Keep Safe in the U.S. Virgin Islands

St. Croix – Wednesday, March 4, 2020 9:00 a.m. to 12:00 p.m.
University of the Virgin Islands
Great Hall - Albert A. Sheen
Campus Golden Grove, St. Croix, USVI

St. Thomas – Friday, March 6, 2020 9:00 a.m. to 12:00 p.m.
Emerald Beach Resort –
Hibiscus Room 8070 Lindbergh Bay Charlotte Amalie West, St. Thomas, USVI
Enterprise: Who We Are

Create opportunity for low- and moderate-income people through fit, affordable housing in diverse, thriving communities.
15 Years of Work in Housing Resilience, Recovery, Rebuilding

- Hurricane Katrina
  August 23, 2005
  800K Homes

- Super Storm Sandy
  October 22, 2012
  650K Homes

- Hurricane Harvey-Houston
  August 17, 2017
  135K Homes

- Hurricane Maria-Puerto Rico/USVI
  September 20, 2017
  370K Homes

- Fires, California
  October 2017, 2018, 2019
  60K Plus
Rapido Temp to Perm
Housing Houston, Texas
HURRICANE MARIA

8:00 PM EDT

LAT: 15.3°N  LON: 61.1°W
15 MI ESE OF DOMINICA

WINDS: 160 MPH
PRESSURE: 925 mb
MOVING: WNW at 9 MPH
“The house is the place where both planning and community development impact upon the family and individual. Planning for housing must therefore take into account more than the physical structure and spatial requirements; it should consider the social, economic and psychological needs of the individuals and families who will occupy the housing. And housing must be considered within the community context.”

Lucilla Fuller Marvel
• Water Infiltration Openings of Buildings around Jalousie Windows and Door Seals;
• Manufactured Housing Performed Poorly
• No Public Safe Rooms Designed for Storm Shelter. Evaluated by Professionals using consistent methodology
• Several large, ground-mounted solar panel systems in the USVI sustained heavy damage that hindered the full return of electrical utility service to the islands.
Housing: Stick Frame, Manufactured, Public
Faces of Resilience
Faces of Resilience

People
The extent of personal discomfort, harm, injury, or loss of life.

Physical Assets
Loss or damage to structural and architectural building components, MEP and IT equipment, utilities, landscaping, contents.

Operations
Disruption to building operations and functionality, occupancy, egress/ingress, critical systems, or lab activities.

Revenue
Loss of revenue due to business interruption, specifically in relation to tenants.

Reputation
Negative media attention or impact on industry reputation in the aftermath of an impactful shock or stress.
MANTÉNGASE SEGURO
UNA GUÍA PARA EL DISEÑO DE VIVIENDAS RESILIENTES EN COMUNIDADES ISLEÑAS

KEEP SAFE
A GUIDE FOR RESILIENT HOUSING DESIGN IN ISLAND COMMUNITIES
KEEP SAFE
A GUIDE FOR RESILIENT HOUSING DESIGN IN ISLAND COMMUNITIES
“A RESILIENT HOME”
ANTONIO LUIS VÁSQUEZ ROSADO
Designing for the Future

**SATELLITE DATA: 1993-PRESENT**

Data source: Satellite sea level observations.
Credit: NASA Goddard Space Flight Center

**RATE OF CHANGE**

↑ 3.3
millimeters per year
Who is it for?

IS THIS GUIDE FOR ME?

Homeowner or Building Owner
As the owner of your home, be it a townhouse or a detached building, you wield the power to make decisions regarding your structure’s resiliency. You can choose to make major, permanent changes to your site and home to ensure safety before, during, and after a natural disaster.

Community leader
The community regards you as their representative. Your communication and organizational skills enable you to serve as a liaison between governmental/external efforts during times of distress. By taking on a leadership role to bring your community together in the face of an emergency, you are catalyzing a collaborative effort towards resiliency that can persist long after the disaster hits.

Tenant
Renting at a multifamily building may limit the actions you can take in terms of fortifying your home against natural disasters because you have limited ability to determine how the building is prepared but you can still provide the authority with suggestions and key information found in this guide to improve your home.

