institute appropriate disaster mitigation and preparedness measures.*

*Policy implementation activities will involve:*

- *Assessment of the nature and threat of current hazards and the formulation of appropriate hazard mapping to guide development.*
- *Formulate and enforce land use requirements and building construction standards for disaster mitigation.*
- *Institute disaster preparedness measures and provisions for emergency management.*

*D.2 Integrate vulnerability reduction and risk avoidance measures and provisions for emergency management.*

*Key actions for policy implementation will include the formulation of vulnerability reduction and risk avoidance measures and the integration of such measures into the planning process.*

There is an action plan for the implementation of these measures with organizational responsibility falling primarily to NERO (now NaDMA) and the PPU with respect to Policy D.1, and with the PPU in collaboration with other relevant agencies having responsibility for the implementation of activities for Policy D.2. The development stages for policy actions are set out in three (3) time periods, namely, 2003 to 2005; 2006 to 2010; and 2011 to 2021.

*Assessment:*

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<sup>3</sup> Physical Planning Unit, Ministry of Finance, 2003, pxiii.

<sup>4</sup> Ibid, p38.

The Comprehensive Disaster Management Strategic Framework for the Caribbean sets out an intermediate result (IR-5) that recognizes the importance of incorporating hazard information into physical planning specifically, and in all development policies, plans and decisions generally, in order to reduce the vulnerability of development (or construction) at the national level.

*IR-5 Hazard information is incorporated into development planning and decision making.<sup>5</sup>*

The National Physical Development Plan clearly sets out a coordinated framework for achieving this output. However, neither the PPU nor NERO were, prior to the Grenada's experience with Ivan, equipped with the human, technical and financial resources to take the stated policy actions. The cost of not reducing risks to natural hazards has been brought to the fore-front on the political agenda and so during this recovery phase, institutional strengthening has been initiated for both these agencies. These measures should have a long-term perspective and should ultimately better equip both agencies to coordinate the proposed policy activities which are aimed at reducing vulnerability, and feed into the decision making mechanisms activated through the Land Development Authority and the National Emergency Advisory Council.

### ***National Environmental Policy and Management Strategy (NEPMS) and Implementation Plan***

#### ***Description:***

This is a broad-based policy framework for environmental management in Grenada in the context of the notion of sustainability. It seeks essentially to incorporate environmental management concerns into national development decisions, setting out practical mechanisms for streamlining and strengthening environmental management within the social, cultural and economic fabric of the society. One of the stated objectives in the pursuit of environmentally sustainable development is to:

*“Prevent and mitigate the negative impacts of environmental change and natural disasters, and build resilience relative to these”.*

The NEPMS, therefore, acknowledges a need to reduce vulnerability to natural hazards, although this concern is not explicitly articulated in the subsequent strategies identified for achieving stated objectives. Nonetheless, Strategy 3, which speaks to the need to create harmony between environment and development objectives, may be considered a very meaningful contribution to current reconstruction efforts spear-headed by the Agency for Reconstruction and Development (ARD). The ARD is proposed as a critical vehicle for ensuring that environmental considerations are integrated with national development programmes. This is a significant outcome of the implementation for the NEPMS. The implementation plan covers a two year period and assigns activities to specific agencies in order to realize key outcomes of the strategy within the given period.

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<sup>5</sup> See Bisek, Jones and Ornstein, 2001, p48.

Additionally, the NEPMS, among its initiatives, includes provision of effective legal and planning instruments. This will involve building on a number of existing policies that deal directly with hazard risk reduction such as the National Land Use Policy, the National Energy Policy and the National Policy Framework on Climate Change.

Assessment:

The institutional strengthening process for environmental management is a process to which the Government of Grenada is fully committed and so offers another mechanism for ensuring that pre-disaster hazard mitigation efforts are incorporated into national decision making.<sup>6</sup> There may be a need to re-visit the strategy, however, to ensure the hazard mitigation concerns and activities are made explicit at the level of the strategic interventions.

***National Disaster Plan***

Description:

This document provides a framework for disaster preparedness and response mechanisms within the disaster management cycle. It sets out details of the composition, duties and responsibilities of various management committees at different organizational levels.

Assessment

The plan does not address natural hazard risk reduction and was not intended to do so. However, one notable criticism of the Plan is that the duties and responsibilities of the members of the various committees are not built into their job descriptions. This oversight reduces the effectiveness of the committees in terms of their functioning members during actual disasters, and this was the experience and observation of several persons interviewed as part of institutional assessment process of this report.

***Master Plan for the Tourism Sector: Final Report***

Description:

This plan document was prepared with the purpose of providing long-range goals and targets for the tourism sector consistent with other policies of the government. The plan states that tourism development will focus on sustainable development in harmony with the resource endowments of the country, linkages with other sectors, and minimum adverse effects on the physical, social and environmental character of the country. The focus is primarily on the financial performance of the sector that is undeniably the lead sector of the Grenadian economy, providing more than 50% in the foreign exchange earnings when the plan was written in 1997. This concern with ensuring the sustainability of the tourism product is set against the backdrop of unsustainable land use trends that are considered to be incompatible with tourism. These land use trends include the growth of

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<sup>6</sup> Personal communication. Ms. Gemma Baln-Thomas, Permanent Secretary, Ministry of Health, Social Security, the Environment and Ecclesiastic Relations, February 10, 2005.

squatter housing, *ad hoc* vending and building development within protected areas. The plan sets out marketing and product development strategies to support the long-term viability of the tourism sector.

Assessment:

This sector suffered enormous losses estimated to be well in excess of EC\$29,000,000<sup>7</sup>. There is no explicit mention of any hazard mitigation activities in this Plan. However, the section dealing with the control of tourism development speaks to development control mechanisms through the Land Development Control Authority and the Physical Planning Unit. This could be interpreted as an awareness of the need for reducing the vulnerability of the tourism sector through direct linkages with an overall land use policy and controls such as compliance with coastal setbacks, and the identification of clear “no development” zones for ecologically sensitive areas. At the same time, the discussion throughout the document is centered on a diversified tourism product through increased environmental awareness and the conservation and development of natural attractions. In this context, the development control activities are more likely a concern with the protection of threatened coastal resources and other natural habitats.

This plan document sets out the development objectives for a significant land user (inclusive of accommodation services, sights and natural attractions) and has complex linkages with other sectors, specifically, and significant implications for the overall development planning process, generally. This Plan is nearing its 10 year lifespan, having been developed in 1997. It would need to be re-visited to incorporate specific proposals to reduce the vulnerability of this sector, given that the attendant accommodation is predominantly coastal-based and that the natural attraction sites are under threat from uncontrolled development activity. This need has already been recognized, as the idea of reviewing the Tourism Master Plan has been initiated by the Ministry of Tourism and agreed to by the Board of Tourism. This will provide an opportunity to incorporate tourism hazard mitigation measures in those elements of the Plan yet to be implemented.<sup>8</sup>

**Programmes**

The main programmes in place with respect to hazard mitigation are being implemented as follows:

- Institutional strengthening for NaDMA – a CIDA-funded project that will last approximately nine (9) months and includes funding for three (3) technical experts in disaster contingency planning, community disaster planning, and public information and outreach.
- Institutional strengthening for the Physical Planning Unit – a project to be funded through funds made available to the ARD and with the assistance of CIDA.

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<sup>7</sup> See Organisation of Eastern Caribbean States, September 2004, p40.

<sup>8</sup> Personal Communication with Ms. Elizabeth Greenidge, Permanent Secretary of the Ministry of Tourism, Civil Aviation, Culture and the Performing Arts, February 9, 2005.

- Development and incorporation of building standards for the Ministry of Health – a World Bank-funded project

These programmes have no legislative base but are the result of executive decisions made by the GOG.

#### 4.3.2 Assessment of Administrative Capabilities

A number of agencies were surveyed using interview and questionnaire methods as a means of assessing their capability to implement hazard mitigation initiatives. Twenty-four (24) agencies were surveyed and 15 persons interviewed during this assessment.

##### Survey Findings

Of the ten (10) agencies that responded to the survey, the majority were within the government with most of the agencies having less than twenty (20) persons as their complement of full-time staff (see Tables 1 and 2).

**Table 1: Organisations by Type**

Type of Organisation	Government	Private Sector	Non-Governmental	Other	Total
Number of Organizations	6	1	1	2	10

**Table 2: Organisations by Size**

Number of Employees	0-5	5-10	10-20	20-30	>30	Total
Number of Organizations	2	3	2	0	3	10

Only five (5) of the agencies surveyed were actively involved in the identification of risks. These were the Land Use Division (LUD) of the Ministry of Agriculture, the Ministry of the Environment, the Grenada Ports Authority, the Project Unit of the Ministry of Finance and the Agency for Reconstruction and Development. The LUD and Ministry of Environment relied heavily on geographic information systems (GIS), maps and databases, the Project Unit and GPA focused mainly on reports while the Agency for Rural Transformation relied on interactions with communities to identify risks.

