



RED SÍSMICA DE PUERTO RICO

Annex H-1: Tsunamis

(Annex to PREMB Puerto Rico All-Hazards Plan)

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Foreword

The Puerto Rico Emergency Management Bureau (PREMB) Puerto Rico All-Hazards Plan describes the response, recovery and mitigation operations that are applicable across a broad spectrum of potential threats and hazards to support the Commonwealth of Puerto Rico and their survivors. This plan provides general guidance and optionality to support the delivery of emergency management support and describes how PREMB implements the federally adopted *Community Lifelines Construct* and guides how PREMB applies these concepts to disaster operations.

The whole community approach reinforces the fact that PREMB is only one part of the emergency management team that includes partners at the federal, commonwealth, and local levels, non-governmental organizations such as faith-based and nonprofit groups, private-sector businesses, and citizens.

The Commonwealth response and recovery efforts must be integrated and coordinated with the other Commonwealth Government agencies, reflecting individual jurisdictional capabilities, and the unique requirements of any disaster. A common framework supported by standard operating procedures provide a basis from which multiple agencies can work together to prepare for, protect against, respond to, recover from, and mitigate all hazards.



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Document Change Log

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Version	Date	Summary of changes	Name

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Annex C: Tsunamis

1 Introduction

Puerto Rico, the smallest of the Greater Antilles, located between the Atlantic Ocean and the Caribbean Sea is exposed to the occurrence of multiple natural phenomena events among which tsunamis are found. The island reality of Puerto Rico and its geographic location, in a region of continuous seismic activity, makes this type of phenomenon a high-risk hazard and impact for the territory. The magnitude of these phenomena, the destruction potential, and the ability to generate secondary incidents, like floods demand adequate planning and preparation to ensure the safety and well-being of the citizens. For the development of this type of strategies, it is imperative to know said phenomena in order to establish appropriate response and recovery actions.

Tsunamis, also known as tidal waves, are natural phenomena that have historically impacted the coasts of Puerto Rico, generating major life, property, and economic losses. This type of natural event that is generated as a result of a series of waves in the ocean can be produced by local earthquakes, regional and distant earthquakes, submarine landslides, air slides, a volcanic eruption or the impact of a celestial body, the last two being the least likely to occur on the island. This information is known through scientific work carried out by the Puerto Rico Seismic Network Tsunami Program.

The Puerto Rico Seismic Network efforts have included the establishment of a Tsunami Alert System for Puerto Rico and the Virgin Islands, which has been continuously operating since 1996. In Puerto Rico, these actions have been developed under the Tsunami Warning and Mitigation Program of the University of Puerto Rico-Mayagüez Campus. It is through said program that the efforts and services of different agencies in the jurisdiction of Puerto Rico are integrated to safeguard the life and property of individuals. The Tsunami Warning and Mitigation Program incorporates the efforts of the Puerto Rico Seismic Network, the National Weather Service (NWS), and the Puerto Rico Emergency Management Bureau (PREMB), among others, to reduce the impact this kind of natural phenomenon may cause.

This annex is one of the components of the Specific Hazards or Incidents Annex of the Puerto Rico All-Hazards Plan (AHP), as developed by the Puerto Rico Emergency Management Bureau (PREMB by its English acronym). This document details emergency management actions in the event of natural hazards caused by events like tsunamis. It is developed in compliance with the National Incident Management System in accordance with the National Response Structure, as established by the United States Department of Homeland Security.

TsunamiReady is a voluntary community recognition program that promotes tsunami hazard preparedness as an active collaboration among federal, state, territorial and local emergency management agencies, community leaders and the public. The main goal of the program is to improve public safety before, during and after tsunami emergencies. To become TsunamiReady municipalities need a tsunami focal point 24/7, tsunami evacuation plan, evacuation map, signs, ways to receive the alert and disseminate to the public and public education. In Puerto Rico we have 46 communities TsunamiReady®, 44 coastal and 2 non-coastal (Bayamon and Canovanas). Those non-coastal municipalities can be affected by the entrance of the tsunami across the river. You can find the tsunami evacuation maps at [Tsunami Program \(uprm.edu\)](http://TsunamiProgram.uprm.edu). According to de 2010 census, around 250,000 people reside within the tsunami evacuation zone in Puerto Rico. When

planning the evacuation, we must consider residents, the floating community, and the vulnerability of those people such as been over 65, flaking, people with mobility problems and kids under 5 years old. We also have at this moment 16 TsunamiReady supporter agencies that are ready to manage the situation in case of a tsunami impact our coast until the local or state aid come to help them.

1.1 Purpose

The purpose of this Tsunami Specific Hazards Annex for is to serve as a guiding tool for planning, preparedness, response and recovery actions for emergency management while facing the hazards that the occurrence of a tsunami represents to the island. It details the operations and the coordination necessary to carry out response and recovery actions in the event of this type of natural phenomenon.

1.2 Scope

This Annex of Specific Hazards for Tsunamis applies to all government agencies (state and local), the private sector, non-governmental organizations (NGO's) and the general public, in the jurisdiction of Puerto Rico.

1.3 Situation

The planning corresponding to preparedness, response and recovery actions facing natural phenomena such as tsunamis takes into consideration the worst scenario this type of danger represents for the island. A total of 46 municipalities and 250,000 residents can be affected if a tsunami warning is issue. The potential occurrence of a tsunami in the Puerto Rico region requires planning that analyzes this type of danger. Also, it must take into consideration the core capabilities the island has to ensure an adequate response to protect the well-being of all citizens. Some of the critical infrastructure that can be affected by a tsunami are main ports, marines (Ceiba, Fajardo, Cabo Rojo, and others), International Airport Luiz Muñoz Marin, National Weather Service, other airports like Ceiba, San Juan Thermoelectric Plant-PREPA, Guayama Central South Coast, Aguirre Thermoelectric Plant and Central Palo Seco, and others.