Administrator
You may be an administrator of a housing program or are able to determine how to regulate a housing facility or home. This guide can help you determine ways to safeguard the building from hazards or set up a program to fund or support housing resilience.

Property Operator
You are the legal owner of a property which you rent out and you are responsible for ensuring it is safe and has emergency plans in place. Your tenants can certainly engage in some of the preventive and prescriptive measures included in this guide.

Construction Professional
As an architect, engineer, contractor, master builder, inspector, or other professional in the construction industry, the information included in the main corpus of this guide may seem basic to you. However, it is becoming increasingly important to bear these principles in mind.
Keep Safe chapters.

Introduction

Chapter 1: A Safer Site

Chapter 2: Building Protection

Chapter 3: Passive Habitability

Chapter 4: Energy Generation

Chapter 5: Water Management

Chapter 6: Household Preparedness

Chapter 7: Community Engagement
CHAPTER 1
A SAFER SITE: SITE FORTIFICATION STRATEGIES
Fortify your site against extreme natural hazard risks.
Soil Orders of the United States Virgin Islands

Legend
- Alfisols: semi-arid to humid areas
- Aridisols: arid or semi-arid climate
- Entisols: unconsolidated sediment or rock
- Histosols: organic materials
- Inceptisols: more developed unconsolidated sediment or rock
- Miscellaneous: Areas of human altered soil and non-soil areas
- Mollisols: semi-arid to semi-humid areas, typically under a grassland cover.
- Oxisols: tropical rain forest
- Spodosols: typical soils of coniferous or boreal forests
- Ultisols: product of continuous weathering of minerals in a humid, temperate climate
- Vertisols: high content of expansive clay minerals

Map Created by: Manuel Matos
State Soil Scientist/State Geodatta Coordinator
USDA-NRCS Caribbean Area
Medicine, Food, Site Fortification, Shading, Repellent
C. BEGIN THE PLANTING PROCESS

Hydroponic Gardening

- a. Hydroponics is a method of growing plants without soil by using mineral nutrient solutions in a water solvent.

- b. The nutrients used in hydroponic systems can come from an array of different sources; these can include, but are not limited to, byproduct from fish waste, duck manure, or purchased chemical fertilizers.

- d. For all techniques, hydroponic reservoirs are built of plastic, but other materials have been used, including concrete, glass, metal, vegetable solids, and wood. Containers should exclude light to prevent algae and fungal growth in the nutrient solution.

- e. With hydroponic farming, there are two types of watering systems: continuous flow or static. Continuous flow systems, water needs continue circulation through the system and this requires...
CHAPTER 5
WATER MANAGEMENT AND STORAGE
Strategies that provide critical needs for water when a facility loses power or other services
1. ROOF
2. CISTERN
   Roof slope directs water to roof drain
3. DISTRIBUTION FIXTURES
   Can supply by gravity or pump according to cistern location and appliances. Distribution and filtering will vary on use.
4. OPTIONAL
   Supplemental PV system can operate pump if cistern is on below appliances and can serve for critical load.
### Calculate How Much Water You Use Yearly

**People in your Household:** [blank]  

<table>
<thead>
<tr>
<th>Activity</th>
<th>Average Gallons/Person/Day</th>
<th>Your Household Gallons/Person/Day</th>
<th>Your Household Total Gallons/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bath</td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shower</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brushing Teeth</td>
<td>1-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing Face/Hands</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaving</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing Dishes</td>
<td>8-27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washing Clothes</td>
<td>8-14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toilet Flush</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking and Cooking</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Water Used in Your Household**

<table>
<thead>
<tr>
<th></th>
<th>Per Person Per Day</th>
<th>Per Person Per Year</th>
<th>Total Household, Per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
SEWAGE DISTRIBUTION OVERALL VIEW

1. SEPTIC TANK
2. LEACH FIELD
3. DRY WELLS
PERFORATED PVC PIPE
“Waste material” all low liquid waste to flow into surrounding gravel and percolate slowly