With respect to training in disaster management, half of the agencies had personnel with training and most of this training occurred in 2004 and, in the case of two agencies, as recently as the first quarter of 2005. The type of disaster management training is presented in Table 3.

**Table 3: Hazard Mitigation Training in Agencies**



Organization	Position	Expertise/ Training
Grenada Red Cross Society	Health Director	7 areas of study including facilitation, first aid, capacity vulnerability assessments
	Disaster Coordinator	see above
	Director General	see above
	Youth Director	Training not detailed
	CDB Facilitator	Training not detailed
Land Use Division, Ministry of Agriculture	Land Use Officer	Workshops with NERO/CDERA
Agency for Rural Transformation	Secretary General	Supplies Management, Earthquake & Tsunamis Simulations
Grenada Ports Authority	General Manager	Maritime Disaster,
	Port Manager	Coastal zone management, Oil spill management
	Staff	Oil spill management
Ministry of Tourism, Civil Aviation and Culture	Senior Civil Aviation Officer	Workshops with NERO/CDERA

Those agencies with hazard mitigation training were five (5) in total with significant expertise being housed by the Grenada Red Cross Society and the Grenada Ports Authority. Agencies such as the ARD and the Ministry of Finance's Project Coordination Unit, notably, had no trained personnel in hazard mitigation at this time. This is significant since all but one of the agencies indicated an involvement in pre-disaster hazard mitigation initiatives, some of these collaborative efforts among the agencies. Only the Government Information Service indicated that they had no involvement in hazard mitigation activities (see Table 4).

**Table 4: Hazard Risk Reduction Involvement by Agency**

Agency	Type of Involvement in Hazard Risk Reduction
Agency for Rural Transformation	Grenada Rural Enterprise Project (GREP) – to be implemented in 2005.  Community-based disaster preparedness, vulnerability assessments and hazard mitigation activities.
Grenada Red Cross Society	Community-based disaster preparedness programmes and vulnerability capacity assessments – currently working with nine (9) communities as micro-projects. Community- based disaster facilitators training
Agency for Reconstruction and Development	Committed to the appointment of a hazard mitigation specialist. Focus on incorporating hazard mitigation into the recovery efforts
Land Use Division, Ministry of Agriculture	Providing technical assistance to NERO for policy formulation
Grenada Electrical Services Ltd.	Development of a comprehensive disaster management plan (85% completed)
Grenada Ports Authority	Internal procedures and simulations
Project Coordination Unit, Ministry of Finance	Through implementation of retrofitting and civil works projects
Ministry of Tourism, Civil Aviation and Culture	Through consultations with the Planning Division, Ministry of Finance
United States Agency for International Development (USAID)	Funding of Caribbean Hazard Mitigation Program (CHAMP) on a regional basis

This involvement in hazard mitigation at various levels, however, has no legislative basis for nearly all of the institutions. The Grenada Ports Authority was the only agency whose activities were grounded in legislation and only half of the agencies were aware of the National Mitigation Policy. This figure is lower than would have been expected given that the National Hazard Mitigation Policy went through a consultative process with the Sustainable Development Council. The specific roles of agencies in the reconstruction efforts post-Ivan are presented in Table 5.

**Table 5: Roles in Reconstruction Efforts by Organization**

<b>Organizations</b>	<b>Role in Reconstruction Efforts</b>
Grenada Ports Authority	Facilitating relief cargo
Agency for Reconstruction & Development	Coordinating all reconstruction efforts
Ministry of Tourism	Reconstruction & development of the attraction sites
Project Coordination Unit, Ministry of Finance	Implementation of World Bank reconstruction programme
Agency for Rural Transformation	Implementing relief projects
Land Use Division – Ministry of Agriculture	Damage assessment
Grenada Red Cross Society	Rebuilding of homes, vulnerability capacity assessment (VCA) in selected communities, Community training.
Grenada Electricity Services Limited	Restoration of electricity
Government Information Service	Operating radio station
USAID	Reconstruction of hospitals, schools, homes

The agencies, in general, used more than one source of financing so that there was a more-or- less equal dependence on finance from Government, international aid agencies, funding agencies and self-financing. Six of the agencies had a budget or provided budget information. These were:

- United States Agency for International Development – US\$42 m for relief work: 2004 –2005.
- Ministry of Finance, Project Coordination Unit – (estimated annual average) EC\$2m – hazard mitigation; EC\$100,000 – disaster preparedness; EC\$50,000 – relief; EC\$ 6m- reconstruction.
- Grenada Electricity Services – (estimated annual average) EC\$20,000 – hazard mitigation; EC\$17, 000 – disaster preparedness; EC\$2,000,000 – reconstruction.
- Grenada Ports Authority – EC250,000 – disaster preparedness; EC\$4.2m – reconstruction.
- Grenada Red Cross Society – varied amounts based on projects secured through grants.
- Agency for Reconstruction and Development – provision made for the salary of a hazard mitigation specialist.

The foregoing information demonstrates some level of commitment on the part of key institutions to disaster management, although, it is noted that only the Project Coordination Unit of the Ministry of Finance and the Grenada Electricity Services had hazard mitigation as a budgeted line item.

The strengths and challenges for hazard risk reduction were consistent with the views expressed by senior members of key agencies during the inception mission for this project. The views expressed by respondents in this regard are summarized in Table 6. The cross-cutting nature of hazard mitigation actions is evident from the views expressed.

**Table 6: Strengths and Weaknesses of Hazard Risk Reduction in Grenada**

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> <li>• Experience of Ivan</li> <li>• Increased awareness</li> <li>• Incorporation of hazard mitigation measures</li> <li>• Standards &amp; practices in civil works re: retrofitting of schools &amp; shelters</li> <li>• Support of the international arena</li> <li>• Policy &amp; legislative process initiated</li> <li>• Cooperation &amp; coordination among some departments</li> </ul>	<ul style="list-style-type: none"> <li>• Non-adherence to building codes (enforcement of standards)</li> <li>• High insurance costs</li> <li>• Inadequate shelters</li> <li>• Buildings too close to the shore</li> <li>• Execution of simulation drills</li> <li>• Sharing of resources</li> <li>• Subcontracting to NGOs</li> <li>• Lack of trained personnel</li> <li>• Communication system</li> <li>• Public awareness – educational programmes</li> <li>• Regulatory capacity is weak – lack of resources (financial &amp; human)</li> </ul>

According to the survey responses and evaluation by the consultant team, there was an extensive list of needs and areas to be strengthened for effective hazard risk reduction in Grenada. These areas were identified as follows, and are not ranked in any order of significance:

- i) Strengthening of the Physical Planning Unit. The PPU is understaffed in both current and long-range planning functions, especially for trained building inspectors and professional planners. Training is needed in the areas of building code enforcement, use of EIA process to address hazard risk reduction, and integrating hazard mitigation in development review and physical planning functions.
- ii) Land use management. Lack of an integrated and collaborative approach to land use management that optimizes but does not duplicate mitigation and sustainable

development initiatives within PPU, NAWASA, National Parks, Forestry and agricultural programmes.

- iii) Data. The key data gaps are an accurate set of hazard maps and vulnerability assessment for critical facilities and existing development. The CDERA/CDB national plan development process is currently addressing this critical data limitation.
- iv) Communication and coordination. National consultations and policy development are collaborative and multi-sectoral in nature; however interagency coordination often suffers when implementation responsibilities are assigned to designated line ministries. The precedent of individual line ministries implementing programmes in isolation must give way to mechanisms that ensure a more collaborative approach.
- v) Legal framework. The lack of a legislative framework for hazard mitigation hinders the strengthening of administrative capabilities.
- vi) Shelters & evacuation procedures. Interviewees noted that better shelters, provisioning, evacuation procedures and public notification needed strengthening.
- vii) Funding. In a small island developing state like Grenada, the inadequacy of both internal and external funding is a limiting factor in implementing hazard mitigation initiatives.
- viii) Political will. In the post-Ivan environment the political will to implement hazard mitigation and mainstream DRR is strong; however, maintaining that focus over time and against competing demands requires concerted efforts and a champion.
- ix) Administrative capability. The need for adequate staffing and training are issues raised by many of the line ministries interviewed for this consultancy.
- x) Educational programmes. Adequate and timely distribution of information to the development community and general public at all phases of the disaster management cycle is essential in implementing a hazard mitigation initiative.
- xi) Monitoring and enforcement. The issue of transparency, monitoring progress, and adequate enforcement of rules and guidelines were raised as important elements of an effective reconstruction effort.
- xii) Increase of personnel at NaDMA. The institutional strengthening of NaDMA through the CDERA/CIDA initiative is an important outcome of the post-disaster needs assessment; however, a long-term on ongoing commitment by GOG will be necessary to institutionalize hazard mitigation in key ministries.
- xiii) Tools and equipment. Communications, computers, and improved information

technologies and equipment needs were most often mentioned during interviews.