1.3.1 Risk Analysis Summary

The location of the island of Puerto Rico between the Atlantic Ocean and the Caribbean Sea, in an area of constant seismic activity, increases the risk of facing the onslaught of a tsunami. As mentioned in the Introduction to this Annex, the occurrence of a tsunami on the coasts of Puerto Rico may arise, among other things, as a result of an earthquake (See the Earthquake Specific Hazards Annex of the Puerto Rico All-Hazards Plan (AHP). In Puerto Rico, major earthquakes have occurred like the ones in 1867 and 1918, the latter being the most recent earthquake to cause a large-scale tsunami in Puerto Rico. As documented in the previously mentioned annex about earthquakes, although the seismic events that are reported daily on the Island are of smaller magnitudes, there is the possibility of an earthquake of a magnitude greater than or equal to 7.1 with the potential of generating a tsunami that affects Puerto Rico and the Virgin Islands.

The consequences of a tsunami off the coast of Puerto Rico would directly or indirectly impact the 3.3 million residents of Puerto Rico, approximate population reported by the United States Census Bureau in 2017. It could significantly impact, mainly, around 250,000 residents (from the tsunami evacuation zone established in the evacuation maps for Puerto Rico), the infrastructure and economy of the 44 coastal municipalities and two non-coastal municipalities (Bayamon and Canovanas where the tsunami could enter through the river). However, the potential for indirect

impact could affect the entire 78 municipalities that comprise the island of Puerto Rico. The catastrophic potential of this type of event requires having the corresponding planning, preparedness, response and recovery strategies to safeguard life, property and economic resources in the event of this type of phenomenon. In 1918 we have around 116 casualties (earthquake and tsunami). Economic losses are estimated to have been around 4 million.

1.3.2 Core Capabilities Assessment

Through the information obtained on the potential occurrence of a natural phenomenon such as a tsunami, the corresponding emergency management actions will be implemented, as determined in this document. Through this annex, the supplies of the Government of Puerto Rico that are considered, as managed by PREMB, will guarantee the best possible emergency management, reducing the loss of life and property and ensuring, as far as possible, the welfare of the survivors. By activating the Emergency Support Functions (ESFs) of the Puerto Rico All-Hazards Plan (AHP), addressing the needs that arise as a result of a tsunami in the Puerto Rico region will be sought. To this end, the Core Capabilities established in the National Preparedness Goal (NPG) have been adopted, grouped into five mission areas: prevention, protection, mitigation, response and recovery. These Core Capabilities will provide the structure to reinforce the teams responsible of managing incidents as a result of the impact of a tsunami off the coast of Puerto Rico.

Figure 1: Mission Areas and Core Capabilities

Prevention	Protection	Mitigation	Response	Recovery
Planning				
Public Information and Warning				
Operational Coordination				
Intelligence and Information Sharing		Community Resilience	Infrastructure Systems	
Interdiction and Disruption			Critical Transportation	Economic Recovery
Screening, Search, and Detection				
Forensics and Attribution	Access Control and Identity Verification	Long-term Vulnerability Reduction	Fatality Management Services	Housing
	Cybersecurity	Risk and Disaster Resilience Assessment	Fire Management and Suppression	Natural and Cultural Resources
	Physical Protective Measures	Threats and Hazards Identification	Logistics and Supply Chain Management	
	Risk Management for Protection Programs and Activities		Mass Care Services	
	Supply Chain Integrity and Security		Mass Search and Rescue Operations	
			On-scene Security, Protection, and Law Enforcement	
			Operational Communications	
			Public Health, Healthcare, and Emergency Medical Services	
			Situational Assessment	

1.4 Planning Assumptions

Tsunamis are one of the natural hazards that pose a risk to the island of Puerto Rico. This type of event, which can be the product of an earthquake, has the potential to generate an emergency of

catastrophic magnitude for the island due to the type of incidents associated with the impact of both phenomena. Considering the different types of scenarios that can arise in the face of these phenomena, this annex is based on the planning assumptions established in the Puerto Rico All-Hazards Plan. In addition, there are specific considerations for emergencies that result from the impact of a tsunami where the planning assumptions presented below will be adopted.

- ❖ Puerto Rico experiences thousands of smaller earthquakes annually that may or may not be felt by citizens. This high seismicity is due to the location of the Island near the edge of the Caribbean Tectonic Plate that interacts with the North American Plate, which in turn could generate a tsunamigenic earthquake. If a local earthquake occur a tsunami can affect our coast in less than an hour, if the earthquake is regional a tsunami can affect our coast between 1 and 3 hours, if is a distant earthquake can take more than 3 hours.
- ❖ The Pacific Tsunami Warning Center (PTWC) along with the Puerto Rico Seismic Network will offer necessary information in real time, through the Tsunami Alert System, of the type of alert that goes into effect once a significant earthquake is registered in the island.
- ❖ If the alert received is a tsunami warning (where the tsunami could affect the coasts) PREMB will send a collective message about the alert in effect, to the Municipal Emergency Management Zones and Offices, using redundant communication systems in the shortest possible time.
- ❖ The municipalities, in turn, will activate their emergency plans and alert the response agencies involved in the management of this emergency and the general public, through the broadcast systems available to them that can include the outdoor sirens and municipalities operational sirens.
- ❖ A tsunami has the potential to generate floods that have been identified in yellow in the tsunami evacuation maps.
- ❖ Citizens in Puerto Rico will respond to evacuation recommendations for tsunami evacuation zones established in the tsunami evacuation maps, moving away from the coast and looking for high ground, following the previously established recommendations in the event of a tsunami emergency.
- ❖ If there are no high areas near the coast, citizens will do a vertical evacuation that consists of going up to the highest floor of a multi-level building that did not get destroyed by the earthquake. Vertical evacuation 4th floor up, or higher.
- ❖ The magnitude of the emergency may require the activation of other plans and/or annexes to carry out response and recovery operations.
- ❖ Once citizens leave the evacuation zone, they should go to the assembly points identified in the tsunami evacuation maps with the letter A.
- ❖ The population may require temporary sheltering services (tent cities) and all shelters will have to be inspected if the tsunami was generated by an earthquake after the emergency, since those could be operational in a short or long term depending on the magnitude of the emergency.
- ❖ In the event of a tsunami resulting from an earthquake, Search and Rescue Teams/ESF-9 can be activated in the event of damage to residential, commercial and institutional structures.
- ❖ In case of a tsunami, the most critical infrastructure, food, fuel, and transportation could be severely affected.