SEPARATION LAYER
2” of saw dust or lay between gravel and top soil

GROUND COVER
Nutrient-rich soil appropriate for growing plant

ROCKS

COARSE GRAVEL
3/4 inch to 2 1/2 inch in diameter

TRENCHES
Filled with gravel, lined with perforated pipes that carry liquid waste

PERFORATED PIPES
Mix of 3 feet between pipes between 1.5
CHAPTER 4

ENERGY GENERATION + BACKUP

Strategies that provide critical needs for power when a facility loses power or other services
Solar Potential St. Croix (October 2019)
Solar Thermal and Solar Electric
• Barrio Toro Negro Inc., Ciales
• Casa Pueblo, Adjuntas
• Centro Comunitario de Caimito, San Juan
• Centro de Adiestramiento para Personas con Impedimentos (CAPI Inc.)
• Comunidad Corcovada, Añasco
• Daguao, Naguabo
• Enlace, San Juan
• Ferdinando Abriña Y Casa Ausente, Dorado
• Heart 911, New York City
• Hogar Alberque Para Niños
• Jaquita Baya/ La Comedería, Miramar, San Juan
• PECES, Punta Santiago, Humacao
• Plenitud, Las Marías
• Resilient Power Puerto Rico, San Juan
• Rio Chiquito, Ponce
• Rosalina Abreu y Susana Sanabria,
• Asociación Recreativa Educativa y Comunal Barrio Mariana, INC. (ARECMA), Humacao
• San Juan Bay Estuary, San Juan
• Taller Salud, Loíza
Home Energy Grid
EMERGENCY PREPAREDNESS

STRATEGY 23  Develop a Household Emergency Plan

STRATEGY 24  Choose a Space to Keep Your Family Safe

STRATEGY 25  Respond + Begin Household Recovery
PUTTING IT TOGETHER

Your Action Plan: Steps
Your Building Team
Financial and Programming Resources
Contacts for Resilience Planning and Protection
Building to Code
How to Obtain a Building Permit
Working with your contractor
Insuring Your Property
Funding Resiliency Improvements

USDA Emergency Community Water Assistance Grants
USDA Community Facilities Direct Loan & Grant Program
USDA Water & Waste Disposal Loan & Grant Program
Weatherization Assistance Program (WAP)
VI energy program
Creamos este recurso para ayudar a las comunidades a diseñar centros comunitarios resilientes para fortalecer la capacidad organizativa, promover la educación durante todo el año y poder enfrentar cambios climáticos, sociales y económicos. Ofrece sugerencias prácticas, incluido el desarrollo organización comunitaria, capacidad operativa y activos físicos relevantes para lograr resiliencia.
Systems of a Community Resilience Center

**COMMUNICATIONS**
- KPFL
- Satellite phone
- Land line
- Wi-Fi/data access for voice calls and emergency communication
- Community-level radio station
- Analog line phone, lint

**SERVICES**
- Outdoor shower
- Water tank with pump
- Refrigerator, solar panel

**ENERGY STORAGE**
- Design a backup system that includes batteries for storing energy. Ensure that it is needed. Use additional emergency lighting and electricity for essential equipment—e.g., emergency

**ENERGY GENERATOR**
- Have a backup energy generator for remote areas. Ensure that the generator is placed outdoors, at least 20 ft from the structure, and is protected from debris.

**RAINWATER COLLECTION**
- Install a rainwater collection system for non-potable water reuse, such as irrigation, flushing toilets, and cleaning. If needed, water can be used for drinking.

**VEGETATION**
- Use native vegetation to increase shade, moderate extreme sunlight, reduce heat gain, and generate biomass. This reduces energy costs.

**VENTILATION**
- Design a ventilation system in which air is supplied to the building. The ventilation system should be connected with natural breezes or mechanical with active systems, such as air conditioning.

**SOLAR POWER**
- Install solar panels with batteries (some service in place). Have a connection to a grid for selling power during low use or storing power during high use and/or other forms of renewable energy. Other recommendations for the community-center or individual house: portable solar chargers for mobile phones, solar ovens, portable solar power generation, or electrically powered equipment for critical infrastructure (e.g., air conditioning or refrigeration, solar panels, or back-up diesel generator).
Mitigation-Investment in Community Development

- Advance other community objectives
- Capital improvements, infrastructure protection, open space preservation, and economic resiliency
- A one-time cost for implementing a mitigation action often results in long-term savings to the community.
KEEP SAFE

KeepSafe@enterprisecommunity.org
lschoeman@enterprisecommunity.org