Annex 1

ANNEX 1

MINISTRY OF AGRICULTURE AND LANDS, FORESTRY AND MARINE RESOURCES

Report on Damage and Needs Assessment and Rehabilitation Plan for the Agricultural Sector in Grenada following Hurricane Beryl

1. INTRODUCTION

Hurricane Beryl, one of the earliest category 5 hurricanes to develop in recent times, pummeled across the Windward Islands, especially impacting the islands of Grenada, St. Vincent and their dependencies. With Beryl reaching land as a category 4 hurricane on July 2, various sectors suffered significant damage. The aftermath of Hurricane Beryl has been devastating, resulting in damage and destruction to homes and other buildings, damage to public infrastructure and the devastation of the agricultural sector. Among the sectors in Grenada, agriculture is one of the most severely affected. The economic tree crop industry – nutmeg, cocoa, soursop among others, the vegetable and vine crop industry, the poultry, apiculture, and small ruminant industries have been demolished, especially in St. John, St. Mark, St. Patrick and St. Andrew. While St. David and St. George have endured some damage, it is incomparable to the other parishes. Assessments will be conducted in St. David and St. George in the upcoming weeks.

This report provides a preliminary assessment of the damage sustained by the agricultural sector in Grenada and outlines the immediate, medium and long-term needs with recommendations to aid recovery and ensure future resilience. The report does not refer to St. George and St. David and Carriacou and Petit Martinique.

2. SUMMARY OF DAMAGE

2.1. Crop Damage

Extent of Damage
Extensive damage to economic tree crops – nutmeg, cocoa and soursop; staple and cash crops – bananas, citrus, vegetables and vine crops.

CROP	PARISH	ESTIMATED TOTAL ACREAGE PRE-BERYL	% DAMAGED OR LOST	ACREAGE DAMAGED OR LOST	# TREES DAMAGED OR LOST	# TREES LOST
Nutmeg (3100 ac)	St. Patrick	930	80 – 90%	837	38,502	
	St. Andrew	1,395	80 – 90%	1,255.5	57,753	
	St. Mark	465	80 – 90%	418.5	19, 251	
	St. John	310	70 – 80%	232.5	10,695	
				TOTAL	**115,506**	**92,405 (80%)**
Cocoa (4000 ac)	St. Patrick	1,200	80 – 90%	1,080	432,000	
	St. Andrew	1,800	70 – 80%	1,440	576,000	
	St. Mark	600	80 – 90%	540	216,000	
	St. John	400	75%	300	120,000	
				TOTAL	**1,344,000**	**604,800 (45%)**
Banana (2000 ac)	All	2,000	90 – 100%	1,900	1,254,00	1,191,300 (90%)
Plantain	All	1,000	90 – 100%	950	627,000	595,650 (95%)
Other Banana spp.	All	200	90 – 100%	190	125,400	119,130 (95%)
Clove	All	100	60%	60	6,000	**2,700 (45%)**
Minor Spices	All	400	70%	160	64,000	**32,000 (50%)**
Soursop	All	200	90 – 100%	190	16,150	**2,423 (15%)**
Other Economic Trees	All	500	70%	350	21,000	**2,100 (10%)**
Vegetables	All	500	90 – 100%	475		

CROP	PARISH	ESTIMATED TOTAL ACREAGE PRE-BERYL	% DAMAGED OR LOST	ACREAGE DAMAGED OR LOST	# TREES DAMAGED OR LOST	# TREES LOST
Vine Crops	All	400	90 – 100%	380		
Flowers	St. Andrew	50	40%	20		
Aquaculture	St. George					

NOTE: -

- For nutmeg – there is an estimated overall 80% total loss – 92,405 trees
- For Cocoa – there is an estimated overall 45% total loss – 604,800 trees
- For Soursop – the losses are mainly due to the loss of fruit. Most of the trees were blown over and not uprooted (10%) and are able to be placed upright.

Estimated Losses

Overall, over 80% of economic tree crops, staple crops, including banana varieties, vine crops and vegetables have been destroyed, leading to substantial economic losses for farmers and the broader economy.

Estimated Cost of Damage

CROP	PARISH	ESTIMATED TOTAL ACREAGE PRE-BERYL	% DAMAGED OR LOST	ACREAGE DAMAGED OR LOST	ESTIMATED LOSS 2024 (ECD)
Nutmeg (3100 ac)	St. Patrick	930	80 – 90%	837	
	St. Andrew	1,395	80 – 90%	1,255.5	
	St. Mark	465	80 – 90%	418.5	
	St. John	310	70 – 80%	232.5	
				TOTAL	**13,860,750**
Cocoa (4000 ac)	St. Patrick	1,200	80 – 90%	1,080	
	St. Andrew	1,800	70 – 80%	1,440	
	St. Mark	600	80 – 90%	540	
	St. John	400	75%	300	
				TOTAL	**14,000,000**
Banana (2000 ac)	All	2,000	90 – 100%	1,900	**57,000,000**
Plantain	All	1,000	90 – 100%	950	**85,536,000**
Other Banana spp.	All	200	90 – 100%	190	**3,000,000**
Clove	All	100	60%	60	**45,000,000**
Minor Spices	All	400	70%	160	**25,000,000**
Soursop	All	200	90 – 100%	190	**22,610,000**
Other Economic Trees	All	500	70%	350	**5,000,000**
Vegetables	All	500	90 – 100%	475	**3,000,000**
Vine Crops	All	400	90 – 100%	380	**3,000,000**
Flowers	St. Andrew	50	40%	20	**500,000**
Aquaculture	St. George				
Infrastructural Damage					**5,000,000**
				TOTAL	**282,898,950**

Note – This does not include projections for loss for tree crops for the next five (5) years, which is estimated at 80% for 2024 – 2026, 60% for 2026 – 2027 and 30% onwards.

Estimated Cost of Damage to Government Stations (Infrastructure and Germplasm) – ECD 4,000,000

Estimated Cost of Damage to the Fishing Fleet by Parish/Location: Fishing Fleet (USD)

Parish						Total Direct Damage			Indirect Losses	Total Losses
	Hull	Gears	Equip	Engine	Camp Houses		# of Boats	# of Fishers	Loss of income (2 months)	
St. Geo	75,000	2,000	3,000	8,000		**88,000**	10	30	180,000	**268,000**
St. John	35,000	3,000	4,000	15,000		**57,000**	15	34	204,000	**261,000**
St. Mark	25,000	4,000	4,000	20,000		**53,000**	20	45	270,000	**323,000**
St. Pat	8,000	1,000	2,000	2,000		**13,000**	5	13	52,000	**65,000**
St. And	3,000	1,000	2,000	2,000		**8,000**	3	10	50,000	**58,000**
St. David	3,000	1,000	2,000	2,000		**8,000**	3	6	21,600	**29,600**
Carr	200,000	70,000	30,000	90,000		**390,000**	50	150	1,050,000	**1,440,000**
PM	225,000	90,000	40,000	100,000		**455,000**	60	180	1,368,000	**1,823,000**
IDR	40,000	25,000	5,000	10,000	72,000	**152,000**	4	15	75,000	**227,000**
Total	**614,000**	**197,000**	**92,000**	**249,000**	**72,000**	**1,224,000**	**170**	**483**	**3,270,600**	**4.494.600**

Estimated Cost of Damage to Aqua-producers by Parish/Location (USD)

	Direct Losses		# of Producers	Indirect Losses	Total Losses

	Plots	Drying Facilities	Total Direct Losses		Loss of Income (2 Months)	
St. David	20,000	12,000	**32,000**	24	**60,000**	**92,000**
St. And	12,000		**12,000**	8	**20,000**	**32,000**
St. Geo	8,000		**8,000**	4	**10,000**	**18,000**
St. Pat	6,000		**6,000**	3	**7,500**	**13,500**
Total	**46,000**	**12,000**	**58,000**	**39**	**97,500**	**155,500**

SUMMARY OF ESTIMATED TREE DAMAGES - FORESTRY

Table 1: Showing estimated percentage of trees damaged at various ecosystems.

ECOSYSTEMS	**% Uprooted and fallen Trees**	**% Defoliated and Broken Trees**
CARRIACOU		
Belair Forest Plantation	20	80
Dover Mangrove and Beach Ecosystem	20	80
Lauriston Mangrove and Associated Coastal Ecosystems	15	85
Harvey Vale Mangrove Ecosystem	15-20	75-80
Island-Wide Forest Resources Other Than Plantation, Mangrove and Beach	15-30	70-85
ST. PATRICK / GRENADA		
Ramsar Site		
a) Mangrove	15	50
b) Woodland Surrounding mangroves	10	45
c) Levera beach	0	0
Bathway Beach	25	30
Forest Vegetation Throughout St. Patrick	15	50

ST. ANDREWS /GRENADA		
Grand E'tang Forest Reserve Including Mt. Qua Qua, Grand E'tang Lake area, Black Forest Area, St. Marguerites Area	50	85
ST. GEORGES/GRENADA		
Annandale Forest Reserve	30	50
Perseverance Dove Sanctuary	***TBA***	***TBA (To be assessed)***
Mt. Hartman national Park and Dove Sanctuary	0	5
Woburn mangrove conservation area	0	2
ST. DAVIDS /GRENADA		
Morne Gazo Forest Reserve	30	50
Les Avocat Watershed Area	***TBA***	***TBA***
Petit Etang Watershed Area	60	80

NOTE – Further support is needed for the cost of the damages to the Forestry Sector.

1. Areas Damaged
   - St. Patrick – 85%
   - St. Andrew – 85%
   - St. Mark – 80%
   - St. John – 75%
   - Other areas received minor damages (approx. 40% in total)

2. Immediate Needs
   a. Road and Farm Clearing (Labour Support; Chainsaw and heavy machinery, woodchippers)
   b. Livelihood Support - Immediate financial aid to affected farmers to cover losses and restart agricultural activities as well as support their families.
   c. Planting Material for replanting
   d. Planting material and other support for Home Garden Initiative
   e. Rehabilitation support to Plant Nursery operators.

PROPOSAL FOR LIVESTOCK

A flat rate of ECD 1000 for the next three (3) months to all affected registered livestock farmers with the Ministry of Agriculture – approximately 1000 farmers – **ECD 3,000,000**

PROPOSAL 2 (RECOMMENDED)
Provide Disaster Relief Support on a scale – depending on acreage and potential earnings for the next three (3) months.

1. Vegetable & Vine Crop Farmers – approx. 1500 farmers – **ECD 10,000,000**
2. Tree Crops (not including Nutmeg & Cocoa – covered by Agri Insurance) – approx. 2500 farmers – **ECD 20,000,000**

4. Overall Percentage of Sector Loss – 85%

Impact on Food Security
Due to these losses, it is expected that there will be significant reduction in food availability, leading to potential food shortages and increased prices. The food import bill will also be affected as the need for fresh vegetables, fruits and staple crops is severely affected.

Damage to Propagation Stations and Estates
Propagation Stations were severely affected.

- Economic tree crop germplasm plots (mango, avocado, cocoa, spice trees, other fruit trees) were damaged and uprooted (80 – 90%)
- Greenhouses and shade houses suffered structural damage due to loss of protective covering and damage to the actual structures.
- Plants prepared for the 2024 Distribution season are currently intact and available for distribution.
- To date the stations are being cleared.
  The Stations were provided with chainsaws and other equipment from the equipment purchased for rehabilitation after Hurricane Beryl.

Grand Bras Estate
The Grand Bras Estate is also being cleared. Access roads were blocked and are now cleared, and rehabilitation of the germplasm and productive plots are being carried out.
NOTE – the security on the Stations and Estates needs to be addressed as valuable germplasm as well as plots of land are being lost due to illegal intrusion.

Propagation Stations

Tree crops production contributes substantially to Grenada's economic development. In 2017 Nutmeg, Cocoa and Soursop export combined generated more than EC$20 million. Local tree crop production is largely driven by farmers' access to quality and affordable plants from the Government propagation facilities for crop establishment and expansion.

The Ministry of Agriculture operates four (4) propagation facilities, Mirabeau Agricultural station and Boulogne Propagation station situated in the parish of St. Andrew, Ashenden Station in the parish of St. David and Maran Station in the parish of St. John. The four stations provide the essential service of propagating traditional tree crops such as cocoa, nutmeg and banana, a variety of fruit trees, spices and ornamental plants.

All 4 of the propagation stations were impacted by Hurricane Beryl. Approximately 30% of the trees in the windbreak surrounding each station and 60% of the shade trees in the cocoa germplasm plots at Maran and Boulogne were uprooted. 70% of the trees along Boulogne Road fell into the road, blocking access to the station from Boulogne playing field.

There was substantial crop loss at Mirabeau Agricultural Station. The Cocoa, Cinnamon spice, Corn, Plantain, Banana, Breadfruit and Soursop germplasm plots at Mirabeau

station were devastated by the hurricane. The two original Burris soursop trees planted at Mirabeau station were destroyed. The loss of the corn germplasm plots will negatively impact corn production in the last quarter of 2024 as more than 90% of farmers depend on the station to supply them with local corn seeds

There was no damage to the administrative buildings and storerooms, however, the nurseries on all four stations suffered substantial damage from hurricane Beryl. A large Galba tree fell and damaged the nursery dedicated to spice propagation at Ashenden Station destroying a large quantity of clove and cinnamon spice plants. Heavy winds removed the shade netting and plastic covering. Some of the shade nettings were left hanging off the sides of the nurseries and can be recovered and reused to cover the nurseries, however the plastic coverings were destroyed. The hurricane force winds also twisted the metal frames on some on the nurseries, further weakening the already fragile structures.

The raw water supply from Cherry hill dam that provides water to Mirabeau station for crop irrigation was substantially impacted. Most of the trees along the track leading to the dam fell and damaged the 4- and 5-inch main lines connected to the dam in multiple locations. The station is without water supply to irrigate and now depends on the rain for the survival of the plants.

Although all propagated plants survived hurricane Beryl, there is an urgent need to recover the nurseries and restore the supply of water for irrigation to prevent losses from direct exposure to elements of the weather (sun & rain) and water stress.

Figure 1: Picture of large tree that fell on a portion of the nursery at Ashenden station

Figure 2: Showing nursery at Ashenden destroyed by fallen tree

Figure 3: Removal of fallen tree on nursery at Ashenden station by worker of the station

Figure 4: showing shade netting completely removed from cocoa nursery at Boulogne Station and plants exposed to elements of the weather

Figure 5: Pictures showing access road to Boulogne lined with fallen trees and trees being removed by worker of the Mirabeau Agricultural Station

Figure 6: Picture of damaged to plastic covering on greenhouse at Mirabeau Station

Figure 7: Picture of damaged circulation fans in greenhouse at Mirabeau Station

Figure 8: Pictures and damaged greenhouses at Mirabeau Station

Figure 9: Picture showing damage to covering on nursery at Mirabeau Station

Government Estate

i. **Mt. Reuil Estate** situated in the northern parish of St. Patrick has been severely affected by the Hurricane with loss to infrastructure up to 90%. The Boucan and office were destroyed or severely damaged. Damages to vegetation, including established crops and agroforestry exceeds 90%. Cocoa, nutmegs, bananas, avocados, coconuts severely affected. This has significantly reduced the productive ability of this estate. Recovery time is expected to take more than 2 years in the first instance, for the short-term producing crops. 70-80% of the tree crops must be replanted, cocoa nutmeg rehabilitation will be exceedingly difficult, due to many trees uprooted.

ii. **Grand Bras Estate** situated in St. Andrew also sustained damages of 90%. Infrastructure not affected. Some areas of cocoa and nutmegs 100% destroyed and replanting is necessary. Traditional trees crops and soursop plots have been destroyed. In many cases breakages and uprooted. 60% of the soursop and 100% of existing bananas on the estate were destroyed. Rehabilitation of cocoa and nutmeg will be extremely difficult. Breadfruit was also severely impacted. The recovery of these estates will be lengthy. A rapid replanting program must be implemented. This must be done simultaneously with clean-up efforts.

Figure 10: Pictures showing flatten boucan and watchman house at Mt. Reuil Estate

Figure 11: Fallen economic trees (Nutmeg, Soursop etc.) at Grand bras Estate

CONCLUSION

Hurricane Beryl has seriously devastated the propagation stations and Government Estate. Germplasm plots, windbreaks, and forest trees on both the propagation stations and estates were destroyed and propagated plants were left exposed to the elements (precipitation and direct sunlight).

The destruction has resulted in the suspension of plant and fertilizers sales and a halt in plant propagation. The operations of the stations and estates are focused only on the recovery from the hurricane. Additional damage to the Cherry Hill Dam that supply water to Mirabeau has left added to the burdens of station as the station remains without a water of irrigation of field sand propagated plants.

The destruction of the stations by Beryl has further reduced their capacity to propagate the 500,000 spice plants targeted for production by the Ministry of Agriculture for the next 3 years and training 50 people in Spice propagation by the end of 2024.

The sale of propagated plants and seeds of various food crops like corn and peas is an essential service provided by the propagation station, it is therefore imperative that the station be restored and operationalized within the shortest possible time. Significant financial investment will be required to rebuild the facilities.

RECOMMENDATIONS:

1. Investment in the rebuilding and upgrade of propagation stations to enhance resilience to climate change and enhance sustainability is critical. Propagation nurseries and other infrastructures must respond to climate change, they must be appropriately designed to withstand hurricane force winds.
2. Identify and propagate targeted qualities of plants to support reafforestation efforts in Carriacou and Grenada and provide training to technical officers of Carriacou in plant propagation to build capacity their capacity in plant propagation.
3. Procure commercial grade shredders to convert fallen trees into mulch, biochar and other useful products for sustainable soil management, environmental protection and promotion of Climate Smart Agriculture practices.
4. Implementation of a rapid replanting program for estate rehabilitation

FORESTRY

This report was conducted in collaboration with the UNDP Climate Resilient Agriculture for integrated landscape [CRA]_Sustainable Landscape Management Specialist and staff of the Forestry Department.

CARRIACOU

Observations

Belair Forest Plantation

The forest is situated towards the middle of the island, but closer to the north. It's a mid-aged forest that consist of hardwood species (mahogany (Swetenia macrophylla), teak (Tectona grandis), and cedar (Cedrella odorata)) that are economically viable (straight logs with few knots). Tree density is of a patchy and irregular nature, the soil is rocky, area is slightly sloped with very little variance in topography and has no understory vegetation/natural regeneration. There were signs of wildlife/birds presence (both calls and sightings). Approximately 20 % of the trees were uprooted and about 80% with broken tops (no crown composition),

Figure 1: Photo Depicting Belair Forest Plantation with Uprooted Trees and Broken Top's

Dover Mangrove and Beach Ecosystem

This ecosystem is situated at the north of the island. The mangrove swamp at Dova is dominated by Red mangrove (***Rhizophora mangle***), Black mangrove (*Avicennia germinans*), White mangrove (*Laguncularia racemosa*), and Buttonwood (***Conocarpus*** erectus) species, while the coastline consists of species that includes, almond (*Terminalia catappa*), manchineel (*Hippomane mancinella*), and coconut (*Cocos nucifera*). Like the Belair Forest, tree density is patchy and irregular. The soil is sandy and the area is flat. Logs are not merchantable (small, knotty, curved and waning trunk). Wildlife were present (sighting of three iguanas and in excess of 15 birds). Approximately 20 % of the trees were uprooted and about 80% with broken tops (no crown composition).

Figure 2: Photo Depicting Dover Mangrove and Associated Ecosystems

Lauriston Mangrove and Associated Coastal Ecosystems:
These ecosystems are situated towards the southwestern part of the island. Like Dover Mangrove and Beach Ecosystem, the Lauriston Mangrove and Associated Coastal Ecosystems have the same tree species, soil type, topography, tree density, age category and timber quality. More than 80% of trees suffered from broken tops with no apparent crown, and approximately 15% uprooted. Wildlife was present (sighting of 3 iguanas and about 10 birds).

Figure 3: Photo Depicting Beach and Mangrove Vegetation at Lauriston

Harvey Vale Mangrove Ecosystem:

Harvey Vale is situated towards the south of Carriacou, and its mangrove ecosystem consists of red, black, white and button wood mangroves. Associated ecosystem (beach), consists of almond, grapes, and manchineel etc. Trees in both mangrove and beach areas are mixed-aged, however, trees at the mangrove ecosystem are mainly short trees, that either experienced stunted growth or are young. The soil is sandy, the area is flat and tree density can be classified as dense (small diameter trees packed together). More than 80% of trees within the mangrove ecosystem were defoliated and bent low to grown level, and about 15% with broken tops. About 75% of trees along the beach lost their tops and approximately 15% uprooted.

Island-Wide Forest Resources Other Than Plantation, Mangrove and Beach in Carriacou

Forest ecosystems throughout the island of Carriacou are dominated by hardwood species, on hill tops or ridges, base of hills, slopes, flats and areas with little variance in topography. The age of trees is mixed (young, mid-aged, and old), and grow on shallow soils. Wildlife was present (sightings of many birds and about 10 iguanas). Approximately 70-85 % of trees suffered from broken tops, and about 15-30% uprooted. Most of the trees are not economically viable but are crucial for protection and provision of essential environmental, social and ecological functions.

Figure 4: Island wide Forest Destruction

ST. PATRICK/GRENADA:

Ramsar Site Levera

The terrestrial component of the Levera Ramsar site consists of the mangrove swamp/ecosystem, sandy beach, and coastal woodlands surrounding the pond/mangroves.

The mangroves within the swamp are of mixed-age and consist mainly of red, black, white and button wood mangroves. Soil varies from sandy to silty clay loam and the site topography ranges from flat to little variance. The trees were significantly affected by Hurricane Beryl. Approximately 50 % of the mangroves lost their tops and about 15% were uprooted. The remaining canopy is distantly spaced, and tree density is patchy and irregular. Regeneration is lush and diverse. Wildlife (birds were seen and heard calling)) were present. Timber quality is poor (logs with curved or waning trunk). About 45% of vegetation surrounding the mangrove swamp lost their tops and approximately 10% uprooted. Recreational facilities (Board Walk and its trail infrastructure), within the mangroves were seriously damaged (only a portion of the board walk trail were apparent, but could not see the board walk-its location was covered with debris). The beach areas were unaffected. See related photos below:

Figure 5: Photo Depicting Portion of Board Walk Trail and Mangrove Swamp

Figure 6: Photo Depicting Levera Beach, Undisturbed by Hurricane.

Figure 7: Photo Depicting Damage to Vegetation Surrounding Pond

Bathway Beach

The vegetation on Bathway beach is predominantly sea grapes, that can be classified as a mixture of mid-aged to old. Hurricane Beryl. Tree density is patchy and irregular. Approximately 30% of trees lost their tops and about 25% felled. No understory vegetation was observed and timber quality was poor (curved, knotty, and waning). See corresponding photos below:

Figure 8: Photo Depicting Remains of Felled Grape Trees

Figure 9: Photo Depicting Felled and De-branched Trees on Bathway Beach

Forest Resources Other Than Ramsar Site and Bathway Beach in St. Patrick

Forest vegetation throughout the St. Patrick is dominated by hardwood species, and can be seen on hill tops or ridges, base of hills, slopes, flats and areas with little variance in topography. Age of trees are mixed (young, mid-aged, and old), and grow on soil that range from sand, silt, clay and rocky. Wildlife were present (sightings of many birds and 1 iguanas). Approximately 50 % of trees suffered from broken tops, and about 15% uprooted. Approximately 35% of vegetation was

unaffected by Hurricane Beryl. Most of the trees are not economically viable but are crucial for protection and provision of essential environmental, social and ecological functions. See photos related to damages and unaffected forest vegetation throughout St. |Patrick below:

Figure 10:Photo Depicting Damage to forest Vegetation in St. Patrick

Figure 11: Photo Depicting Damage to Forest Vegetation in St. Patrick

Figure 12:Photo Depicting Damage to Forest Vegetation in St. Patrick

Figure 13:Photo Depicting Forest Vegetation in St. Patrick, Un-affected by Beryl.

PHOTOS RELATED TO FOREST RESOURCES IN ST. ANDREW, ST. DAVID, AND ST. GEORGE

Ministry of Agriculture and Lands, Forestry and Marine Resources

SUMMARY OF ESTIMATED TREE DAMAGES

Table 1: Showing estimated percentage of trees damaged at various ecosystems.

ECOSYSTEMS	% Uprooted and fallen Trees	% Defoliated and Broken Trees
CARRIACOU		
Belair Forest Plantation	20	80
Dover Mangrove and Beach Ecosystem	20	80
Lauriston Mangrove and Associated Coastal Ecosystems	15	85
Harvey Vale Mangrove Ecosystem	15-20	75-80
Island-Wide Forest Resources Other Than Plantation, Mangrove and Beach	15-30	70-85
ST. PATRICK / GRENADA		
Ramsar Site		
d) Mangrove	15	50
e) Woodland Surrounding mangroves	10	45
f) Levera beach	0	0
Bathway Beach	25	30
Forest Vegetation Throughout St. Patrick	15	50
ST. ANDREWS /GRENADA		
Grand Etang Forest Reserve Including Mt. Qua Qua, Grand Etang Lake area, Black Forest Area, St. Marguerites Area	50	85
ST. GEORGES/GRENADA		
Annandale Forest Reserve	30	50

Perseverance Dove Sanctuary	***TBA***	***TBA (To be assessed)***
Mt. Hartman national Park and Dove Sanctuary	0	5
Woburn mangrove conservation area	0	2
ST. DAVIDS /GRENADA		
Morne Gazo Forest Reserve	30	50
Les Avocat Watershed Area	***TBA***	***TBA***
Petit Etang Watershed Area	60	80

DISCUSSION/CONCLUSION:

Hurricane Beryl has seriously devastated the forest resources of Grenada and Carriacou including Petit Martenique. Trees were left void of crown, wildlife habitats were destroyed, and soils exposed to the elements (precipitation and wind) of erosion, and animals are freely roaming and browsing on all they can in Carriacou. In the absence of tree crown (vegetative cover), soil erosion would be accelerated, particularly during intense and prolonged precipitation. Additionally, since the food sources for wildlife were destroyed, they would be negatively affected (population levels will be significantly reduced due to motility that are associated to exposure and lack of food). Furthermore, trees contribute towards socio-economic and environmental benefits through the provision of amicable conditions for increase agricultural crop production, amelioration of weather, social wellbeing and overall environmental health (loss of available and suitable conditions for farming would negatively affect farmers, particularly in Carriacou). The capacity of the Ramsar site to provide food and habitat for local and migratory species is significantly reduced. Locals in communities surrounding the Ramsar site that are dependent on the pond for fishing would also be affected. Interventions that speak to environmental best practices, including ecosystem restoration (mangrove, plantations, beach and other forest), is crucial and require immediate operationalization to restore social, economic and environmental benefits for the people of Carriacou.

RECOMMENDATIONS

1. Establishment of Financial Mechanisms that would ensure transparency, accountability, and quickest possible disbursement for forest ecosystems restoration efforts (CSA, SLM and Biodiversity Conservation).
2. Continuing with recovery efforts, simultaneously with capacity building and other support initiatives for the damaged areas, particularly for Carriacou, while situation is gloomy.
3. Use the Rapid Assessment Report as a baseline to track interventions and determine their level of effectiveness.
4. Put in place a multidisciplinary team consisting of institutions/individuals that possesses the necessary and relevant expertise and experiences to monitor/track and evaluate associated interventions.

5. Provide machinery (shredders, chain saws etc.), and necessary mechanisms (for transparency and sustainable use etc.), for farmers, to ensure that biodegradable debris are converted in useful product for use in SLM, CSA and Biodiversity Conservation.
6. Facilitate/mobilize necessary financial and technical support for speedy restoration of forest reserves and protected areas, including Levera Ramsar Site, for continued socio-economic, environmental and ecological functions.

APPENDIX:

a) RAPID FOREST ASSESSMENT FORM

Date..... Location: .....

CATEGORY/ATTRIBUTES	SCORE					COMMENTS
	1	2	3	4	5	
1. Tree Species						Higher score (4-5) for forest with hardwood species, followed by forest mixed with hardwood and conifers (3) and. Lower score (1-2) for forest dominated with conifers.
2. Age						Score {2) if young, (4) if old, (3) if mid-age, and (5) if mixed-aged). Forest with multiple cohorts or ages of trees, are more commonly older forest.
3. Tree Density						Lower score (1-2) for denser forest (small diameter trees packed together), followed by open forest (3) and, highest score (4-5).for forest with patchy, irregular density.
4. Canopy Composition						No trees with suppressed crown (5), crown tend to be well spaced (4), crowns are crowding each other (3) some trees with supressed crown (2), many trees with supressed crown (1),
5. Mortality (snags and downed logs/uprooted)						Greater than 80% (1), 60-79% (2), 40-59% (3), 20-39% (4), and 0-19% (5)
6. Trees with Broken tops						Greater than 80% (1), 60-79% (2), 40-59% (3), 20-39% (4), and 0-19% (5)
7. Wildlife Habitat						Look for evidence of wildlife. List calls from different bird species and take note of other species observed etc. dead trees can indicate suitable habitat for certain species. 5 or more observation of wildlife (5), 2-4 observations (3), less than 2 observations (1)
8. Timber Quality						Straight logs without knots (5), straight logs with few knots (4), straight logs with many knots (3), logs with curved or waning trunk (2).

9. Understory Vegetation						Understory is bare (1), understory is lush and diverse (3), understory in very lush and diverse (5).
10. Non-Native Species						Capture percentage cover / area
11. Soil						Rocks or sand (1), peat/bog (2), clay (3), silt (4), loam (5)
12. Hydrology						Look out for the hydrological nature of the site. Are there any streams, ponds, lake, or other surface water etc. older forest provide more protective function to wetlands than younger trees. Riparian areas are near or in older forest (5), Riparian areas are near or in younger forest (3), riparian areas are very exposed, with little forest cover nearby (1).
13. Topography						Capture if it's a hilltop or ridge, base of hill, flat area, little variance in topography

2.2. Livestock Damage

Livestock Losses
On the island of Grenada, there has not been many instances of livestock casualties, including cattle, ruminants (goats and sheep), and pigs. However, most bee farmers lost all of their hives and some poultry farmers lost birds and infracstructure.
Most of the birds lost were due to juvenile birds being exposed to the wind and rain. Entire colonies of bees were lost due to the wind and rain.

Small and large ruminant losses were insignificant – An approximate figure of nearly fifty animals might have died during the passage of Beryl on island. The majority of those losses would have come from the north of the island. The presumed cause of death might have been hypothermia, other terminal illness exacerbated by stress and serious injuries from fallen trees.

Poultry
200 – 500 birds were lost due to suffocation and drowning. This figure is shared between layers and broilers.

Apiculture

- Total number of Beekeepers – 50
- Total number of hives 3, 120
- Loss due to Hurricane Beryl – 35%

Pigs
Minor damages to some of the infrastructure especially in the north but no significant recorded deaths.

Infrastructure
The damages to infrastructure were minimal. Farmers lost complete roofs or a portion of their pens due to fallen trees. Damages estimated around ECD 20,000.00.

Carriacou and Petite Martinique recorded figures for both small and large ruminants were approximately 7000 animals. They would have lost over 65% of that recorded number.

Pigs - over 75% losses

Poultry- over 75% also

Bees - 100% of losses recorded (one of the largest beekeepers lost all his hives)

Animal Shelter Infrastructure – 100% damages recorded with an estimated equivalent of nearly ECD5 -10,000,000 E.C (including livestock and infrastructure)

Infrastructure Damage
Damage was sustained to livestock housing, sheds for feed and equipment storage, and other critical infrastructure.

Impact on Livelihoods
While the hurricane affected livestock farmers, the damage was minimal and mainly dine to the infrastructure.

2.3. Infrastructure and Equipment Damage

Irrigation Systems
All the farmers with irrigation systems, suffered damages, especially in St. Andrew and St. Patrick. While entire systems were not lost, the loss of portions of the systems will lead to reduced water availability for crops and increased losses for farmers. Since we are currently in the rainy season, the need for these systems is not immediate. However, they should be replaced as soon as possible, given the unpredictability of the weather.

Farm Buildings
Nursery managers incurred severe to moderate damage to greenhouses, storage facilities, and processing units. This included loss of protective material (plastic and shade cloth), seedling trays and other material, as well as structural damage to the nurseries.

Machinery and Equipment
Loss or damage to essential farming machinery and equipment hampering farm operations.