- ❖ Damage to critical infrastructure could significantly impact power generation impacting health services, as well as public safety.
- ❖ Damage to transportation infrastructure could affect maritime-commercial ports and/or airports, causing a delay in the supply of medicines, commodities and food.

2 Operations Concept

Planning, preparedness, response and recovery operations for the natural hazard of a tsunami will be conducted as established in this annex in compliance with the Puerto Rico All-Hazards Plan. Operations will always start at the local level and will have state assistance in case it is necessary. State intervention will occur if local resources have been exhausted or do not exist.

2.1 Tsunami Watch

PREMB's preparedness and planning for the impact of tsunamis in Puerto Rico is supported mainly by the notices received from the PTWC and the efforts of the Puerto Rico Seismic Network. This agency has a monitoring system that obtains necessary data to retransmit alerts issued by the PTWC and, if necessary, issue corresponding notices through the Tsunami Alert System. The monitoring system operates around 30 seismic stations in Puerto Rico and the Virgin Islands (US and British) with a network of around 16 tide gauges located in different coastal areas of the aforementioned islands, equipment that is part of the alert system. Data generated by tide gauges, which are instruments used to measure sea level changes caused by a disturbance in the water column during a tsunami, in addition to seismic data collected by seismic stations, are used by relevant agencies to issue the various tsunami warnings.

The Tsunami Alert System constantly monitors the information generated by the equipment previously described with the objective of identifying and reporting significant seismic events of a magnitude greater than or equal to 3.5 that occur or felt in the PR region. Through said equipment it is possible to locate seismic events and determine their tsunami generating capacity, as well as possible inland reach in each event. The generated information is disseminated to the NWS and PREMB for the corresponding notification.

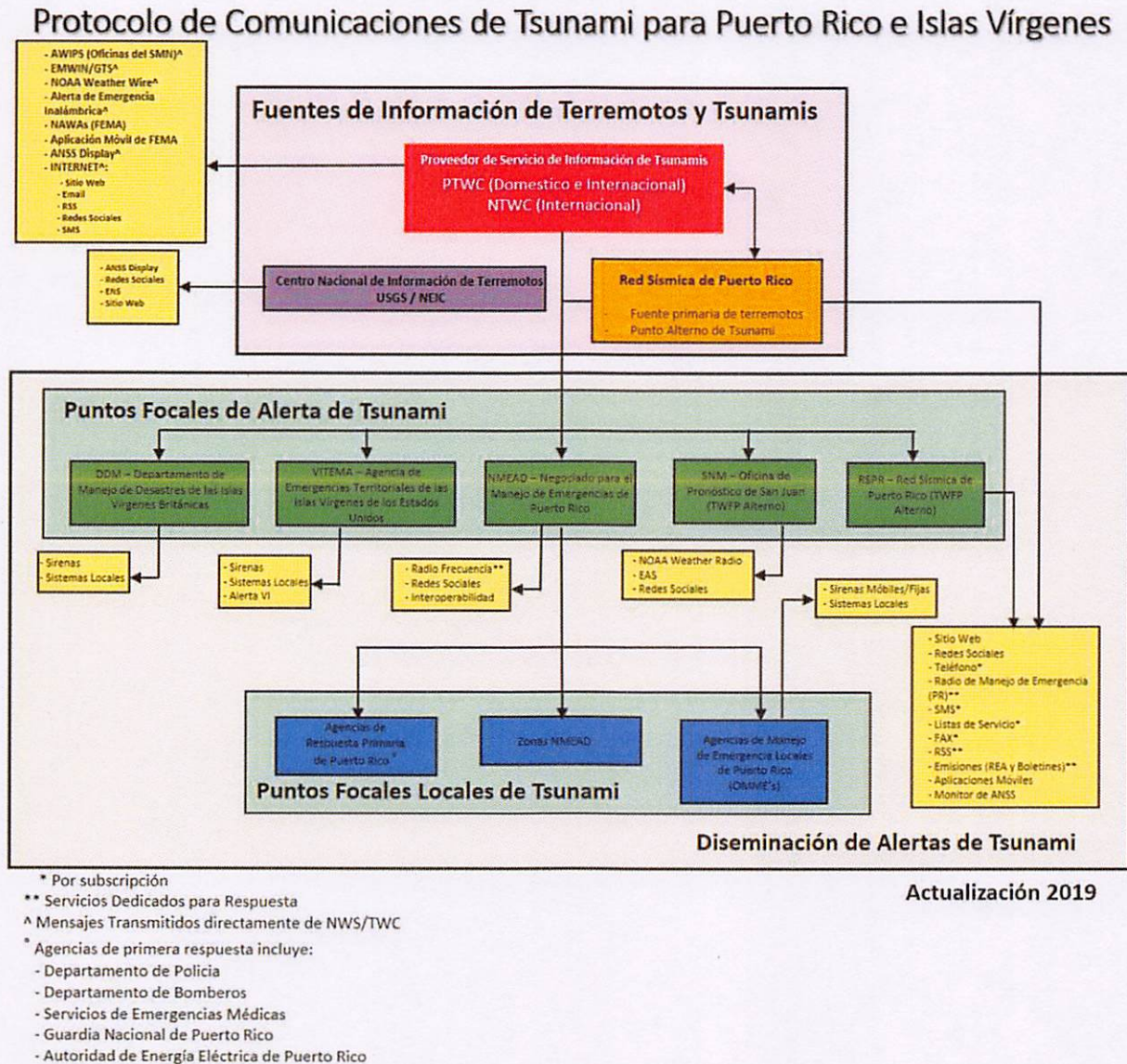
2.2 Notice and Warning

Information related to the notice of a tsunami event affecting the region of Puerto Rico and the Virgin Islands will be received from the Pacific Tsunami Center and the Puerto Rico Seismic Network. Said information will be provided in Puerto Rico to the National Weather Service (NWS) and PREMB. These agencies, in turn, have the responsibility of disseminating the information and implementing the corresponding emergency management actions. Corresponding information will also be released to the British Virgin Islands Department of Disaster Management (BVI-DDM) and the Virgin Islands Territorial Emergency Management Agency (VITEMA), who will oversee the release of related information in their respective islands.