- xiv) Coordination among stakeholders. The NACRD can play an important role in improving coordination among stakeholders. Providing linkages from the Mitigation Plan and Hazard Mapping/Vulnerability Assessment Committees to the NACRD, SDC and ARD can also serve to enhance coordination.
- xv) Planning capacity. Incorporating hazard mapping and vulnerability assessment data from later phases of the national hazard mitigation planning process into development review and long-range planning functions will increase physical planning capacity. Training on how to best utilize this information is recommended.
- xvi) Implementation. National policies on hazard mitigation and mainstreaming DRR into the reconstruction programme have been adopted. The findings of the consultation for a sustainable recovery lay out recovery strategies and implementation priorities. An operational framework for sustainable recovery is currently in place. Successful implementation will hinge on a sustained commitment and establishment of feedback mechanisms to identify hindrances and recommend solutions.

Opportunities for collaboration with other countries in the region were identified as:

- i) Training
- ii) Opportunities for country visits so that a first hand experience is obtained on the implementation of their project
- iii) Funding
- iv) Equipment and technology
- v) Information sharing
- vi) Regional budget for disasters

Finally, information was collected on the measures perceived by respondents that could be taken by their individual agencies or institutions to reduce or eliminate the risks of future disasters. These steps are presented in Table 7.

All the agencies surveyed recognized the significance of incorporating hazard vulnerability reduction into development decision-making and expressed a willingness to collaborate on this matter. Clearly defined implementation actions are now needed to allow this to occur in the context of a coordinated information system where principal stakeholders understand their role and the roles of others.



**Table 7: Organizational Measures to Reduce Vulnerability**

ORGANIZATION	MEASURES
Government Information Service	Facilitating the flow of information for other entities
Agency for Rural Transformation	Promoting community awareness
Grenada Ports Authority	Funding, training & simulations
Grenada Electricity Services Ltd.	Training of employees. Ensuring each employee has a family disaster plan. Completion of a CDMP
Grenada Red Cross Society	Community training, conduct vulnerability capacity assessments, conduct hazard mitigation micro-projects
Project Coordination Unit	Integrate hazard mitigation specs for high wind and seismic activity in reconstruction programme, especially for educational and health service centers
Land Use Division – Min. of Agriculture	Preparation of maps, database Public awareness campaign
Agency for Reconstruction & Development	Provide coordination and oversight to reconstruction programme. Access funding and provide transparency. Intercede with elected officials and line ministries to expedite redevelopment projects
Ministry of Tourism	Ensure that disaster resistance is incorporated in future tourism development projects and programmes
USAID	Ensuring that disaster resistant construction is incorporated into all USAID redevelopment projects

### 4.3.3 Key Outcomes

Based on the survey information, it may be concluded that hazard mitigation is at the forefront of the political agenda at the moment because of the recent experience with Hurricanes Ivan and Emily. The key findings of the survey are:

1. **Coordination** - There is a commitment on the part of ARD to incorporate hazard mitigation into the recovery efforts and funding is available due to international support. A system of coordination has begun with the ARD having its specialist staff work directly with key line ministries such as the Ministry of Tourism. A collaborative process is also being strengthened through links between the ARD and a number of recently established as well as longstanding committees involved in the recovery process. Our survey revealed, however, that there is still some

- suspicion and doubt among a range of agencies about the effectiveness of having the reconstruction process led by the ARD. In light of this, the ARD needs to continue to strengthen its relationship with existing entities to establish a coordinated network. It is noted that at the time of the survey, the Project Coordination Unit had no direct relationship with the ARD, but had responsibility for the implementation of important hazard mitigation measures in the form of retrofitting programmes and sea defense building programmes.
2. **Community Focus** - Mechanisms need to be put in place to allow the work of the Grenada Red Cross Society and the Agency for Rural Transformation to be expanded and built upon. This is an excellent opportunity for the development of community-based hazard mitigation and planning.
  3. **Collaboration** – Agencies do not share information in a consistent manner, resulting in several gaps in the system. For example, several agencies pointed out that they were required to share information with the Emergency Housing Committee (EHC) but that the EHC in turn would not inform them of which districts and households they were addressing in their own programmes. Appropriate mechanisms need to be put in place for effective inter-agency collaboration. This is an area that may require the inputs and influence of the NACRD and/or the SDC to bring about change among the existing agencies.
  4. **Technical Resources** - Institutional strengthening for the key coordinating agencies, namely the Physical Planning Unit (PPU) and NaDMA, has begun and needs to be approached from a long-term perspective. These two agencies did not respond to the survey, but a previous review of disaster management mechanisms in Grenada, pre-Ivan, speaks of the lack of staffing, technical and financial resources allocated to NaDMA agencies to carry out its significant coordinating role in disaster management.<sup>9</sup> The same is true of the Physical Planning Unit. This renders the agency ineffective in the conduct of development and building control, enforcement and forward planning activities. There is a need for training in hazard mitigation throughout all sectors and at all levels.

Table 8 offers an assessment of the capability of the institutions involved in hazard mitigation and that are at the forefront of the recovery and reconstruction efforts in Grenada, based on the information collected through interviews and questionnaires. This assessment includes those agencies currently involved in hazard mitigation and/or are required to carry out the plans and programs identified in the previous two sections. The strategic objectives of two of the intermediate results (IR) of the framework for comprehensive disaster management in the Caribbean are used as the criteria against which to measure the capability of the existing agencies.<sup>10</sup>

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<sup>9</sup> See CDERA 2004, p10.

<sup>10</sup> See Bisek 2001, p 6-7.

These are:

*IR-4: Preparedness, response and mitigation capability is enhanced and integrated, and*

*IR-5: Hazard information is incorporated into development planning and decision making.*

*On a scale of 1 to 10 the following ranking has been used to describe these institutions.*

Low Adequacy: 0 - 3  
 Medium Adequacy: 4 - 6  
 High Adequacy: 7- 10

**Table 8: Assessment of Capability**

Agency	Type of Involvement in Hazard Risk Reduction	Adequacy of Governing Policy, Plans and Strategies	Adequacy of Trained Staff	Adequacy of Budget
Agency for Rural Transformation (ART) Ltd.	- Grenada Rural Enterprise Project (GREP) – to be implemented in 2005. - Community-based disaster preparedness, vulnerability assessments and hazard mitigation activities.	3	3	2
National Disaster Management Agency	-Collaboration with other agencies on hazard mitigation - Implementation of disaster preparedness and response mechanisms.	5	3	2
Physical Planning Unit, Ministry of Finance	-Incorporation of vulnerability reduction and risk avoidance measures into development plans - Implementation of land development policies and plans - Collaboration with other agencies to prepare hazard maps.	4	2	2

Agency	Type of Involvement in Hazard Risk Reduction	Adequacy of Governing Policy, Plans and Strategies	Adequacy of Trained Staff	Adequacy of Budget
Grenada Red Cross Society	-Community-based disaster preparedness programmes. -Community-based vulnerability capacity assessments -Community-based disaster facilitators training.	6	8	5
Agency for Reconstruction and Development	-Committed to the appointment of a hazard mitigation specialist. -Focus in on incorporating hazard mitigation into the recovery efforts.	5	1	9
Land Use Division, Ministry of Agriculture	Providing technical assistance to NERO for policy formulation.	4	4	2
Grenada Electrical Services Ltd.	Development of a comprehensive disaster management plan (85% completed).	7	5	8
Grenada Ports Authority	Internal procedures and simulations.	6	6	7
Planning Coordination Unit, Ministry of Finance	Implementation of structural hazard mitigation measures through project funding.	3	2	7
Ministry of Environment	Implementation of a national environmental policy and management strategy.	6	3	3
Public Works Department	- Design, implementation and management of civil works - Flood and drainage management.	3	3	2
Ministry of Tourism	Introduce tourism mitigation measures.	3	2	5

#### **4.4 Fiscal Capability**

As can be summarized from the above data in Table 8, many agencies obtained a low score for their budgets to reduce vulnerability to hazards. Key agencies such as NaDMA, the Public Works Department and the PPU have low budgets for their day to day functioning. Several initiatives are being coordinated through the ARD to build the capacity of the PPU to perform its instrumental role in the development planning process. The Grenada Electricity Services Ltd and Grenada Ports Authority have institutionalized disaster management and thus have very high fiscal capacity for hazard mitigation. In some cases, those with a low level of resources had some plans, policies or programmes in place but resource limitations will hinder implementation. In summary, many of the agencies surveyed during this consultancy need to be considerably strengthened in terms of their financial resources to effectively incorporate hazard mitigation into their decision-making. Almost two years post-Ivan, the current situation needs to be assessed to determine whether hazard mitigation has taken a foot hold into the functioning of agencies.