2.4. Soil and Land Degradation

Soil Erosion
Severe soil erosion due to heavy rainfall and flooding, has been noted in St. Patick and St. Andrew, leading to loss of fertile topsoil. Due to the topography of the island, felled trees and the influx of heavy rain caused many areas to slide. The practices of our farmers, totally clearing the land for production, also contributed to the erosion of the soil.

Land Degradation
There is an increased risk of landslides and land degradation, affecting future agricultural productivity and personal safety, especially on the Western coast.

3. NEEDS ASSESSMENT

3.1. IMMEDIATE NEEDS

Financial Assistance
Immediate financial aid to affected farmers to cover losses and restart agricultural activities as well as support their families.

Farmers should be provided with Emergency Relief Livelihood Support dependent on the productive acreage of the farmer's holdings and volume of produce sold (especially from the GCNA and GCA).

PROPOSAL FOR LIVESTOCK
A flat rate of ECD 1000 for the next three (3) months to all registered livestock farmers with the Ministry of Agriculture, and who suffered damage from Hurricane Beryl *(Following more in depth assessments, a final figure will be provided.)*

PROPOSAL 2 (RECOMMENDED)
Provide Disaster Relief Support on a scale – depending on acreage and potential earnings for the next three (3) months.

3. Vegetable & Vine Crop Farmers
   - ¼ ac – 1ac – ECD 1,500
     For each acre after 1ac - ECD 500 for each additional acre

4. Tree Crops (not including Nutmeg & Cocoa)
   - ¼ ac – 1ac – ECD 2,500
     For each acre after 1ac - ECD 500 for each additional acre

   NOTE – Farmers who qualify for both will receive the higher rate as well as receive ECD500 per ac for each acre of vegetable and vine crop previously under production.

This is the more difficult of the options but may be more equitable.

STIPEND FOR OFFICERS
A stipend of ECD 500 per month as well as ECD 100 Data plan for tablets being used.

Seeds and Planting Material
Seeds, seedlings, and other planting materials will have to be procured and to replace destroyed crops. On completion of the assessments, a recovery plan will be presented.

Clearing of Farm Roads and Farms
Access to farms is blocked due to fallen trees. Farmers are unable to access their farms as well as remove remaining produce. The use of woodchippers should be encouraged and adequate equipment provided, as there are large logs which will most likely be burned by the farmers. Burning is a practice which should not be encouraged due to the risks it poses to the environment and to human and animal health.
In addition, labour support should be provided for clearing, land preparation and planting and maintenance until the crop is ready for harvest.

Roads Cleared To Date

ST. JOHN

ROAD	STATUS	COMMENTS

1. Mt. D'or	Completed	
2. Mt. Plasir to Concord	Completed	Needs heavy machinery
3. Palmiste to Mt. Granby	Completed	
4. Mt. Granby	Completed	
5. Clozier Sapote Hill	Completed	
6. Clozier Mountain Road	Completed	

ST. PATRICK / ST. MARK

ROAD	STATUS	COMMENTS
1. Tufton Hall, St. Mark	Completed	
2. Celeste Road, St. Patrick	Incomplete	
3. Pointzfield (2 Roads)	Completed	
4. Lower LaTaste (2 Roads)	Completed	
5. Mt. Rich (1 Road)	Complete	

ST. ANDREW

ROAD	STATUS	COMMENTS
1. Mt. St. John (1)	Completed	
2. Boulogne (3)	Completed	
3. Cadrona (1)	Completed	
4. Fond Peche (1)	Completed	
5. Paradise Model Farm	Completed	
6. Orange Hill, Mirabeau	Completed	
7. Bellevue	Completed	Completed by farmers
8. Conference Bamboo Road	Completed	Completed by farmers
9. Mt. Hope	Incomplete	Will begin on Monday
10. Dry River	Incomplete	Will begin next week

ST. DAVID

ROAD	STATUS	COMMENTS
1. Marlmount, St. David	Complete	
2. Marlmount Bay Road	Incomplete	Used by Seamoss Farmers
3.		

Drone Assessments Conducted

- Bathway, St. Patrick
- Black Bay, St. John
- Clozier – Mountain Hill and Sapote Hill
- Grand Etang Lake
- Grand Etang Road
- La Force, St. Andrew
- La Poterie, St. Andrew
- La Taste, St. Patrick
- Lake Antoine (Bertrand John)
- Levera, St. Patrick
- Mirabeau Prop Station
- Mt. D'or
- Mt. Rose, St. Patrick
- River Antoine, St. Patrick
- Rose Hill, St. Patrick
- Spring Garden, St. Andrew

Livestock Replacement
Support for restocking Poultry and feed and rebuilding livestock shelters.
The animals being imported under the World Bank Food Security Program will serve as breeding stock for the rebuilding of the Ruminant Industry.

3.2. SHORT-TERM RECOVERY

Reconstruction of Infrastructure
Repair and reconstruction of damaged farm buildings, irrigation systems, and other critical infrastructure.

Soil Restoration
Measures to prevent further soil erosion and restore soil fertility. This can be done with support from the SOILCARE project.

Technical Support
Training and technical support for technical officers and farmers on best practices for post-disaster recovery and resilient farming techniques.

Provision of Vegetable and Staple Crop Seedlings and Seeds
The Ministry of Agriculture will work with private nursery operators, CARDI and Ministry operated seedling nurseries to provide seedlings and seeds to citizens and institutions who are interested in developing backyard and school gardens to ensure that vegetables and staple crops are available in the short term.

3.3. LONG-TERM RESILIENCE BUILDING

Diversification of Crops
During the replanting phase, especially of long-term tree crops, farmers will be encouraged to diversify their production to reduce reliance on a single crop and improve resilience. Intercropping with shorter term vegetables and staple crops will provide the farmers with income while the other crops are established.

Sustainable Farming Practices
The Ministry of Agriculture will promote sustainable farming practices to enhance resilience to future disasters.

Disaster Preparedness
Disaster preparedness plans and early warning systems will be developed and implemented.

Financial Mechanisms
Establishing insurance schemes and other financial mechanisms to protect farmers against future losses.

4. Conclusion

Hurricane Beryl has caused devastating damage to the agricultural sector, affecting crops, livestock, infrastructure, and soil health. The immediate and long-term needs are substantial and require coordinated efforts from government agencies, international organizations, and the local community. By addressing these needs, it is possible to not only recover from the current

disaster but also build a more resilient agricultural sector capable of withstanding future challenges.

While these are difficult times, we can look at this disaster as an opportunity to reset and rebuild, ensuring better resilience.

Fisheries Sector Report

Preliminary Damage Assessment Following the Passage of Hurricane on 01st July 2024

Introduction

Hurricane Beryl, a category 5 hurricane was the most destructive weather system that early in the season made landfall on Monday 01st July 2024 with the eye traversing directly over the sister island of Carriacou. This resulted in widespread devastation to the fishing industry in Carriacou, Petite Martinique, Isle De Rhonde and to a lesser extent the northern part of mainland Grenada such as St. Patrick, St. Mark and St. John. Some fishers in the other parishes (St. George, St. Andrew and St, David also received damages. Other persons seriously affected by the hurricane were Aqua-producers (seamoss farmers involved in mariculture in the coastal waters).

Importance of the fishing industry

The fisheries sector in Grenada is one of the fastest growing sectors within Grenada's economy over the past four decades. The value of total fish catch increased from six million EC dollars in 1978 to almost fifty million EC dollars as of last year. Similarly, fish exports increased from two million EC dollars in 1984 to over thirty-five million currently. Overall investments in infrastructure and services in the fishing industry are now valued at approximately four hundred and fifty million EC dollars. Currently, the sector provides direct and indirect employment to over five thousand persons which represent about 12% of the labour force.

The number of fishing units within the sector over the past two decades grew by 62%, from 601 to 970 vessels. During the same period, the number of fishermen increased by 76%, from 2,600 to 3,400. The sector now provides direct and indirect employment to almost four thousand persons which represents about 10% of the labour force.

Fisheries is a major contributor to poverty alleviation, employment and income generation, foreign exchange earnings and savings, supply an important source of protein and minerals and provides sustainable livelihoods and social well-being to many coastal and rural communities.

Pre-Hurricane Preparation

Prior to the passage of hurricane Beryl, the Fisheries Division utilized the services of the Ministry of Agriculture Facebook page to notify the entire fishing industry (fishers, fish market centres and fish processing establishments) of the need to secure and protect their assets and investments. In particular, fisherfolks were strongly advised to hall up all of the smaller boats to safer grounds and to secure all of the movable items (engines, gears, safety equipment and other auxiliary items).

A final appeal was made for the industry to secure all of its assets through the public relations arm of the National Disaster Management Agency (NaDMA). From all indications, the industry responded to the appeal thus preventing a more catastrophic impact especially to the fishing fleet.

Methodology

Following the passage of Hurricane Beryl, the Fisheries Division undertook a rapid damage assessment of the fisheries sector to ascertain the extend of the damage and to quantify the losses. Field work was conducted from 8th to 11th July 2024 as follows:

- 8th to 9th July – mainland Grenada
- 10th July – Isle De Rhonde
- 11th July – Petite Martinique and Carriacou

Surveyors / Data Collectors utilised were:

- Fisheries Officers
- Clerical Assistants
- Managers / Supervisors of District Fish Market Centres

The team was briefed on the protocol involved in the field work and the expectations of the assessment.

Operations surveyed for damage assessment:

- Fishing vessels
    - Hull
    - Engine
    - Fishing Gears
    - Safety equipment
    - Equipment
- Aqua-producers – seamoss farms / infrastructure
- Fish processors / exporters
- Fisheries infrastructure
    - Buildings
    - Jetties
    - Communication network
    - Other

Number of existing landing sites / operations

- Primary landing sites – 7
- Secondary landing sites – 40
- Tertiary landing sites – 1
- Fish processing exporting establishments – 4
- Small-scale processors – 6
- Aqua producers
    - Seamoss farmers (mariculture) - 50

Structure of the fisheries sector

Fishing fleet

Category	Length category (Feet)	Tuna Longline	Trolling /FAD	Demersal (handline / bottom longline)	Traps /Gill nets	Scuba	Beach seine	Total
Open vessels with oars	12 -16	20	10	80	30	20		140 160
Open vessels with single or double outboard motor	12 – 26	120	220	60	20	30	0	390 450
Pirogues with a forward cabin and single or double outboard motor	20 -31	75	30	25	10	0	0	135 140
Open vessels with or without engines	26 – 32						40	40
Launch with single Diesel Inboard Engine	32 -54	150	5	5	0	0	0	150 160
Launch with single Diesel Inboard Engine	55-80	20	0	0	0	0	0	20
TOTAL		**385**	**265**	**170**	**60**	**50**	**40**	**970**

Number of Fishers involved in various fisheries

Size Category	No. of Boats	Number of Fishers		Total Fishers
		Fulltime	Parttime	
Tuna longline	385	1,700	150	1,850
Trolling / FAD	265	500	95	595
Demersal (handline / bottom longline)	170	320	110	430
Traps /Gill nets	60	40	80	120
Scuba	50	110	40	150
Beach seine	40	160	90	250
Total	**970**	**2,830**	**565**	**3,395**

Employment in the sector

Category	Fulltime	Parttime	Total
Fishers	2,830	565	3,395
Private Vendors	60	30	90
Fish Plants	80	20	100
Others	40	80	120
Total	**3,010**	**695**	**3,705**

Organisations / Businesses Serving the Fishing Sector

Name of Company	Fish Exporting	Suppliers of Gears / Equipment	Primary Processing	Sale of fuel	Suppliers of Ice	Engine Supplier	Representation
Spice Isle Fish House Ltd.	√	√		√	√		
Southern Fishermen Association Inc.	√			√	√		√
Grenada National	√		√				

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Name of Company	Fish Exporting	Suppliers of Gears / Equipment	Primary Processing	Sale of fuel	Suppliers of Ice	Engine Supplier	Representation
Traceability Technology Ltd. (GNExTT)							
Caribbean Seafoods Ltd	√		√		√		
Vinyard Ltd	√		√				
Marine World		√					
Island Water World		√					
Budget Marine		√					
McIntyre Bros. Ltd.						√	
Anro Agencies						√	
The Bullet Fishing Tackle		√					
Soubise Fishermen's Cooperative				√			√
Petite Martinique Fishermen's Cooperative					√		√
Gouyave Fishermen's Cooperative				√			√
Calliste Fisherman's Cooperative							√

Name of Company	Fish Exporting	Suppliers of Gears / Equipment	Primary Processing	Sale of fuel	Suppliers of Ice	Engine Supplier	Representation
Grand Anse Fisherman's Cooperative							√
Carriacou Fisherfolk Association							√
Sauteurs Fisherman's Cooperative							√
Victoria Fisherman's Cooperative							√

Number and capacity of cold storage nationally (Government and private sector)

NO.	Location	Number	Production Capacity per day / Lbs.
1.	St. George	10	160,000
2.	St. John	6	60,000
3.	St. Mark	2	12,000
4.	St. Patrick	1	5,000
5.	St. Andrew	2	20,000
6.	Carriacou	2	10,000
	Total	23	267,000

Vessels using preservation methods

Category	Number
Vessels using purchased ice	350
Vessels with ice machines	2
Vessels with refrigeration equipment	0

Limitation to the Assessment

During the data collection phase of the field visits, a number of vessel owners and or operators were not present therefore, an assessment was made of the extent of the damage and a value of the loss determined based on the approximate replacement cost.

With respect to Carriacou and Petite Martinique, only one day could have been assigned for the field visit, similarly, the owners and or operators of all the affected vessels were not available for the interview. As a result, an approximate replacement cost was also applied to the affected vessel.

Summary of Damage Assessment

Estimated Cost of Damage to the Fishing Fleet by Parish/Location: Fishing Fleet (USD)

Parish						**Total Direct Damage**			**Indirect Losses**	**Total Losses**
	Hull	**Gears**	**Equip**	**Engine**	**Camp Houses**		**# of Boats**	**# of Fishers**	**Loss of income (2 months)**	
St. Geo	75,000	2,000	3.000	8,000		**88.000**	10	30	180,000	**268,000**
St. John	35,000	3,000	4,000	15,000		**57,000**	15	34	204,000	**261,000**
St. Mark	25,000	4,000	4,000	20,000		**53,000**	20	45	270,000	**323,000**
St. Pat	8,000	1,000	2,000	2,000		**13,000**	5	13	52,000	**65,000**
St. And	3,000	1,000	2,000	2,000		**8,000**	3	10	50,000	**58,000**
St. David	3,000	1,000	2,000	2,000		**8,000**	3	6	21,600	**29,600**
Carr	200,000	70,000	30,000	90,000		**390,000**	50	150	1,050,000	**1,440,000**
PM	225,000	90,000	40,000	100,000		**455,000**	60	180	1,368,000	**1,823,000**
IDR	40,000	25,000	5,000	10,000	72,000	**152,000**	4	15	75,000	**227,000**
Total	**614,000**	**197,000**	**92,000**	**249,000**	**72,000**	**1,224,000**	**170**	**483**	**3,270,600**	**4.494.600**

Estimated Cost of Damage to Aqua-producers by Parish/Location (USD)

	Direct Losses			**# of Producers**	**Indirect Losses**	**Total Losses**
	Plots	Drying Facilities	Total Direct Losses		Loss of Income (2 Months)	
St. David	20,000	12,000	**32,000**	24	**60,000**	**92,000**
St. And	12,000		**12,000**	8	**20,000**	**32,000**
St. Geo	8,000		**8,000**	4	**10,000**	**18,000**
St. Pat	6,000		**6,000**	3	**7,500**	**13,500**

Total	**46,000**	**12,000**	**58,000**	**39**	**97,500**	**155,500**

Ship-to-Shore Communication Network

The fisheries communication network that consists of three repeater sites and towers suffered significant damage. These sites are located at Mount St. Catherene, Grand Etang and Belair in Carriacou. The towers at Mount St. Catherene and Belair, Carriacou were broken and Grand Etang were damaged.

The estimated damage was as follows:

- Belair, Carriacou – USD15, 000
- Mount St. Catherene – USD30,000
- Grand Etang – USD40,000

Total cost of damage – USD85,000

Infrastructure

The fish market complex at Hillsborough received extensive damage to the building and equipment. The equipment consists of two ice machines and one cold storage unit. The building lost its roof and there was severe structural damage. The estimated cost of damage are as follows:

- Two ice machines – USD120,000
- Condensing unit and cold-room – USD25,000
- Building including roof – USD150,000

Total estimated cost of damage – USD295,000

The fish market at Dover incorporated with the new facility received some structural damage. Also, two ice machines to be installed was blown away, as well as the current ice machine that appears to be severely damaged. Total cost of damage are as follows:

- Three ice machines – USD145,000
- Building – USD40,000

Total estimated cost – USD185,000

Petite Martinique Fishermen's Co-operative building received extensive damage to the roof, building and solar panels. The ice machine is in place, but its functionality needs to be ascertained.

The estimated damage are as follows:

- Roof and building – USD35,000
- Solar panels – USD20,000
- Ice machine – USD5,000

Total cost – USD60,000

Fish processing

A fish processor lost his four solar drying units on Petite Martinique. Three units measured 20 ft X 12 ft and one unit measured 20 ft X 20 ft. The cost of damage was as follows:

- 3 units (20ft x 12ft) at USD2,500 per unit – USD7,000
- 1 unit (20ft x 2oft) – USD3,500

Total cost – USD10,500

The fish market at Duquesne suffered damage to the roof by a fallen tree. The estimated cost of damage is USD6,000.

Environmental damage

There were severe observable damage to the marine ecosystem in Carriacou that include the mangroves in the oyster bed and most of Sandy Island has been virtually eroded and washed away.

An assessment could not be made to coral reefs and seagrass beds around Carriacou and Petite Martinique as well as mainland Grenada as this involves under water surveys of the biological and physical features that requires persons with specialized skills and appropriate equipment.

Nonetheless, preliminary estimates of damage to the environment amounts to USD500,000.

A reef restoration project utilizing bio-rock technology at four sites (St. John, St. Mark, Carriacou and Petite Martinique) were completely destroyed. This project was spearheaded by the Grenada Coral Reef Foundation.

Cost of Damages to Coral Nurseries

Total Lost in the following Nurseries:

	USD	USD

1. **Petite Martinique Coral Nursery:**

• 1 Floating Pontoon	@ $2,500	=	$2,500
• 6 Solar Panels	@ $300	=	$1,800
• 1 Solar Array Aluminum Frames	@ $1,700	=	$1,700
• 6 Coral Trees	@ $250	=	$1,500
• 4 Bio-rock Structures with anodes etc.	@ $1,250	=	$ 5,000
	Total	**=**	**$12,500**

2. **Carriacou Coral Nursery**

• 12 Solar Panels	@ $300	=	$3,600
• 2 Solar Array Aluminum Frames	@ $1,700	=	$3,400
• 8 Coral Trees	@ $250	=	$2,000
• 6 Bio-rock Structures with anodes etc.	@ $1,250	=	$ 7,500
	Total	**=**	**$16,000**

3. **Waltham Coral Nursery**

• 1 Floating Pontoon	@ $2,500	=	$2,500
• 6 Solar Panels	@ $300	=	$1,800
• 1 Solar Array Aluminum Frames	@ $1,700	=	$1,700
• 6 Coral Trees	@ $250	=	$1,500
• 4 Bio-rock Structures with anodes etc.	@ $1,250	=	$ 5,000
	Total	**=**	**$12,500**

4. **Gouyave Coral Nursery**

• 2 Floating Pontoon	@ $2,500	=	$5,000
• 12 Solar Panels	@ $300	=	$3,600
• 2 Solar Array Aluminum Frames	@ $1,700	=	$3,400
• 12 Coral Trees	@ $250	=	$3,000
• 6 Coral Tables	@ $650	=	$3,900
• 8 Bio-rock Structures with anodes etc.	@ $1,250	=	$ 10,000
	Total	**=**	**$28,900**

Total for all Nurseries	**=**	**$69,900**

Estimated Grand Total Cost of Damage to the Fishing Industry (USD)

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	Fishing Fleet	**Infrastructure**	**Ship-to-Shore Communication**	**Aqua-producers**	**Fish Processing**	**Marine Environment (Ecosystem)**	**Grand Total**
St. Geo	268,000			18,000			**286,000**
St. John	261,000					28,900	**289,900**
St. Mark	323,000	6,000				12,500	**341,500**
St. Patrick	65,000			13,500			**78,500**
St. And	58,000			32,000			**90,000**
St. David	29,000			92,000			**121,000**
Isle De Rhonde	227,000						**227,000**
Carriacou	1,440,000	480,000				16,000	**1,936,000**
Petite Martinique	1,823,000	60,000			10,500	12,500	**1,906,000**
Island wide			85,000			500,000	**585,000**
Grand Total	**4,494,600**	**546,000**	**85,000**	**155,500**	**10,500**	**569,900**	**5,860,900**

Damaged fishing vessel at Petite Martinique

Boats destroyed at Petite Martinique

Damaged fishermen co-operative building at Petite Martinique

Broken tower at Belair, Carriacou

Hillsborough Fish Market

One of 13 fishermen camp houses destroyed at Isle De Rhonde

Another fishermen fisherman's camp houses destroyed at Isle De Rhonde

Damaged vessel at Gouyave

Sunken boat at Kirani James Boulevard

Solar unit to power the bio-rock reef no longer exist

Reef growth using bio-rock technology

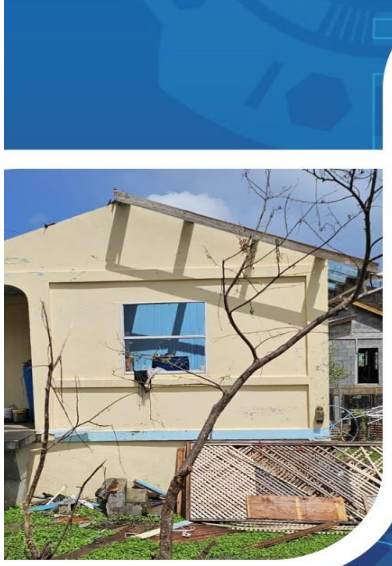
Annex 2

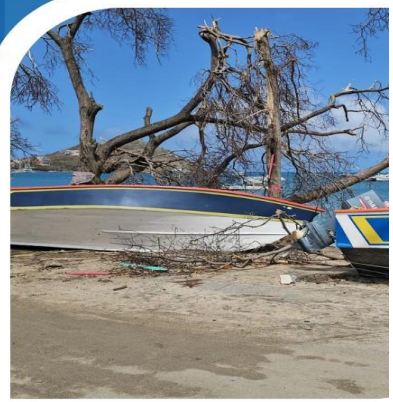
ANNEX 2

HOUSING ASSESSMENT REPORT

Prepared by :

Grenada Central Statistical Office





1-473-440-1369
www.stats.gov.gd
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Melville Street, St. George's

HOUSING ASSESSMENT REPORT

INTRODUCTION:

Hurricane Beryl, one of the earliest hurricanes to have developed in recent times, impacted Grenada and its dependencies on Monday the 1st of July 2024. The aftermath of Hurricane Beryl has been devastating, resulting in damage and destruction to homes and other buildings, including public infrastructure and other sectors of the economy. The housing stock was severely impacted in Carriacou and Petite Martinique as well as in the parishes to the north on the mainland.

This report provides a preliminary assessment of the impact of the hurricane on the housing sector in Grenada, Carriacou, and Petite Martinique.

METHODOLOGY:

A Structured questionnaire was designed in Survey Solutions (World Bank Survey portal). The questionnaire was uploaded to the tablets with enumerators using direct interviews for data capture. Information was collected on damage levels to buildings which includes residential homes, businesses, institutions, and public units across all parishes and constituencies including Carriacou and Petite Martinique.

The Enumerators visited every building that sustained damage within each parish throughout the three islands.

Data collection started on the 5th of July 2024 in Grenada and lasted for five days with approximately fifty interviewers canvassing each parish to ascertain the damages.

Data collection started on the 4th of July 2024 in Carriacou with nine interviewers and the process is currently ongoing. The enumeration is expected to be completed by the 17th of July 2024. The team that are currently enumerating in Carriacou travelled to Petite Martinique on the 9th of July 2024 and completed the data collection in one day.

This report highlights damage levels to residential buildings with further disaggregation by parish, constituency, material of roofing, material of outer walls, age, sex, and number of occupants in addition to the estimated cost of damages.

Damage was categorized into four levels using the Damage Assessment Needs Analysis (DANA) methodology:

- **Level 1**: Damage minimal and easily repaired
- **Level 2**: The structure can be repaired
- **Level 3**: The structure can be safely occupied
- **Level 4**: The structure is destroyed

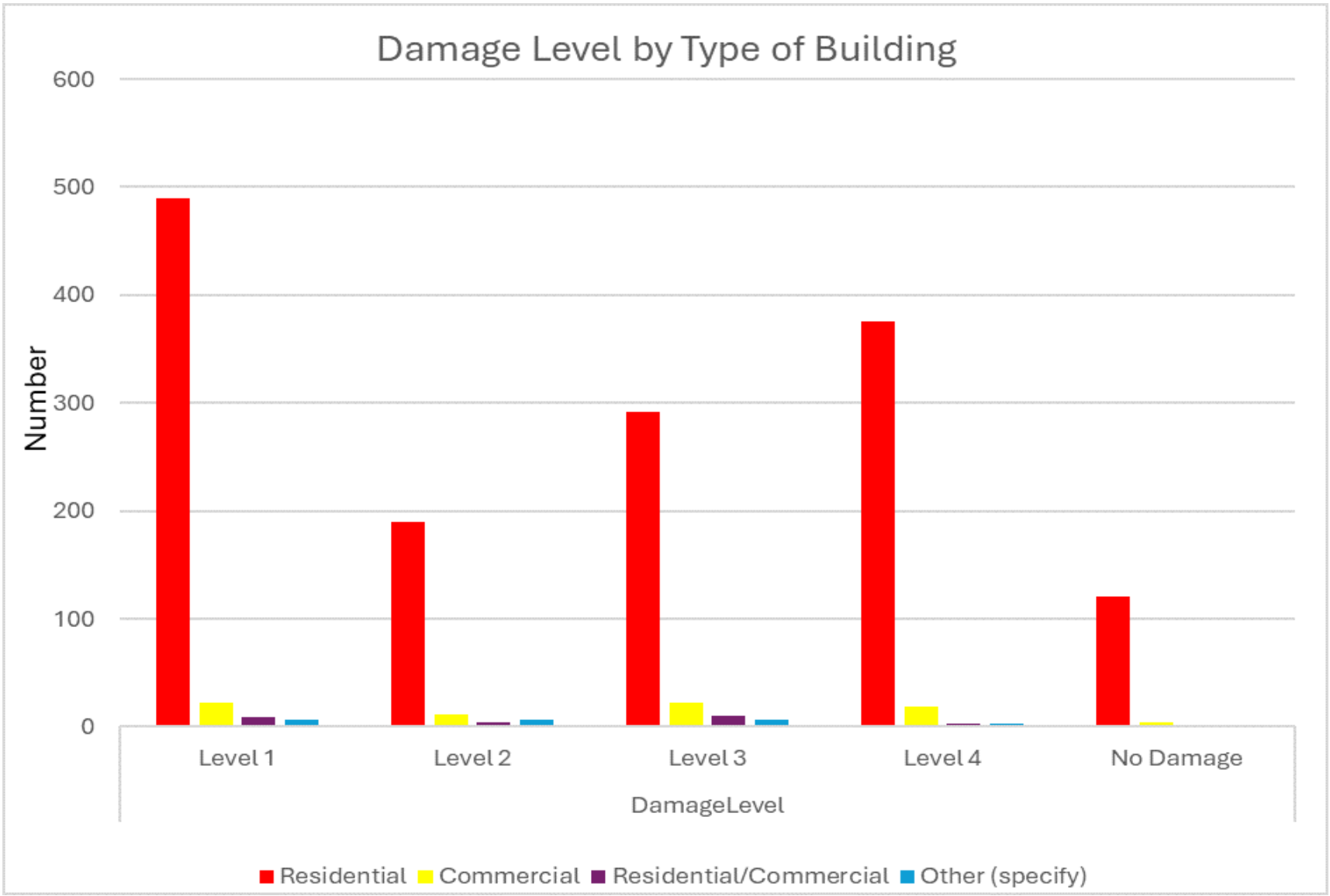
DAMAGE LEVEL BY TYPE OF BUILDING

TABLE: 1

TYPE OF BUILDING	DAMAGE LEVEL					TOTAL
	Level 1	**Level 2**	**Level 3**	**Level 4**	**No Damage**	
Residential	490	190	292	376	121	1469
Commercial	22	11	22	19	4	78
Residential/Commercial	9	4	10	3	2	28
Other (specify)	7	6	7	3	0	23
Don't Know	0	1	2	0	0	3
TOTAL	**528**	**212**	**333**	**401**	**127**	**1601**

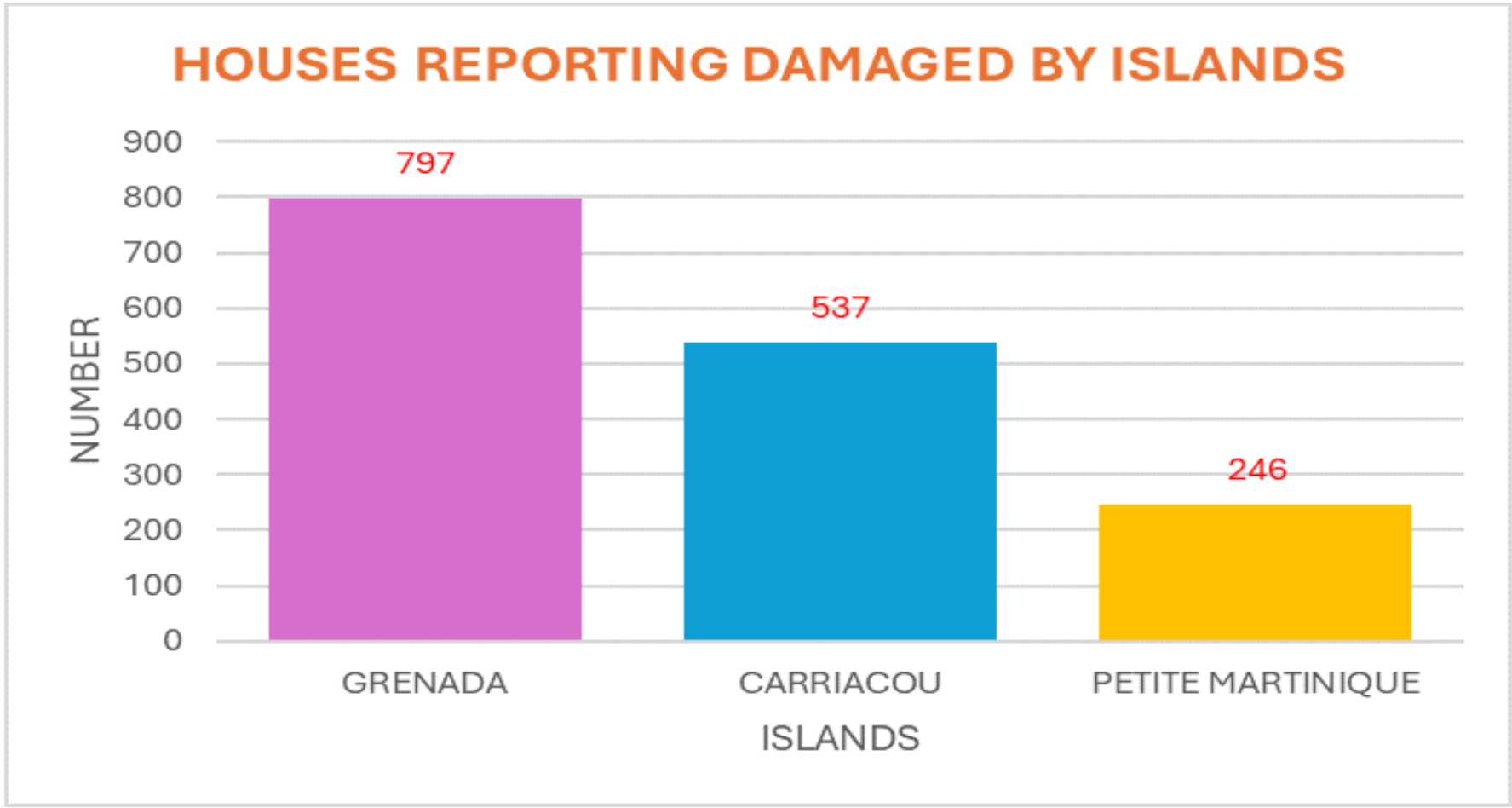
NB: DATA FOR CARRIACOU IS ONGOING: FINAL NUMBERS WILL BE DIFFERENT TO WHAT IS REFLECTED ABOVE.