Upon an earthquake in our region of magnitude of 7.1 or a tsunami notice for the jurisdiction of Puerto Rico, PREMB will work in continuous coordination with the respective Agency Zones, the Municipal Emergency Management Offices (OMME, by its Spanish acronym), as well as with other response support agencies. These agencies, led by PREMB, will assume the responsibility of activating corresponding plans and/or annexes, including this document, to ensure the best possible management of the emergency, reducing loss of life and property and ensuring, as best as possible, the welfare of the survivors. On the other hand, the NWS will be in charge of issuing

corresponding alerts through the Emergency Alert System (EAS) and NOAA Radio. PREMB will notify Zones and Local Municipalities after official message from the PR Seismic Network, and/or PTWC. After PREMB and the OMME's, the public will be notified. Figure 2, below, illustrates the flow of information and notification corresponding the concerned agencies in the event of a tsunami for the region of Puerto Rico and the Virgin Islands.

Figure 2: Tsunami communication protocol for Puerto Rico and the Virgin Islands

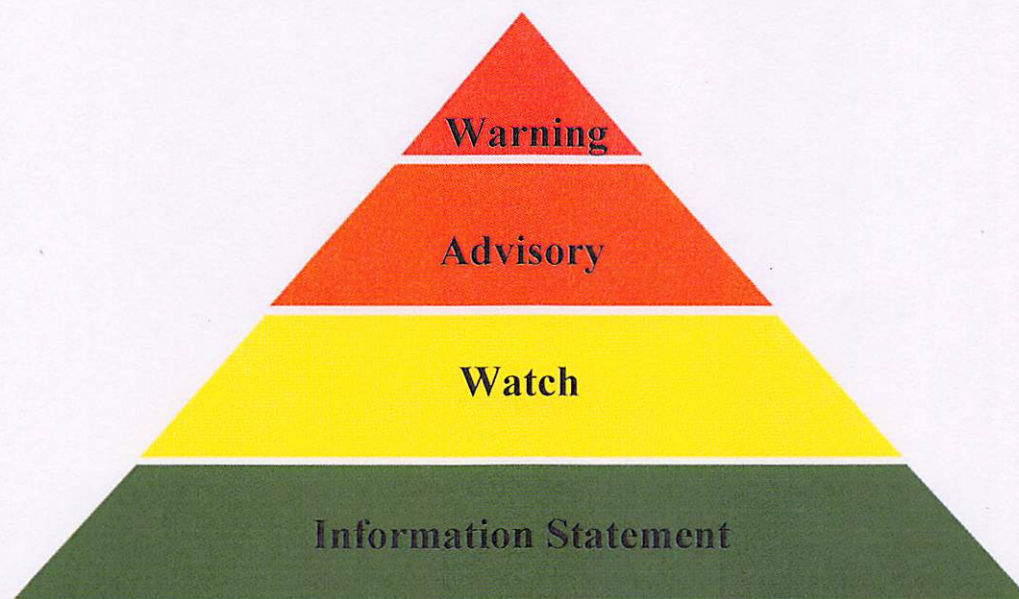


2.3 Tsunami Alerts Levels

Issued notifications will correspond to the alert levels established for this type of natural phenomenon in the region of Puerto Rico and the Virgin Islands. As illustrated next, there are four main tsunami notification levels. These levels, described in greater detail in Appendix H-1:1:

Tsunami Alert Levels of this Annex, begin with a basic information statement related to an earthquake. These alerts increase according to level of importance and require different preparedness and response actions of the relevant agencies, as well as the public. The highest level of alert is warning, which represents imminent coastal flooding as a result of a tsunami event. A cancellation is issued after an evaluation of water-level data confirms that a destructive tsunami will not impact an area under a warning, advisory, or watch or that a tsunami has diminished to a level where additional damage is not expected.

Figure 3: Tsunamis Warning Levels



2.4 Activation and Implementation

The activation of this annex will be carried out by the Governor of Puerto Rico or his/her authorized representative, ensuing the recommendation of the PREMB Commissioner. Such activation will require the execution of certain actions, as established in this Annex, to guarantee the implementation of response and recovery activities when a tsunami impacts the coasts of Puerto Rico. The activation of this Annex may require the concurrent activation and implementation of other annexes and/or plans to be able to act in response of the emergency.

3 Response

Response actions to a natural hazard such as a tsunami can begin with the notification of a seismic incident in the Puerto Rico region. These actions involve numerous efforts in favor of safeguarding, as much as possible, the lives of the citizens in the island. Once the event is notified, and as tsunami alert levels increase, priority will be given to the efforts to ensure full compliance with the main response actions. The highest priority response action will be for citizens to leave the tsunami evacuation areas that could be impacted by the phenomenon.

The response to the imminence of this type of hazard will be supported by the stipulations in the Annexes of the Emergency Support Functions (ESFs) of the Puerto Rico All-Hazards Plan (AHP). This Plan includes the core areas to manage the operations when a tsunami event impacts on the island. Here are some areas taken into consideration during the response to an emergency resulting from this type of phenomenon.