#### **4.5 Technical Capability**

Previous sections alluded to the fact that there is need for strengthening the technical capability of all agencies, particularly the PPU and NaDMA. Several initiatives are ongoing which have relevance for hazard mitigation. The work of the Human Settlement Task Force of the ARD has resulted in increased collaboration between the agencies responsible for land management. Plans are underway to remap the country and to harmonize the database of all agencies to form a national GIS. This process which led to the formulation of this national hazard mitigation plan has significantly contributed to building the technical capability in both public and private sector agencies. Training was conducted in GIS, hazard identification, mapping and vulnerability assessment. Through the ARD, in association with the OECS, public sector agencies received training in natural hazard damage assessment using the UNECLAC methodology.

#### **4.6 Summary of National Capability**

There remains the need to change public perception held on disaster management so that it is viewed as an integral part of the mandate of all agencies and not only NaDMA. The impacts of Hurricanes Ivan and Emily provided a window of opportunity for concerted action and inclusion of natural hazard mitigation into the planning framework of all sectors. With time once the saliency of natural hazards to everyday life is removed, it will be necessary to reinforce the gains made through the work of a strong champion coordinating agency. At present the ARD is performing this role and it will be necessary to identify and develop an appropriate mechanism through the relationships that are presently emerging. From the above assessment of capability, it seems evident that NaDMA and the PPU will remain central to implementation of natural hazard mitigation activities in Grenada.

## SECTION 5.0 MITIGATION STRATEGY

### 5.1 Plan Vision

*To develop a holistic national hazard mitigation culture to create social, economic and environmental sustainability*

### 5.2 Guiding Principles

The guiding principles underlying the elaboration of the national hazard mitigation policy are as follows:

- A multi-sectoral and integrated approach to hazard risk management and development planning.
- The need for effective public education and public awareness programmes
- The need for community mobilization and active civil society involvement.
- The need for environmental protection and reduction in social and economic vulnerabilities

#### 5.2.1 A Multi-sectoral and Integrated Approach to Hazard Risk Management and Development Planning

In the context of a small island developing state, and its particular unique vulnerabilities, a hazard risk reduction policy must be concerned with the capacity and resource constraints and the reality that there are competing uses for these resources.

To this end, the policy recognizes that a multi-sectoral and integrated approach will facilitate a more efficient use of these scarce resources. Due cognizance must be given to other initiatives at community, sectoral and national levels to promote complementary and synergetic relationships to avoid unnecessary overlaps and costs. To this end, the policy must promote innovation, creativity, accountability and public stewardship in the use and deployment of national resources.

#### 5.2.2 The Need for Effective Education and Public Awareness Programme

The call for an effective public education and awareness programme underscores the need to build the necessary capacity for a sustained effort at hazard risk reduction.

National resilience to hazard risks requires a sustained programme of activities to educate, inform and support the local communities. The programmes must induce behavioral changes aimed at strengthening the national social and physical infrastructure for hazard response and management. To a large extent public education and awareness and outreach programmes will promote the sense of urgency to action and ownership to



hazard risk reduction initiative. This in turn will make for a more meaningful and sustainable development programme.

### 5.2.3 The Need for Community Mobilization and Active Civil Society Involvement

Achieving sustainable development requires partnership between Government and civil society.

This partnership must enable the full and effective participation and involvement of civil society including the private sector, NGOs and CBOs in planning and implementation of various initiatives at hazard risk reduction. Effective mechanisms must be developed so that these initiatives promote ownership and involvement by all sectors of the society.

Hazard risk reduction activities must elicit a sense of commitment at individual and community levels to engagement for the benefit of the society as a whole. This can only occur through a policy which promotes partnership, diversity, inclusiveness, trust and compassion. All sectors of society must feel a sense of belonging to the national effort at hazard risk reduction.

### 5.2.4 The Need for Environmental Protection and Reduction in Social and Economic Vulnerabilities

Subsequent to the completion of various assessment reports including assessment on poverty, biological diversity and climate change, there was a national call for renewed and dedicated efforts aimed at the eradication of poverty and environmental protection, since the fundamental linkage between environmental degradation and social and economic deprivation was evident in these reports and especially when considering issues of waste management, pollution and unsustainable use of biological diversity.

The relationship was also evident through the impact of continuous development, especially on the coastal areas and the degradation of coastal habitats through destruction in mangroves and wet lands and sand mining activities, where it was clearly demonstrated that environmental decay was exacerbating the poverty condition.

Hazard risk reduction activities pursuant to the determined policy must be implemented giving total cognizance to the need to protect the environment and the same time to facilitate the creation of viable and sustainable use initiatives for social and economic advancement.

## **5.4 Plan Goal**

Given the recent disaster experiences, existing natural hazard vulnerability and national capacity for undertaking effective mitigation programs for the same, the goal that this hazard mitigation plan contributes towards is:

*Sustainable and livable communities, resilient to natural and technological hazards*

## 5.5 Plan Objectives

- To strengthen the policy framework for hazard risk reduction
- To empower the private sector, NGOs and individuals to participate effectively in the management of hazards
- To reduce vulnerability of the poor and high risk areas to the impacts of natural hazards

## 5.6 Strategic Interventions

To achieve each plan objective and thus make the goal of the hazard mitigation plan a reality, a series of necessary strategic interventions were identified. These interventions are consistent with the findings of the capability assessment. Specific actions were developed for implementation of each Strategic intervention.

### 5.6.1 Plan Objective 1

- *To strengthen the policy framework for hazard risk reduction*

An effective hazard mitigation policy framework includes the mitigation policy, tools (plans, legislation and regulations) and intergovernmental mitigation system. For the case of Grenada the following strategic interventions and plan actions are required to strengthen the existing framework:

#### **OBJ1 – Strategic Intervention 1:**

*Integration of hazard risk reduction into national policy frameworks*

##### Plan Actions:

- i. Review existing policies and identify linkages for hazard risk reduction.
- ii. Integrate hazard risk reduction principles into national policy framework and ensure coherence to/with sub-regional, regional and international commitments.
- iii. Develop and strengthen national and sector disaster management plans.
- iv. Integrate hazard risk reduction and environmental management best practices into the national poverty reduction strategy.
- v. Incorporate analysis for hazard mitigation planning at the national, local area and action area planning level.

#### **OBJ1 – Strategic Intervention 2:**

*Development, implementation and enforcement of appropriate legislation and regulation to support hazard risk reduction*

##### Plan Actions:

- i. Develop a comprehensive national disaster management Act (all phases of disaster cycle).
- ii. Include Natural Hazard Impact Assessment as part of the EIA process. (EIA/NHIA).
- iii. Build human resource and technical capability of the PPU to enforce the building code and other development planning regulations.
- iv. Develop a mechanism to encourage voluntary compliance of legislation/regulations for hazard risk reduction.
- v. Review, update and coordinate all existing legal instruments that have implications for hazard risk management.
- vi. Develop regulations and standards to implement legislation.
- vii. Identify and build capacity and administrative mechanisms to implement laws, regulations and standards.

**OBJ1 – Strategic Intervention 3:**

*Development and implementation of knowledge management and information sharing framework for hazard mitigation*

**Plan Actions:**

- i. Develop a disaster management database on hazard events.
- ii. Create a National GIS Centre and promote effective use and information sharing on hazard mapping and vulnerability assessment data.
- iii. Conduct CDM training on GIS, remote sensing, damage assessment including generating damage inventories for each event, trend analysis and modeling.
- iv. Prepare a Best Practices Manual on risk reduction.
- v. Identify gaps in the HMVA and conduct assessments for natural and technological hazards.
- vi. Non-technical training for decision-makers, community leaders, NGOs, private sector and other targeted groups.
- vii. Natural hazard assessment data should be integrated into the EIA process.
- viii. Include sources of hazard assessment data in on-going development of Developer's Manual.

**5.6.2 Plan Objective 2**

- *To empower the private sector, NGOs and individuals to participate effectively in the management of hazards*

**OBJ2 – Strategic Intervention 1**

*Implementation of a programme for sensitization, public education and outreach and information sharing at all levels*

**Plan Actions:**

- i. Conduct Public outreach needs assessment on effective media and techniques for communication to civil society, especially vulnerable populations.