CHART:1


Damage Level by Type of Building
600
500
400
300
200
100
0
Number
Level 1
Level 2
Level 3
Level 4
No Damage
DamageLevel
Residential
Commercial
Residential/Commercial
Other (specify)

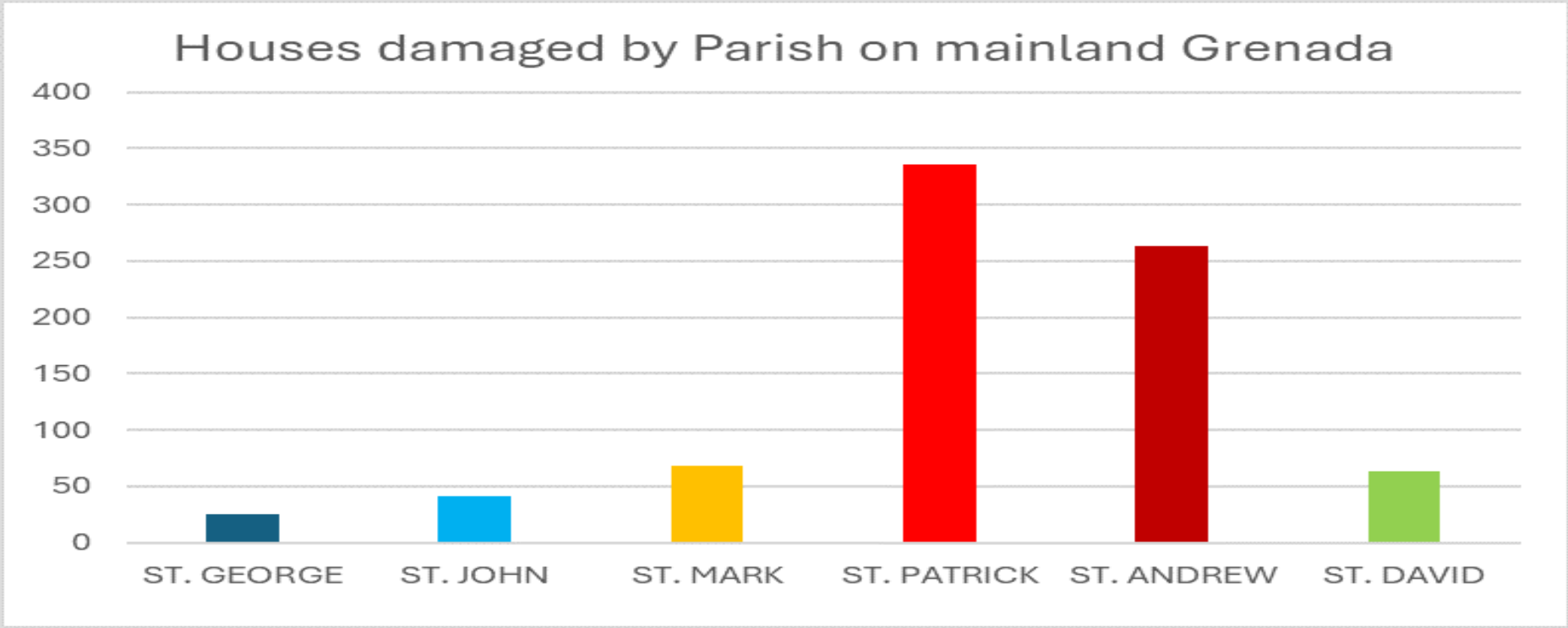
As shown in table1, a total of one thousand six hundred and one buildings were visited. Overall, residential buildings reported the highest figure at all levels. Most of the damages reported were at level one of which one thousand four hundred and sixty-nine were residential buildings, seventy-eight were commercial buildings, twenty-eight were both residential and commercial, twenty-three were reported as other and three were reported as don't know. An analysis by level of damage indicates that residential buildings sustained the most damage at all levels.

CHART: 2



ANALYSIS OF HOUSES DAMAGED ON MAINLAND GRENADA
TABLE 2: NUMBER OF HOUSES AFFECTED IN GRENADA BY LEVELS OF DAMAGES

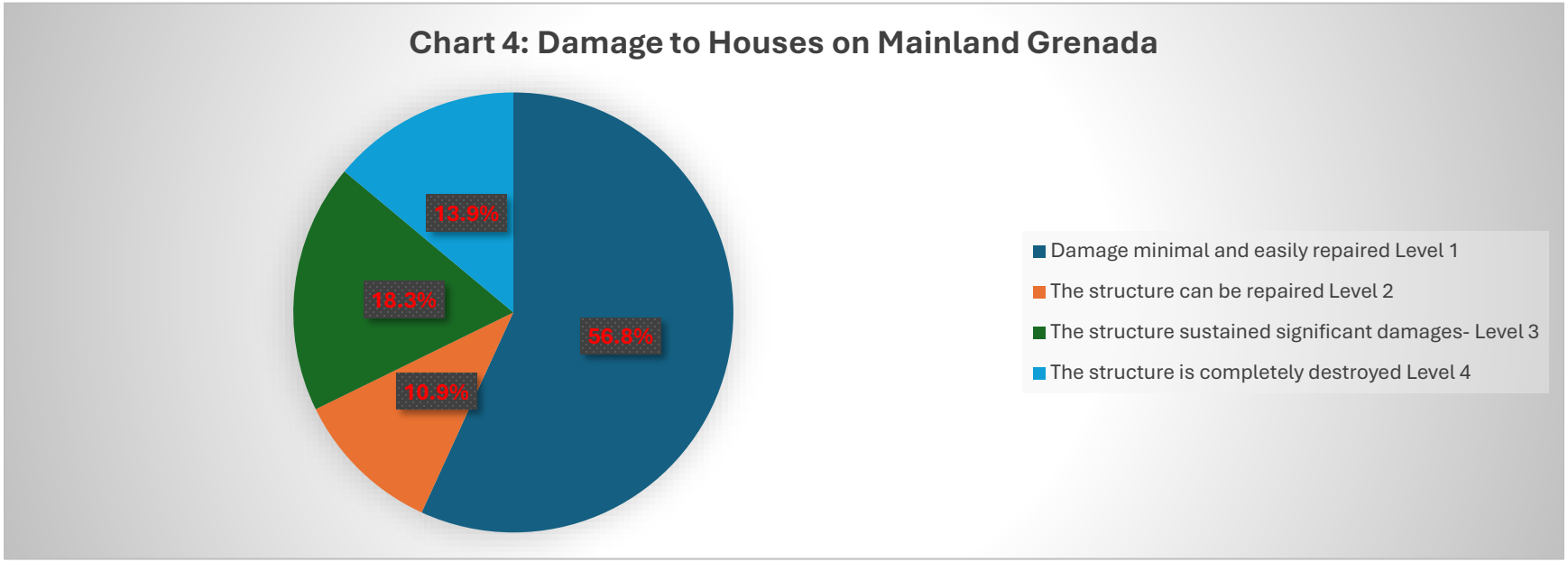
PARISH	Level 1 Damage minimal and easily repaired	Level 2 The structure can be repaired	Level 3 The structure has significant damage	Level 4 The structure is totally destroyed	TOTAL	PERCENTAGE
ST. GEORGE	14	1	11	0	**26**	**3.3**
ST. JOHN	19	6	8	8	**41**	**5.1**
ST. MARK	36	7	14	11	**68**	**8.5**
ST. PATRICK	149	37	71	79	**336**	**42.2**
ST. ANDREW	184	29	40	10	**263**	**33**
ST. DAVID	51	7	2	3	**63**	**7.9**
TOTAL	**453**	**87**	**146**	**111**	**797**	
PERCENTAGE	**56.8**	**10.9**	**18.3**	**13.9**		**100**



On mainland Grenada a total of seven hundred and ninety-seven (797) houses reported to have sustained some form of damage from hurricane Beryl. The parish of St. Patrick sustained the most impact with three hundred and thirty-six (336) houses sustaining damages, which is equivalent to 42.2% of all houses that sustained damage. This was followed by the parish of St. Andrew with two hundred and sixty-three (263) houses accounting to 33.0% of all houses that sustained damages.

Houses in St. Mark, sustained 8.5% of all damages which in absolute numbers is sixty-eight (68) houses, followed by the parish of St. David that reported sixty-three of the houses sustaining some form of damage which is 7.9% of the total. This was followed by the parish of St. John and St. George that reported forty-one (41) and twenty-six (36) houses respectively reporting damages, accounting for 5.1% and 3.3% respectively.

ANALYSIS BY LEVELS OF DAMAGE



A total of four hundred and fifty-three houses sustained damage that is minimal and could easily be repaired which is 57% of all houses that sustained damages. Eighty-seven houses or 11% sustained level two damages, whilst one hundred and forty-six or 18% and one hundred and eleven houses or 14% sustained level three and four damages respectively. Level three and level four are the most severe damages, with level three damages indicates that significant restoration to the structure needs to be done whilst level four indicates that everything needs to be restored.

Totally Destruction of houses reported by parish indicates that St. Patrick had a total of seventy-nine (79) houses that were totally destroyed, St. Mark's had a total of eleven (11), St. Andrew had a total of ten (10), St. John eight (8) and St. David three (3).

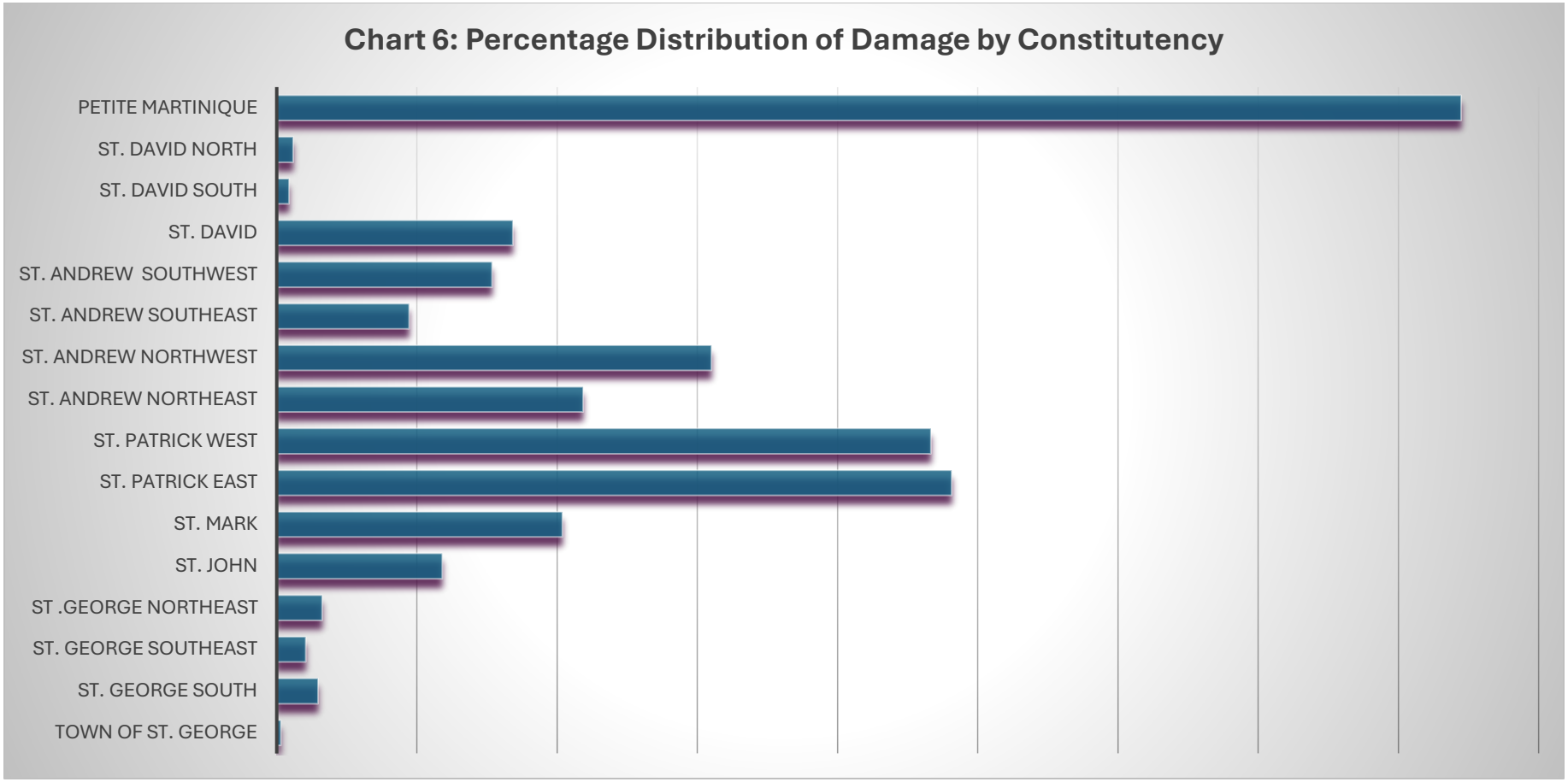
TABLE: 3 LEVEL OF DAMAGES REPORTED BY CONSTITUENCY

Constituency		Type of Building					Total
		Residential	Commercial	Residential/Commercial	Other (specify)	Don't Know	
Level 1	St. George South	4	1	0	0	0	5
	St. George NorthEast	9	0	0	0	0	9
	St. John	16	0	0	0	0	16
	St. Mark	27	0	1	0	0	28
	St. Patrick East	50	3	0	0	0	53
	St. Patrick West	67	1	2	0	0	70
	St. Andrew NorthEast	46	2	1	0	0	49
	St. Andrew NorthWest	70	3	1	1	0	75
	St. Andrew SouthEast	20	0	0	0	0	20
	St. Andrew SouthWest	24	3	1	1	0	29
	St. David	27	1	0	0	0	28
	St. David South	2	0	0	0	0	2
	St. David North	2	0	0	1	0	3
	Carriacou	88	6	0	0	0	94
	Petite Martinique	38	2	3	4	0	47
	Total	**490**	**22**	**9**	**7**	**0**	**528**
Level 2	St. George South	1	0	0	0	0	1
	St. John	6	0	0	0	0	6
	St. Mark	7	0	0	0	0	7
	St. Patrick East	19	1	0	3	0	23
	St. Patrick West	13	1	0	0	0	14
	St. Andrew NorthEast	5	1	0	0	0	6
	St. Andrew NorthWest	11	0	0	0	0	11
	St. Andrew SouthEast	3	0	0	0	0	3
	St. Andrew SouthWest	8	1	0	0	0	9
	St. David	5	0	0	0	0	5
	St. David South	1	0	0	0	0	1
	St. David North	1	0	0	0	0	1
	Carriacou	74	5	3	1	0	83
	Petite Martinique	36	2	1	2	1	42
	Total	**190**	**11**	**4**	**6**	**1**	**212**

ANNEX 2

Constituency		Type of Building					Total
		Residential	Commercial	Residential/Commercial	Other (specify)	Don't Know	
Level 3	**Town of St. George**	1	0	0	0	0	1
	St. George South	3	1	0	0	0	4
	St. George SouthEast	5	0	1	0	0	6
	St. George NorthEast	1	0	0	0	0	1
	St. John	7	0	0	0	0	7
	St. Mark	9	2	3	0	0	14
	St. Patrick East	34	3	0	0	0	37
	St. Patrick West	23	4	0	1	0	28
	St. Andrew NorthEast	9	0	0	0	0	9
	St. Andrew NorthWest	11	0	0	0	0	11
	St. Andrew SouthEast	5	0	1	0	0	6
	St. Andrew SouthWest	12	0	1	0	0	13
	St. David	1	1	0	0	0	2
	Carriacou	113	7	2	4	0	126
	Petite Martinique	58	4	2	2	2	68
	Total	**292**	**22**	**10**	**7**	**2**	**333**
Level 4	St. John	8	0	0	0	0	8
	St. Mark	9	1	0	0	0	10
	St. Patrick East	35	0	1	0	0	36
	St. Patrick West	33	3	0	0	0	36
	St. Andrew NorthEast	3	0	0	0	0	3
	St. Andrew NorthWest	5	0	0	0	0	5
	St. Andrew SouthEast	1	0	0	0	0	1
	St. David	5	0	0	0	0	5
	Carriacou	174	6	0	1	0	181
	Petite Martinique	103	9	2	2	0	116
	Total	**376**	**19**	**3**	**3**	**0**	**401**

Constituency		Type of Building					Total
		Residential	Commercial	Residential/Commercial	Other (specify)	Don't Know	
No Damage	St. George NorthEast	1	0	0	0	0	1
	St. Mark	1	0	0	0	0	1
	St. Patrick East	4	0	0	0	0	4
	St. Patrick West	1	0	0	0	0	1
	St. Andrew NorthEast	1	0	0	0	0	1
	St. Andrew NorthWest	1	0	0	0	0	1
	St. Andrew SouthWest	0	0	1	0	0	1
	St. David	12	1	1	0	0	14
	Carriacou	88	2	0	0	0	90
	Petite Martinique	11	1	0	0	0	12
	Total	**120**	**4**	**2**	**0**	**0**	**126**
Total	**Town of St. George**	**1**	**0**	**0**	**0**	**0**	**1**
	St. George South	**8**	**2**	**0**	**0**	**0**	**10**
	St. George SouthEast	**5**	**0**	**1**	**0**	**0**	**6**
	St. George NorthEast	**11**	**0**	**0**	**0**	**0**	**11**
	St. John	**37**	**0**	**0**	**0**	**0**	**37**
	St. Mark	**53**	**3**	**4**	**0**	**0**	**60**
	St. Patrick East	**142**	**7**	**1**	**3**	**0**	**153**
	St. Patrick West	**137**	**9**	**2**	**1**	**0**	**149**
	St. Andrew NorthEast	**64**	**3**	**1**	**0**	**0**	**68**
	St. Andrew NorthWest	**98**	**3**	**1**	**1**	**0**	**103**
	St. Andrew SouthEast	**29**	**0**	**1**	**0**	**0**	**30**
	St. Andrew SouthWest	**44**	**4**	**3**	**1**	**0**	**52**
	St. David	**50**	**3**	**1**	**0**	**0**	**54**
	St. David South	**3**	**0**	**0**	**0**	**0**	**3**
	St. David North	**3**	**0**	**0**	**1**	**0**	**4**
	Carriacou	**537**	**26**	**5**	**6**	**0**	**574**
	Petite Martinique	**246**	**18**	**8**	**10**	**3**	**285**
	Total	**1468**	**78**	**28**	**23**	**3**	**1601**



NB: Carriacou was not included because data collection is ongoing

An analysis of the damages of residential buildings by constituencies which signifies houses by constituencies shows that the constituencies of St. Patrick west, St. Patrick East, St. Andrew Northwest, St. Andrew Northeast, St. Mark, and St. David on the mainland Grenada had the most houses with damages.

The damage to residential buildings was extensive in Petite Martinique with almost all the residential buildings being destroyed.

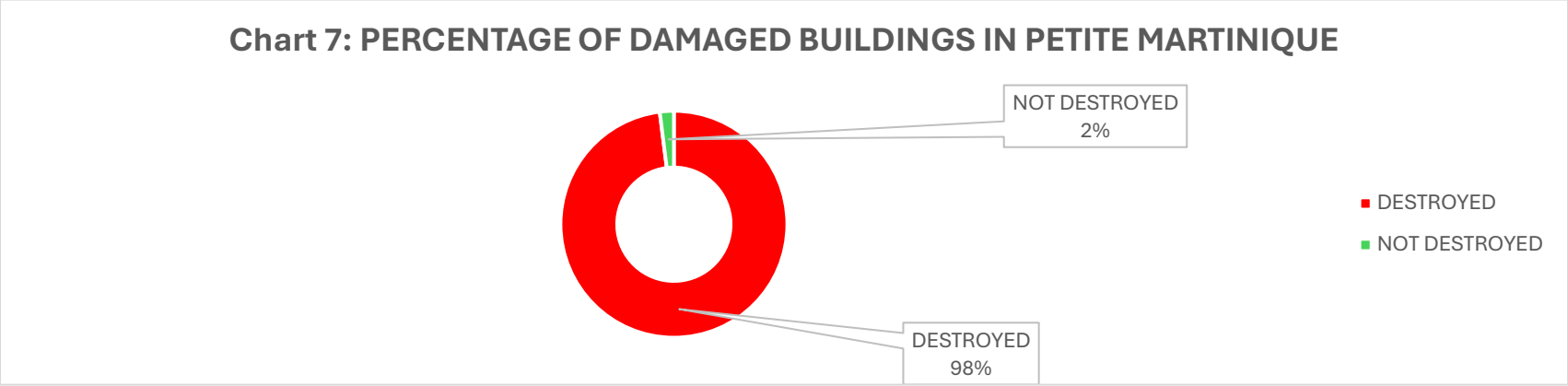


Table 4: Damage Level by Type of Outer Walls of buildings Visited

Material of Outer Wall	Damage Level					
	Level 1	Level 2	Level 3	Level 4	Damage not Reported	Total
Wood	127	33	59	165	15	399
Wood and Brick	41	0	6	4	1	52
Wood and Concrete	77	28	47	61	4	217
Wood and Galvanise	1	0	0	1	0	2
Concrete and Blocks	209	135	193	100	101	738
Stone	0	1	0	0	0	1
Stone and Brick	0	1	0	0	0	1
Plywood	58	7	18	49	4	136
Plywood and Concrete	11	3	5	16	0	35
Concrete/Cement Board	0	0	0	1	0	1
Makeshift	0	0	1	2	0	3
Sheet metal	3	1	0	0	0	4
Other (specify)	4	3	4	2	1	14
Total	**531**	**212**	**333**	**401**	**126**	**1603**

TABLE 5: MATERIALS USED FOR ROOFING IN CARRIACOU AND PETITE MARTINIQUE

Constituency	Material of the Roof							
	Sheet metal (zinc, aluminum, galvanize)	**Shingle (asphalt)**	**Shingle (fiberglass)**	**Concrete**	**Rubber Rye**	**Thatch/Makeshift**	**Other (specify)**	**Total**
Carriacou	568	0	0	4	0	0	0	572
Petite Martinique	279	0	0	6	0	0	0	285
TOTAL	**847**	**0**	**0**	**10**	**0**	**0**	**0**	**857**

NB: Data collection is ongoing in Carriacou

TABLE 6: HOUSES WITH LEVEL 1 DAMAGES

PARISH	The main material of the outer walls											TOTAL
	Wood	Wood and Concrete	Wood and Galvanise	Concrete and Blocks	Stone	Stone and Brick	Plywood	Plywood and Concrete	Sheet Material	Makeshift	Other (specify)	
ST. GEORGE	4	4	0	4	0	0	2	0	0	0	0	**14**
ST. JOHN	4	3	0	4	0	0	4	1	0	0	0	**16**
ST. MARK	10	7	0	6	0	0	5	0	0	0	0	**28**
ST. PATRICK	35	18	1	35	0	0	24	6	0	0	4	**123**
ST. ANDREW	58	73	0	26	0	0	14	4	1	0	0	**176**
ST. DAVID	9	10	0	11	0	0	2	0	1	0	0	**33**
CARRIACOU	5	3	0	59	0	0	2	0	0	0	0	**69**
PETITE MARTINIQUE	2	0	0	24	0	0	5	0	1	0	0	**32**
TOTAL	**127**	**118**	**1**	**169**	**0**	**0**	**58**	**11**	**3**	**0**	**4**	**491**

TABLE 7: HOUSES WITH LEVEL 2 DAMAGES

PARISH	The main material of the outer walls											TOTAL
	Wood	Wood and Concrete	Wood and Galvanise	Concrete and Blocks	Stone	Stone and Brick	Plywood	Plywood and Concrete	Sheet Material	Makeshift	Other (specify)	
ST. GEORGE	0	0	0	1	0	0	0	0	0	0	0	**1**
ST. JOHN	2	2	0	2	0	0	0	0	0	0	0	**6**
ST. MARK	1	4	2	0	0	0	0	0	0	0	0	**7**
ST. PATRICK	22	20	0	11	0	0	0	1	0	0	3	**57**
ST. ANDREW	10	8	0	9	0	1	1	0	0	0	0	**29**
ST. DAVID	2	1	0	3	0	0	1	0	0	0	0	**7**
CARRIACOU	5	2	0	44	1	0	4	2	0	0	0	**58**
PETITE MARTINIQUE	1	1	27	0	0	0	1	0	1	0	0	**31**
TOTAL	**43**	**38**	**29**	**70**	**0**	**0**	**7**	**3**	**1**	**0**	**3**	**196**

TABLE 8: HOUSES WITH LEVEL 3 DAMAGES

PARISH	The main material of the outer walls											TOTAL
	Wood	Wood and Concrete	Wood and Galvanise	Concrete and Blocks	Stone	Stone and Brick	Plywood	Plywood and Concrete	Sheet Material	Makeshift	Other (specify)	
ST. GEORGE	0	0	0	1	0	0	0	0	0	0	0	**1**
ST. JOHN	2	2	0	2	0	0	0	0	0	0	0	**6**
ST. MARK	1	4	2	0	0	0	0	0	0	0	0	**7**
ST. PATRICK	22	20	0	11	0	0	0	1	0	0	3	**57**
ST. ANDREW	10	8	0	9	0	1	1	0	0	0	0	**29**
ST. DAVID	2	1	0	3	0	0	1	0	0	0	0	**7**
CARRIACOU	5	2	0	44	1	0	4	2	0	0	0	**58**
PETITE MARTINIQUE	1	1	27	0	0	0	1	0	1	0	0	**31**
TOTAL	**43**	**38**	**29**	**70**	**0**	**0**	**7**	**3**	**1**	**0**	**3**	**196**

TABLE 9: HOUSES WITH LEVEL 4 DAMAGES

PARISH	The main material of the outer walls											TOTAL
	Wood	Wood and Concrete	Wood and Galvanise	Concrete and Blocks	Stone	Stone and Brick	Plywood	Plywood and Concrete	Sheet Material	Makeshift	Other (specify)	
ST. GEORGE	0	0	0	0	0	0	0	0	0	0	0	**0**
ST. JOHN	6	1	0	0	0	0	1	0	0	0	0	**8**
ST. MARK	3	5	0	1	0	0	1	0	0	0	0	**10**
ST. PATRICK	54	25	1	3	0	0	10	0	0	0	1	**94**
ST. ANDREW	3	1	0	1	0	0	3	0	0	1	0	**9**
ST. DAVID	4	0	0	1	0	0	0	0	0	0	0	**5**
CARRIACOU	89	58	0	107	0	0	24	6	0	0	0	**284**
PETITE MARTINIQUE	36	20	0	37	0	0	11	11	0	0	1	**116**
TOTAL	**195**	**110**	**1**	**150**	**0**	**0**	**50**	**17**	**0**	**1**	**2**	**526**

TABLE 10: ESTIMATED COST OF DAMAGES TO HOUSES IN GRENADA, CARRIACOU AND PETITE MARTINIQUE

TYPE OF MATERIAL OF OUTER WALLS		LEVEL 1		
		25%	No. of Houses	Total Cost
Estimated cost of board House	$80,000.00	$20,000.00	132	$2,640,000.00
Estimated cost of wood and concrete House	$100,000.00	$25,000.00	121	$3,025,000.00
Estimated cost of wood and Galvanized House	$50,000.00	$12,500.00	1	$12,500.00
Estimated cost of concrete and blocks House	$500,000.00	$125,000.00	228	$28,500,000.00
Estimated cost of stone House	$400,000.00	$100,000.00	0	$0.00
Estimated cost of stone and brick House	$400,000.00	$100,000.00	0	$0.00
Estimated cost of Plywood House	$50,000.00	$12,500.00	60	$750,000.00
Estimated cost of Plywood and Concrete House	$60,000.00	$15,000.00	11	$165,000.00
Estimated cost of sheet metal House	$60,000.00	$15,000.00	3	$45,000.00
Estimated cost of Makeshift House	$15,000.00	$3,750.00	0	$0.00
Estimated cost of "other material" House	$20,000.00	$5,000.00	4	$20,000.00
TOTAL			560	$35,157,500.00

TABLE 10a: ESTIMATED COST OF DAMAGES TO HOUSES IN GRENADA, CARRIACOU AND PETITE MARTINIQUE

TYPE OF MATERIAL OF OUTER WALLS		LEVEL 2		
		50%	No. of Houses	Total Cost
Estimated cost of board House	$80,000.00	$40,000.00	83	$3,320,000.00
Estimated cost of wood and concrete House	$100,000.00	$50,000.00	96	$4,800,000.00
Estimated cost of wood and Galvanized House	$50,000.00	$25,000.00	29	$725,000.00
Estimated cost of concrete and blocks House	$500,000.00	$250,000.00	184	$46,000,000.00
Estimated cost of stone House	$400,000.00	$200,000.00	0	$0.00
Estimated cost of stone and brick House	$400,000.00	$200,000.00	0	$0.00
Estimated cost of Plywood House	$50,000.00	$25,000.00	11	$275,000.00
Estimated cost of Plywood and Concrete House	$60,000.00	$30,000.00	5	$150,000.00
Estimated cost of sheet metal House	$60,000.00	$30,000.00	1	$30,000.00
Estimated cost of Makeshift House	$15,000.00	$7,500.00	0	$0.00
Estimated cost of "other material" House	$20,000.00	$10,000.00	3	$30,000.00
TOTAL			412	$55,330,000.00

TABLE 10b: ESTIMATED COST OF DAMAGES TO HOUSES IN GRENADA, CARRIACOU AND PETITE MARTINIQUE

TYPE OF MATERIAL OF OUTER WALLS		LEVEL 3		
		75%	No. of Houses	Total Cost
Estimated cost of board House	$80,000.00	$60,000.00	144	$8,640,000.00
Estimated cost of wood and concrete House	$100,000.00	$75,000.00	149	$11,175,000.00
Estimated cost of wood and Galvanized House	$50,000.00	$37,500.00	0	$0.00
Estimated cost of concrete and blocks House	$500,000.00	$375,000.00	460	$172,500,000.00
Estimated cost of stone House	$400,000.00	$300,000.00	0	$0.00
Estimated cost of stone and brick House	$400,000.00	$300,000.00	0	$0.00
Estimated cost of Plywood House	$50,000.00	$37,500.00	30	$1,125,000.00
Estimated cost of Plywood and Concrete House	$60,000.00	$45,000.00	13	$585,000.00
Estimated cost of sheet metal House	$60,000.00	$45,000.00	0	$0.00
Estimated cost of Makeshift House	$15,000.00	$11,250.00	1	$11,250.00
Estimated cost of "other material" House	$20,000.00	$15,000.00	4	$60,000.00
TOTAL			801	$194,096,250.00

TABLE 10c: ESTIMATED COST OF DAMAGES TO HOUSES IN GRENADA, CARRIACOU AND PETITE MARTINIQUE

TYPE OF MATERIAL OF OUTER WALLS		LEVEL 4		
			No. of Houses	Total Cost
Estimated cost of board House	$80,000.00	$80,000.00	284	$22,720,000
Estimated cost of wood and concrete House	$100,000.00	$100,000.00	168	$16,800,000
Estimated cost of wood and Galvanized House	$50,000.00	$50,000.00	1	$50,000
Estimated cost of concrete and blocks House	$500,000.00	$500,000.00	307	$153,500,000
Estimated cost of stone House	$400,000.00	$400,000.00	0	$0
Estimated cost of stone and brick House	$400,000.00	$400,000.00	0	$0
Estimated cost of Plywood House	$50,000.00	$50,000.00	74	$3,700,000
Estimated cost of Plywood and Concrete House	$60,000.00	$60,000.00	23	$1,380,000
Estimated cost of sheet metal House	$60,000.00	$60,000.00	0	$0
Estimated cost of Makeshift House	$15,000.00	$15,000.00	1	$15,000
Estimated cost of "other material" House	$20,000.00	$20,000.00	2	$40,000
TOTAL			860	$198,205,000.00

NB: WEIGHTS WERE APPLIED TO THE FIGURES FOR CARRIACOU TO REFLECT THE ENTIRE COUNTRY

TABLE 10d: ESTIMATED COST OF DAMAGES TO HOUSES IN GRENADA, CARRIACOU AND PETITE MARTINIQUE

Total Estimated damages to level 1 houses	**$35,157,500.00**	**$ 12,940,299.61**
Total Estimated damages to level 2 houses	**$55,330,000.00**	**$ 20,365,122.01**
Total Estimated damages to level 3 houses	**$194,096,250.00**	**$ 71,440,336.41**
Total Estimated damages to level 4 houses	**$198,205,000.00**	**$ 72,952,629.84**

TOTAL COST OF ALL DAMAGES IN EC$	**$482,788,750.00**
TOTAL COST OF ALL DAMAGES IN US$	**$180,819,756.55**

The overall estimated cost of the damages to houses in Grenada, Carriacou and Petite Martinique as a result of Hurricane Beryl was Four hundred and eighty-two million, seven hundred and eighty-eight thousand, seven hundred and fifty Eastern Caribbean dollars ($482,788,750.00 EC) which equates to One Hundred and eighty million, eight hundred and nineteen thousand, seven hundred and fifty-six United States dollars and fifty-five cents ($ 180,819,756.55 US).