3.1 Evacuation

As mentioned above, leaving the evacuation zones that are at risk of the impact of the tsunami will have the highest priority in the response actions. The evacuation will be a voluntary action on the part of the citizens, but, as previously established, they are expected to abide by the recommendations offered to save their lives. The core recommendation will always be to move away from the coast and look for high places to prevent the direct impact of the floods that are produced as a result of the phenomenon.

The evacuation actions that will be applied under this Annex will be guided by the Flooding and Evacuation Maps for the Tsunami Ready Municipalities (See Appendix H-1:2: Tsunami Ready Program), according to the document developed by the Puerto Rico Seismic Network, NOAA, the University of Puerto Rico in Mayagüez and PREMB. These actions will be supported by the prior identification of out of the evacuation zones as established on the maps, evacuation routes, and assembly points, among other spaces that will support safeguarding the lives of individuals. These spaces are duly identified by information signage (See Appendix H-1:3:- Tsunamis Information Signage) in all the municipalities recognized as Tsunami Ready [Tsunami Program \(uprm.edu\)](http://uprm.edu).

Depending on the expected impact time of the first wave resultant from the phenomenon, different types of evacuation will be recommended and/or carried out. The types of evacuation that are recommended are: total evacuation, partial evacuation, vertical evacuation, or ports, marines, beaches, during an advisory. The table below briefly describes these types of evacuation with the corresponding actions in the event of a tsunami for the jurisdiction of Puerto Rico.

Table 1: Types of evacuation and corresponding actions in the event of a tsunami warning in Puerto Rico

Types of Evacuation	Description	Actions
Total Evacuation	Evacuation that requires the movement of the entire population that is in the coastal and/or flooded areas at risk of the onslaught of the phenomenon.	<ul style="list-style-type: none"> ❖ Notification to the public through the corresponding media and communication systems about an imminent tsunami within the next three hours, for which they are urged to evacuate coastal and floodplain areas to high places or the nearest assembly points. ❖ Activation of ESF #1-Transportation – to support the evacuation actions initiated by the municipalities at risk of having the impact of a tsunami.

		<ul style="list-style-type: none"> ❖ After the evacuation- Activation and advice of ESF #8-Public Health and Medical Services – to support with first aids actions of individuals with medical and access needs. ❖ Activation of ESF #13-Public Safety and Protection – will provide transportation routes and traffic control to carry out the evacuation of the larger number of citizens in coordination with the municipalities. ❖ After evacuation - Activation of ESF #6-Mass Care, Emergency Assistance, Housing and Human Services – to provide collective care, commodities, and emergency assistance, such as the operation of shelters and mass evacuation.
<p>Partial Evacuation</p>	<p>Evacuation of the areas at higher risk within the impact zone of the phenomenon, having the highest probability of being affected.</p>	<ul style="list-style-type: none"> ❖ Notification to the public through the corresponding media and communication systems about the imminence of a tsunami within the next 30 to 45 minutes, for which they are urged to vacate coastal and floodplain areas, move to higher places or to the nearest assembly point. ❖ Activation of ESF #13- Public Safety and Protection – will provide transportation routes and traffic control to carry out the evacuation of the larger number of citizens in coordination with the municipalities.
<p>Vertical Evacuation</p>	<p>Evacuation carried out in the same facility, location or building in which the person is moving to the upper floors if they cannot leave on time and move away from the coast.</p>	<ul style="list-style-type: none"> ❖ Notification to citizens through the corresponding media and communication systems about the imminence of a tsunami within the next few minutes, for which they are urged to evacuate coastal and floodplain areas, move to higher places or upper floors of the structure in which they are situated. The main recommendation is to be located on the fourth floor or higher. <i>Note: Vertical evacuation actions must be evaluated in advance because the height of the structure does not guarantee its safety.</i>

Table 2: Types of evacuation and corresponding actions in the event of a tsunami advisory in Puerto Rico

Types of Evacuation	Description	Actions
<p>Evacuation of ports, marines and beaches</p>	<p>Evacuation that requires the movement of the entire population inside the water at ports and marines that is in the coastal and / or flooded areas at risk of the onslaught of the phenomenon.</p>	<ul style="list-style-type: none"> ❖ Notification to the public through the corresponding media and communication systems about the advisory. Visitors of coastal areas need to evacuate ports, marines and beaches areas to high places or the nearest assembly points. ❖ Activation of ESF #1-Transportation – to support the evacuation actions initiated by the municipalities at risk of having the impact of a tsunami. ❖ After the evacuation- Activation and advice of ESF #8-Public Health and Medical Services – to support with first aids actions of individuals with medical and access needs. ❖ Activation of ESF #13-Public Safety and Protection – will provide transportation routes and traffic control to carry out the evacuation of the larger number of citizens in coordination with the municipalities. ❖ After evacuation- Activation of ESF #6-Mass Care, Emergency Assistance, Housing and Human Services – to provide collective care, commodities, and emergency assistance, such as the operation of shelters and mass evacuation.

3.2 Shelters

The imminence of a tsunami on the coasts of Puerto Rico could require the immediate activation of shelters to be able to accommodate individuals who are evacuating areas at risk of the impact of the phenomenon. In addition, if there is the incidence of this type of event in the Puerto Rico region, there is a high probability that citizens residing in the affected coastal and/or floodplain areas will need to make use of the shelters due to the onslaught the phenomenon has produced in their households. Shelter management relies largely on the strategies outlined in ESF #6 - Mass Care, Emergency Assistance, Housing and Human Services. As established in ESF #6, the Puerto

Rico Department of Housing plays the lead role in these actions supported by other government agencies, as well as voluntary and non-governmental organizations.