- ii. Development of a public outreach strategy that emphasizes effective partnerships.
- iii. Prepare and distribute a glossary of terms on Comprehensive Disaster Management and Hazard Mitigation Vulnerability Assessment.
- iv. Sensitize key decision makers about the requirements and benefits of hazard risk reduction.
- v. Develop community hazard risk reduction training programmes.
- vi. Develop tailored programmes including curricula at all levels in hazard risk reduction.
- vii. Develop and implement public awareness programmes on policies and laws related to hazard risk reduction.
- viii. Develop and disseminate an inventory of existing hazard information and research.

**OBJ2 – Strategic Intervention 2**

*Effective Mechanisms for coordination, cooperation, collaboration and sustained involvement in risk reduction initiatives by Private sector and NGOs:*

**Plan actions:**

- i. Incorporate professional organizations and funding agencies into hazard risk reduction framework (e.g. Engineers, Bankers, Contractors, Architects, Insurers).
- ii. Expand mandate of NADMA utility sub-committee to include hazard reduction initiatives.
- iii. Strengthen the National Hazard Mitigation Council to play a lead role as champion for adoption of hazard mitigation strategies across sectors.
- iv. Develop hazard reduction and business continuity strategy in collaboration with Private sector agencies [GCIC and GPSA, GHTA].

**OBJ2 – Strategic Intervention 3**

*Development and implementation of appropriate economic programmes for hazard risk reduction*

**Plan Actions:**

- i. Provide economic incentives to encourage mitigation banking initiatives such as land banks and reservation of sensitive ecosystems.
- ii. Develop a disaster fund to support hazard mitigation initiatives for vulnerable communities.
- iii. Use risk-based insurance and taxation as a strategy for investment in hazard mitigation or avoidance of high risk areas.
- iv. Reduction or elimination of duties on risk reduction or retrofitting goods and services.
- v. Include hazard risk analysis and climate change scenarios in benefit/cost analysis for major development proposals.
- vi. Conduct disaster/risk reduction trade expositions in collaboration with private sector associations.

### 5.6.3 Plan Objective 3

- *To reduce vulnerability of the poor and high risk areas to the impacts of natural hazards*

#### **OBJ3 – Strategic Intervention 1**

*Development of community-based initiatives to effectively manage hazard risks*

Plan Actions:

- Evaluate and prioritise vulnerable communities for locally-based risk reduction initiatives.
- Strengthen NGOs and CBOs in supporting community-level risk reduction initiatives.
- Strengthen NaDMA linkages to community-based initiatives to create information channels back to national level.
- Undertake community cleanups and environmental enhancement
- Improve of sanitary infrastructure in vulnerable communities.
- Removal of trees and other potential hazards in local neighborhoods.

#### **OBJ3 – Strategic Intervention 2**

*Implement hazard mitigation measures to reduce vulnerability of critical facilities and infrastructure*

Plan Actions:

- Review findings of hazard vulnerability assessment and prioritize areas for action.
- Design mitigation measures for critical facilities based on present and future natural hazard risks.
- Perform all hazard vulnerability assessment for all planned infrastructure projects.
- Develop insurance risk sharing scheme for all public facilities and infrastructure.
- Create forward plans to secure low vulnerability locations for future development as a mitigation banking measure.
- Restore dunes and coastal habitats with “soft” engineering to increase the resilience of coastal infrastructure and ecosystems.
- Protect Pearls airstrip for emergencies and future development, environmental clean up and waste management for hazard reduction.

#### **OBJ3 – Strategic Intervention 3**

*Develop management plans for high vulnerable areas (HVA)*

- Integrate hazard risk maps and database for highly vulnerable areas into national GIS.
- Identify critical facilities, infrastructure and populations in HVAs.
- Assess human vulnerability for HVAs and for communities dependent on resource flows from these areas.

- iv. Develop mechanism to update information on HVAs and monitor development activities in these locations.
- v. Restrict development activities that will exacerbate conditions within HVAs.
- vi. Develop best practical environmental options for vulnerability reduction of HVAs (physical, environmental, human/socio- economic).
- vii. Where feasible, relocate households and infrastructure from highly vulnerable areas.

The above strategic interventions were developed and agreed to during a series of workshops with key stakeholders. At each workshop the outputs of previous sessions were revisited and reviewed so that the process was iterative giving rise to desired actions for which there is consensus. The input from the special workshop with NGOs and district coordinators was particularly insightful as it provided insights to issues at the community level and possible mechanisms for increase collaboration between NaDMA and the NGO community. Annex III and IV provide the suggested timeframe for undertaking these actions.



## **SECTION 6.0 PLAN IMPLEMENTATION**

### **6.1 Introduction**

Plans express a vision for the future, especially how future development will look and function. Without implementation, continuous monitoring and evaluation, they will remain simply statements of intent. It is therefore essential that an implementation plan be developed to complement the hazard mitigation strategy presented in Section 5.0.

Effective implementation will require sustained interagency coordination and collaboration. Although the National Disaster Management Agency (NaDMA) must be actively involved with hazard mitigation initiatives, it serves as a coordinating agency for disaster management activities and is not a national planning and implementation agency. It can create awareness of the need for hazard mitigation and coordinate plan development; but it must rely on other agencies to implement plan proposals.

Implementation responsibilities do not reside solely within the key line ministries that have a role to play in natural hazards risk reduction; a successful implementation programme must define the myriad ways that government agencies can collaborate with the private sector, NGOs, and local community organizations to affect meaningful change. The Plan provides an institutional framework for reducing future vulnerabilities, but implementation only occurs when it affects the day-to-day activities of professionals in the private sector, those working on behalf of NGOs, and the general public.

A number of government agencies have already been involved in developing the national hazard mitigation policy, as well as in the implementation of specific hazard mitigation projects. However, there is still the need for further enhancement of these activities, particularly in the ability of the national government to execute and implement hazard mitigation measures through formal or informal multi-agency collaborative actions. The plan also identifies mechanisms for achieving synergy between related policies and programmes that can help create a more sustainable future for Grenada. The implementation plan is meant to serve as a catalyst for change in the way in which development is carried out, so that hazard mitigation measures become a part of the everyday activities of all facets of civil society.

### **6.2 Implementation Mechanisms**

The strategic interventions described in the hazard mitigation strategy cannot occur overnight. The Plan envisions a 10-year planning horizon for implementing the hazard mitigation programme. Many of the implementation elements are multi-year in scope and may require new legislation, institutional changes, additional staffing, and new training requirements. However, programming all of the detailed implementation elements over a 10-year timeframe is not realistic, and the plan includes provisions for Annual Action Plans to effectively mobilize resources and target high priority interventions on an annual basis. The first Annual Action Plan is presented in Section 7.0. The Annual Action Plans

also provide a convenient mechanism to monitor, evaluate, and refine hazard mitigation initiatives as the programme evolves over time.

Plan implementation has both a pre-disaster component and a post-disaster recovery and reconstruction component. By pre-disaster, we are referring to all the planning and preventive measures that can be undertaken prior to a disaster event occurring. Although no community wants to be faced with the daunting task of disaster recovery, the fact remains that the post-disaster environment provides one of the greatest opportunities to implement hazard mitigation and enable the community to become more disaster resilient and sustainable. Advance planning for the post-disaster period enables the national government to take advantage of this “window of opportunity” to mainstream disaster risk reduction in the reconstruction process.

Pre-disaster implementation mechanisms described in this section include: legislative and regulatory changes; necessary administrative changes to the organizational framework, public education and outreach initiatives; and monitoring, evaluation, and plan updating requirements.

### **6.3 Institutional Framework**

The institutional framework refers to the formal and informal policies along with the respective organizations (formal and informal) that implement them. In the case of disaster management much emphasis is given to the formal institutions (legislation and organizations) reflecting the perception that governments and bureaucratic agencies are largely responsible. Local disaster experience has revealed that non-governmental organizations are actively involved at the community level, representing the informal policy space for disaster management. To meet the challenge of achieving the Plan’s goals necessitates the design of strategies for integration of the informal sector into the planning and implementation process.

During the plan adoption process specific attention was given to the role of NGOs and their contributions led to the formulation of the plan actions for community involvement. It is recognized that there is need for a combination of interventions that address both structure and process for plan implementation. No attempt will be made to formalize the informal and undermine the significant contributions that NGOs make towards vulnerability reduction at the community level. What is necessary therefore is a twofold strategy that builds the required formal structures while enhancing the informal processes. One way to achieve this is to work towards a paradigm shift and transition from viewing natural disasters as physical attributes over which society has no control, to viewing them as social constructions which can be reduced through effective hazard mitigation measures.

Participants of the special one day workshop with community leaders recommended that greater collaboration be established between the district coordinators of NaDMA and the NGOs. It was agreed that the 10 year National Hazard Mitigation Plan and annual work plans provide the policy basis for programs for all sectors. An annual meeting must

therefore be convened between NaDMA, the Red Cross and Red Crescent Society (RC & RC) and other NGOs to harmonize work plans at the community level thus maximizing limited resources. For example NaDMA has 18 district coordinators whereas RC & RC has coordinators working in 34 communities. Quarterly progress reports are required from NGOs as well as information sharing. These arrangements should be formalized in the proposed Disaster Management Act.