The estimated cost of level one (1) damages was thirty-five million, one hundred and fifty-seven thousand, five hundred Eastern Caribbean dollars ($35, 157,500.00 EC) or twelve million, nine hundred and forty thousand, two hundred and ninety-nine United States dollars and sixty-one cents ($12,940,299.61US).

The estimated cost of level two (2) damages was fifty-five million, three hundred and thirty thousand Eastern Caribbean dollars ($55,330,000.00EC) which equates to Twenty million, three hundred and sixty-five thousand, one hundred and twenty-two United States dollars and one cent. ($20,365,122.01 US).

Level three (3) damages had an estimated cost of One hundred and ninety-four million, ninety-six thousand, two hundred and fifty Eastern Caribbean dollars ($194,096,250.00 EC), which is equivalent in United States dollars to seventy-one million, four hundred and forty thousand, three hundred and thirty-six dollars and forty-nine cents, ($71,440,336.41 US).

Level four (4) which represents the highest severity of damages had an estimated cost of One hundred and ninety-eight million, two hundred and five thousand Eastern Caribbean dollars, which is equal to seventy-two million, nine hundred and fifty-two thousand, six hundred and twenty-nine United States dollars and eighty-four cents ($72,952,629.84 US).

ANALYSIS BY INDIVIDUALS AFFECTED

Parish Household Level: Member of the Public Affected by Parish and Level of Damage Report from the Beryl 2024 Survey.

It is important to note that Enumerators were unable to contact the occupants in many cases, given that there was no one to be interviewed given the severity of damage. People affected could be much more than what is reported.

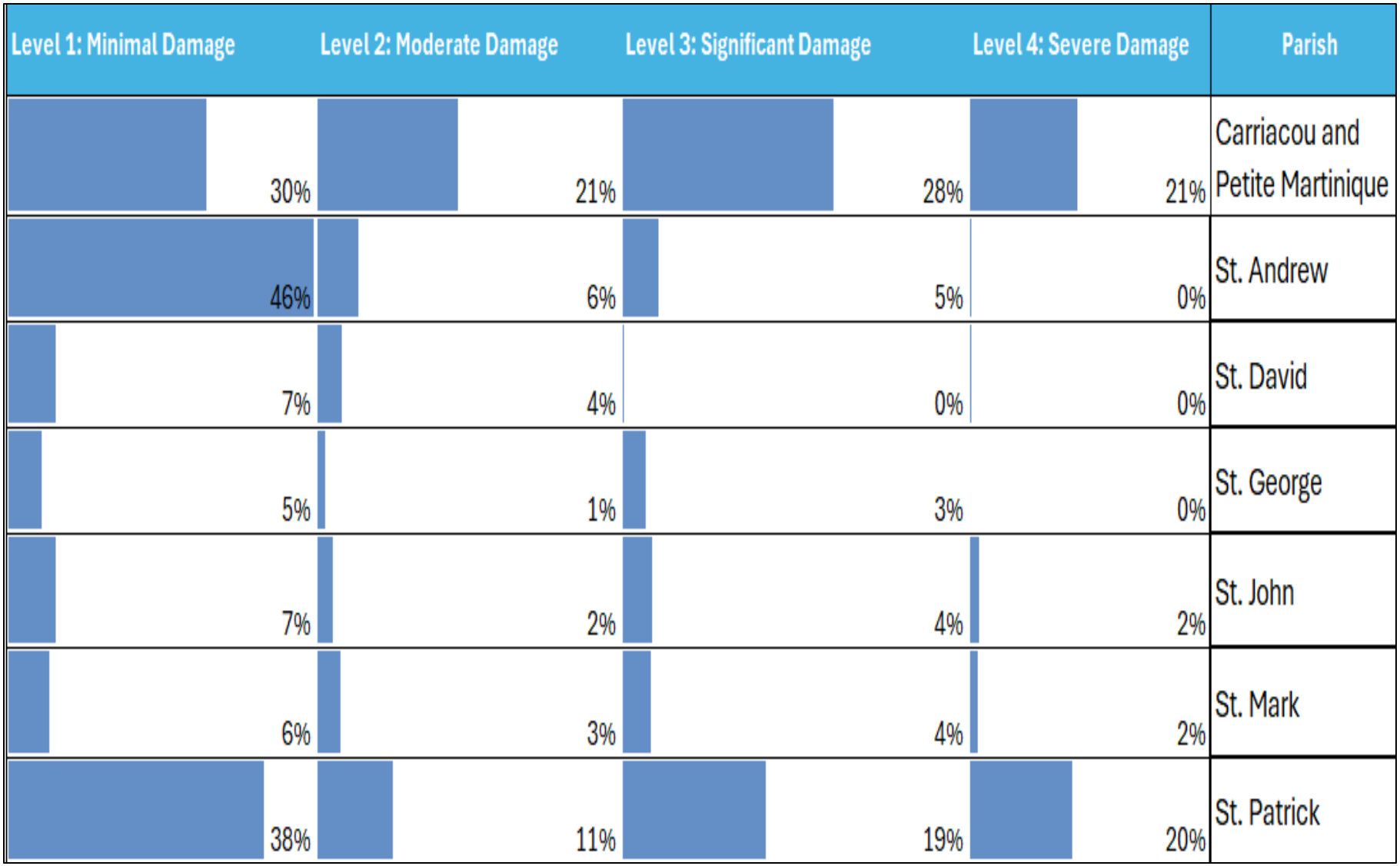
Data collected continues in Carriacou. The total will change once data collection is completed.

Summary of Damage by Parish:

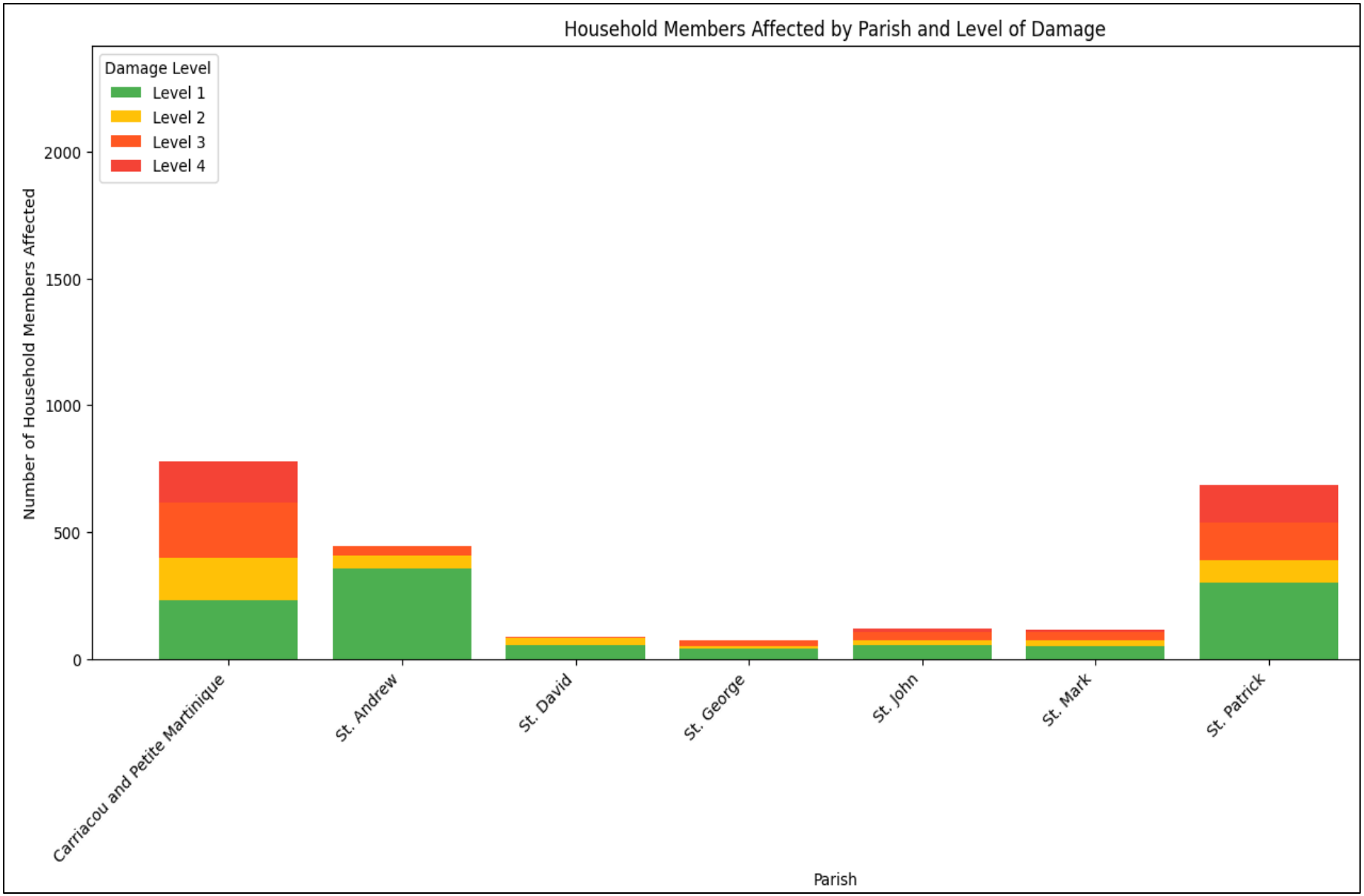
This report provides an analysis of the damage levels caused by Hurricane Beryl in 2024, focusing on the number of household members affected across different parishes. The data highlights the extent of the damage and the areas most in need of resources and support.

PARISH	Level 1	Level 2	Level 3	Level 4	TOTAL
Carriacou and Petite Martinique	232	167	219	160	778
St. Andrew	357	49	37	2	445
St. David	55	29	1	1	86
St. George	39	9	24	0	72
St. John	56	18	31	14	119
St. Mark	48	27	29	12	116
St. Patrick	299	89	148	152	688
TOTAL	**1086**	**388**	**489**	**341**	**2304**

Visual Representation: (Household Member affected by Parish level from Beryl Damages – based on Level of Damage Causes, Disaggregated by Parishes in Grenada.


Level 1: Minimal Damage
Level 2: Moderate Damage
Level 3: Significant Damage
Level 4: Severe Damage
Parish
30%
21%
28%
21%
Carriacou and Petite Martinique
46%
6%
5%
0%
St. Andrew
7%
4%
0%
0%
St. David
5%
1%
3%
0%
St. George
7%
2%
4%
2%
St. John
6%
3%
4%
2%
St. Mark
38%
11%
19%
20%
St. Patrick

ANNEX 2


Household Members Affected by Parish and Level of Damage
Damage Level
Level 1
Level 2
Level 3
Level 4
Number of Household Members Affected
0
500
1000
1500
2000
Carriacou and Petite Martinique
St. Andrew
St. David
St. George
St. John
St. Mark
St. Patrick
Parish

Analysis and Key Insights:

1. **Overall Impact:**
    - The total number of household members affected by the hurricane across all parishes is estimated to be two thousand three hundred and four (2304).
    - The data shows significant variations in damage levels, with certain parishes experiencing more severe impacts than others.
2. **Parish-Level Impact:**
    - **Carriacou and Petite Martinique** reported the highest number of affected household members, with an estimated total of seven hundred and seventy-eight (778) members where household suffered damage. This includes substantial numbers across all levels of damage.
    - **St. Patrick** also experienced a high total number of reported cases, with an estimated six hundred and eighty-eight (688) affected household members. The number of severe damage cases (Level 4) is notably high at an estimated one hundred and fifty-two (152) persons impacted.
    - **St. Andrew** saw a total of an estimated four hundred and forty-five (445) affected household members, with the majority experiencing minimal damage (Level 1).
    - **St. David** and **St. George** reported relatively fewer cases, with estimated totals of eighty-six (86) and seventy-two (72), respectively.
3. **Damage Severity:**
    - Level 1 (Minimal Damage): Estimated 1086 cases
    - Level 2 (Moderate Damage): Estimated 388 cases
    - Level 3 (Significant Damage): Estimated 489 cases
    - Level 4 (Severe Damage): Estimated 341 cases

Recommendations:

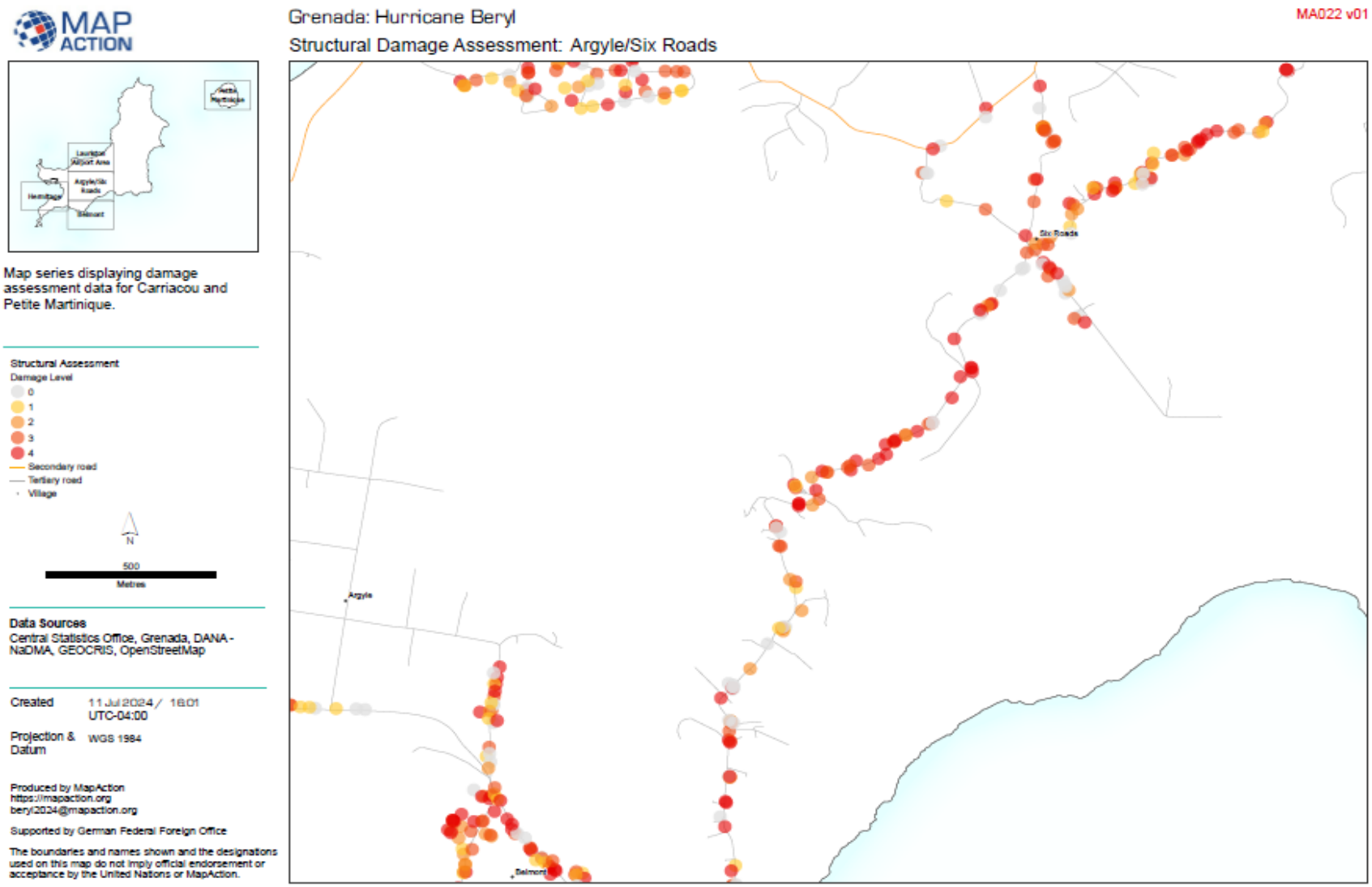
- **Resource Allocation:** Direct resources and support to parishes with the highest total number of affected household members, specifically Carriacou and Petite Martinique, and St. Patrick. These areas show the greatest need for assistance in rebuilding and recovery efforts.
- **Focus on Severe Damage:** Pay particular attention to areas with high levels of severe damage (Level 4), such as St. Patrick, Carriacou and Petite Martinique. These regions may require more intensive interventions and long-term support.

- **Community Support:** Engage with local communities to provide immediate relief and long-term support, ensuring that the most vulnerable populations receive the help they need.
- **Preventive Measures:** Invest in preventive infrastructure and community preparedness programs to mitigate the impact of future hurricanes.

Conclusion:

The analysis indicates significant variations in damage levels across different parishes. Carriacou and Petite Martinique, along with St. Patrick, experienced the highest total number of reported cases, where number of household member reported to be affected. These insights are crucial for directing resources and efforts to the areas most affected by damage, ensuring effective and targeted recovery initiatives.

ANNEX A Carriacou and Petite Martinique



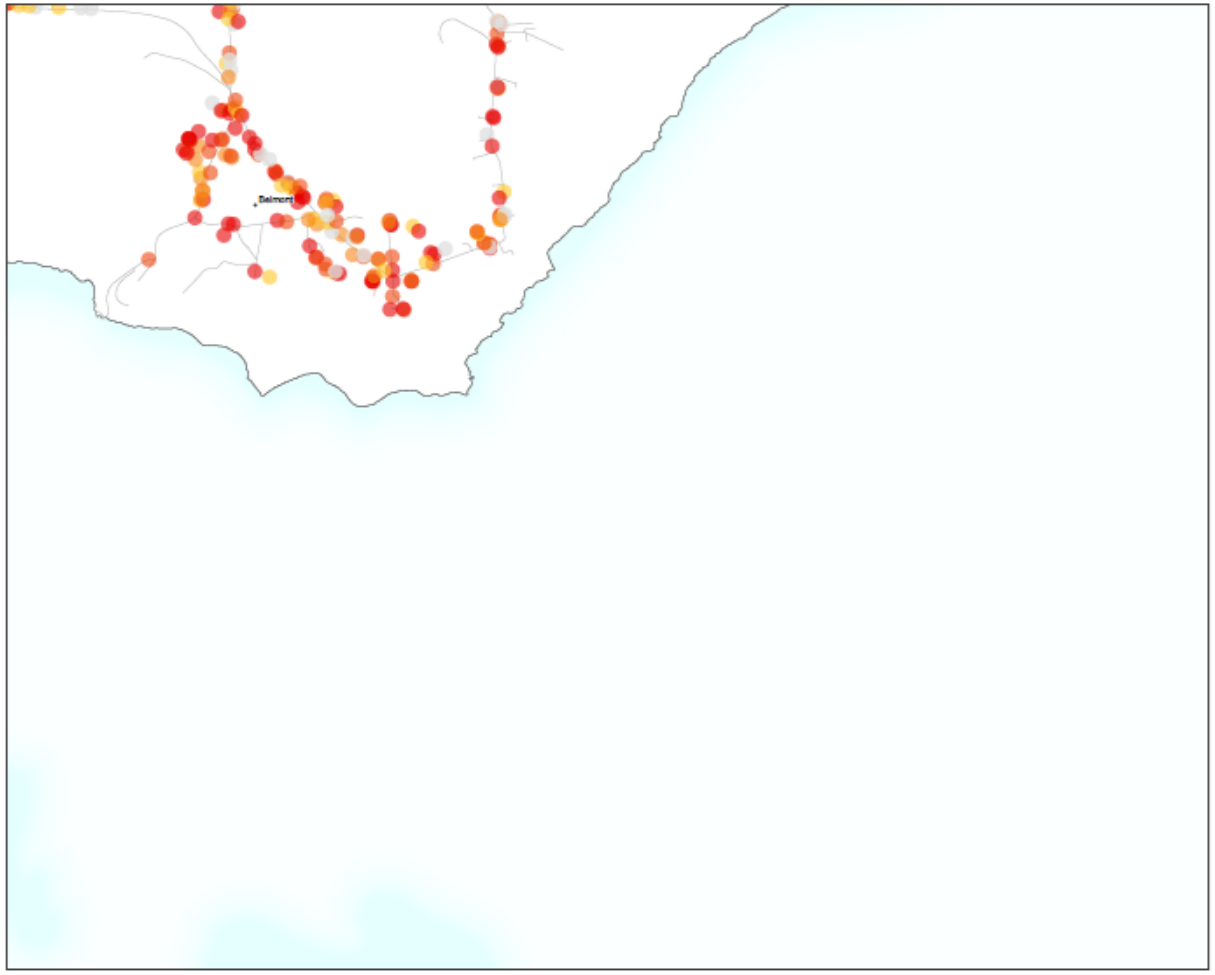
MAP ACTION

Grenada: Hurricane Beryl

MA022 v01

Structural Damage Assessment: Belmont

Map series displaying damage assessment data for Carriacou and Petite Martinique.



Structural Assessment
Damage Level
0
1
2
3
4
Tertiary road
Village

N

500
Metres

Data Sources
Central Statistics Office, Grenada, DANA - NaDMA, GEOCRIS, OpenStreetMap

Created 11 Jul 2024 / 16:01 UTC-04:00

Projection & Datum WGS 1984

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beryl2024@mapaction.org

Supported by German Federal Foreign Office

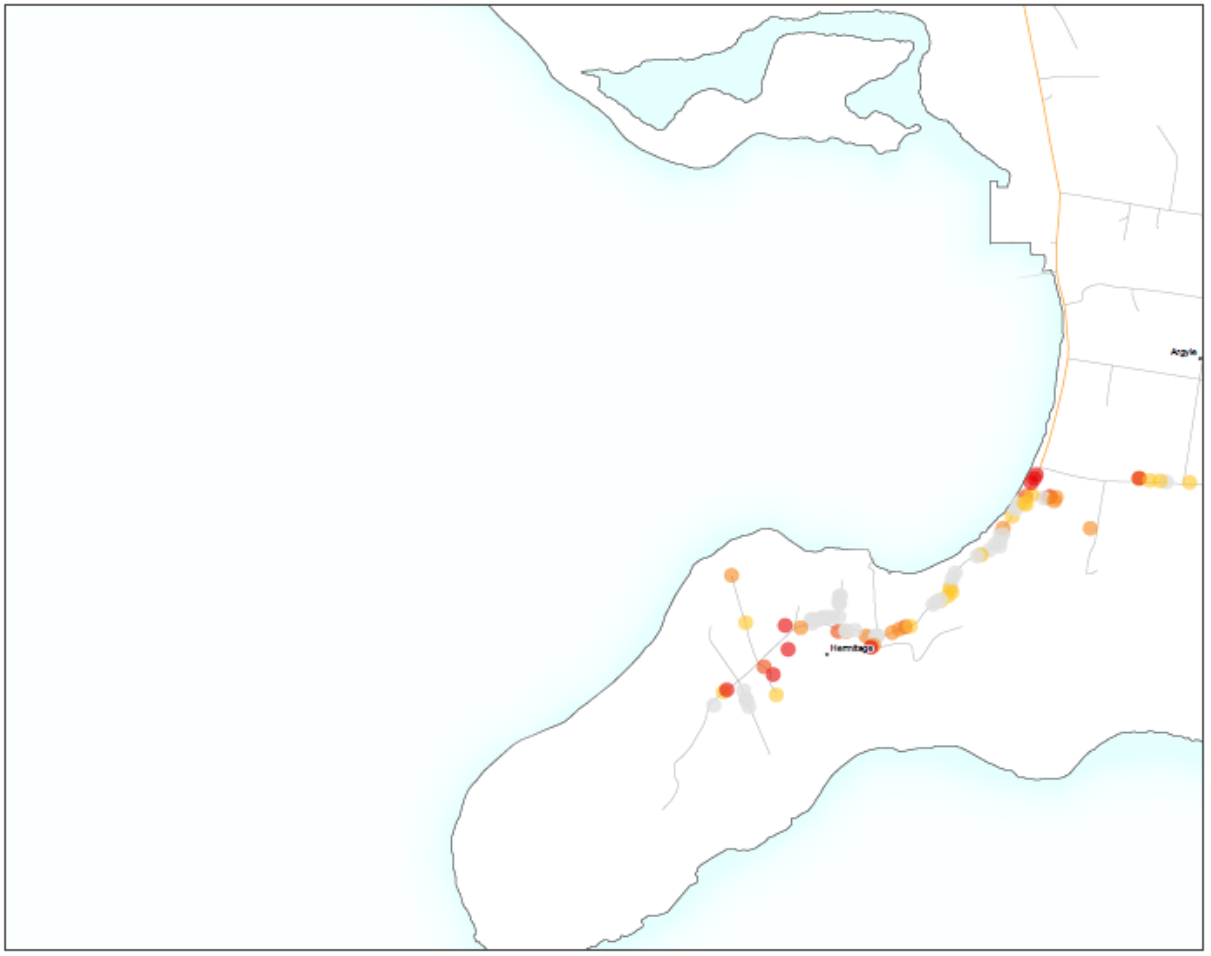
MAP ACTION

Grenada: Hurricane Beryl

MA022 v01

Structural Damage Assessment: Hermitage

Map series displaying damage assessment data for Carriacou and Petite Martinique.



Structural Assessment
Damage Level
0
1
2
3
4
Secondary road
Tertiary road
Village

N

500
Metres

Data Sources
Central Statistics Office, Grenada, DANA - NaDMA, GEOCRIS, OpenStreetMap

Created 11 Jul 2024 / 16:02 UTC-04:00

Projection & Datum WGS 1984

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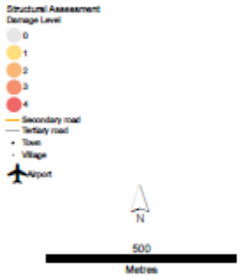
MAP ACTION

Grenada: Hurricane Beryl

MA022 v01

Structural Damage Assessment: Lauriston Airport Area

Map series displaying damage assessment data for Carriacou and Petite Martinique.



Data Sources
Central Statistics Office, Grenada, DANA - NaDMA, GEOCRIS, OpenStreetMap

Created 11 Jul 2024 / 16:02 UTC-04:00

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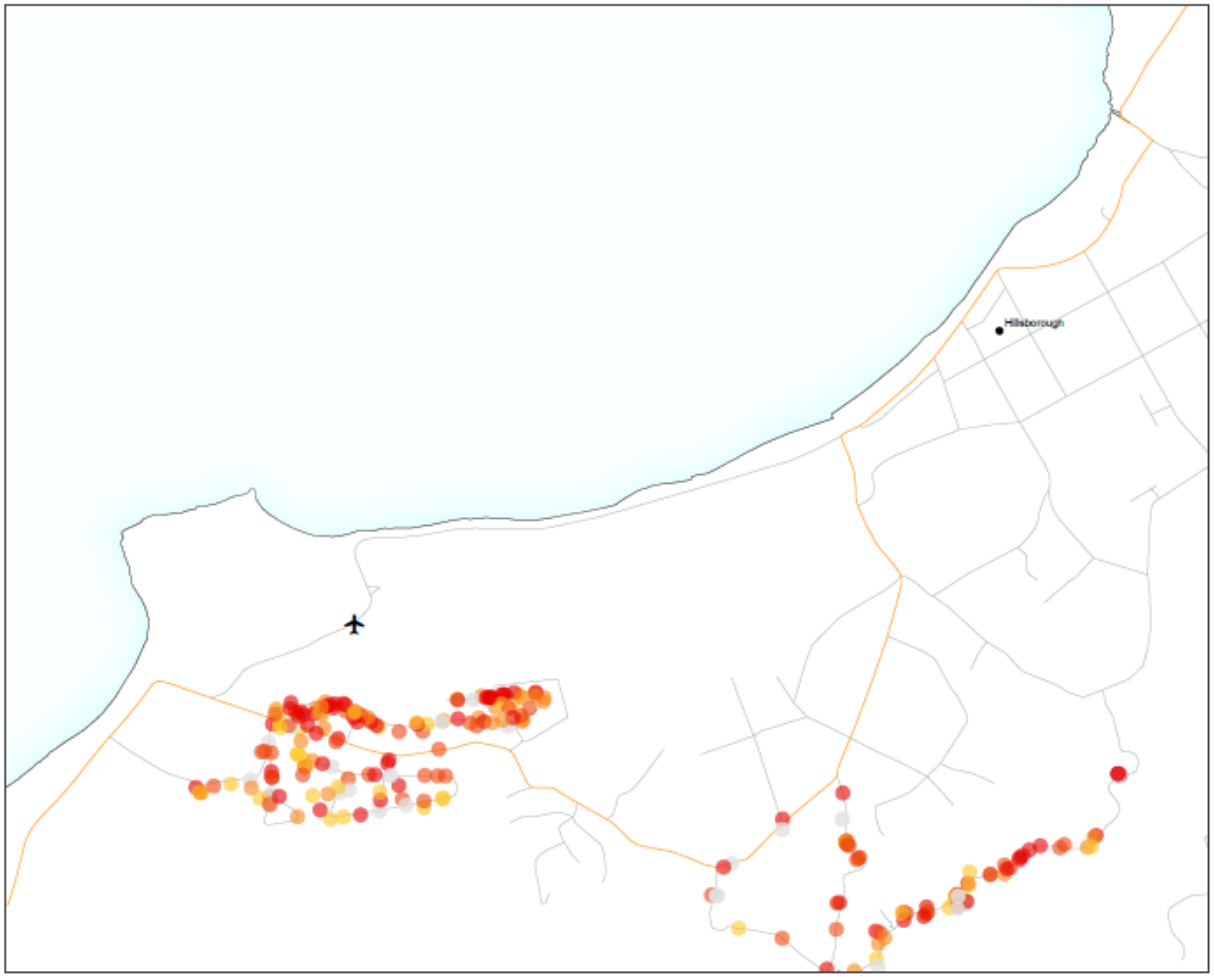


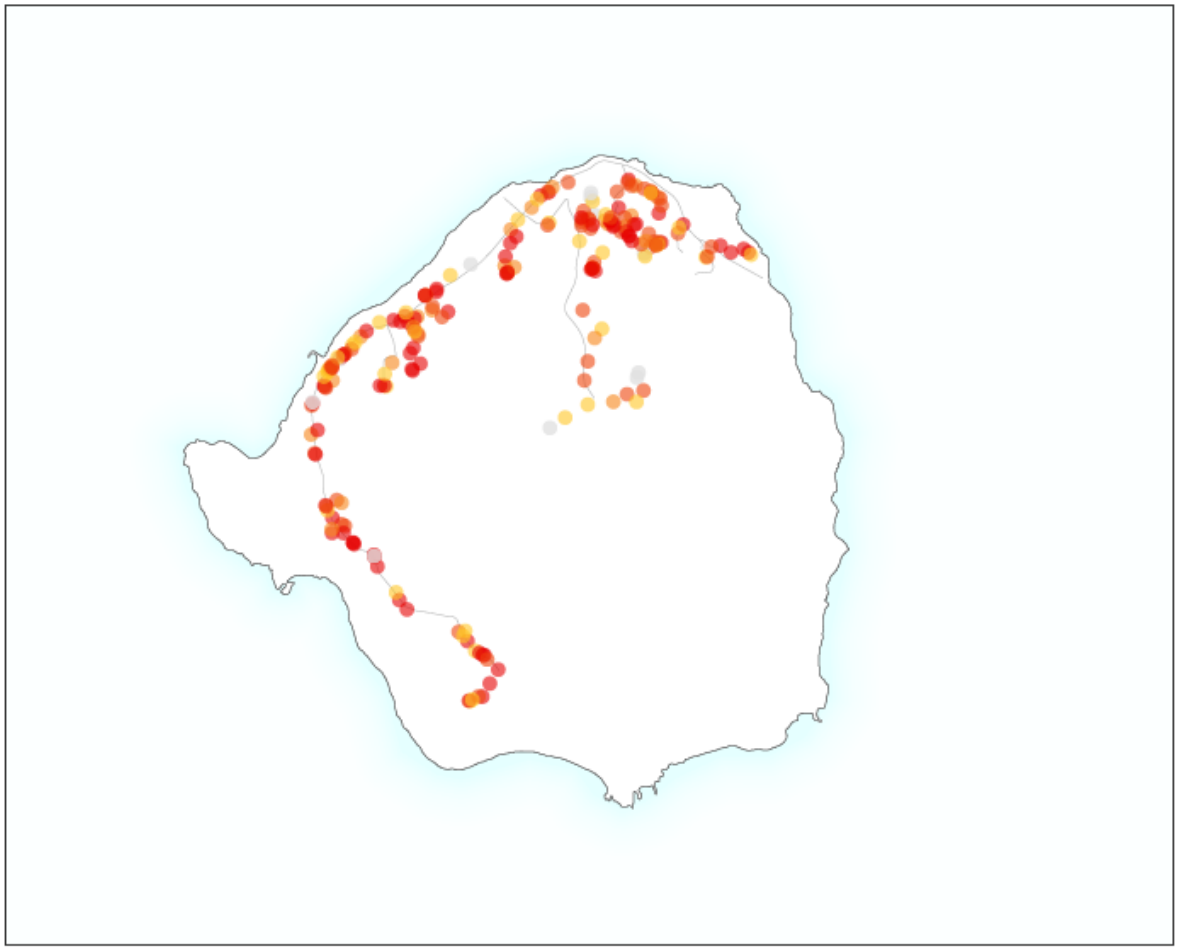
MAP ACTION

Grenada: Hurricane Beryl

MA022 v01

Structural Damage Assessment: Petite Martinique

Map series displaying damage assessment data for Carriacou and Petite Martinique.