4 Recovery

In Puerto Rico, 338 facilities have been identified with the ability to be used as shelters to house individuals in the event of an emergency such as the incidence of a hurricane. The facilities, distributed throughout the 78 municipalities, are classified as shelters. These shelters are mostly public schools, a total of 269, of the Puerto Rico Department of Education (DE). The remaining 69 are either private facilities or facilities of the municipalities. Shelters enabled in Puerto Rico to provide accommodation to citizens in the event of an emergency caused by a weather hazard and have the capacity to house 83,416 people. However, to maintain social distancing due to the pandemic situation, the capacity for accommodation and shelter would be for 41,708 people. As part of the sheltering plan, an outline to transition to non-congregate sheltering as alternate option will be evaluated with federal assistance. These facilities, when facing a catastrophic emergency, without pandemic condition, could expand their accommodation capacity and shelter some 96,038 people.

4.1.1 *Damage assessment*

Assessments of the damage that ensued as a consequence of the impact of a tsunami in the jurisdiction of Puerto Rico will start once it has been identified that the phenomenon has ended (cancellation message). At that time, it must be certified that the dangers of the direct onslaught of the tsunami, such as tsunamigenic waves or secondary earthquakes, have finished. Therefore, the actions carried out should not represent a direct risk to the life of the responders involved in the tasks.

These actions will begin at the local level through the Municipal Emergency Management Offices (OMME) of the respective municipalities affected by the phenomenon. At the state level, these functions will be coordinated through PREMB by the ESF #3-Public Works and Engineering. This Emergency Support Function, which is coordinated and led by the Department of Transportation and Public Works, will be responsible for the following activities:

- ❖ Recognition of damages to critical infrastructure such as water and energy utilities;
- ❖ Identification of damages and cleaning actions, such as removal and disposal of debris in buildings and public properties;
- ❖ Identification of damage and restoration of land routes (bridges and highways) and maritime routes in the impacted areas

Depending on the magnitude of the onslaught of the phenomenon, these actions could result in the identification of the need to request help through the Public Assistance Program. Through the provisions of the Stafford Act, the Public Assistance Program provides supplemental federal disaster assistance for debris removal and disposal; protective measures for emergencies; and the repair, replacement or restoration of public facilities and private facilities of qualifying non-profit organizations that have been damaged by a disaster. This type of assistance will be requested and coordinated by PREMB with due assistance from ESF #3.

In addition, there is the possibility that the onslaught of the phenomenon puts the public health of the island at risk. For that purpose, through ESF #8-Public Health and Medical Services, damage

assessment activities will also be carried out. This Emergency Support Function, led by the Puerto Rico Department of Health, will be responsible for activities such as the following:

- ❖ Identify outbreaks;
- ❖ Identify the quantity, location and condition of human and animal remains;
- ❖ Acknowledgement of environmental contamination incidents;
- ❖ Assessment of drinking water, wastewater and solid waste disposal.

4.1.2 Debris Removal

One of the main consequences of natural phenomena, such as tsunamis, is the creation or presence of debris as a result of the onslaught of the phenomenon. In the event of a tsunami that affects the island of Puerto Rico, it will be necessary to coordinate the pertinent efforts to remove all kinds of debris resulting from the event. To this end, the pertinent tasks will be coordinated through ESF #3-Public Works and Engineering and ESF #11-Agriculture and Natural Resources to guarantee that the works are carried out with the collaboration of the support agencies and, if necessary, request any additional assistance, if required.

These actions will be initiated at the local level to handle incidents that have happened in the respective affected municipalities, with the support of the area. At the state level and led by the Department of Transportation and Public Works under ESF #3, actions related to debris removal include: waste sampling, classification, packaging, transportation, treatment, demolition, and disposal. Such works could include contaminated debris or produced by hazardous materials, so the corresponding tasks will be conducted with the support of ESF #10-Oil and Hazardous Materials Response under the lead of the Environmental Quality Board and in coordination with PREMB.

4.1.3 Public Health

Emergencies, such as tsunamis, have the potential of causing large numbers of casualties. These victims frequently require medical care or attention from one of the different health disciplines, which could overload the service delivery scenarios and the availability of resources. To guarantee adequate attention to the health of the population, the pertinent tasks related to medical care, public health, mental health, fatalities management, among others, will be coordinated through ESF #8-Public Health and Medical Services.

4.1.4 Assistance programs

A tsunami incident in the jurisdiction of Puerto Rico could result in an emergency with catastrophic consequences.

The onslaught of a phenomenon of this magnitude would directly impact citizens, making it imperative to use of support programs. To these ends, the Puerto Rico All-Hazards Plan (AHP) through Emergency Support Function #6 addresses immediate needs of the population facing emergencies and disasters.

ESF #6-Mass Care, Emergency Assistance, Housing and Human Services is led by the Puerto Rico Department of Housing. This Emergency Support Function, with the support of PREMB, coordinates the State's response and recovery operations in close coordination with municipalities local governments, voluntary and non-governmental organizations, the private sector and, if necessary, the Federal government. These recovery efforts will start simultaneously with the response activities.

Among the assistance offered to victims through the ESF #6 operations areas are the following:

- ❖ Shelters
- ❖ Food
- ❖ First aid
- ❖ Emergency items
- ❖ Rental assistance
- ❖ Home repairs
- ❖ Pre-manufactured homes
- ❖ Semi-permanent and permanent construction
- ❖ Food stamps
- ❖ Crisis counseling
- ❖ Disaster unemployment
- ❖ Disaster legal services
- ❖ Support and services for populations with special needs
- ❖ Coordination of federal government assistance

5 Organization and Assignment of Responsibilities

The Annex of Specific Hazards from Tsunamis, in accordance with the Puerto Rico All-Hazards Plan and the National Response Structure, will organize its operations based on the Emergency Support Functions. Through the activation of the different ESFs, as deemed necessary, coordination will be guaranteed to offer the needed assistance to local governments or other sectors requiring it (see the PREMB Emergency Operations Center Standard Operating Procedure for ESFs details). In addition, Section IV. B of the Puerto Rico All-Hazards Plan describes the responsibilities of the different governmental and private sectors that will take part in the management of any type of incident in the Puerto Rico jurisdiction.