### **6.3.1 Legislative and Regulatory Framework**

Based on the findings of the legislative review described in Section 4 it can be concluded that the legislative and regulatory framework for natural hazard mitigation in Grenada has several limitations. One of the strategic interventions identified for achieving the objectives of this plan will address this issue. The appropriate legislation is first needed to formalize the expanding mandate of NaDMA from primarily response and recovery to addressing all aspects of the disaster cycle.

To this end a Comprehensive Disaster Management Act, focusing on all phases of the disaster cycle including preparedness, response, recovery and reconstruction is proposed. Comprehensive disaster management legislation may include provision to activate a redevelopment agency immediately following a major disaster event, empower it to assess damages and quickly develop an overall recovery strategy, and oversee reconstruction. Once the redevelopment authority completes its mission, it would then be deactivated. This act must contain provisions for effective participation of informal sectors and should give consideration to a precautionary approach to disaster management.

The National Hazard Mitigation Council (NHMC) through its secretariat NaDMA should initiate the process for the formulation of the Act. It is anticipated that the institutional capacity of the NHMC will be strengthened and that the council will champion the process. Together with NaDMA other key stakeholders whose mandate will be affected by this Act, for example the PPU, should be actively involved in the formulation of the new legislation. Collaboration is also required from development partners in the form of financing and technical resources to develop the new disaster management act.

The overriding goal of the act should be complementary to that for the hazard mitigation plan. The following outcomes are suggested:

- Establish a disaster management entity with clearly defined functions throughout the disaster cycle and promoting a champion for comprehensive disaster management;
- Define clear roles, assign counterpart staff responsibilities, and budget for key line ministries and departments that can support hazard mitigation and sustainable development objectives;
- Establish necessary staff and institutional arrangements focusing on: (1) mitigation research and implementation, (2) readiness, (3) capability, (4) communication and (5) recovery and reconstruction;

- Provide a coordinated institutional framework for disaster management;
- Empower the private sector, non-governmental organizations and individuals to participate effectively in the management of hazards;
- Encourage forward planning and preparation through the development and integration of national, local and sectoral disaster management plans;
- Establish a National Disaster Management Fund to help finance related activities and emergency relief; and
- Provide strong enforcement and compliance mechanisms, especially in the area of building code enforcement.

The foregoing intimates that the regulations for organizations within the formal institutional framework for disaster management will need to be updated where necessary. Among them include the Physical Development Control Act and the Environmental Management Act (presently in draft). The new land and land use policy which is being formulated must incorporate data generated from the hazard vulnerability assessment.

Drawing on lessons learnt from the EIA adoption process, it is recommended that the process for formulation of the new Disaster Management Act commence within the third to fifth year of plan implementation. Emphasis should first be placed on enhancing the process and perceptions on natural hazard so that disaster reduction measures will be widely accepted as being fundamental to achieving sustainable development. Broad base acceptance will promote the implementation and enforcement of disaster management legislation.

### **6.3.2 Organizational Framework**

It was alluded to in the capacity assessment that several agencies have contributing roles to play in hazard mitigation. This reflects the fact that natural hazard mitigation is a cross cutting issue and requires a multi-sector approach to achieve vulnerability reduction. At present NaDMA operates in two organizational modes:

1. Network Administration Organization (NAO) – in this mode NaDMA functions as a facilitator and coordinates a range of disaster management activities with agencies from several sectors. In this mode, NaDMA is not necessarily required to implement activities but rather to ensure that they deliver the desired results to the target audience.
2. Expanding Organization – during times of a disaster, NaDMA expands to include the agencies and individuals that comprise the various sub-committees. Several initiatives have been undertaken to increase the capacity of NaDMA and the

respective committees to function, particularly the community district coordinators. The lessons learnt from the Hurricane Ivan and Emily experiences serve to reinforce the organizations role in this functional mode.

It is the former role as an NAO that needs to be strengthened, so that the profile of NaDMA as the champion for comprehensive disaster management can be lifted.

The policy framework for hazard mitigation includes the inter-governmental network of organizations which are already represented on the Natural Hazard Mitigation Council and the various sub-committees that were involved in the plan development process. At present the composition of the Council includes:

- Permanent Secretary in the Prime Minister's Ministry – Chairman
- Permanent Secretary in the Ministry of Finance – Deputy Chairman
- Representative from the Professional Association
- Civil Aviation Officer
- Community Development Officer
- Chairman of the Climate Change Project
- Representative for the Sustainable Development Council
- Chief Technical Officer in the Ministry of Works
- Physical Planning Officer
- Representative for the Land Use Division, Ministry of Agriculture
- National Disaster Coordinator
- Deputy National Disaster Coordinator

It is quite clear that the Council and hence the sub-committees include only the formal organizations involved in natural hazard mitigation. The non-governmental organizations and informal sector is not represented within the present framework and this must be remedied. Also the private sector and social development sectors are not represented on the Council. As part of the process of final approval and adoption of the hazard mitigation plan as a national policy document these sectors must be brought into the framework.

It is proposed that the new Council assume responsibility for spearheading the implementation of the 10 year plan. The terms of reference of the Hazard Mitigation Council should be revised to ensure consistency with this new role. The following are suggestions for the terms of reference:

- a. To utilize the Natural Hazard Mitigation Policy and Plan as the primary policy documents over the next 10 years (2006 – 2016);
- b. To promote the Natural Hazard Mitigation Framework among the public and private sectors and the community in general;
- c. To review mitigation plans and programmes implemented by lead agencies to ensure that they are in keeping with the Mitigation Action Plan;

- d. To assist implementation agencies with the development of projects as they relate to natural hazard mitigation and disaster management in general;
- e. To assist implementation agencies in preparing request for technical assistance for the implementation of projects (when applicable);
- f. To monitor the implementation of plan proposals with a view to ensuring that they fulfill project objectives;
- g. To coordinate the implementation of mitigation projects which cross-cut several sectors;
- h. To ensure that implementation agencies coordinate their projects;
- i. To ensure that adequate resources are allocated for the implementation of programmes and projects;
- j. To review plan proposals on an annual basis and supervise the preparation of annual work plans;
- k. To ensure that lead agencies have the supporting resources such as appropriate finances, manpower and legislative framework; and,
- l. To provide a focal point for collaboration in mitigation activities with external agencies.

Day to day responsibility for the implementation of the annual action plans will be that of NaDMA. It is proposed that a new position be created within the agency for an individual whose job will be to facilitate the actual implementation of the action plan along with the various sectors. Mitigation Working Groups should be established, where necessary, with the responsibility for specific subject areas such as *infrastructure development, environmental protection, social and economic development, health and safety and, damage assessment*.

The Mitigation Working Groups should comprise senior professional officers from key agencies, and at least two (2) representatives from the private sector and NGO community. The coordination or chairmanship of each working group should be, ideally, the Hazard Mitigation Officer of NaDMA or a representative from the agency. The following groups are suggested:

**Group A. Infrastructure Development:** Responsible for activities relating to preventive, property protection and structural mitigation measures. The *Ministry of Communications & Works* should be responsible for the coordination of this working group.



- Housing Authority
- Ministry of Works
- NAWASA
- GRENLEC
- Physical Planning Unit
- Cable & Wireless; Digicel
- NaDMA – Hazard Mitigation Officer
- Contractors and Engineers Association

**Group B. Environmental Protection:** Responsible for mitigation activities relating to natural resources protection., integrating risk reduction into development review and physical planning. The *Physical Planning Unit* should be responsible for the coordination of this working group.

- Environmental Affairs Department
- Land Use & Forestry Divisions
- Grenada Industrial Development Corporation
- Physical Planning Unit
- NaDMA – Hazard Mitigation Officer
- Fisheries Division
- Chamber of Commerce
- IAGDO (NGO Rep) and Red Cross

**Group C. Social and Economic Development:** Responsible for activities relating to public information measures and socio-economic assessments and planning. The *Economic Affairs Division of Ministry of Finance* should be responsible for the coordination of this working group.

- Ministry of Education
- Ministry of Social Development
- Grenada Board of Tourism
- NaDMA – Hazard Mitigation Officer
- Media Association of Grenada
- Economic Affairs Division – Ministry of Finance
- Chamber of Commerce and Hotel Association
- IAGDO and Community Based Organizations
- Insurance and Banking Associations

**Group D. Health and Safety:** Responsible for activities relating to emergency services measures. The *Ministry of Health & the Environment* should be responsible for the coordination of this working group.