Structural Assessment
Damage Level
0
1
2
3
4
Tertiary road

N

500
Metres

Data Sources
Central Statistics Office, Grenada, DANA - NaDMA, GEOCRIS, OpenStreetMap

Created 11 Jul 2024 / 16:02 UTC-04:00

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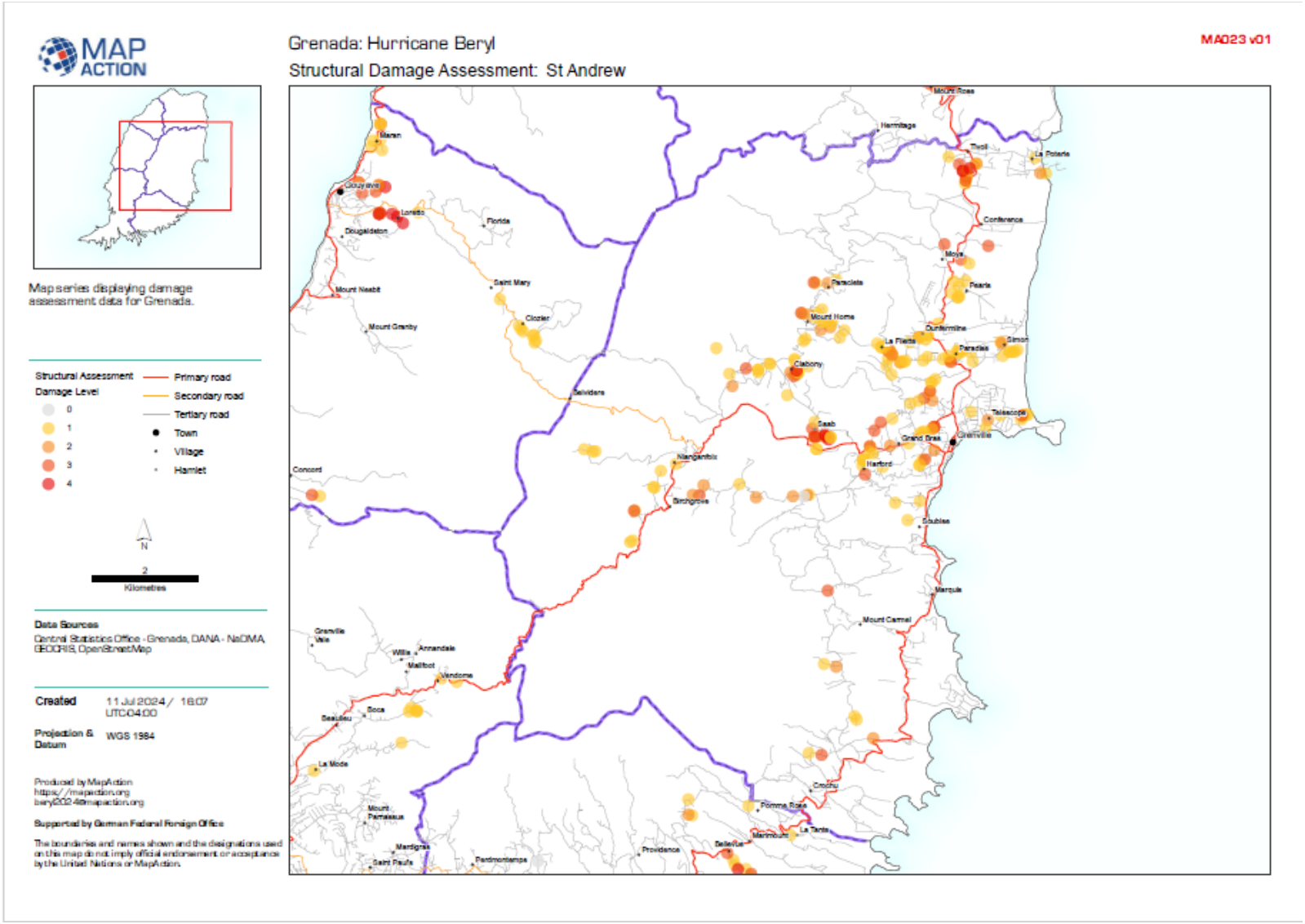
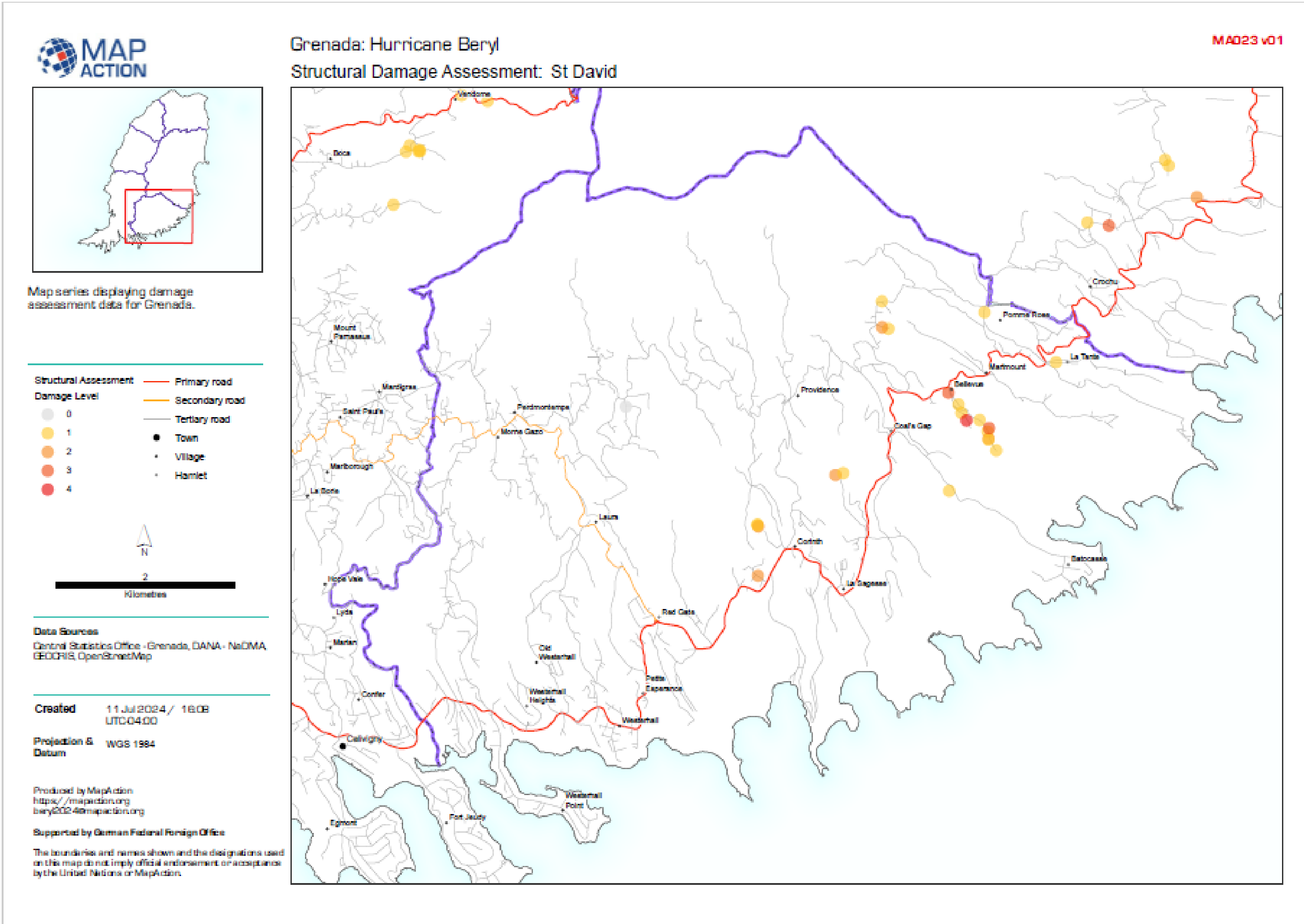
ANNEX B Grenada




MAP ACTION
Grenada: Hurricane Beryl
Structural Damage Assessment: St David
MA023 v01
Map series displaying damage assessment data for Grenada.
Structural Assessment Damage Level
0
1
2
3
4
Primary road
Secondary road
Tertiary road
Town
Village
Hamlet
N
2
Kilometres
Data Sources
Central Statistics Office - Grenada, DANA - NaDMA, GEOCRIS, OpenStreetMap
Created 11 Jul 2024 / 16:08 UTC-04:00
Projection & Datum WGS 1984
Produced by MapAction
https://mapaction.org
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Vendome
Boca
Mount Parnassus
Mardigras
Saint Pauls
Marlborough
La Borie
Perdmontemps
Morne Gazo
Laura
Providence
Crochu
Pomme Rose
Marmount
La Tante
Bellevue
Corinth
La Sagesse
Red Gate
Hope Vale
Lydia
Marian
Old Westerhall
Petite Esperance
Westerhall Heights
Westerhall
Conifer
Calivigny
Egmont
Fort Jeudy
Westerhall Point
Bacolet

ANNEX 2

MAP ACTION

Grenada: Hurricane Beryl

Structural Damage Assessment: St George

MA023 v01

Map series displaying damage assessment data for Grenada.

Structural Assessment Damage Level
0
1
2
3
4

Primary road
Secondary road
Tertiary road
Capital
Town
Village
Hamlet

N

2
Kilometres

Data Sources
Central Statistics Office - Grenada, DANA - NaDMA, GEOCRIS, OpenStreetMap

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ANNEX 2

MAP ACTION

Grenada: Hurricane Beryl

Structural Damage Assessment: St John

MA023 v01

Map series displaying damage assessment data for Grenada.

Structural Assessment Damage Level
1
2
3
4

Primary road
Secondary road
Tertiary road
Town
Village

N

2
Kilometres

Data Sources
Central Statistics Office - Grenada, DANA - NaDMA, GEOCRIS, OpenStreetMap

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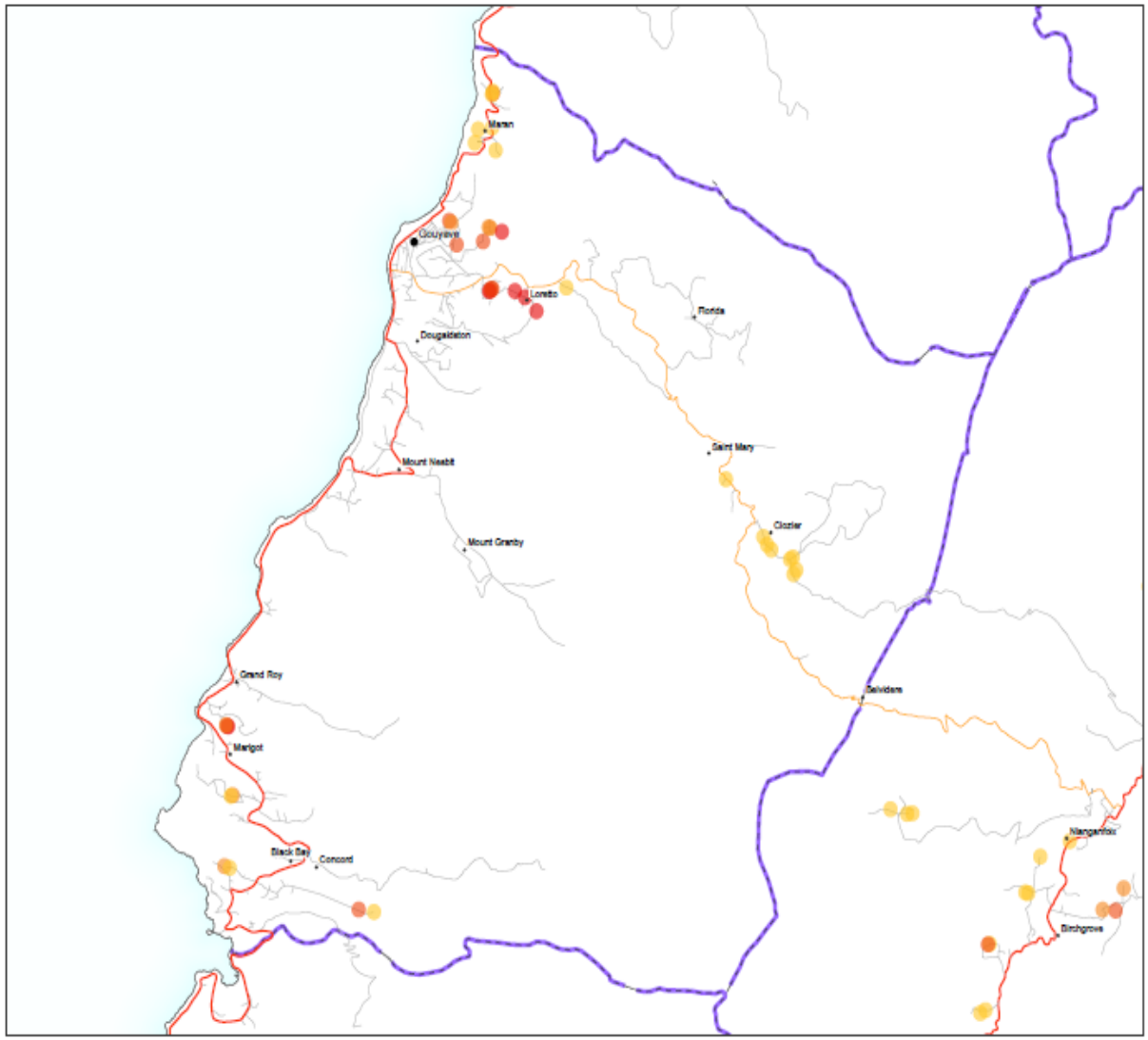


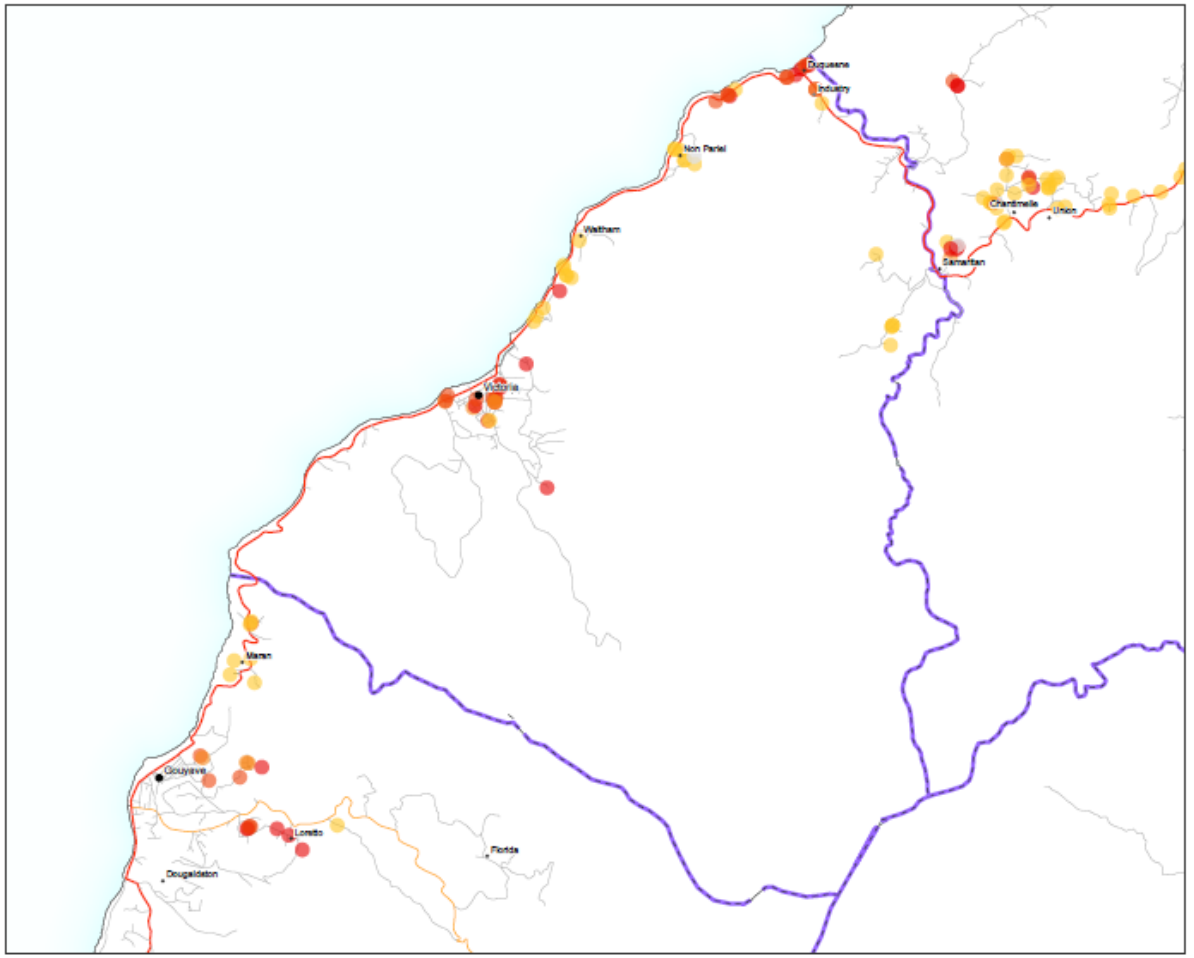
MAP ACTION

Grenada: Hurricane Beryl

Structural Damage Assessment: St Mark

MA023 v01

Map series displaying damage assessment data for Grenada.



Structural Assessment Damage Level
0
1
2
3
4

Primary road
Secondary road
Tertiary road
Town
Village
Hamlet

N

2
Kilometres

Data Sources
Central Statistics Office - Grenada, DANA - NaDMA, GEOCRIS, OpenStreetMap

Created 11 Jul 2024 / 16:08 UTC-04:00

Projection & Datum WGS 1984

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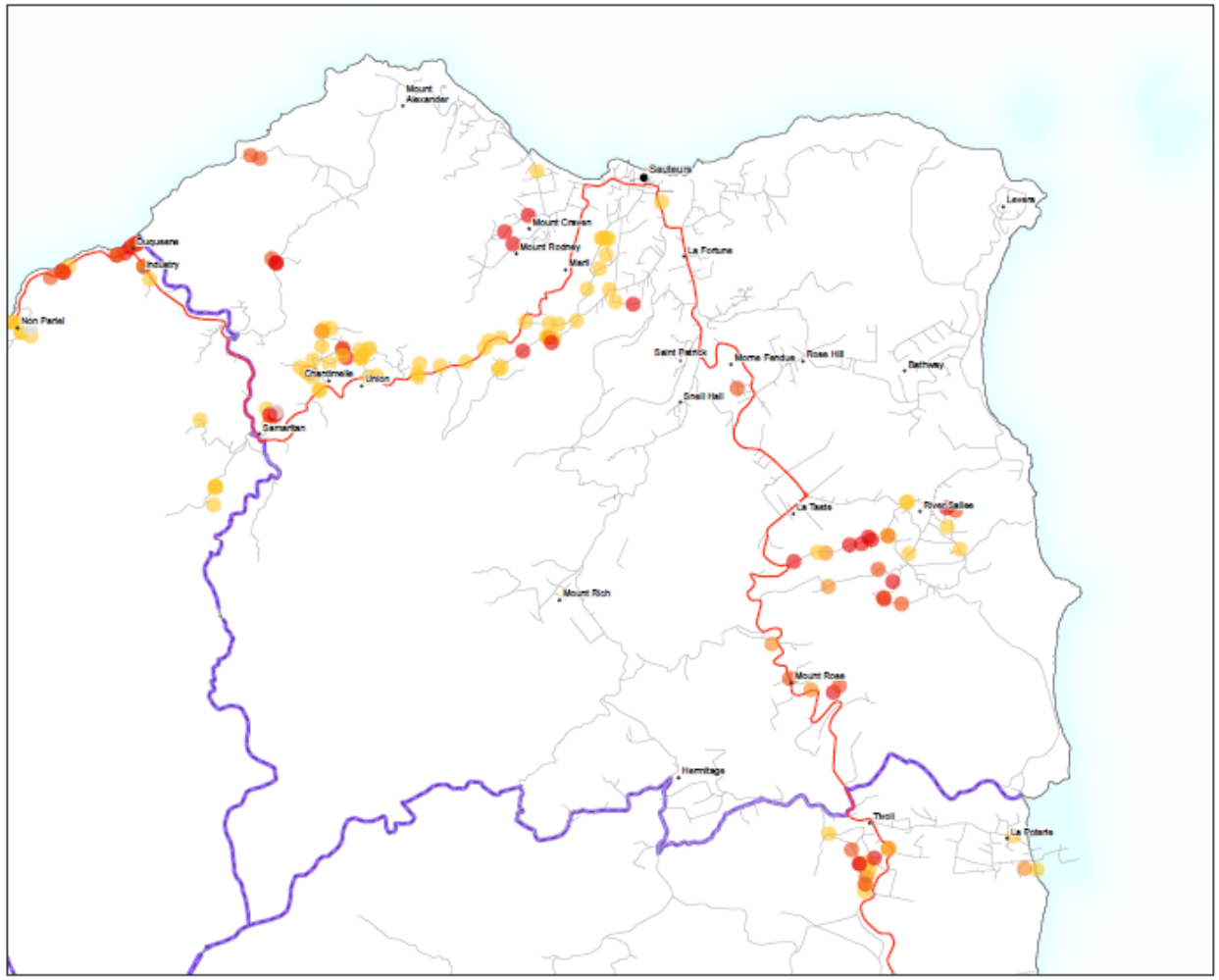
MAP ACTION

Grenada: Hurricane Beryl

Structural Damage Assessment: St Patrick

MA023 v01

Map series displaying damage assessment data for Grenada.



Structural Assessment Damage Level

0
1
2
3
4

Primary road
Tertiary road
Town
Village
Hamlet

N

2
Kilometres

Data Sources

Central Statistics Office - Grenada, DANA - NaDMA, GEOCRIS, OpenStreetMap

Created 11 Jul 2024 / 16:08 UTC-04:00

Projection & Datum WGS 1984

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ANNEX: C -

ESTIMATES OBTAINED FROM HOUSING AUTHORITY

Walls - 6-inch hollow concrete block
Roof - timber frame with metal roof covering
Finishes - standard (e.g. ceramic tiles instead of porcelain)
External works (retaining walls, driveways, pools, lawns, etc) - Not included
Land cost - Not included

Description	Average Floor Area (Sq. Ft)
2 Bedroom and 1 bath	678
3 Bedroom and 1 bath	935
2 Bedroom and 2 bath	850
3 Bedroom and 2 bath	1366

The average cost of construction was found to be **XCD $335 per square foot.**

Please note that square footage rates range from as little as XCD $300 to $400. This is attributed to the type of finishes, earthworks involved, roof style/structure, etc.

The cost will need to be adjusted to cater for works on Carriacou and Petite Martinique.

Please note that the square footage cost of $400 was applied in estimating the total cost.

ESTIMATES OBTAINED FROM A REPUTABLE BUILDER

1. **Average estimated cost of a board house with full amenities – Range from $80,000.00 to $120,000.00 EC**
2. **Average estimated cost of a board and concrete house with full amenities – Ranges from $90,000.00 to $130,000.00 EC**
3. **Average estimated cost of a concrete house with full amenities – Ranges from $300,000.00 - $ 650,000.00 EC and above**

Annex 3

ANNEX 3

RAPID NEEDS ASSESSMENT TEAM (RNAT)
FINAL REPORT

GRENADA, CARRIACOU, PETITE MARTINIQUE

11 JULY 2024

CONTENTS

ACRONYMS

CARDI	Capacity for Disaster Reduction Initiative
CARPHA	Caribbean Public Health Agency
CAWASA	Caribbean Water & Sewerage Association
CDEMA	Caribbean Disaster Emergency Management Agency
CRA	Climate Resilient Agriculture
CRFM	Caribbean Regional Fisheries Mechanism
GBV	Gender-based violence
IOM	International Organization for Migration
NaDMA	National Disaster Management Agency
NaDMA	National Disaster Management Agency
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OECS	Organisation of Eastern Caribbean States
PAHO/WHO	Pan American Health Organization / World Health Organization
RNAT	Rapid Needs Assessment Team
RRM	Regional Response Mechanism
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund

ACKNOWLEDGEMENTS

The RNAT team would like to express our gratitude and appreciation to the Government and People of Grenada who supported the operations of the team on the ground and who themselves have been affected but continue to provide assistance and work towards the assistance of others. We would particularly like to mention the staff and volunteers from NaDMA and other government agencies who graciously gave us their time and resources to ensure we could conduct our assessments and reach the most affected areas.

EXECUTIVE SUMMARY

The passage of Hurricane Beryl left a wave of destruction on the islands of Grenada, Carriacou and Petite Martinique. In its aftermath the Government of Grenada requested a Rapid Needs Assessment Team (RNAT) as part of the Regional Response Mechanism (RRM) to undertake a rapid needs assessment report. The large team consisted of specialists from a variety of United Nations and regional government agencies, covering a number of crucial sectors. Additional members were added to the team at the request from Ministry partners who identified key areas of interest during initial briefings.

The assessment process entailed on the ground observations and interviews with key informants in a number of critical locations. This included staff, volunteers, residents and national officials. Various Government Ministries have requested the incorporation of their representative preliminary findings to create a cohesive report. Due to time constraints, these findings have been summarised where possible to provide additional insights or complement the team's findings. All information from Government assessments will be highlighted in blue.

The priority needs and key recommendations are outlined below according to sector:

CRITICAL INFRASTRUCTURE: On the islands of Carriacou and Petite Martinique, almost all critical infrastructure has sustained significant damage. Beyond temporary repairing of roofs with tarpaulins, urgent needs include shoreline defence and robust building repairs in Grenada, Carriacou, and Petite Martinique. Immediate recommendations are to consolidate and reclaim shorelines, repair key facilities such as hospitals and schools, and provide temporary housing for families so that homes can begin reconstruction according to strictly enforced and improved guidelines.

ENVIRONMENT: Beryl has had a severe impact on the ecosystems of Grenada, particularly coastlines. Immediate actions needed include rapid coastal clean-up and the development of transparent financial mechanisms for forest ecosystem restoration. Specific recommendations for Carriacou involve detailed assessments and solid waste removal plans for Tyrell Bay, Lauriston, Sandy Island, Hillsborough, Winward and Petite Carenage to address environmental health impacts and biodiversity conservation.

AGRICULTURE: Agricultural needs include debris clearance, replanting efforts, and soil erosion control to recover from significant losses in tree crops, cash crops, and sea moss farming. Immediate recommendations are to implement ecosystem restoration, establish financial mechanisms for forest restoration, and provide cash transfer programmes to assist farmers.

TOURISM & FISHERIES: Tourism and fishery businesses urgently need support to resume operations and stabilize livelihoods amidst income loss, with a focus on sourcing aid locally and implementing cash-transfer programmes. The fishing sector requires immediate assistance in replacing damaged vessels and equipment, alongside assessments to understand the hurricane's impact on marine ecosystems and fish stocks for future conservation efforts.

HEALTH: Lack of safe water, barriers in accessing health services, favourable conditions for the spread of diseases and inadequate shelters all present significant humanitarian challenges. Urgent needs include repairing damaged health facilities, establishing health surveillance in shelters, and preventing the spread of communicable diseases. Immediate recommendations are to set up medical stations in shelters, supply essential water and sanitation equipment, provide mental health support and personal protective equipment with proper training.

SHELTER: Although numbers in shelters continue to decrease daily, there are an estimated 300-400 still in formal and informal pop-up shelters, primarily in Carriacou. Shelters urgently need resources to increase security, tools and materials to make critical repairs, secure storage, and improved food preparation facilities to ensure the health and safety of residents. Immediate recommendations include providing partitioning materials, solar lights, generators and community toolkits, as well as improving distribution strategies to ensure aid is reaching both formal and informal shelters.

PROTECTION: Specific protection concerns, particularly in shelters, include barriers to accessing essential services, safety concerns for women and girls, insufficient child protection and a lack of GBV reporting mechanisms. Immediate recommendations include establishing GBV/SRH referral pathways, improving shelter conditions to ensure privacy and safety, and implementing child protection programmes such as Child Friendly Spaces and the Return to Happiness initiative.

WASH: Water is one of the most critical issues to date, with no running water across both Carriacou and Petite Martinique. Immediate action is critical to restore water supply and sanitation systems, addressing infrastructure damage and ensuring access to potable water and sanitation products for displaced persons. Recommendations include repairing water systems, restoring power to desalination plants, promoting water disinfection practices, and distributing hygiene supplies along with key information to maintain good hygiene practices and prevent infections in affected communities and shelters.

EDUCATION: Education facilities across Carriacou and Petite Martinique have suffered extensive damage or been repurposed as shelters for displaced families. Both islands urgently require temporary childcare solutions to support early childhood development and the continuity of learning. Immediate actions should focus on repairing damaged schools, clearing debris for temporary learning spaces, distributing essential educational materials and providing financial support for families who wish to send their children to the mainland to continue their studies. Facility repairs and psychosocial support for teachers and students should be prioritized before the upcoming school term in September.