6 Direction, Control and Coordination

The direction, control and coordination of the operations of this Annex will be executed in accordance with the provisions of the Puerto Rico All-Hazards Plan (AHP), as adopted from the National Response Framework, maintaining its detailed organizational elements. In addition, all the activities to be carried out will maintain the command and coordination structure of the Incident Command System, as detailed in the Puerto Rico AHP.

7 Data Collections, Analysis and Dissemination

The collection, analysis and dissemination of information related to the incident and response and recovery actions will be directed from the PREMB State Emergency Operations Center (EOC). This will be supported by the collection of tsunamis incidents information from the Puerto Rico Seismic Network, the Pacific Tsunami Warning Center, as well as from the United States National Oceanic and Atmospheric Administration (NOAA).

The information provided by these organizations will be used to perform the corresponding response and recovery actions in the event of a tsunami on the island. Additionally, this information will be shared with the ESFs leaders at the PREMB State EOC. These leaders must keep up-to-date information corresponding to their respective Emergency Support Functions in relation to victims, damage assessments and the status of resources in order to speed up decision-making.

8 Communications

As mentioned above, the agencies in charge of offering official scientific information related to the occurrence of a tsunami for the jurisdiction of Puerto Rico are the Puerto Rico Seismic Network and the Pacific Tsunami Warning Center. These organizations will communicate the corresponding information through their respective web pages and service lists that include emails, text messages, RSS, EMWIN, among other means. This information will be received and disclosed on the island by the National Weather Service and the Puerto Rico Emergency Management Bureau. In addition, this information will be available to the public and the media through the previously mentioned means.

The National Weather Service uses the Emergency Alert System (EAS) managed by the Federal Communications Commission (FCC) to issue emergency communications related to the event. The National Weather Service, in collaboration with PREMB, will activate the EAS given the need to alert the population of Puerto Rico about this incident. This alert system activates a communications network, through radio and television stations, cable television, high definition television and satellites, which transmit the corresponding alert to the public. In addition, the National Weather Service uses NOAA Radio to disseminate information corresponding to the natural phenomenon.

On the other hand, PREMB will activate the Integrated Public Alert and Warning System (IPAWS). Also, through the Municipal Emergency Management Offices (OMME), respective areas of the Agency and various primary response agencies is also responsible of communicating pertinent information to the public. Through the OMME, resources such as mobile sirens, outdoor sirens, telephone tree, circuits and local systems are utilized to alert the public about the danger. In turn, PREMB will inform the appropriate response agencies according to the tsunami alert level. Among the agencies that will be notified are the Puerto Rico Police, the Puerto Rico Fire Department, the Puerto Rico Medical Emergency Corps and the Puerto Rico National Guard.

The actions mentioned previously will be supported by the specifications in the Communications section of the Puerto Rico All-Hazards Plan. The corresponding communications will be carried out with other agencies, municipalities and others concerned parties in relation to the emergency. In addition, as the activity related to the phenomenon changes, the response actions, including those involved, will change.

9 Administration, Finance and Logistics

PREMB, represented through General Service Administration (GSA), is the central point of contact for all emergency requisitions process. Department of Public Safety (DPS) will support this process with the administrative and finance personal staff, as establish in the Circular Letter ASG CC-2021-03.

Each agency purchasing agent will be responsible to process/activate procurement process for the specific agency using the tool created in the WebEOC system.

10 Development and Maintenance

This document, prepared by PREMB's Preparedness Division personnel, has been developed using the "Developing and Maintaining Emergency Operations Plans - Comprehensive Preparedness Guide" (CPG) 101 Version 2.0 as a guide. As well as other related guides, codes or statutes. The

maintenance of this plan will be responsible of PREMA's Planning Division and the Operations Division, who continue direct coordination of its upkeep procedures. A record of each transaction should be file and secure for auditing purpose.

11 Authorities and References

A. Authorities

- ❖ United States Robert T. Stafford Disaster Relief and Emergency Assistance Act Disaster and Emergency Assistance Act.
- ❖ HSPD-5 - Domestic Incidents Management of the United States Department of Homeland Security.
- ❖ HSPD-8 - National Preparedness of the United States Department of Homeland Security.
- ❖ Law 20-2017 - Law of the Department of Public Safety.
- ❖ Executive Order 2014-44 - Executive Order of the Commonwealth of Puerto Rico.
- ❖ Executive Order 2014-43 - Executive Order of the Commonwealth of Puerto Rico.

B. References

- ❖ Department of Homeland Security. (May 2013). National Response Framework (NRF), Second Edition.
- ❖ Department of Homeland Security. National Incident Management System (NIMS).
- ❖ Department of Homeland Security. Incident Command System (ICS).
- ❖ Department of Homeland Security. Federal Emergency Management Agency. (November 2010). Comprehensive Preparedness Guide (CPG) 101 version 2.0.
- ❖ United States Census Bureau. (2014). 2014 Population Estimates. American Fact Finder.
- ❖ Puerto Rico Seismic Network. (2015). Tsunami Program of the Puerto Rico Seismic Network.

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Appendix H-1:1: Tsunami Alert Levels

1 Tsunami Alert Levels

Scientific information related to the impact of a tsunami affecting the Puerto Rico and Virgin Islands regions will be received from the Pacific Tsunami Alert Center (PTWC) and the Puerto Rico Seismic Network. The information will be provided, in Puerto Rico, to the National Weather Service and PREMB. These agencies, in turn, have a responsibility to disseminate the information and implement the corresponding emergency management measures.

Different alert levels will be activated based on the information communicated by the relevant scientific organizations. They will be used to notify different government agencies, the private sector, non-governmental organizations, and volunteers, as well as citizens about the occurrence of this type of natural phenomenon. Depending on the alert level communicated or activated, those concerned are told about the different emergency management measures they must take to move to zones outside the direct impact of the tsunami.