- Grenada Solid Waster Management Authority
- Environmental Health Department
- NaDMA – hazard mitigation officer
- Texaco and Sol
- Grenada Ports Authority
- Response Agencies
  - *Fire & Rescue*
  - *Police*
  - *Coast Guard*
  - *Red Cross*
  - *Volunteer Organizations*
- Health Services (public and private)

**Group E. Damage Assessment:** Responsible for damage and needs assessments and activities to enhance the mechanism for damage assessment. This group will also be

responsible for development of restoration and reconstruction measures for vulnerability reduction. The *National Disaster Management Agency* should be responsible for the coordination of this working group.

- Ministry of Communications and Works
- Physical Planning Unit
- Ministry of Finance
- National Housing Authority
- Ministry of Health and the Environment
- Health Services (public and private)
- Chamber of Commerce and Hotel Assoc.

It must be noted that the role of these groups is different to that for similar groups and sub-committees that only function in the event of a national disaster. Their role is primarily for pre-disaster natural hazard mitigation for vulnerability reduction.

The proposed organizational framework cannot be executed without the provision of appropriate budgetary allocations. It must be emphasized again that NaDMA is not an implementing agency, but rather a coordinating agency under the authority of the Prime Minister's Office. The establishment of resource needs for mitigation and disaster management activities in general should be structured around annual programmes and projects approved and submitted by the Mitigation Council. Therefore, the [financial] resources for the implementation of mitigation initiatives should be made available to the lead agencies that are responsible for specific activities.

## 6.4 Public Education and Outreach

The perceptions commonly held on natural hazards and the contribution of human development activities to the creation of natural disasters must underpin public education and outreach programs in order for them to elicit a change in behavior. Research conducted in Grenada (Jessamy, 2003) provides evidence that a wide range of decision makers view disasters as "Acts of God". This was played out after the passage of Hurricane Ivan up to present day as evident by the number of nationals who are praying for the aversion of natural disasters.

Experience with disasters provides the best opportunity for society to implement vulnerability reduction measures. However the lessons learnt after the passage of hurricanes Ivan and Emily will be lost if the contribution of human action in the creation of disasters is not made explicit. By shifting the responsibility for hazard mitigation from government agencies to society at large, the attainment of sustainable disaster resilient communities will become a reality. Thus public education and outreach programs must be designed based on informal norms and practices and not solely upon the formal structures or policies that any plan will seek to develop. Notwithstanding they should be guided by empirical evidence on hazards, past disaster events and future expectations.

In the case of Grenada the following target groups and accompanying strategy is proposed for elaboration:

- *Professional Associations (architects, engineers, planners)*

This grouping of individuals performs an important role in the physical development process and can contribute to adoption of physical/structural hazard mitigation measures by private the sector and general public. The following activities are recommended:

- Conduct seminars with professional associations to share results on hazard vulnerability assessment;
- Develop booklets and CD rooms with hazard maps and database and make available for use in project planning;
- Conduct awareness seminars and training workshops on environmental and natural hazard impact assessment; and
- Include professional organizations in implementation of mitigation plan actions.

- *NGOs and donor community*

Disaster experience has shown that NGOs and donors often by-pass the formal organizational structure and work directly at the community level. It is therefore crucial that these agencies are provided with high quality information so that their efforts will lead to sustainable disaster reduction outcomes.

- Conduct seminars to disseminate results on hazard vulnerability assessment;
- Conduct awareness seminars on hazard mitigation strategies that can be incorporated into community development programs;
- Develop lay-manuals and handouts on hazard vulnerability for high risk areas and communities;
- Include NGO representatives on natural hazard mitigation committees.

- *Local community organizations*

- Provide simplified information on local hazards and associated risks in print form;
- Involve communities in implementation and evaluation of mitigation plans;
- Use local community organizations as focal points to collect data on disaster histories and to disseminate information to the general public.

- *Voluntary relief organizations*

- Provide simplified information on local hazards and associated risks in print form;
- Involve relief organizations in implementation and evaluation of mitigation plans;
- Use local voluntary organizations as focal points to collect data on disaster histories and to disseminate information to the general public.

- *Banking and investment community*

- Conduct awareness seminars on findings from hazard vulnerability assessments;
  - Develop booklets and CD rooms with hazard maps and database and make available for use in approving projects for funding;
  - Conduct awareness seminars on the role of environmental and natural hazard impact assessments in project planning;
  - Develop criteria for funding projects based on environmental impact and natural hazard risk exposure;
  - Develop incentives to fund projects that promote environmental protection and hazard vulnerability reduction.
- *Insurance sector*
    - Conduct awareness seminars on findings from hazard vulnerability assessments;
    - Develop booklets and CD rooms with hazard maps and database and make available for use in developing insurance premiums;
    - Conduct awareness seminars on the role of environmental and natural hazard impact assessments in project planning;
    - Develop risk based insurance as a strategy for investment in hazard mitigation measures.
- *Construction sector (both formal and informal)*
    - Conduct awareness seminars on findings from hazard vulnerability assessments;
    - Develop booklets and CD rooms with hazard maps and database and make available for use in project planning and implementation;
    - Conduct awareness seminars on the role of environmental and natural hazard impact assessments in project planning;
    - Conduct technical training workshops on best practices for natural hazard mitigation and environmental protection.
- *Tourism sector*
    - Conduct awareness seminars on findings from hazard vulnerability assessments;
    - Promote strategies to incorporate coastal zone management and tourism sector development for natural hazard vulnerability reduction;
    - Encourage eco-tourism projects that promote conservation of coastal habitats emphasizing the secondary benefit of natural hazard vulnerability reduction;
    - Involve tourism sector in the implementation and evaluation of mitigation plan actions.
- *Agricultural Sector*
    - Conduct awareness seminars on findings from hazard vulnerability assessments;

- Conduct awareness seminars on soil conservation methods and farming best practices to reduce risk of landslides, flooding and other hazards
- Promote use of land use code and best practices manual (to be developed under sustainable land management projects)
- *Businesses and industry*
  - Conduct awareness seminars on findings from hazard vulnerability assessments;
  - Promote business and industry recovery plans to limit disaster damages and accelerate business recovery following natural disasters;
  - Develop incentives for private sector investment in hazard mitigation activities;
  - Disseminate print materials and hazard maps for use in project planning.
- *Educational system*
  - Infuse information on natural hazards that exist in our environment into the school curriculum, e.g. geography, integrated science, social studies;
  - Develop framework for research and data collection on natural hazards as part of school science projects;
  - Disseminate print materials on local hazards.
- *General public*
  - Conduct social action research on natural hazard perception to determine factors that affect adoption of mitigation measures;
  - Disseminate information on local hazards using all media (newspapers, radio, TV, internet, brochures);
  - Provide focal point for community interface with NaDMA both for information sharing and for feedback on public awareness programs;
  - Over time, evaluate the impact of public outreach programs.

## 6.6 Monitoring, Evaluating, and Updating the Plan

The national hazard mitigation plan is not intended as a static document and its objectives, strategies, programmes, and projects may be changed over time based upon assessments of whether they are effective in achieving the stated goals and objectives. Monitoring of plan implementation will be the responsibility of the National Hazard Mitigation Council; however, the lead implementing agencies will have responsibility for the day-to-day monitoring of hazard mitigation programmes and projects. As noted earlier NaDMA will function as a Network Administrative Organization and ensure that the desired outcomes [effective natural hazard mitigation and by extension natural disaster reduction] are delivered to its customers.

## 6.7 Planning for Post-disaster Recovery and Reconstruction

Planning for post-disaster recovery and reconstruction differs from many of the preventive measures described elsewhere in this Plan in that the activities will only be implemented after a disaster event. As such, recovery planning is similar to the traditional preparedness activities associated with emergency response functions. Emergency preparedness focuses on increasing the capability of police, fire, medical, and other emergency management staff to respond to critical health, safety, evacuation, and sheltering issues that arise in the immediate aftermath of a natural or human-caused disaster event. However, recovery and reconstruction planning focuses on expediting and facilitating the transition from the response to recovery and having mechanisms already in place to better integrate hazard mitigation into long-term reconstruction.