INTRODUCTION

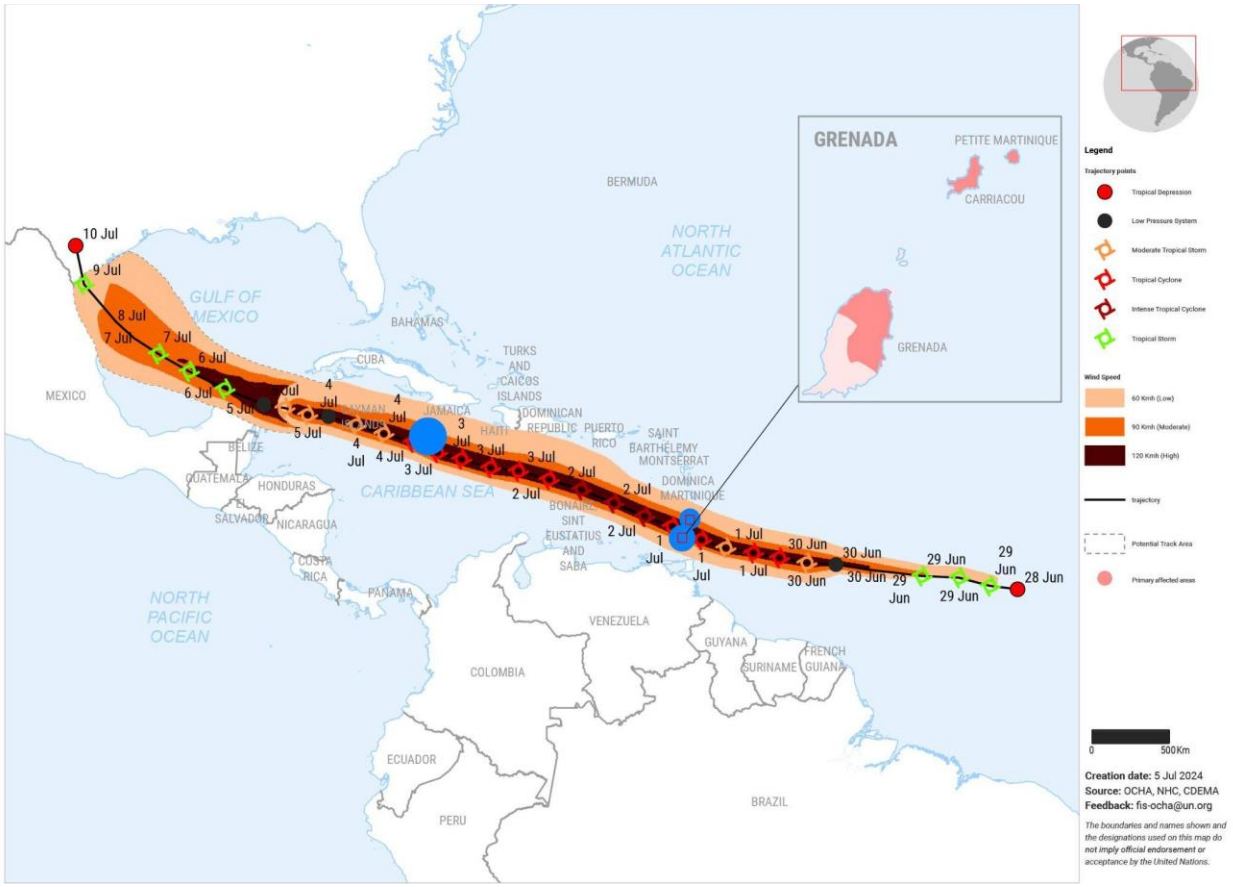

FIGURE 1: HURRICANE BERYL MADE LANDFALL ON GRENADA, CARRIACOU, PETITE MARTINIQUE AND THE SURROUNDING ISLANDS ON JULY 1ST.

Hurricane Beryl originated as a tropical depression on June 28th before undergoing a rapid intensification, making it the earliest major hurricane on record in the Atlantic Ocean.[1] On June 29th, Beryl was about 960 km/h east-southeast of Barbados with maximum sustained winds of near 136 km/h, moving west at around 30 km/h toward the Windward Islands (Saint Lucia, Saint Vincent and the Grenadines, Grenada and Martinique). On July 1st, Beryl made landfall on the islands of Carriacou and Petite Martinique in Grenada as a high-Category 4 hurricane, with sustained winds of up to 240 km/h (150mph).

Grenada, through the National Disaster Management Agency (NaDMA), requested technical support from the CDEMA in the area of Rapid Damage and Needs Assessment.

The multi-agency team comprised of specialists from various UN agencies, including IOM, UN Women, UNICEF, PAHO/WHO, UNFPA and OCHA, as well as technical engineers, environment specialists, a water specialist, a tourism specialist, coastal experts, a public health specialist, a social and community

[1] NOAA

programme analyst and an agriculture specialist. Mandela Christiansen coordinated the team as team leader.

This report consists of the results of the assessment across the three identified areas of impact: the northern parishes of mainland Grenada, Carriacou and Petite Martinique.

OBJECTIVES

The Rapid Needs Assessment Team conducted rapid assessments across mainland Grenada and the islands of Carriacou and Petite Martinique between 6-9th July with the aim of identifying impact, immediate needs and offering short, medium and long-term action recommendations. The results will provide the government of Grenada guidance for making key decisions to ensure an efficient and informed response, and an effective recovery process.

This assessment aims to complement the ongoing efforts of the Government of Grenada and support the next phase of recovery. Coordination between ministries and government counterparts has been vital to this.

METHODOLOGY

The RNAT deployed to Grenada consisted of the following members:

- Mandela Christiansen - CDEMA, Team Leader
- Ram Sahadeo - CDEMA Engineer, Critical infrastructure
- Jared Joseph - St Kitts & Nevis Public Works Department, Critical Infrastructure
- Letitia Nicholas - UN Women, Protection
- Alexandra Bate - IOM, Shelter & Migration
- Titian-Rose Whittle - UNFPA, Shelter, Protection & GBV
- Anthony George - Caribbean Development Bank, Social Analyst
- Jarelle Branford - CARPHA, Public Health
- Joyce Thomas - PAHO/WHO, Health
- Lisa McClean Trotman - UNICEF,Education
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A list of contact details for the team can be found in Annex 1.

The CDEMA-led RNAT conducted assessments between 6-10 July 2024, with a particular focus on the following areas:

- Impact on Critical Infrastructure and the Environment
- Agriculture
- Tourism
- Fisheries
- Health
- Shelter
- Protection
- Water, Sanitation and Hygiene
- Education

Data was collected by direct observations, both by foot and vehicular, and through discussions with key informants. It was then complemented by expert judgement in assessment and analysis.

Challenges and limitations included the limited time (4 days) to cover three islands and a lack of quick vehicular transport, which would have made it possible to cover more areas. Access to the lagoon and damaged boats was also unavailable.

Throughout the assessment, close contact has been maintained with government counterparts in the relevant ministries to share preliminary findings and share information. Various ministries submitted their latest findings to the RNAT to complement this report. Due to time constraints, these findings have been summarised where possible and incorporated to provide additional insights or complement the team's findings. All information from Government assessments will be highlighted in blue.

IMPACT

The impact of Hurricane Beryl on Grenada and its dependents was significant, prompting a level 2 response support from the Regional Response Mechanism (RRM). On July 3rd, the government of Grenada placed the islands of Carriacou and Petite Martinique under a state of emergency, imposing a daily curfew from 7pm to 6.59am.

1. IMPACT ON CRITICAL INFRASTRUCTURE

FIGURE 2: DAMAGE TO THE GAZEBO AT PRINCESS ROYAL HOSPITAL. PHOTO: RAM SAHADEO, CDEMA

Critical infrastructure was assessed in **Grenada, Carriacou and Petite Martinique**.

In **Grenada**, areas without water and electricity were reported in the North (St. Patrick). At Latas front, severe back and central sea intrusion was observed. At Latas Sauteurs, it was reported that the bay jetty is badly damaged (although the supporting structure seems to be in a reasonable condition).

In **Carriacou**, jetties, banks, schools, hospitals, government buildings, and residential houses were severely damaged. Residential and government buildings were assessed on 8 July 2024.

Minor damage was reported at the Princess Royal Hospital, where the galvanized roofing was almost completely removed and constant leaking resulting in flooding is currently occurring. The gazebo area roof of the Hospital was completely removed due to the uplift pressure of the winds, resulting in a damage level 4 (on a scale of 1 to 5). At the Desalination Plant, damage was not significant, with one window blown out. However, two walls collapsed in the generator room, causing damage level 4.

At the Power Station Administration building, moderate damage (level 3) was reported to all doors, rafters and ridge beams (first office), with galvanized sheeting almost completely removed by the storm and major leaking currently occurring in every room. At the Power station garage, moderate damage to the galvanized roofing was reported, as well as damage to the rolling door and rear wall.

Moderate damage to the galvanized sheeting and roofing was also reported at the Bishops High School and at the Stadium shelter.

In **Petite Martinique**, an assessment of critical infrastructure was conducted on 7 July 2024.

Damage to the St. Thomas Aquinas School was minor, with the exception of a specific section (opposite to the street side) that reported moderate to major damage, with complete destruction of the roof and lifting of the beam. Damage to the Desalination Plant was moderate. The Medical Clinic lost its roof, which now needs to be replaced.

The Maurice Bishop International Airport sustained minor damages to the perimeter fence in the south-west runway area and some water damage but resumed operations by Tuesday July 2nd. Lauriston Airport in Carriacou sustained extensive structural and equipment damage, affecting critical facilities such as the air terminal, security equipment and airfield lighting systems. Immediate needs include engaging local contractors for repairs, reinstating the electrical system, providing psychosocial support for staff, ensuring security for the terminal, and cleaning debris from the runway and terminal area to restore operational functionality swiftly. Damage assessments are ongoing along with coordination with the Ministry of Civil Aviation for the facilitation of humanitarian flights.

Damage to industrial facilities and warehouses in Carriacou not only threaten the livelihoods of the population, but also threaten supply chains in the immediate and medium-term future. Damage to telecommunication towers, lines and equipment is causing communication outages. In addition, interruptions to internet services are impacting personal and business communications.

Recommendations to Mitigate the Impact on Critical Infrastructure

Short-Term Actions:

- In **Grenada**: urgent shoreline consolidation and reclamation, shoreline defence and relocation of housing (Latas, Sauteurs Bay), fixing bay jetty and installing handrails on jetty deck (Latas Sauteurs).
- In **Carriacou**: fixing buildings following the technical guidance provided by experts and available in Annex 2, immediate attention to the Hospital (roof, bed mattresses, cleaning, rainwater guttering, water pump), attention to stadium and upgrading it to Hurricane Shelter, repair school and power station.
- Engage local contractors to assist with repair works at the terminal building, the cleaning of debris from the terminal building and runway and the reinstallation of the electrical system at Lauriston Airport.
- In **Petite Martinique**, fixing buildings following the technical guidance provided by experts and available in Annex 2, urgent attention to the Medical Clinic (including: roof, storage for medical supplies, bed mattresses, water pump).
- Provide more long-term temporary housing for families so that reconstruction of homes can be planned and initiated.
- Immediate repair and restoration of damaged industrial facilities. Seek to reestablish supply chains and normalize trade activities. Provide programmes to stimulate economic activity and support local businesses.
- Repair telecommunication towers, lines and equipment.

Medium to long-term actions:

- Having a certified Civil or Structural Engineer design the buildings and sign the drawings.
- Fully adhere to building codes, enforced by the building board or another body appointed by the Government. Engage with local actors on this process to encourage local buy-in.
- Further developing the building codes in collaboration with the OECS.
- Updating construction material/ practices.
- Joint effort between the governing bodies and the media to begin sensitizing the public on the

construction standards that must be kept.

The following recommendations have been provided for specific infrastructure:

Grenada Mainland

No	Observation	Immediate	Short Term	Long Term	Remarks
1	Sauteurs Bay Jetty	Barricade/Cordon off	Repair	Replace/Upgrade	
2	Latas Front, Middle and back	Remove sand from concrete drain and reclaim land	Consolidate shoreline with large rocks	Build Sea wall	
3	Sauteurs Sea Defense Wall	Shoreline's land erosion on leeward side shoreline	Monitor/study wave flow and direction. Redesign shoreline defense	Move large boulders from defense wall and place on shoreline	
4	Health Facilities	Refurbish as require	Repaint and add back up generators		

Petite Martinique

No	Observation	Immediate	Short Term	Long Term	Remarks
1	Medical Centre	Repair roof or use temporary facility - building or shipping container	Cleaning Water supply Roof and building repairs	Make new hurricane resistant building.	
2	EOC	Replace building			

Carriacou

No	Observation	Immediate	Short Term	Long Term	Remarks
1	Desal NAWASA	Inatall a Variable Frequency Drive (VFD) for pump to reduce initial current	Supplement the desal plant with a larger capacity Genset suitable for full power		

		demand.	demand.		
2	Schools (Bishops College)	Repair Roof and install new rainwater collection guttering			
3	Hospital Princess Alice Smart Hospital	Provide immediate assistance to clean, cover roof with tarp and secure records and medical supplies.	Replace roofing sheets soonest. Replace all bed mattresses		
4	Power Station	Repair buildings and roof. Ensure that fuel supply and storage is safe. Secure compound by repairing perimeter fences.			
5	Stadium	Replace roof ceiling, roof sheets, rainwater guttering. Upgrade facility to Hurricane Shelter. Replace overhead plastic tanks and ensure that water from cistern is pumped	Upgrade facility to Hurricane Shelter to accommodate more persons.		

		automatically.			
6	EOC	Construct kerb wall and improve drainage to avoid mud from getting onto the road. Pave road to reduce mud from getting into the building area.	Install guard hut and construct parking/waiting area for oncoming supplies Use paving stones to improve the area for chef outdoor preparation and cooking areas		

2. IMPACT ON THE ENVIRONMENT

Forest resources across the whole island of Carriacou were seriously damaged by the Hurricane. Trees were left void of crown, wildlife habitats were destroyed, leaving animals free to roam and browse on everything they can, and soils exposed to precipitation and wind, causes of erosion.

FIGURE 3: LAURISTON MANGROVES JULY 2024 VS OCTOBER 2023. PHOTOS: SHANNA EMMANUEL, OECS

Approximately 20 % of the trees were uprooted and about 80% with broken tops in the Belair Forest Plantation (towards the middle of the island, closer to the North) and Dover Mangrove and Beach Ecosystem (North of the island); more than 80% of trees suffered from broken tops with no apparent crown, and approximately 15% uprooted in Lauriston Mangrove and Associated Coastal Ecosystems (South-West of the island); about 75% of trees along the beach lost their tops and approximately 15% uprooted in the Harvey Vale Mangrove Ecosystem (South of the island); finally, approximately 70-85 % of trees suffered from broken tops, and about 15-30% uprooted in the remaining island-wide forest resources.

In the absence of tree crown (vegetative cover), soil erosion will be accelerated, particularly during intense and prolonged precipitation. Additionally, since the food sources for wildlife were destroyed, animal population levels will be significantly reduced. Finally, it is expected that agricultural crop production will be impacted, as trees normally provide favourable conditions for increasing production. Farming conditions will also be less favourable, with expected subsequent impact on the whole population of Carriacou.

In addition to the extensive forest devastation, the Hurricane significantly impacted the **coastal areas** of Carriacou and **Grenada**.

In **Carriacou**, coastal erosion was observed (Tyrell Bay, Main Street, Harvey Vale, Windward Bay, Petite Carenage Bay) and beach scarps were reported (Main Street, Harvey Vale). Fallen trees and damaged mangrove were observed too.

Both marina areas within Tyrell Bay were compromised with major damage to the vessels on the dry dock and in the water, causing the potential risk of oil leakage into the surrounding environment. In addition, floating finger piers were damaged and left in complete disarray in Tyrell Bay Marina (level 1 – critical condition). At the Carriacou Marina, several damaged boats in the water were reported, which need to be removed. In addition, failure of the wall which separates the Tyrell Bay Port from the Tyrell Bay Marina (level 1 –critical condition) was observed. On the side of the Oyster Bed, more than 20 vessels in various stages of damage were observed and cannot be reached by land. They will need to be assessed and extracted. Preventing oil leakage and ensuring solid waste disposal is crucial and urgent to prevent further environmental damage and avoid attracting pests. Fallen trees also represent a threat to homes and businesses. In Lauriston, erosion in parts of the beach on the road to the airport was observed. Here, the mangrove and canopy appear to have been heavily impacted, with many trees fallen. Sandy Island also appears to have been eroded, although this could not be directly observed from the Carriacou mainland.

Erosion was also observed in the beach near Hillsborough, likely from storm surge. In the hills surrounding the town, many of the trees fell and there is no observed canopy currently. Several logs can be seen, and large trees were broken.

Finally, large spread damage was observed in Winward and Petite Carenage, where several of the homes, businesses, and buildings were impacted. The forested areas on the hills surrounding the areas were also heavily impacted with several fallen trees, and no canopy could be observed. Finally, part of the coastal road in Petite Carenage (between Froggy's Reef Tours and The Corner Shop) was undermined and a vessel was observed to be trapped inside the mangrove in this area.

In **Grenada**, beach scarps and fallen trees were seen in the areas of Gouyave (damaging beach access and property), Prospect Beach (damaging property) and Bathway Beach. Erosion was seen in areas which did not have any form of shoreline protection, whether natural or man-made. At Bathway Beach, the sand was eroded from the foreshore and deposited in the backshore. Exposed roots were seen along the coastlines in the areas of Gouyave, Prospect Beach, Bathway Beach and Grenville. As a result, debris blocked roads across Grenada (although they have already been cleaned up in most locations) and Coastal Drains in Gouyave.

Preliminary assessments from Aria St. Louis from the Government of Grenada indicate that serious vegetation damage with ranking between 4 and 5 (on a scale of 1 (leaves and twigs) to 5 (at least one large tree knocked down and smaller trees and branches with debris on the ground) was observed in multiple locations in northeast, north and northwest Grenada. Severe and serious damage to vegetation was observed in multiple locations in Carriacou and in Petite Martinique ranking 5 (at least one large tree knocked down and smaller trees and branches with debris on the ground) was observed and reported at multiple locations across both sister islands.

With respect to storm surge and coastal erosion, the total amount of coastline impacted by Beryl's wave, wind and flood damage is estimated at approximately 25% of Grenada's coastline was impacted, approximately 80% of Carriacou's coastline was impacted while over 90% of Petite Martinique's coastline was impacted. Coastal erosion impact was assessed at different coastal ecosystems: sandy shore beaches, rocky shores, mangrove wetlands and cliff areas using a ranking system from 1 - 100. In Grenada the rank for coastal erosion impact ranged from 10 – 60 while in Carriacou and Petite Martinique, the coastal erosion impact ranged from 40 – 80 signalling how serious the storm surge and coastal erosion impacts were for affected locations.

Municipal, solid waste, construction and demolition (C&D) waste and institutional, commercial and industrial (ICI) waste generation will increase significantly. Solid waste is dispersed over large areas in drains, entangling in vegetation and threatening the cleanliness and safety of the environment.

Recommendations to mitigate the impact on the environment.

Implementing environmental best practices and ecosystem restoration (including mangroves, plantations, beaches, and forests) is crucial to restore the social, economic, and environmental benefits for the people of Carriacou. The following recommendations are structured into short-term, medium-term, and long-term actions to ensure a comprehensive and effective response:

Short-Term Actions:

- Rapid coastal clean-up.
- Establishing financial mechanisms to ensure transparency, accountability, and rapid disbursement for forest ecosystem restoration efforts, including Climate-Smart Agriculture (CSA), Sustainable Land Management (SLM), and Biodiversity Conservation.
- Implementation of waste separation and use of temporary holding areas for transportation to permanent disposal or recycling initiatives.
    - Metal is being separated for recycling.

- Composing of organic waste to reduce nuisance occurring from the waste accumulation due to delays in collection.
    - A woodchipper was dispatched to Carriacou to assist with the management of green waste.

In **Carriacou**:

- Developing and implementing a plan of action for removing both organic and inorganic waste within the Tyrell Bay area.
- Conducting a detailed assessment of the state of the mangroves within the Oyster Bed after vessel removal, followed by continued monitoring.
- Conducting a detailed inventory of biodiversity in the Tyrell Bay area, including both flora and fauna impacted
- Performing a detailed assessment of the mangroves near the Lauriston airport, focusing on overall tree mortality.
- Developing and implementing a solid waste removal plan for the Lauriston area.
- Conducting a detailed assessment of Sandy Island beach and surrounding reefs.
- Developing and implementing a plan of action for solid waste removal and management in Hillsborough to prevent the spread of diseases, pests, and other environmental health impacts.
- Conducting a detailed assessment of the biodiversity impacts post-hurricane in Hillsborough.
- Implementing a comprehensive plan for solid waste removal and disposal in affected areas.
- Conducting detailed assessments of the biodiversity impacts in Winward and Petite Carenage.
- Performing a detailed assessment of the impacts on the Petite Carenage mangrove.
- Removing any vessels trapped in the mangrove area.

<u>Medium-Term Actions:</u>

- Repairing jetties to assist with efficiency of docking relief and response vessels.
- Conducting coral reef assessments to assess damage.
- Restoring mangrove stands and replanting appropriate coastal vegetation.
- Increasing public awareness of hazards and implementing community response training.
- Establish a multidisciplinary team with the necessary expertise to monitor, track, and evaluate restoration interventions.
- Regularly monitoring forests, beaches, and other ecosystems surrounding towns for environmental changes.
- Developing and implementing a plan for livestock control to prevent environmental stress pre- and post-disaster.

In **Carriacou**:

- Implementing a monitoring plan to track regrowth of the Oyster Bed mangroves post-hurricane.
- Developing and implementing monitoring plans for Lauriston Mangroves and Sandy Island to observe ecological recovery.

Long-Term Strategies:

- Revising the design life for coastal structures (should design for 1 in 100-year events).
- Increasing shoreline protection on coastlines (i.e. green, grey and hard engineering).
- Policy guiding Integrated Coastal Zone Management with incorporation of guidelines for climate change adaptation and disaster risk management. Local communities should be included in this to encourage buy-in and resilience.
- Conduct a full ecological assessment post-Beryl in the context of resilience action, as well as to aid in identification of the best species and location(s) for successful future coastal vegetation restoration to support resilience.
- Sensitization of visitors and locals alike to the limitations of Dumferies and the need to think and make wise choices with respect to bringing to the islands single use items that can readily break down.
- Support inclusion of local communities in all aspects of an ecological assessment from citizen scientists to “local experts” who are keepers of the natural history of locations where they live.

In **Carriacou**:

- Formulating and implementing disaster evacuation plans for the two marinas in Tyrell Bay.
- Undertaking restoration projects for Lauriston Mangrove and Sandy Island Beach.
- Implementing long-term restoration efforts for all degraded ecosystems on the island.

3. IMPACT ON PEOPLE

FIGURE 4: A CARRIACOU RESIDENT WALKS PAST THE REMAINS OF HIS HOME. THEIR BEACHFRONT RESTAURANT HAS ALSO BEEN DESTROYED LEAVING THEM WITH NO HOME AND NO LIVELIHOOD. PHOTO: JOLENE MUIR, OCHA

In addition to casualties and injuries, the social, economic and physical impact on the people of Grenada, particularly Carriacou and Petite Martinique, has been significant and will have long-lasting ramifications. The social fallout and gendered impact resulting from Hurricane Beryl are particularly severe and the adverse economic and social outcomes will likely result in increased incidence vulnerability and poverty among the population. The vulnerable populations of male and female single heads of households, children, unemployed youth, older persons, and persons with disabilities (PWDs) are at a higher risk of adverse social and economic impact over a protracted period. Where these categories overlap, the impacts will be more severe.

Hurricane Beryl devastated homes, livelihoods, and community infrastructure, exacerbating pressures on an already strained social services system. The hurricane severely impacted both formal and informal sectors, including tourism, agriculture, restaurants, and street vendors, leading to significant income and livelihood losses for workers and communities dependent on these industries, particularly fisherfolk and farmers.

The hurricane has contributed to increased vulnerability and major disruptions in social sector services, including education, health, and social protection services. There is an increased demand for access to basic food and non-food needs among individuals, households, and communities in north of Grenada, Carriacou, and Petite Martinique. An observation of the EOC Storage and the ongoing delivery of food items confirm that there is an adequate supply of basic food items in the islands, however distribution strategies need to be strengthened to ensure equal access to supplies. For fishing and farming families,

who are accustomed to sourcing their own food, the risk of food insecurity is high.

The adverse impact of Hurricane Beryl has resulted in adverse psychological impacts. Reports show that women, men, young people and children as well as frontline workers, including shelter managers, are among those affected. Failure to provide adequate MPHSS will likely further contribute to increases in cases of depression, anxiety, stress and more in the short to medium term. This in turn may lead to increased substance abuse and suicidal ideation as coping mechanisms among vulnerable persons. Adequate planning, programmes and human capacity is necessary to prevent, mitigate and redress the likely increased psycho-social problems and potential gender-based and intimate partner violence caused by the adverse impact of the hurricane.

It must be recognized that Carriacou and Petite Martinique residents expressed the need for greater community ownership, meaningful engagement in the decision making and dignity through the operations and management of the relief efforts. Petite Martinique and Carriacou by their location, size, nature, history, and culture have always been a close knit and self-sufficient community. However, a major disaster, like Hurricane Beryl, has affected every member of the community, placing the community structure under tremendous pressure. Underutilized local community capacity may result in fractured relations between volunteers and local community leaders.

Immediate social response recommendations:

- Meaningful participation of the community and Local NADMA Committee Members in the planning, decision making, management and regulation of activities to strengthen community capacity, ownership and greater operational efficiency.
- Empower the vulnerable population and groups by increasing their access to cash. Transferring cash to vulnerable groups can: increase their ability to influence and/or make decisions within their household; reduce (or eliminate) economic dependency on a partner or other relative; strengthen their sense of self-worth and dignity (by being able to make choices); improve their status within households and communities; and provide them with access to financial services.

Medium to long-term social response recommendations:

- Careful consideration and implementation of integrated, socially- inclusive and gender-responsive and shock-responsive social protection programmes to build resilience and transform the lives of vulnerable persons.
- Expand social safety nets through additional cash transfers among vulnerable populations and labour-intensive employment programmes for unemployed residents.
- Some key imperatives include country ownership, long-term political support, flexibility, and an adaptive social protection approach that is integrated into life cycle coverage to respond to changing socio-economic circumstances.

The impact on people and society is further detailed below and divided per sector under the respective paragraphs:

AGRICULTURE

1. SECTORAL OVERVIEW

A rapid impact assessment was conducted for the agricultural sector with a focus mainly on crops (tree crops, vegetables, root and tubers). The areas visited were along the main roads of the Parishes of St. George (Mt. Gay, La mode and Willis), St. Andrews (Grand Etang and Birch Grove), St. Patrick (La Poterie, River Sallie, Upper Conference, Mirabeau, Hermitage, Mount Rose, Mt. Rich, Snell Hall, Rose Hill, Union, Red Mud, Mt. Reuil, Plains, La Taste and Mt. Fendue), St. Mark (Waltham and Victoria) and St. John (Gouyave, Mt. Nesbit and Palmiste). The majority of the crop damage were tree crops, mainly in the Parishes of St. Mark and St. Patrick, due to wind speeds and saltwater wind damage from sea spray. No major damages were observed for vegetables, root and tuber cropping systems.

2. DAMAGE AND LOSSES

The rapid assessment focused on crop damage in the Parishes of St. George, St. Andrew, St. Patrick, St. Mark, and St. John. In St. George (La Mode, Willis), bananas experienced 15-20% damage due to heavy winds, with recovery possible by removing damaged tops, while breadfruit suffered 40% loss due to uprooted and windblown trees with major stem and foliar damage. In St. Andrew (Grand Etang, Birch Grove), nutmeg faced 30-40% loss and damage, including broken branches and uprooted trees. Cocoa crops had 10-20% damage, bananas experienced 30% damage with potential recovery by removing tops, and breadfruit saw a 25% loss from uprooted and windblown trees.

In the north of Grenada, there has been over 90% destruction of agricultural areas. These include Bananas, Nutmeg, Cocoa, Forestry and ground crops.

St. Mark (Waltham, Victoria) experienced significant losses, with nutmeg and cocoa suffering 70% loss and damage, including broken and uprooted trees, and breadfruit facing 60% loss due to extensive damage to trees. In St. John (Gouyave), sea moss farming faced an 80% loss of planting material and ropes. St. Patrick (Mt. Rich, Mt. Reuil, etc.) reported major losses and damages to nutmeg and cocoa, with 50-70% damage and trees showing signs of foliar necrosis from windblown sea spray, indicating potential soil salinization. Fruit trees also experienced major losses and damage, while mango windbreaks suffered 15-40% damage to trees.

The assessment identified several potential hazards and risks, including fallen trees blocking fields and roadways in areas like River Sallie, Hermitage, and Mt. Rich, posing safety hazards. Land degradation was observed in St. Patrick and St. Mark, with loss of topsoil, landslides, and erosion. Foliar necrosis and soil salinization were visible in cocoa and nutmeg crops in Red Mud, St. Patrick, suggesting potential soil salinization from sea spray.

Loss of food supplies and income to farmers who were already affected by Hurricane Ivan 20 years ago was further compounded after much effort and resources were put into recovering from Hurricane Ivan.

Overall, tree crops such as nutmeg, cocoa, and breadfruit experienced major losses, while cash crops like bananas suffered moderate damage with some potential for recovery. Sea moss farming faced significant loss of planting material. This comprehensive damage assessment highlights the immediate need for debris clearance, replanting efforts, and soil erosion control measures to support recovery and build resilience in Grenada's agricultural sector.

3. RECOMMENDATIONS ON IMMEDIATE RESPONSE

Immediate:

- Ecosystem restoration (mangrove, plantations, beach and other forest) is crucial and requires immediate operationalization to restore social, economic and environmental benefits for the people of Carriacou.
- Establishment of Financial Mechanisms that would ensure transparency, accountability, and quickest possible disbursement for forest ecosystems restoration efforts (CSA, SLM and Biodiversity Conservation).
- Establishment of cash transfer or subsidiary programmes to assist farmers as they replant and regrow.
- Provide veterinary services, feed, and shelter for surviving livestock.

TOURISM & FISHERIES

1. SECTORAL OVERVIEW

Tourism and fishing are two of the primary sources of livelihoods for the populations of the affected areas, particularly Carriacou and Petite Martinique. Carriacou serves as a central hub for the Grenadine islands, particularly for Petite Martinique. Known for its cultural richness, Carriacou hosts five annual festivals and functions as an economic centre for essential services such as banking and produce. Hillsborough, the main town and most populous area on the island, is the retail and administrative heart of both Carriacou and Petite Martinique. In Petite Martinique, tourism is mostly seasonal with a peak season from December to June, keeping with the wider Caribbean region. Tourism to Carriacou is reportedly consistent year-round. While there were no recorded visitors on Petite Martinique during Beryl, accommodation facilities interviewed in Carriacou indicated that there were visitors who chose to stay on the island at the time of the impact, as well as at least one foreign national who was staying on his personal boat. The entire island was severely impacted by hurricane Beryl, with the vast majority of buildings severely compromised. At the time of writing the report, all public services had been suspended, with efforts concentrated on hurricane relief.

In recent years, the fishing industry in Grenada has evolved from somewhat artisanal to small-scale commercial, becoming a major source of employment and income, and a significant contributor to food

stock and food security.[2] Carriacou is home to one of Grenada's seven main fish markets and exports fish stock to neighbouring islands such as Martinique and Guadeloupe. Damage within the fishing sector not only threatens the immediate livelihoods of fishermen and their families, but also the food security of the island's population.

2. DAMAGE AND LOSSES

Damage to the tourism sector in the northern parishes of Grenada was minimal, with all observed reopened for business. Although not all are currently operating at full capacity, resumption of full services is anticipated within a month.

In Carriacou and Petite Martinique, all tourism-related businesses were impacted, ranging from severely damaged to completely destroyed. In particular, many small food and beverage outlets such as bars, restaurants were completely destroyed. In Carriacou, two hotels remain partially open for business and are currently housing humanitarian relief personnel. Businesses estimate the resumption of busy activity within a year but there are significant concerns over loss of livelihood and long-term reductions in income as they look to rebuild. Estimated repair costs varied significantly from EC$200 to over EC $600,000.

Dive operators located in St. George have resumed full operation, however, those based in Carriacou have suffered catastrophic loss. Estimated repairs have averaged approximately $250,000USD. Emphasis has been placed on better structural integrity and equal treatment in recovery efforts.

The Oyster Bed Marine Protected area is a significant tourist attraction as it is the only one in this part of this hemisphere. The area has also typically been used as a shelter for sailboats and yachts during the hurricane season. More than 50% of boats anchored sunk or overturned during the hurricane.

Sandy Island, a small islet/quay midway between Carriacou and Petite Martinique, was also a popular attraction for both locals and visitors. This oasis featured a pristine sandy beach surrounded by palm trees, which had been rehabilitated after Hurricane Ivan. Unfortunately, the hurricane resulted in nearly all trees being uprooted or stripped of vegetation.

FIGURE 5: THE CARRIACOU MUSEUM (LEFT) AND THE VENDORS MARKET AND BUS TERMINAL (RIGHT), ONCE POPULAR TOURIST ATTRACTIONS, SUFFERED EXTENSIVE DAMAGED FROM BERYL. PHOTO: AMANDA CHARLES, CTA

Other notable attractions included the Botanical Garden, the Carriacou Museum in down-town Hillsborough, and the Vendors Market and Bus Terminal, a central hub for food, fresh produce, local art

[2] FAO

and craft and souvenirs. All of these attractions suffered significant damage, with the Botanic Garden's completely flattened and the entire top level of the historic museum building destroyed.

Business owners expressed concerns for livelihoods in the immediate and long-term. Service industries were concerned about when business activity will resume given the inflow of aid, which they recognize as necessary at this time. Aid and resources for the response should be sourced locally, where possible and the implementation of cash-transfer programmes is recommended to assist in the stimulation of the local economy.

Of the business owners interviewed, none were insured, with some indicating that insurance is unavailable for beachfront properties. Many businesses are annexed to the homes of patrons and in the few instances where properties were not completely destroyed, businesses are being used to provide shelter. Beyond business owners, employees of tourism businesses, particularly the island's resorts, are concerned for their livelihoods and their families' well-being given the loss of income for the foreseeable future.

A breakdown of damage to the tourism industry by individual property is available in Annex 3.

The damage to the fishing sector on Carriacou was significant. Within the fishing communities of Winward, Dover, L'Estere and Harvey Vale, a preliminary count indicates that approximately 75 vessels, including longliners (38ft) and open hull (16-18ft), were damaged or completely destroyed. Fishers reported that the cost of replacing a longliner vessel along with engines and equipment was between EC$250,000 – EC$350,000. Fishing equipment including engines, safety equipment was also lost. As many as 200 fishers have lost their livelihoods including net fishers, divers, longliners and reef fishers. The Hillsborough Fish Market also suffered significant damage.

FIGURE 6: DAMAGE TO FISHING VESSELS IN DOVER. PHOTO: JUNE MASTERS, CRFM

3. RECOMMENDATIONS ON IMMEDIATE AND MEDIUM-TERM RESPONSE

Immediate Recommendations

- Basic building materials to temporarily mend damaged buildings and secure open areas.
- Cash-transfer programmes to stimulate the local economy and support local businesses.
- Empower fishers and business owners by providing training and equipment to involve them in cleanup efforts, helping them regain control and purpose after losing their homes, boats, and businesses.
- Assess the impact of the hurricane on the marine ecosystem and fish stocks, establishing a baseline for future research and stock assessments.
- Ensure cleanup efforts consider marine ecosystems, involving relevant agencies to protect turtle nesting sites and other sensitive areas.
- Consider providing a loan through the GDB for fishermen to finance servicing or replacement of boats.

Long-term Recommendations

- Offer alternative livelihoods for fishers and tourism providers until they can return to their respective industries, prioritizing their quick reemployment.
    - Partner with other OECS islands to send interns to hotels in other islands.
- Implement comprehensive record-keeping for Carriacou's fishery, including registration and licensing, with offsite storage for data protection in catastrophic events.
- Invest in adventure and nature tourism to attract tourists to the islands again. The zip line, hiking and diving spots, for example, are attractions that require minimal investment to boost.
- Restore the community/tourism enhancement initiative that began before the hurricane, including the visitor welcome centre and booths, to signal the island is open for business.
- Involve community members in the rebuild and restart of the tourism sector, particularly by providing training for displaced workers and unemployed youth.
- To assist in both the recovery and stimulation of the tourism industry, create voluntourism packages with modest accommodations for philanthropists and voluntourists.
- Infrastructure Improvements: Various measures were planned, including commissioning additional RO plants, investing in generators, installing hurricane-resistant trees and windows, and adding hurricane shutters and a solar system with batteries.
- Communication and Coordination: Businesses suggested better collaboration with utility sectors for quicker repairs and emphasized the need for better tracking of hurricane progress and strategic planning before the next hurricane season.
- Emergency Protocols: Some businesses planned to implement signages or booklets for guests on disaster preparedness, while others highlighted the importance of treating the tourism sector as essential workers during emergencies.

HEALTH

1. SECTORAL OVERVIEW

Hurricane Beryl led to an estimate 7 deaths (6 on Carriacou[3] and 1 in Grenada) and 97 injuries (56 Carriacou, 35 Petite Martinique, 6 Grenada), including lacerations, puncture wounds and polytrauma. There were no deaths or injuries reported among health staff.

The hurricane has severely disrupted health services, with significant damage to an estimated 83% of the health facilities in Carriacou and Petite Martinique (5 out of 6) and a shortage in medicine and medical and cleaning supplies. This has left shelters in Petite Martinique and Carriacou with critical public health challenges and inadequate healthcare access. The St. Thomas Aquinas RC School shelter in Petite Martinique houses 68 individuals, including two with untreated mental health conditions, posing health and safety risks. Other shelters report cases of gastroenteritis and respiratory illnesses, highlighting the ease of the spread of communicable diseases. Access to healthcare is limited in shelters, with no dedicated health staff and only occasional visits from health workers, while immediate secondary and tertiary care are unavailable. Shelters also lack essential resources such as personal protective equipment, potable water, and adequate food storage. Significant barriers to accessing general and reproductive health services persist, exacerbated by the lack of transportation. Immediate public health measures are crucial to address these challenges and ensure the well-being of displaced persons.

FIGURE 7: THE HILLSBOROUGH HEALTH CENTRE IS THE ONLY OFFICIAL FUNCTIONING HEALTH CENTRE IN CARRIACOU. THERE ARE OFTEN LONG LINES AND WAITS AND INSUFFICIENT STAFF TO MEET DEMAND. PHOTO: JOLENE MUIR, OCHA

[3] Three of these deaths reportedly occurred due to injuries sustained during the hurricane

2. DAMAGE AND CHALLENGES

Health Facilities and Health Surveillance - The hurricane has caused significant damage to hospitals and health centres. Many health facilities stressed the need for generators, which PAHO/WHO has provided where necessary. In the northern parishes of mainland Grenada, damage was minimal, but water was still unavailable at all health facilities (as of 6 July). The Petite Martinique Health Centre is damaged but operational, with water leaking on the ground floor. On Carriacou, the Princess Royal Hospital, Mt Pleasant Medical Station, Windward Medical Station and Leaster Medical Stations all sustained damage to the roof and windows, leaving only Hillsborough Health Centre operational on the island. There have been significant lines and patient wait times. The field hospitals erected by Samaritan's Purse near the stadium and to be erected by the Ministry of Health near the EOC aim to fill gaps in health services, however residents report difficulties in accessing health facilities, particularly due to lack of transport. Health surveillance across all shelters, including St. Thomas Aquinas RC School, is notably absent. Community health centres in Petite Martinique and Carriacou face limitations in healthcare staff, with only one permanent nurse and a visiting doctor available once a week. Furthermore, displaced persons in these shelters do not have access to immediate secondary and tertiary levels of care.

Illness / Injuries - There are concerns surrounding individuals with mental health issues who are unable to access services. Two individuals with untreated mental health conditions in the St. Thomas Aquinas RC School shelter pose a major health and safety risk to themselves and others. There have also been cases of gastroenteritis and respiratory illnesses that have been reported in several shelters, indicating a spread of communicable diseases.

Access to essential services - There are significant barriers in accessing essential life-saving services, including sexual and reproductive health services, in all shelters. The absence of transportation also poses a challenge in accessing these services, particularly at the pop-up hospital in Carriacou. Furthermore, it has been reported that there is an absence of dedicated health staff at the shelters and there is a lack of ongoing health surveillance in most of these areas. This can hinder immediate medical response and continuous care and monitoring.

3. RECOMMENDATIONS ON IMMEDIATE AND MEDIUM-TERM RESPONSE

Immediate recommendations

- Supply water storage and carrying equipment (buckets, jerrycans) for cleaning, flushing toilets, and washing.
- Provide mosquito coils as preferable options to mosquito nets.
- Focus on establishing medical stations at shelters with basic supplies and healthcare staff to monitor health status and implement public health measures.
- Ensure displaced individuals with chronic diseases receive treatment by creating a database and providing regular check-ups.
- Conduct routine inspections of food storage, preparation areas, and sanitation facilities, and train staff and residents on safe food handling and hygiene practices.
- Provide personal protective equipment such as gowns, gloves, face masks, and hair nets, and train staff and residents on their proper use.

- There should be focus on implementing daily health surveillance and train staff to accurately report health data.

Medium-term recommendations

- It is essential to conduct a public health and medical needs assessment to gauge the needs of the affected population and understand the status of the systems and structures in place already.
- Conduct prevention and vector control interventions at shelters, such as distributing mosquito nets, and insect repellents, and implementing pest control measures.
- It is recommended to mobilize and ensure assistance modalities for evacuees upon arrival on the mainland, including family reunification, rental support, and livelihoods assistance, as life-saving medical evacuations are expected to increase in the near future.

4. OTHER POINTS OF IMPORTANCE

Vulnerable Groups

- People with chronic illnesses remain the most vulnerable amidst limited access to health infrastructure. Two individuals at St. Thomas Aquinas RC School with untreated mental health conditions pose a risk, and displaced persons with chronic diseases are unable to receive continuous treatment and care at the shelters.
- A case of gastroenteritis in a child was reported, indicating that children may be particularly vulnerable to communicable diseases and poor sanitary conditions.
- Major obstacles to accessing essential life-saving services, including sexual and reproductive health services, present additional risks for pregnant women and individuals needing sexual and reproductive health Services.
- Elderly individuals are likely to have higher healthcare needs and may face difficulties in accessing appropriate care and managing chronic conditions. The same is true for people with limited mobility who might struggle in accessing health care centres and hospitals.

Priority Needs

Needs at formal shelters - There is a need for public health care items like disposable dressing trays, wound cleaning solutions, sanitizing solutions, bleach, gloves, incontinent pads, water purification tablets, fogging machines, malathion, BTI, rodent bait and water testing kits.

SHELTER

1. SECTORAL OVERVIEW

FIGURE 8: ST THOMAS ACQUINAS SCHOOL IS THE ONLY FORMAL SHELTER ON PETITE MARTINIQUE. PHOTO: JOLENE MUIR, OCHA

Formal shelters in Carriacou and Petite Martinique approximately house 300 to 400 displaced individuals. As of 8 July, there were 14 individuals in shelters on mainland Grenada, 68 in shelters on Petite Martinique, 140 across the three formal shelters on Carriacou and 131 in informal pop-up shelters on Carriacou, indicating approximately 353 individuals in shelters. Of these, an estimated 51% are adults, 24% are children and 7% elderly. A full breakdown of shelter demographics can be found in Annex 4 but given the time constraints in data collection and the dynamic nature of these shelters, these numbers are approximate only and should not be taken as concrete figures. Day to day, this number is steadily decreasing as families source materials to repair roofs and return home, relocate to the homes of friends or family, or evacuate to mainland Grenada and other neighbouring islands. With the reduced need for shelters, only 3 of the 8 formal shelters remain operational, however at least 12 informal pop-up shelters remain. Due to the fact that not all pop-up shelters were assessed, and the anticipation that there are

additional pop-up shelters not already identified, there is a strong likelihood that the number of persons in pop up shelters is higher than captured.

FIGURE 9: SUNSET HOTEL IS AN INFORMAL POP-UP SHELTER IN CARRIACOU, CURRENTLY HOUSING AT LEAST 9 PEOPLE. THERE ARE LARGE SECTIONS OF THE ROOF MISSING, RESIDENTS ARE CRAMPED INTO TWO ROOMS, AND MOSQUITOS ARE BECOMING A SIGNIFICANT PROBLEM. PHOTO: JOLENE MUIR, OCHA

Conditions in many of the formal and pop-up shelters across Carriacou and Petite Martinique remain suboptimal, with overcrowded spaces and insufficient resources for rainproofing and managing leakages. All of the shelters suffered structural damages, relied on limited electricity provided by generators, and lacked running water. Food preparation facilities in the shelters are significantly inadequate, elevating the likelihood of foodborne diseases and compromising the overall health of shelter residents. The lack of personal space and proper locks in pop-up shelters pose security and health risks. The overall situation underscores the urgent need for improved logistical support, secure storage, and better communication regarding distribution schedules.

2. DAMAGE AND CHALLENGES

Damage to shelter infrastructure.

The shelter infrastructure in Carriacou and Petite Martinique is in a state of significant disrepair. Out of the 8 originally activated shelters, only 3 remain operational, as the reduced need for shelters has allowed for their deactivation. All these formal shelters suffered structural damages and relied on limited electricity provided by generators. In addition, 12 pop-up shelters have been identified, all of which are in inadequate conditions.

These pop-up shelters often lack proper locks, with many exhibiting significant structural damages, including missing locks for toilets and showers, making them unsafe and increasing the risk of insecurity

and violence. CDEMA identified a damaged roof over the kitchen and the main administrative area of St Thomas Acquinas RC School in Petite Martinique, posing minor health and safety risks to staff and residents operating it as a shelter.

Over 65% of the Government shelters visited during a Protection and GBV Assessment were in a state of disrepair. The most severely damaged was the shelter at the Dover Government Primary School - the classroom walls had broken down, the locks on bathrooms were destroyed.

Status of facilities (overall):

NFI and food preparation facilities: Food preparation facilities in the shelters are notably inadequate. The reliance on bottled water hampers efficient meal preparation. Fresh food storage is unavailable without consistent refrigeration, increasing the risk of spoilage. Shelters lack essential cooking equipment, such as gas stoves and adequate gas supplies, and personal protective equipment (PPE) for meal preparation, resulting in substandard food safety practices. The use of dry wood for cooking at St. Thomas Primary and Dover Primary poses severe risks of structural fires and health hazards due to smoke inhalation. These conditions elevate the likelihood of foodborne diseases and compromise the overall health of shelter residents. Shelter managers requested more nutritional food going forward.

Sleeping accommodations: Sleeping accommodations in the shelters are marked by moderate to severe overcrowding, exacerbating discomfort and potentially leading to rapid spread of communicable diseases. The shelters are not designed for long-term housing and lack adequate space. At Our Lady of the Rosary Catholic School and Dover Primary, the absence of gender-separated sleeping areas increase the risk of gender-based violence and psychological stress. Despite an adequate supply of bedding and mattresses, the non-use of available cribs for infants indicates potential gaps in care practices.

Personnel - Shelter managers are understaffed, and in the case of pop-up shelters, these are being operated by de facto managers and volunteers, resulting in inconsistency in the administration of Shelter Guidelines and Procedures. For example, one pop-up manager reported repeated use of alcohol and marijuana within the shelter premises, unaware that regulations existed. Police and security personnel presence was also inconsistent and limited between shelter sites.

Access to information and Services - Several shelters reported having begun receiving psychosocial support services from the Ministry of Social Development, with some having received at least 2 visits by July 6th. Services offered included counselling and recreational activities such as art classes for children and cricket. Residents of the shelter report finding the intervention useful and positive. Nonetheless, access to these services and information with respect to other protection services including Gender Based Violence remains limited and inconsistent, with pop up shelters in particular stating they did not have access.

Distributions - In several pop-up locations the primary issue was that distributed supplies were not reaching the residents. This was partly due to a lack of information on distribution schedules and partly because some (but not all) locations are not easily accessible by vehicle. Shelter managers reported attempting to chase down passing trucks or walk to other locations to try to access food and bottled water. Others were using savings to purchase water from the few supermarkets that have reopened. Most of these places also lacked power sources, cleaning supplies, and materials to address inadequate roofing and leaks during rainstorms.

Situation of facilities (specific):

Dover Government Primary School: The Dover Government Primary School shelter is in dire condition. It has only one functional room, used for all activities, posing severe public health risks due to pervasive decay and fly infestations. Space is inadequate, with everyone sleeping in the same room, leading to a lack of privacy and comfort. The shelter has no electricity and relies solely on donations for safe drinking water, exacerbating the already critical living conditions.

Hillsborough Government Primary School: Hillsborough Government Primary School offers spacious accommodation with separate sleeping arrangements for men and women. However, it faces significant challenges, including inadequate water supply and lack of electricity. Police patrols provide a semblance of security with daily rotations, either at midday or 6 PM, but the lack of essential utilities remains a major concern for the shelter's inhabitants.

Harvey Vale Government Primary School: The Harvey Vale Government Primary School shelter hosts 39 people, including a blind man. Initially, it accommodated 55 individuals before many moved to live with family and friends. The shelter is divided using blackboards for partitions, offering some degree of privacy for families, single mothers, and boys. Nonetheless, it suffers from a lack of water and electricity, impacting the quality of life and hygiene for its residents.

Our Lady of the Rosary Catholic Church L'Esterre: Currently housing 45 people, this shelter saw a peak of 81 occupants after the hurricane. The population includes vulnerable groups like elderly women, a breastfeeding mother, young children, and a physically disabled person. While the shelter lacks electric lights, it has illumination at night. A police presence from 6 PM to 6 AM ensures some security. The shelter manager has requested training to better manage the shelter's needs and challenges.

Stadium pop-up Shelter: This shelter, located in a stadium, is plagued by a smell of decay. It shares its compound with the INGO Samaritan's Purse International Disaster Relief. The population includes 17 individuals with varied demographics, including the elderly and those with mental disabilities. Families and single persons have separate sleeping areas, but the absence of lights and running water exacerbates the traumatic conditions for children who are experiencing active flashbacks. The overall environment is highly distressing and unsuitable for recovery.

3. RECOMMENDATIONS ON IMMEDIATE AND MEDIUM-TERM RESPONSE

Immediate recommendations:

- Meet critical non-food item needs and urgently increase security (secure storage, locks for washrooms and showers, solar lamps, cots/bedding).
- Provide partitioning materials or other items to create more private spaces in shelters or homes shared by multiple families.
- Improved distribution strategies to ensure both formal and informal shelters are receiving the support they need. A mapping of completed distributions would assist in this regard.

- Ensure the availability of child-friendly spaces.
- Provide community toolkits (hammers, saws, screwdrivers, nails, screws) for emergency repairs and tools for debris removal (shovels, wheelbarrows, cutters).
- ACCESS TO CASH: While these recommendations focus on government-led provision of Non-Food items and shelter repair materials, it should be noted that reports were received of persons going to the mainland to bring cash sent from family overseas. Facilitating the flow/readily availability of cash in the immediate term via ATMs to Carriacou and Petite Martinique should be a key priority, particularly for the more financially secure members of the community. This would help ease the burden on the NaDMA distribution network and allow for beneficiaries in critical need to be identified and have their needs met more rapidly.
- Cash transfer programmes. (Please note that an amount has already been allocated by UNW for Grenada, Carriacou and Petite Martinque for joint implementation with WFP.)
- Shelter Management via training, and mobilization of UN volunteers to assist on the ground. Important to note that while short-term relief is currently being offered to Shelter Management staff, capacity building is critical as we remain at the beginning of the hurricane season.
- Evacuations: While life-saving evacuation for medical attention has been facilitated, it is likely that evacuations to the mainland will continue to grow in the near future. Recommendations around this would be mobilizing and ensuring assistance modalities for evacuees upon arrival on mainland (family reunification, rental/accommodation support and livelihoods assistance).

Long-term recommendations:

- Scaling Back and Prepositioning: Scale back non-food item warehousing. Pivot to prepositioning strategic items for future hurricanes/storms, including tarpaulins, roofing materials, food, water, generators, and Starlink units for government offices.
- Target Population/Shelter Assessments: Using NaDMA and other key informant networks on the ground such as primary healthcare physicians/nurses/teachers, determine alternative locations where displaced persons may be located. Surveys can indicate unmet needs and movement intentions (foreseen time staying in shelter, etc). Incorporate more comprehensive needs assessments, particularly for pockets of migrant communities who may not have the same family networks as Grenadian nationals and otherwise vulnerable persons.
- Track movement intentions, sociodemographic profiles (education level, employment status, occupation before and after Beryl), reasons for movement and future movement intentions of persons displaced by Hurricane Beryl between Mainland Grenada, Carriacou and Petite Martinique.
- Explore Diaspora engagement, including mapping data on remittances.

4. OTHER POINTS OF IMPORTANCE

Priority groups:

- People with disabilities: 10 individuals with physical or mental disabilities were mapped across the assessed locations in Carriacou.

- Chronically ill: Health concerns at shelters in Carriacou due to lack of appropriate nutritional food, especially for those with non-communicable diseases, and inadequate sanitation, posing significant health risks.
- Vulnerable population: There are approximately 247 to 300 displaced individuals housed in formal shelters. However, this number is steadily decreasing as persons are being evacuated to mainland Grenada and other neighbouring islands. Many of the displaced persons being housed at the shelters include vulnerable persons such as children, pregnant and breastfeeding women, senior citizens and individuals with mental health conditions.

Priority needs at shelters:

Priority needs identified at shelters might include goods or services from other sectors yet were identified within these facilities. The inclusion of these elements in this list does not exclude them from further prioritizations at sector level.

- Water and food: Limited access to drinking water and water for sanitation purposes, and a need for more nutritional food, especially for individuals with non-communicable diseases.
- Personnel and management: Shelters are understaffed, particularly pop-up shelters which rely on de facto managers and volunteers.
- Lighting solutions: Provision of lanterns, preferably solar-powered, to improve safety and security, especially at night.
- Access to information and services: Improved access to information for shelterees regarding available services and support and addressing the displacement and separation of families due to evacuation and different shelter locations.
- Shelter fittings and supplies: Inadequate number of cots, bedding, mosquito nets, cooking equipment, and utensils. Limited supplies of personal hygiene items such as child and adult diapers, insect repellent, and cleaning supplies.
- Cleaning and sanitation: Need for better cleaning and sanitation supplies to ensure hygienic conditions in shelters. One extreme case within an established shelter noted that after an incident involving urine and blood spillage, the shelter was cleaned with water but not yet sanitized days after.

The following specific needs have been identified by shelter managers:

CARRIACOU	IMMEDIATE NEEDS LIST/REQUIREMENTS
Dover Government School Library	- Safe toilet facilities, currently the toilet is barely intact with the container resting on the roof. Residents are scared to use the toilet for its unsafe structure. - Water supplies, for drinking, bathing and cleaning - More beds/bedding - Replenish stocks of medication, especially for elderly and general hygiene kits

	- No access to a generator or power were observed in this location.
L'Esterre-Our lady of the Rosary Catholic School	- Water for bathing and cleaning - Water tank - Tarpaulin - Items for safety (partitions, lights, locks for shelter storage) - Generator - Collapsible jerrycan
Hillsborough Government School	- Cold food storage and fresh, nutritious food - Solar lights - Elderly supplies - Beds/bedding - Solar lamps - Clothes - Collapsible jerrycans
Harvey Vale Government School	- Cleaning and sanitation items for shelter and toilets - Baby kits - Bedding and sheets - Batteries - No power source observed at the time, would recommend generator or solar lamps
Bogles preschool / Community Centre	Location inactive, no needs reported at this time.
Windward Fish Market	- Cooking stove - Generator - Beds and bedding - Partitions recommended
Stadium	- Generator, currently only one small generator for charging phones only) - Flood lights and solar lamps (only 3 lights for 4 rooms currently) - Tarpaulin, roof repair materials - Cots, beds and bedding (currently mattresses are wet and unusable -

Pop up Camina Joseph (Sunset Beach)	- Fumigation for mosquitoes, serious concentration of mosquitoes observed around noon during location assessment. - Food - Drinking Water - Roofing materials - Partitions for shelter - Solar lamps
Pop up Brendon McKie (Lauriston)	- Water, water tank - Clothes for everyone (children, adults) - Generator/chargers - Solar lamps, flashlights - Roofing materials - Mosquito coils were preferred over mosquito nets (nowhere to put nets) - Cleaning supplies -
Pop up Susan Peters (Lauriston)	- Tarpaulins - Water catching items for leakages in the house (buckets, and other cleaning supplies) - Galvanize, plywood and roofing materials. - Cold food storage -
Pop up Princess John (Brunswick)	- This site was inactive, no needs reported at this time.
PETITEMARTINIQUE	IMMEDIATE NEEDS LIST/REQUIREMENTS
St Thomas Acquinas School	- More tarpaulin and roofing materials because the kitchen is exposed. More beds and bedding. - Children's supplies: toys, clothes, games, and children's items (as well as assistance in organizing to send children to mainland Grenada for summer camp) - Cold food storage and fresh nutritious food (vegetables, fruits, etc) - A bigger generator, flood lights and solar lamps ● Over-the-counter medication supplies are low and need replenishment. ● Special attention and treatment are required for residents with mental health conditions,

	including two specific cases at St. Thomas Aquinas School. ● Family planning services are currently unavailable and needed for the shelter residents.

PROTECTION

1. SECTORAL OVERVIEW

The protection situation in Grenada's shelters post-hurricane is critical. Most shelters in Carriacou and Petite Martinique suffer from damaged structures and inadequate facilities, increasing protection risks. Lack of electricity and locks have led to reluctance in using insecure restrooms, especially among women. Violence against women and girls (VAWG) is a major concern, worsened by poor lighting and security measures. Barriers to essential services, including psychosocial and GBV support, are pervasive and compounded by a lack of transportation. Privacy issues and insufficient childcare elevate GBV risks, with overcrowded shelters like Dover Government Primary School lacking basic amenities. Although no signs of violence against children were observed, their reactions to minor incidents indicate high stress levels. Unsupervised children in shelters, particularly in Carriacou, are vulnerable to abuse and violence as parents attend to their homes or seek supplies. Immediate actions should include establishing GBV/SRH referral pathways, improving security infrastructure, and implementing child protection programs like Return to Happiness and a buddy system.

2. DAMAGE AND CHALLENGES

In Carriacou:

Physical security: Many shelters, especially pop-up ones, lack proper locks and have significant structural damage, increasing the risk of insecurity and violence. Issues include missing locks for toilets and showers, and structurally unsafe restroom facilities, which increase risks, especially at night.

Security challenges: One shelteree expressed hesitation to use restrooms due to the structure's extensive damage, causing them to travel away from the shelter site to find alternative facilities, which can increase vulnerability to violence.

Incidents of theft: One shelter reported food items being stolen due to lack of secure storage facilities, indicating a need for secure storage solutions.

Gender-based violence: Protection concerns were particularly highlighted with respect to gender-based violence, especially in the context of inadequate security measures and lack of lighting at night.

Child protection: Although no signs of violence against children were observed, their reactions to minor incidents indicate high stress levels. A major concern is that children in shelters, particularly in Carriacou, were often unsupervised as their parents attended to their homes or sought supplies, leaving them vulnerable to abuse and violence.

In Government shelters (Dover Government Primary School, Hillsborough Government Primary School, Harvey Vale Government Primary School, Our Lady of the Rosary Catholic Church, and a pop-up shelter at the National Stadium):

Barriers to accessing services: Each shelter presented significant barriers to accessing essential life-saving services such as health care including sexual and reproductive health services, GBV support services, psych-social support services and legal and justice services. All shelters with the exception of two stated that there was no consistent provision of medical services within the shelter. Interviewed persons highlighted that they were aware that services could be accessed at the pop-up hospital in Carriacou. The lack of transportation, however, is a major deterrent to service access. Addressing these barriers requires a comprehensive approach that includes the creation of one-stop shops where the most at risk persons can access multi-sectoral services in one location. Another option would be the provision of mobile lifesaving services.

Perceptions of safety by women and girls: The shelter assessments revealed critical safety concerns for women and girls. All respondents reported a lack of lighting in toilet and bathroom facilities, and 75% noted inadequate space in shelters. Our Lady of the Rosary Catholic Church was the only shelter providing clear privacy partitions. Over 65% of the shelters were in disrepair, with Dover Government Primary School being the most severely damaged, housing 27 individuals in cramped conditions with non-functional bathroom locks and no electricity. Safety concerns were heightened by an incident where a service provider displayed aggression towards the shelter manager, highlighting the lack of complaint mechanisms for protection against physical attacks. Additionally, the absence of childcare and the risk of children being exposed to adult sexual activity in shared spaces posed significant GBV risks.

Lack of protection policies or measures: There is no clear reporting mechanism for women and girls facing GBV in the assessed shelters, with only informal understandings at some of these centres such as Hillsborough and Our Lady of Leicester. Privacy for women and girls is lacking, exemplified by a breastfeeding mother at Harvey Vale Shelter who must nurse in the open. Gender-sensitive safety measures are insufficient, with no female police officers patrolling the shelters, which shelter managers, including at Our Lady of the Leicester Rosary, acknowledge.

Insufficient child protection considerations: Childcare and activities are also inadequate, with no structured systems in place. At Hillsborough and Our Lady of Leicester Rosary, children were left under the supervision of unvetted INGO personnel, highlighting the need for more organized and safe activities for children. While two shelters showed promising engagement by providing simple card games for children, almost all shelters lacked child friendly spaces, with managers expressing the need for toys and activities for children. Shelters also requested treats such as chocolate or candy to raise children's spirits.

3. RECOMMENDATIONS ON IMMEDIATE AND MEDIUM-TERM RESPONSE

Short Term

- Establish GBV/SRH referral pathways, including psychosocial support and health care in all the shelters.
- Conduct service mapping to know who is doing what and where to enhance the provision of multispectral GBV services.

- Establish critical lifesaving GBV services (Case management, Psychosocial support, referral, Clinical management of rape) and provide information on available GBV services. Work with the Health sector and the Ministry of Health and Gender on this.
- Mainstream GBV and GBV risk mitigation across all sectors
- Raise awareness among actors distributing assistance and advocate for improved queueing mechanisms to reduce the risk of GBV.
- Quickly address issues related to overcrowding and privacy concerns.
- Ensure lockable doors, clear disaggregation, and adequate lighting in toilets and bathing facilities.
- Prioritize training on GBV, PSEA, safe disclosures (GBV pocket guide training) and referral pathways for all humanitarian and government actors.
- Train GBV case workers on case management and GBV services to support resilience and recovery - consider the provision of remote service delivery to include.
- Distribution of dignity kits customized to meet the needs and reduce GBV risks of women and girls.
- Work with women groups to respond and prevent GBV.
- Establish GBV action groups within the community/ shelters to support prevention and response to GBV.
- Child protection: To support children's mental health after Hurricane Beryl, it is recommended to implement the Return to Happiness program, with refresher training provided for counsellors. Additionally, a child protection buddy system should be established in shelters, where an adult or older teen assists in supervising children. Clearing debris and creating Child Friendly Spaces (CFS) will provide safe and supervised areas for children to engage and recover. These measures will collectively ensure a safer and more supportive environment for affected children.

Medium Term

- Establish women and girls safe spaces in shelters.
- Conduct shelter management training.
- Promote and conduct community-based awareness, risk mitigation and prevention activities.
- Capacity development of GBV service providers on GBV, safe referrals, case management and GBViE minimum standards
- Strengthen the capacity of healthcare providers to deliver survivor-cantered care for survivors of sexual assault.

Long term

- Advocate for integration of GBV and SRH actions in other sectors such as Food Security and Livelihood, Nutrition, WASH, Health; Protection; CCCM, logistics; and education.
- Support inclusion of GBViE and SRHiE components in collective outcome documents including Humanitarian Response Plans (HRPs) and National Development or Disaster Risk Reduction (DRR) plans and strategies.
- Conduct periodic (after 12 months) minimum initial services package for sexual and reproductive health in emergencies (MISP) Readiness Assessment and disseminate results.

4. OTHER POINTS OF IMPORTANCE

Priority Protection-related needs at shelters in Carriacou:

Physical security: Immediate need for secure locks for toilets and showers, and secure storage for food and medical supplies to reduce the risk of theft and improve safety.

Lighting solutions: Provision of lanterns, preferably solar-powered, to improve safety and security, particularly at night, to reduce the risk of violence and improve visibility.

Personnel and management: Shelters are understaffed, leading to inconsistent administration of shelter guidelines and procedures, including those related to protection and security. Training and additional staff are needed to ensure consistent management and protection measures.

WATER, SANITATION & HYGIENE

1. SECTORAL OVERVIEW

The hurricane has caused extensive infrastructure damage in Carriacou and Petite Martinique, severely impacting the water supply and sanitation systems. The St. Thomas Aquinas RC School shelter in Petite Martinique, housing 68 individuals, faces critical WASH challenges. The Princess Royal Smart Hospital in Carriacou has significant water system failures, and the Carriacou Desalination Plant suffers from a power outage. Essential resources like potable water, sanitation products, and personal protective equipment are scarce. Roof and gutter damage at the emergency shelter prevents rainwater collection, worsening water shortages. Similarly, in Petite Martinique, the desalination plant lacks power, and a large tank has a significant hole. Immediate action is needed to address these WASH issues and ensure the well-being of displaced persons.