The International Strategy for Disaster Reduction (ISDR) refers to the opportunity to reduce vulnerability in the post-disaster setting in Mainstreaming Disaster Risk Reduction (UNDP, undated). The guidelines highlight the conventional approaches to recovery that often fail to grasp these opportunities:

- “Response to disasters is still dominated by humanitarian assistance and emergency management. While vital, ... [it] does not address the underlying causes that resulted in the disaster, nor does it automatically stimulate rapid recovery ... and may even exacerbate the underlying causes of vulnerability.
- The long time spans required for the necessary impact studies, the design of programmes and projects, the negotiation of multilateral loans for reconstruction, and the timeframe for approval of development funding generates a gap between the ending of humanitarian assistance and the initiation of reconstruction programming in which affected people are usually left without support for recovery.
- Reconstruction is frequently conceptualized and designed to return a country to the conditions of the normal development it enjoyed before a disaster occurred. This too often leads to rebuilding the conditions of risk which existed before the disaster, thus preparing the ground for future disasters and possibly contributing to increase the country’s debt levels with large reconstruction loans.
- Similarly, during the gap, people begin to recover spontaneously, rebuilding and reproducing conditions even more risk prone than those that existed before the disaster occurred.
- Support to recovery by government organizations, international agencies, NGOs, and others is often done through isolated and uncoordinated interventions, leading to a duplication of efforts in some areas, gaps in others, and again a failure to factor in risk reduction considerations.



- Too often, societies affected by a major disaster tend to seek rapid and visible solutions to restore normalcy, frequently at the cost of more sustainable and durable solutions that truly address the root causes of the disaster.”

This section describes the mechanisms proposed by the national government to effectively mainstream disaster risk reduction by having a post-disaster assessment and recovery strategy in place before the next major natural disaster strikes. Four mechanisms are described in the following subsections – disaster assessment, legislative requirements, institutional mechanisms, and identification of post-disaster opportunities.

#### 6.7.1 Disaster Assessment

The rapid assessment of disaster damages and societal needs following a major event is critical, not only to inform immediate emergency response functions, but to provide preliminary estimates of recovery and reconstruction needs. This information is vital to guide the actions of government agencies in both the short- and long-term and also is valuable in informing regional relief organizations and the international donor community.

#### 6.7.2 Legislative Requirements

It is envisioned that the proposed Disaster Management Act will include provisions for the activation of the appropriate agency to guide post-disaster, reconstruction initiatives. The lessons learnt from the establishment and functioning of the ARD should be used to develop the requirements for that agency. One of the apparent lessons is the fact that the ARD functions mainly as a gatekeeper, brokering relations between national agencies to foster horizontal integration and at the same time filter relations with external agencies fostering vertical integration. These relationships are often affected during disaster events. The legality of any agency that will be activated under this circumstance needs to be established. However it is envisioned that since present projects are intended to lead to sustainable capacity development, NaDMA and line agencies will be expected to continue functioning in the event of disasters.

#### 6.7.3 Institutional Mechanisms

The post-disaster period provides the opportunity to examine the policy framework for natural hazard mitigation and make improvements where necessary. The Natural Hazard Mitigation Council will be expected to review all recovery and reconstruction plans to ensure that they do not restore systems to the pre-disaster conditions thus leading to social amplification of risk. The role of the Hazard Mitigation Officer will be crucial to ensure involvement in planning activities of all key sectors. The following roles are suggested for the involvement of the existing organizations in the post-disaster period:

- a. To update hazard maps and accompanying database on disaster histories;
- b. To update the Mitigation Action Plan and reorder priority for implementation of actions where appropriate;

- c. To review recovery and reconstruction plans by lead agencies to ensure that they are in keeping with the Mitigation Action Plan;
- d. To assist implementation agencies with the development of projects as they relate to natural hazard risk reduction and disaster management in general;
- e. To assist implementation agencies in preparing request for technical assistance for the implementation of projects (where applicable);
- f. To monitor the implementation of reconstruction plan proposals with a view to ensuring that they fulfill project objectives;
- g. To coordinate the implementation of reconstruction projects which cross-cut several sectors;
- h. To ensure that implementation agencies coordinate their projects;
- i. To ensure that adequate resources are allocated for the implementation of programmes and projects; and
- j. To provide a focal point for collaboration in hazard risk reduction activities with external agencies.

#### 6.7.4 Identifying Post-disaster Mitigation Opportunities

Disasters provide windows of opportunity to implement hazard mitigation measures. The new GIS database of information and the hazard mitigation plan provide the foundation for implementation of plan actions. Suggested plan actions that can be implemented include:

- Relocation of households, critical facilities and infrastructure away from highly vulnerable areas;
- Restore dunes and coastal habitats that provide protective environmental functions using “soft” engineering approaches;
- Removal of taxes and/or duties on goods and services for risk reduction or retrofitting (e.g. building materials);
- Introduction of risk-based taxation and insurance premiums for infrastructure located in highly vulnerable areas;
- Perform benefit/cost analysis and all hazard vulnerability assessment for all redevelopment projects;
- Restrict development activities that will exacerbate vulnerability of high risk locations.

## SECTION 7.0 ANNUAL ACTION PLAN

### 7.1 Introduction

The Grenada National Hazard Mitigation Plan is designed to be implemented over a ten year period from 2007 through 2016. The timeframe for implementing the strategic interventions and plan actions are provided in Annex IV. Each intervention and action is designed to meet the objectives and overall goals of the hazard mitigation plan. It is recognized that participation from a cross section of sectors and the general public is required if the desired outcomes are to be achieved. Financial resources are needed to implement mitigation actions by the specific agencies. A Mitigation Officer must be added to the NaDMA staff to coordinate plan implementation. Technical skills and resources will be project specific and it is envisaged that the respective agencies that are involved in plan implementation will develop the appropriate capability as required.

### 7.2 First Year Annual Plan

The plan actions were prioritized based on the findings of vulnerability and capability assessment and present status of natural hazard mitigation in Grenada. The plan actions which are prioritized for implementation in the first year were regrouped under five themes:

#### 7.2.1 Policy Measures

- Review existing policies and identify linkages for hazard risk reduction.
- Integrate hazard risk reduction principles into national policy framework and ensure coherence to/with sub-regional, regional and international commitments.
- Develop and strengthen national and sector disaster management plans.
- Integrate hazard risk reduction and environmental management best practices into the national poverty reduction strategy.
- Include Natural Hazard Impact Assessment as part of the EIA process (EIA/NHIA).
- Include hazard risk analysis and climate change scenarios in benefit/cost analysis for major development proposals.

#### 7.2.2 Administrative Measures

- Review, update and coordinate all existing legal instruments that have implications for hazard risk management.

- Develop a comprehensive national disaster management Act (all phases of disaster cycle).
- Build human resource and technical capability of the PPU to enforce the building code and other development planning regulations.
- Incorporate professional organizations and funding agencies into hazard risk reduction framework (e.g. Engineers, Bankers, Contractors, Architects, Insurers).
- Expand mandate of NADMA utility sub-committee to include hazard reduction initiatives.
- Strengthen the National Hazard Mitigation Council to play a lead role as champion for adoption of hazard mitigation strategies across sectors.
- Strengthen NaDMA linkages to community-based initiatives to create information channels back to national level.

#### 7.2.3 Preventative Measures

- Identify gaps in the HMVA and conduct assessments for natural and technological hazards.
- Review findings of hazard vulnerability assessment and prioritize areas for action.
- Conduct community cleanups and environmental enhancement.
- Undertake improvement of community sanitary infrastructure in vulnerable areas.
- Remove of trees and other potential hazards in neighborhoods.
- Create forward plans to secure low vulnerability locations for future development as a mitigation banking measure.
- Identify critical facilities, infrastructure and populations in HVAs.
- Restrict development activities that will exacerbate conditions within HVAs.

#### 7.2.4 Public Information Mitigation Measures

- Develop a disaster management database on hazard events.

- Create a National GIS Centre and promote effective use and information sharing on hazard mapping and vulnerability assessment data.
- Integrate hazard risk maps and database for highly vulnerable areas into national GIS.
- Prepare a Best Practices Manual on risk reduction.
- Non-technical training for decision-makers, community leaders, NGOs, private sector and other targeted groups.
- Conduct Public outreach needs assessment on effective media and techniques for communication to civil society, especially vulnerable populations.
- Development of a public outreach strategy that emphasizes effective partnerships.
- Sensitize key decision makers about the requirements and benefits of hazard risk reduction.
- Conduct disaster/risk reduction trade expositions in collaboration with private sector associations.

#### 7.2.5 Emergency Measures

- Prepare public and private sector disaster business continuity/contingency plans.
- Develop a disaster fund to support hazard mitigation initiatives for vulnerable communities.
- Revise and test disaster contingency plans on a periodic basis.
- Review, update and acquire hazard-warning systems for the Territory.
- Develop strategic evacuation plans for population centres at high risk to natural hazards.
- Assess the capacity of all response agencies and improve where necessary.
- Conduct routine simulation exercises in response to various disaster events or crisis.
- Improve the health services sector's capacity to manage an emergency crisis of a specific magnitude.

- Conduct an assessment of the current stock of emergency shelters within the Territory and develop an effective network of emergency shelters.
- Upgrade existing shelters and build new ones where necessary.
- Protect Pearls airstrip for emergencies and future development, environmental clean up and waste management for hazard reduction.



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