2. DAMAGE AND LOSSES

Infrastructure damages - In Carriacou, the Princess Royal Smart Hospital is grappling with significant issues in its water system, including several leaks and a broken 2” PVC pipe. The hospital's primary water pump is faulty, leaving only the less powerful 1 HP standby pump operational. Additionally, the Carriacou Desalination Plant is experiencing a critical power outage, with the status of its 6” raw water suction line needing urgent assessment. The pop-up shelter at the stadium has also sustained damages to its roof and gutters, preventing rainwater collection into the cistern. Both the elevated tanks and the ground-level 1,000-gallon tank remain empty, compromising the water supply for the shelter. Similarly, in Petite Martinique, the desalination plant is without power, and the raw water intake marker is missing. There is a significant hole in the 45,000 imperial gallon tank near the 15-foot mark, which severely affects its capacity. Additionally, several domestic tanks have been damaged or displaced, further exacerbating the water supply challenges in the area.

Disruption to Water Supply - Parts of Grenada, especially the islands of Carriacou and Petite Martinique are facing serious water supply problems. The National Water and Sewerage Authority (NAWASA) manages water distribution, but many desalination plants are not working. Residents mainly rely on rainwater stored in cisterns and bottled water, but many water tanks were damaged or blown away by the hurricane, making the situation worse. This is particularly true in Carriacou, where the Desalination plant is affected leaving around 18 residents at the emergency stadium shelter without potable water for six days. A similar situation is also seen in Petite Martinique where there is no central power or running potable water. Roof and gutter repairs are needed to collect rainwater, but these have not been done, leaving residents with very limited water options.

Sanitation and Hygiene concerns - There is no water available to flush toilets, so people have to fill buckets with water for flushing, making maintaining hygiene challenging and leading to unsanitary conditions. Portable toilets are used as a last resort due to various concerns, including hygiene issues, unpleasant odours, and the difficulty of maintaining them in a clean and functional state. Shelters have separate bathrooms for males and females, but they lack signs and privacy, leading to confusion and discomfort for the occupants and further exacerbating the already difficult living conditions.

Waste Management - There have been reports of inadequate waste management practices, with insufficient disposal bins and improper handling and disposal of waste, including burning garbage in the open air, which can potentially increase health risks. Solid waste management has been a major issue for shelters since municipal collection has halted, leaving disposal to shelter volunteers who often lack personal protective equipment. This has been cited as a major disruption in all shelters except Bel Air Primary, which has experienced only some disruption. Additionally, there is no separation of potentially infectious waste, which is stored in open containers close to the shelter. In some instances, this waste is burnt in the open air, posing adverse health and environmental effects for the remaining population. With potential rains incoming, proper waste management will be crucial for the health and safety of the population, particularly as aid continues to be delivered and the clean-up process begins.

The GSWMA's compound at Dumfries was affected, the roof of the mechanic shed, storeroom, security booths, fencing, track loader, pickup, surveillance system and solar lights at the Dumfries Landfill sustained damages. The working shed of the waste collection provider was also damaged with other minor damage to the equipment. The Boat that transports solid waste from Petite Martinique to Carriacou twice per week was also damaged and to date is not able to move. As such an alternative arrangement has been made to transport the waste from Petite Martinique once per week July 11, 2024.

The waste infrastructure at the Perseverance Landfill sustained minor damages which will be repaired once the restoration at Carriacou has advanced further.

3. RECOMMENDATIONS ON IMMEDIATE AND MEDIUM-TERM RESPONSE

Immediate recommendations

- **Carriacou -** Focus should be on installing a water level monitoring system, repairing leaks, and servicing both the primary and standby pumps at the Princess Royal Smart Hospital. The Carriacou Desalination Plant needs to restore power, clear and inspect the raw water suction line, and replace the faulty transfer pump. Additionally, at the emergency shelter at the stadium, it is recommended to provide a truck-borne water supply, repair the roof and guttering for rainwater harvesting, and unlock the pump control room to access the cistern water.
- **Petite Martinique** - Focus should be on investigating and replacing the raw water suction line, restoring power to the desalination plant, educating residents on using chlorine tablets for water disinfection, and promoting safe methods for water collection and storage.
- **WASH messages and supplies -** There should be a focus on rolling out hygiene messages along with PPE and hygiene supplies to ensure good practices and IPC protocols in affected communities and shelters.

    - GSWMA's communications unit has dispatched an officer to work along with the team to promote desired waste management practices, health and environmental protection and waste reduction measures.
- **Provision of Water Supply -** There should be provision of water through WASH partners and water treatment tablets. Additionally, the distribution of pre-positioned WASH supplies, focusing on customized kits tailored to the needs of the affected population is recommended.
- **Prevention of water- and vector-borne diseases -** Education should be provided around safe storage of water and proper safe water practices in order to eliminate mosquito breeding sites and prevent the spread of water- and vector-borne diseases.

Medium-term recommendations

Distribution Network and Drainage Improvements - Assess and repair the distribution network to ensure reliable water supply. Implement drainage systems to prevent standing water and reduce mosquito breeding sites. This is particularly true in the islands worst affected by the hurricane where the population remains most vulnerable to health risks.

Alternative Water Supply Methods - Promote rainwater harvesting and other alternative water sources to enhance resilience and reduce reliance on a single water supply.

Health and Safety Measures - Provide disinfection materials like chlorine tablets regularly and ensure they are available. Educate the community on proper disinfection practices to prevent waterborne diseases.

Infrastructure Upgrades - Inspect and assess water intakes and storage tanks for any issues. Mobilize resources for necessary repairs and maintenance to keep the infrastructure functional and reliable.

4. OTHER POINTS OF IMPORTANCE

Vulnerable Groups

- People in evacuation centres remain extremely vulnerable as some centres reportedly lack potable water and are relying on other sources, particularly pop-up and informal shelters where bottled water is not being routinely delivered. Distribution of bottled water has been a challenge at some shelters and there have been reports of displaced individuals hoarding or consuming bottled water in excess, which ultimately creates conflict between shelter volunteers and displaced individuals. These shelters also lack proper bathroom facilities and do not meet adequate WASH standards.
- Residents of Hillsborough and Lauriston areas are served by Carriacou Desalination Plant which was affected by the storm leaving the population in the area struggling to access adequate potable and drinking water.
- In Carriacou, 10 people with physical or mental disabilities were identified. These people could face challenges due to the lack of accessible bathrooms in the affected areas.

Priority Needs

Hygiene awareness - There is a pressing need for education on hygiene and the proper use of toilet facilities to prevent the spread of disease. Concerns have also been raised about the safety, cleanliness, and privacy in shelter bathrooms, highlighting the urgent need for improvements in these areas to ensure the well-being of all occupants.

Hygiene items - There is a request for hygiene products, including diapers for children and adults, sanitary napkins, feminine wipes, toothpaste, deodorant, shaving cream and body wash.

Water Supply Repairs - The Princess Royal Smart Hospital needs water supply repairs, including installing a level indicator for the water cistern, repairing leaks, troubleshooting the primary water pump, servicing the standby pump, and ensuring clear access to the pipeline network. The Carriacou Desalination Plant requires an inspection of the raw water suction line, installing a variable frequency drive for the transfer pump, and clearing drains of debris. Additionally, the Stadium (Emergency Shelter) in Carriacou needs a truck-borne water supply to fill the 1,000-gallon tank, roof and guttering repairs to resume rainwater harvesting, and an inspection of the elevated tanks, pipe system, and safety rails. Similar repairs are also needed in the water systems of Petite Martinique.

EDUCATION

1. SECTORAL OVERVIEW

The education sector in Carriacou and Grenada has both public and private institutions with educational services and support systems such as libraries, administrative offices, and school feeding programs, serving students across early childhood, primary, and secondary levels. The sector is important in the cognitive and social development of children and is foundational to the community's growth. Educational infrastructure and services are essential for maintaining continuity in learning and development, particularly in regions vulnerable to natural disasters.

2. DAMAGE AND LOSSES

The education sector in Carriacou and Grenada has been severely impacted by Hurricane Beryl. Early childhood facilities are particularly affected, with all private daycare centres destroyed and the government centre repurposed as a shelter. Primary and secondary schools in Carriacou have suffered extensive damage, disrupting education for over 1,247 students, including those from Petite Martinique. The damage also impacts school support services and infrastructure, so immediate and long-term interventions to restore educational continuity and quality are important.

Early Childhood

Across Carriacou, all private daycares were completely destroyed by Beryl. The government day care, while still standing, is unable to be used as it is being utilised for shelter by a displaced family. The early childhood years are the most important for children’s social and cognitive development and the absence of early stimulation through early childhood care and development has the potential to delay developmental milestones in children.

FIGURE 10: A PRIVATE DAYCARE CENTRE IS LEFT IN RUINS IN CARRIACOU. PHOTO: LISA MCCLEAN TROTMAN, UNICEF

Primary and Secondary education

With the exception of Munroe College where part of the roof was off, the primary and secondary schools in the affected parishes of St. Andrew, St. Marks and St. Patrick in mainland Grenada remain intact. In Carriacou, however, many of the primary and secondary schools are severely damaged or completely destroyed. Those that avoided significant damage are currently being used as shelters. This also has implications for the secondary school children from PetiteMartinque who attend school in Carriacou as there is no secondary school on the island of PetiteMartinque. The learning of the 1,247 school aged children that reside on the island of Carriacou and PetiteMartinque will be negatively affected if repairs and systems are not put in place before the reopening of the academic school term in September. Also, MHPPS support must be provided for the 124 teachers from Carriacou and PetiteMartinque to ensure that they are mentally ready to teach.

FIGURE 11: ONLY THE LIBRARY AND ONE BATHROOM REMAIN AT THE DOVER PRIMARY SCHOOL IN CARRIACOU. PHOTO: LISA MCCLEAN TROTMAN, UNICEF

3. RECOMMENDATIONS ON IMMEDIATE AND MEDIUM-TERM RESPONSE

Short term

- In the absence of physical day care facilities, the implementation of the Roving Caregivers programme in Carriacou is recommended. With this programme, trained Rovers from Grenada can visit shelters where 0–3-year-olds are located and work with mothers and caregivers on how to provide early stimulation for young children using available materials.
- Donation of toys, manipulatives and other early stimulation materials to support early stimulation of young children whether in temporary childcare spaces or through the Roving Caregivers programme.
- Repair of damaged homes or provide temporary housing for currently displaced people so that those residing in schools for shelter can return to their homes and schools that have received minor damage can be fixed in time for reopening of schools in September.
- Clearing of debris and hazardous materials so that temporary learning spaces can be established when the academic terms resume in September.
- MHPSS for teachers and students, especially those from Carriacou and Petite Martinque
- Distribution of age-appropriate educational materials to families.
- Financial support (for purchase of uniforms, books etc) for parents who would want their children to relocate to Grenada with relatives to attend school.
- Improve telecommunications to enable online learning.

Long term

- Rebuild schools with a focus on climate smart specifications.

4. PRIORITY NEEDS, AREAS, GROUPS

The immediate needs following Hurricane Beryl in the education sector are critical. Damaged schools and daycare centres urgently need to be repaired and rehabilitated, and temporary housing must be provided for displaced families currently sheltering in schools. Creating temporary learning spaces and clearing debris is essential to get students back to their education routines. Mental health and psychosocial support (MHPSS) programmes are important for helping students and teachers cope with trauma, including implementing the "Return to Happiness" programme for affected children. Additionally, it is essential to distribute educational materials and provide financial assistance to families relocating children to Grenada for schooling. The focus areas include heavily damaged primary and secondary schools in Carriacou, restoring destroyed daycare centres, and minor repairs in Grenada (St. Andrew, St. Mark, and St. Patrick). Priority groups include displaced families who need immediate housing solutions, students affected by school closures, young children requiring early childhood development support, teachers needing MHPSS to resume teaching, and parents and caregivers who need support for early childhood education and financial aid for relocation.

Annex 4

Annex 4

Preliminary Damage Assessment (PDA) Report

Limlair Solar PV/Hybrid Project, Carriacou.

Assessment Date: Friday, July 19th, 2024.

Submitted by: Leslie Smith, Team Lead on behalf of Assessment Team

July 23, 2024

Executive Summary

This preliminary assessment report evaluates the damage caused to the Limlair Solar PV plant by Hurricane Beryl. It covers the extent of the damage, the impact analysis, safety issues, recovery planning, and recommendations for future actions. It serves as a guide for immediate and future resilience planning and detailed assessments.

The Solar PV Farm is located in Limlair, Carriacou, near the northeastern coastline. Before Hurricane Beryl, all major components were installed, and the system was operational, dispatching 500 kW to the grid.

The assessment included evaluations of structural, electrical, modules, BESS, and ground damages. Safety assessments for immediate hazards and long-term concerns were conducted, along with developing mitigation and recovery plans.

The assessment team conducted a walk-through assessment (WTA) involving visual inspections to identify immediate issues. Key elements included checks for physical damage to PV modules, structural integrity of mounting structures, conditions of inverters and combiner boxes, and BESS condition. Environmental conditions and ancillary infrastructure were also assessed.

Assessment of the damages revealed the following:

- Structural Damage: Extensive damage to PV modules, mounting supports, and frames. Evidence of water ingress and electrical fires in some modules.
- Electrical Damage: No visible signs of electrical damage.
- BESS Damage: No visible signs, but a burnt smell indicates a need for thorough investigation.
- Ground Damage: Erosion and collapse of perimeter fencing.
- Ancillary Infrastructure: Damage to storage containers and the weather station.

From the preliminary safety assessment conducted, there was potential exposure to electrically charged (live) wires, sharp objects, and flying debris. No long-term safety concerns were identified from this investigation.

There is one concern that requires immediate action. The site must be secured to prevent unauthorized entry and exposure to potential hazards identified and for unwanted removal of salvageable system components.

Key failure points and recommendations include:

- Undersized T-Clamps: Recommend using longer T-clamps for better anchoring.
- System Orientation: Consider a south-facing orientation to resist high winds.
- Inappropriate Modules: Use mono-facial modules with stronger support structures.
- Mounting Poles and Rails: Reduce spacing and overhang of mounting poles and rails.
- Bolt and Clamp Torque: Ensure proper fastening according to specifications.
- Drainage: Implement proper ground preparation and drainage systems early in construction.
- BESS Assessment: Conduct a thorough assessment to determine the source of the burnt smell and its functionality.

The findings highlight the need for improvements in design and construction practices to enhance the resilience of the facility against future extreme weather events.

1.0 INTRODUCTION:

The Limlair Solar PV Hybrid Battery Storage project was conceptionalized under the UAE's Caribbean Renewable Energy Fund (CREF) in 2019, through an agreement with the Government of the United Arab Emirates (UAE) and the Government of Grenda at a cost of USD 3.2 million dollars.

Notice to proceed was given to the Engineering, Procurement and Construction contractor (Enzen) in December 2021and was expected to be completed in October 2022.

The key elements and scope of the project include:

- Solar PV plant, with a total capacity of 856 kWp.
- Battery Energy Storage sub-system (BESS), with a total storage capacity of 768 kWh and 400kVA peak power capacity. (Power capacity was revised from 600 to 400 kVA)
- Step-up low voltage/medium voltage distribution transformer with a capacity of 750kVA.
- 1450 bifacial modules - 590 Wp
- 38 rack structures
- 16 inverters
- 3 combiner boxes
- Weather station
- Perimeter fencing

The system is projected to generate annually 1,565 MWh of energy and save over 83,500 gallons (about 316,081.74 L) of diesel per year. This amounts to savings of approximately

38,000 USD/month or 103,240 USD/year. This would offset 15-20% of the electricity that is generated by diesel on the island.

1.1 Purpose:

This preliminary assessment report provides an overview of the extent of the damage to the Limlair Solar PV as a result of the devastation caused by Hurricane Beryl. The report covers an assessment of the damage, an analysis of the impact, an identification of hazards and safety issues, strategic recovery planning processes and recommendations for next step actions. The report can also serve as a guide for immediate actions and as a reference for future resilience planning and the development of a more detailed assessment.

1.2 Scope of Assessment

This scope of the assessment ensured that all critical aspects of the solar PV plant were assessed, allowing for a cursory understanding of the damages and for facilitating an effective recovery and mitigation strategy. The scope of the assessment outlined the specific areas, components, and aspects to be evaluated. This included:

- **Damage assessment** (structural, electrical, modules, BESS, ground, other)
- **Impact analysis** (energy production loss, financial, environmental and social impacts)
- **Safety assessment** (immediate hazards, long term safety concerns)
- **Mitigation and recovery plans** (immediate actions, short term repairs, long term restoration plans)
- **Conclusions and recommendations** (next steps, preventative measures, resilience enhancements

1.3 Methodology

The assessment team conducted a walk-through assessment (WTA). It involved visual inspections of the site to record observations and identify obvious and immediate issues that need to be addressed. The key elements of the WTA included:

- **Pre-assessment preparation** – distribution of assessment guidelines and personal protective equipment (PPE), safety briefing and identification of hazards, assessment of tools needed (cameras, note pad, measuring tape, calculator, flashlight, multi-meters)

- **Assessment of PV Modules** – checks for physical damage, alignment and positioning, surface debris, electrical testing, infra-red imaging
- **Assessment of Mounting Structures** – observations for structural integrity, inspections of clamps and bolts
- **Assessment of Inverters and Combiner boxes** – assess for physical condition, water, wind and projectile damage, electrical/wire connections and condition
- **Assessment of Battery Energy Storage System (BESS) and Trafo –** assess physical condition, water damage, electrical connections
- **Assessment of Environment Conditions** – assess soil and ground conditions, drainage system, access roads, vegetation condition, fencing and gates
- **Assessment of Ancillary Infrastructure** – weather station, material storage container.

On completion of the WTA, the team met onsite to report and to briefly discuss the key observations made. Comparisons were made to the neighboring NAWASA Solar PV site where damage was on a much smaller scale. Each member of the technical assessment team is required to prepare an assessment report. These reports will be collated and compiled into one final report.

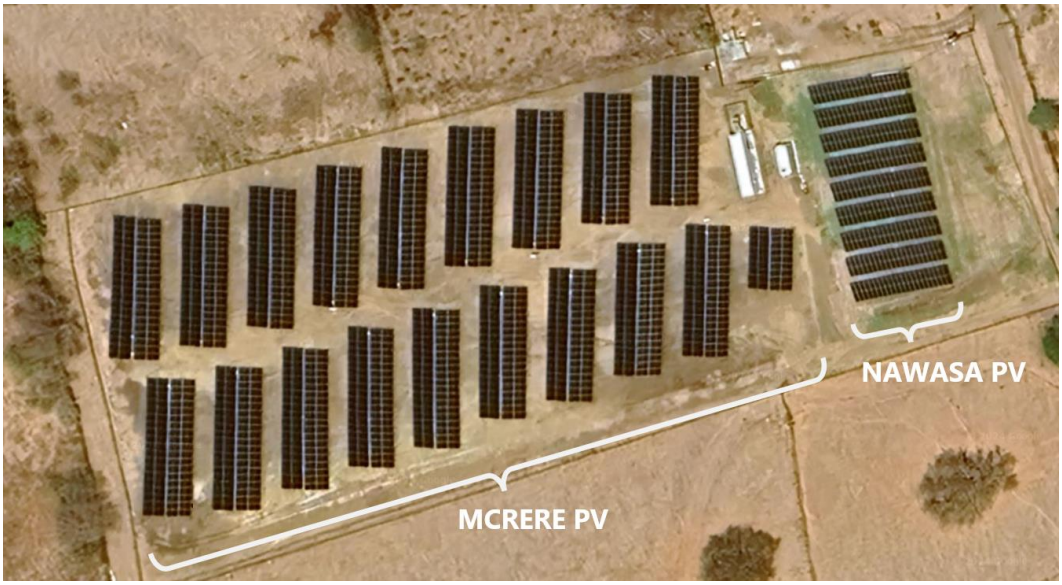
2.0 SITE OVERVIEW

2.1 Plant location

The Solar PV Farm is located in Limlair, Carriacou at the following GPS coordinates: 12.4731° N latitude and -61.4575° W longitude. The plant is relatively close to the coastline towards the north-eastern side of the island.

2.2 Plant layout

A total of 1,450 solar PV modules were installed at the plant, arranged in two planes and positioned in two rows along an east-west orientation, mounted on 38 racks. The BESS container and Transformer are located to the eastern side of the facility



2.3 Pre-hurricane condition

Before hurricane Beryl, installation of all major components of the plant was already in place. This included the PV modules, mounting support and racking structures, inverters, combiner boxes, battery energy storage system (BESS) perimeter fencing and communications systems. Commissioning started on June 19th and was into its 12th consecutive day with the system operating at full capacity, dispatching 500kw of power to the grid. At the same time, work began on improving the ground, draining and access road construction.

2.4 Brief Description of Hurricane Beryl

Hurricane Beryl was the first hurricane of the 2024 Atlantic hurricane season. The hurricane originated from a tropical wave that emerged off the coast of West Africa on June 25, 2024. It quickly developed into a tropical depression by June 28, and within 24 hours, it intensified into a tropical storm. The storm continued to strengthen rapidly, becoming a hurricane on June 29 and reaching Category 5 status by July 2 with maximum sustained winds of 165 mph.

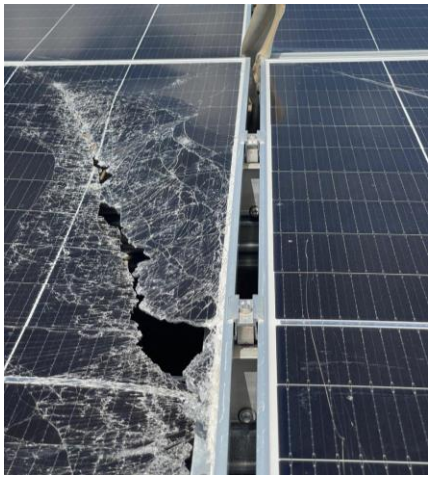
The unusually warm sea surface temperatures and favorable atmospheric conditions contributed to Beryl's explosive growth. Beryl maintained its Category 5 status as it moved westward, eventually weakening slightly due to increasing wind shear and interaction with land. It made landfall in Carriacou, as a high-end Category 4 hurricane on July 1, causing significant damage. The storm continued its path through the Caribbean, impacting Jamaica and the southern coast of the Dominican Republic, before eventually entering the Gulf of Mexico.

3.0 DAMAGE ASSESSMENT

Almost every aspect of the PV plant suffered damage from the hurricane; either from the sheer force of the wind, water damage or flying debris. The following is an account of the extent of the damage observed from the walk-through assessment.

3.1 Structural Damage:

3.1.1 **PV Modules:** Cracked and shattered glass surfaces.



Evidence of damage caused by flying objects and projectiles.

Complete detachment of the modules from rails

Panels wrapped around PV frames.

Evidence of water ingress and short circuiting

Evidence of water ingress and flame and short circuiting causing electrical fire on some modules

3.1.2 Mounting Support and frames: The mounting poles remained intact, however, the supporting rails on which the modules were fixed displayed signs of twisting and bending. The end clamps and mid clamps (T-lamps) also showed signs of bending and twisting.

Bent rail

Twisted mid-clamp

3.1.3 Inverters: no visible damage to the inverters

3.1.4 Combiner boxes: no visible damage to the combiner boxes nor the electrical connections. However, the support structure for one of the combiners boxes seen leaning to one side with the combiner box still attached.

Inverter

Combiner box

3.2 Electrical Damage:

The WTA did not reveal any visible signs of electrical damage

3.3 Battery Energy Storage System (BESS) Damage:

There were no visible signs of damage to the BESS or evidence of water intrusion. On entry there was a strong smell that was considered either new electrical equipment installation or the smell of an electrical fire or a combination of both. A more thorough investigation is required.

Inside BESS Container

Transformer and BESS Container

3.4 Ground Damage:

Large gullies due to erosion were observed. These may have been worsened by the rain and surface flooding during the hurricane. There was evidence of soil around some of the mounting structures – could have also been worsened by the flooding. The entire perimeter fencing around the facility collapsed



3.5 Damage to Ancillary infrastructure

3.5.1 (Material) Storage Container:

The storage container was removed from its foundation and tossed on its side approximately 20 feet away.

3.5.2 Damage to Ancillary infrastructure:

The weather station installed at the site was severely damaged

4.0. SAFETY ASSESSMENT

4.1 Immediate Hazards:

There is the potential for exposure to live electrical wires since the modules are still producing power. The presence of sharp objects mangle (metal and glass) is another area of concern. There is also the potential for flying debris and objects if wind speeds intensify.

4.2 Long-term Safety Concerns:

None identified

5.0 MITIGATION AND RECOVERY PLAN

5.1 Immediate Actions:

At the risk of not wanting to endanger human and animal life, the site needs to be secured. Security personnel need to be deployed immediately to prevent unwanted and illegal entry because of the potential of electrically charged high voltage exposed wires and damaged modules. Unauthorized removal of salvageable PV components is also an area of major concern.

5.2 Short-term Repairs (if necessary):

This is not a viable possibility since a detailed inspection to assess the full extent of the damage and functionality of all components would be required.

5.3 Long-term Restoration:

- A more detailed assessment of the facility is required. On completion of the detailed assessment, a plan for repairs, replacement and restoration will have to be developed in moving the project forward.

6.0 COST ESTIMATION:

This is outside of the scope of this assessment.

7.0 CONCLUSION AND RECOMMENDATIONS

7.1 Summary of Findings:

Considering the strength of the winds in this upper-level Category IV hurricane, there were many failure points observed during the assessment which created a cascading effect on the entire facility. Below is a list of failure points and possible mitigations that can derisk the facility.

7.1.1 Under sized T-Clamp/Anchoring Clamp – The T-clamps used to fasten the modules to the lateral supports were undersized (2-inch) and were ineffective in anchoring the modules under hurricane conditions. Essentially, the wind forces caused some panels to be dislodged. Given the T-clamp holds two panels, when the first panel is dislodged the clamp tilts which reduces pressure applied to the adjoining panel. This created a cascading effect in causing neighboring panels to be

liberated. Some clamps were observed to experience shear from the forces that were experienced.

Recommendation: Longer T-clamps should be used, at least 4 inches long. At the NAWASA PV farm where 4-inch clamps were used, much less PV module detachment was observed.

7.1.2 Orientation of the system – The arrays at the farm had an East-West Orientation. This exposed the panels to significant wind drag from the East-West wind gusts. The differential pressures created by the wind across the panels essentially contributed to their rupturing. In can be assumed that in some cases when the East-facing panels were dislodged, the West-facing panels were more exposed and experienced greater uplift pressure which resulted in those panels being damaged and/or detached from the rails.

Recommendation: Although the East-West orientation may optimize the irradiance capacity, a south facing orientation may be a better option to resist high wind forces, as was seen in the case of the NAWASA plant

7.1.3 Inappropriate Modules – the Modules used for this installation were Risen RSM120-8-590BMDG. These bifacial modules were not fit-for-purpose for this installation given the facility's designed orientation and ground clearance. The backside of these bifacial panels is not exposed to significant reflective irradiance in the East-West orientation and low ground clearance. Further, the bifacial panels have minimal reinforcement, and many modules show evidence of laminate tears and cracks to support this observation.

Recommendation: Mono-facial modules should be used with stronger support structures.

7.1.4 Excessively Spaced ground mount poles and insufficient lateral rails – The mounting poles for the system were very widely spaced which created significant flex in the lateral rails. Additionally, lateral rails extended up to 40 inches beyond the final mounting post. Mounting the large solar panels on this extended portion of the mounting rail did not provide the appropriate support to the panels under high-speed wind conditions. Many modules folded over these overhanging extensions

Recommendation: The ground mounting poles should be closer spaced, and the rails should be installed in such manner to reduce the panel overhang. At the NAWASA plant where the panel overhang was much shorter, less damage was observed

7.1.5 Under Torqued bolts and clamps – During the assessment some bolts on mounting clamps were finger turned without using the appropriate tools while others appeared to be very secured. This is evidence that some bolts and clamps were not torqued to the manufacturer's specifications.

Recommendation: Bolts must be fastened properly according to the manufacturer's recommendations and using the appropriate torquing tools.

7.1.6 Lack of Drainage – the lack of a properly designed drainage system on the facility resulted in water being channeled directly through the generating plant and creating large gullies. There was also evidence of compromise on the structural foundations of some of the mounting poles by the erosion of soil around the base. This also weakened the foundation under one of the combiner boxes causing it to lean under the force of the wind.

Recommendation: Appropriate ground preparation including drainage, surface protection and fencing should be undertaken in the very early stages of the site construction.

7.1.7 BESS Container: The BESS container seemingly did not receive any recognizable damage. However, a 'burnt' smell was observed on entering.

Recommendation: A thorough assessment must be made of the BESS to determine the source of the smell and its functionality.

8.0 APPENDICES

Assessment Team:

No.	Designation	FIRST NAME	SURNAME	DEPARTMENT/INSTITUTION
1	Minister	Hon. Kerryne	James	
2	Director	Leslie	Smith	Renewable Energy
3	Director	Aria	St. Louis	Environment
4	Senior Renewable Energy Officer	Terah	Antoine	Renewable Energy
5	Project Coordinator	Herbert	Samuel	Geothermal Project Unit
6	Administrative Assistant	Rosemarie	Andrew	Administrative
7	Communication Officer	Abigeil	Mc Intyre	NAP
8	Technical Regulator	Raheem	Elliot	PURC
9	Program Manager	Dr. Devon	Gardner	CCREEE
10	General Manager	Clive	Hosten	GRENLEC
11	Personal Assistant	Shakira	Lee	
12	Videographer	Dorville	Henry	GIS
13	Electrical Contractor	Allan	Mitchell	Modern Electrical Solutions

14	Member, Project Steering Committee	Davon	Baker	Ministry of Carriacou Home Affairs
15	Driver	Rickelson	Scott	
16	Manager	Wallace	Collins	GRENLEC - Carriacou

Annex 5

ANNEX 5

Victim Impact Statement

The lost family graves at Tibeau cemetery at Carriacou, Grenada

The Carbon footprint of the large, industrialized countries have taken its toll on the island of Carriacou, Grenada which is receiving punishment for their actions. This was evident in the recent passing of Hurricane Beryl, which left 98% of our island Carriacou destroyed. Besides the damage to homes, schools, churches, businesses, and the lone hospital, what hurt the most was to see the beating that Tibeau cemetery, one the oldest cemeteries on the island took. This cemetery has suffered at the hands of climate change and global warming. The rising sea level and surging sea have already taken many of the graves, including those of my paternal grandfather, great-grandfather, great-grandmother, and other relatives. My last visit to Carriacou, Grenada April 2024, I was devastated, and angry to see what was left of that cemetery. To add injury to insult, with Beryl's passing, further irreparable damage was done. Besides trees falling on remaining graves, tombs were uprooted and deposited at another location than their original spot. Again, due to rising tide, surging sea, this could have only happened. One of the tombs uprooted belonged to the late Theodora Cox, a distant relative of mine (see **Image 1**, below).

Tell me why must we suffer like this? Not even our loved ones can get a final resting place because of global warming. A situation which is becoming more and more powerful. This is solely because of humankind's greed, and power struggle to be on top of the game. Should small Caribbean islands, like Carriacou, Grenada, and others take the blows every year? Where is respect and consideration for us.

I urge whatever agencies, or organizations that are fighting to bring the ones responsible for contribution to the increase in the effects of global warming and

climate change, be made to answer for their involvement and be brought to justice for their actions.

As one who is directly affected by this, I am very angry and past upset. I am ready and willing to take up this fight on behalf of my ancestors. Tibeau cemetery deserves to be like any other cemetery.

Please see the photos below demonstrating the impact that Hurricane Beryl had at Tibeau cemetery.

Kennisha Douglas

Native from Carriacou, Grenada, West Indies

13 August 2024

Image 1 – The Tomb of my relative late Theodora Cox, Tibeau cemetery, Carriacou

Image 2 – A damaged grave (unidentified) on the beach at the Tibeau cemetery

Image 3 – Gravestone under the sand after Hurricane Beryl, Tibeau cemetery, Carriacou

Image 4 – Destruction everywhere, Tibeau cemetery, Carriacou