These levels begin on a basic news phase to warn citizens about a seismic event. They will be escalating in importance and relevance of action as the threat is taking place. Table 2 below details the four main tsunami warning levels:

Table 3: Identification of Tsunami Alert Levels according to their Classification, Description of Corresponding Action

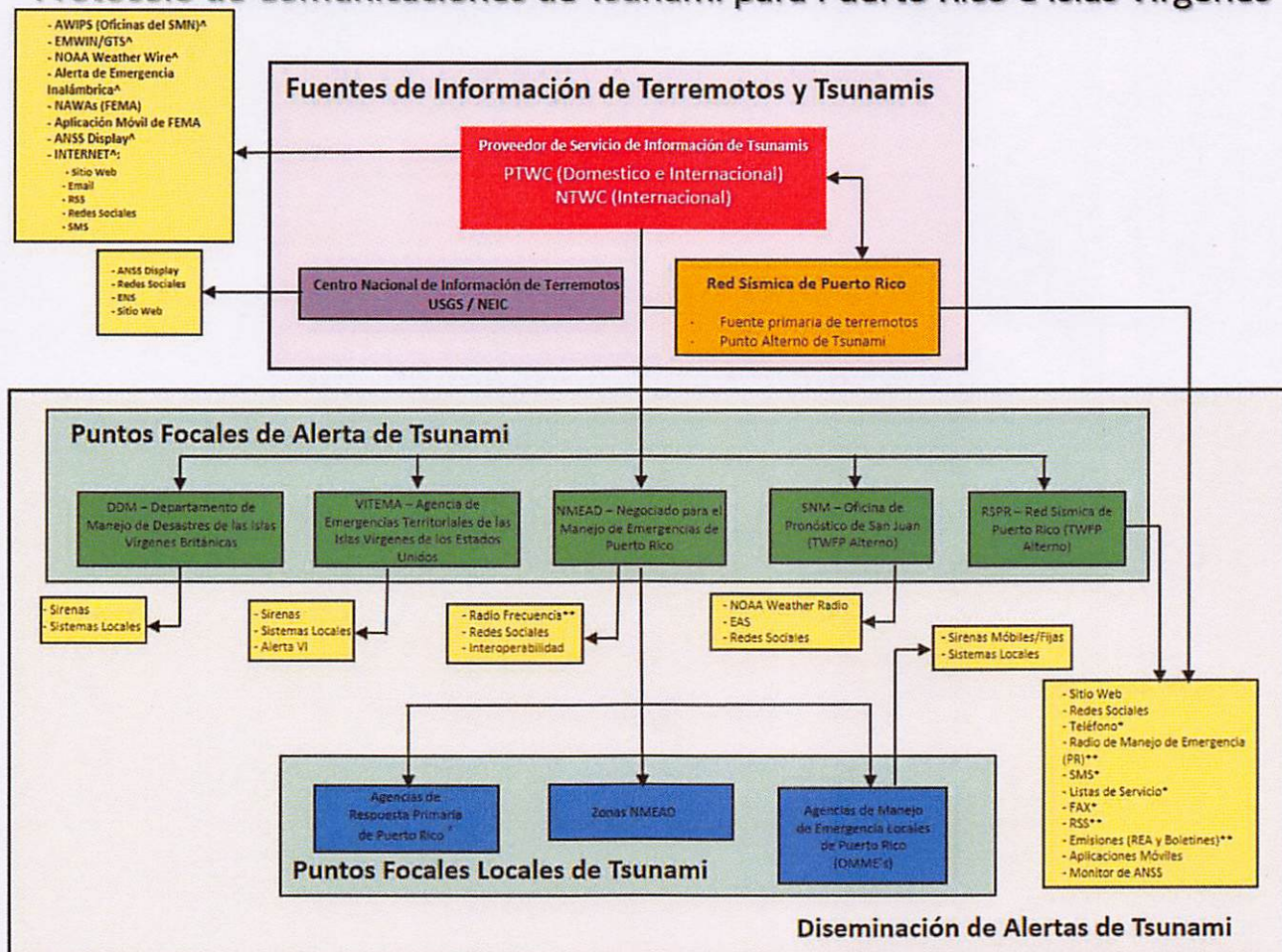
Identification	Classification	Description	Action
Cancellation	PREMB will require a message with cancellation notification from PTWC.	Based on this information other resources could be allowed into the affected area.	Deploy support to affected area and an “all clear notification” from municipalities will be in effect.
Information Statement	4 - Basic	A basic alert level reporting about the occurrence of a seismic event that does not have the potential to generate a tsunami.	An informative message given about the phenomenon that occurred and asks to remain calm as the notice about the occurrence of the event does not represent the origination of such a phenomenon for the coasts of the jurisdiction.

Watch	3	An event has occurred that may eventually affect the coasts of the jurisdiction. It has the potential of scaling to either of the top two levels (advisory or warning), but it could also be canceled according to available scientific information.	Citizens are asked to remain vigilant and informed about the communications being disseminated and to follow emergency management instructions.
Advisory	2	There is a potential danger that a tsunami generates strong currents or dangerous swell on the coasts of the jurisdiction. It has the potential to become a tsunami warning or it could be cancelled according to available scientific information.	The public is advised to leave water bodies, particularly the beaches, marines and ports. As well as staying informed about the progress of the phenomenon, following the emergency management instructions.
Warning	1	The danger is imminent and coastal flooding is expected as a result of the tsunami. The warning may be extended for a few hours after the impact of the first wave.	The main recommendation is to leave the evacuation zones in the maps, mobilize to high areas and follow the emergency management instructions.

Note: See Figure 2 in the Tsunami Alert Section of the Operational Concept of this Tsunami-Specific Hazards Annex that explains the levels of tsunami alerts from the main to the basic

2 Tsunami Communication Protocol for Puerto Rico and Virgin Islands

Protocolo de Comunicaciones de Tsunami para Puerto Rico e Islas Vírgenes



* Por subscripción

** Servicios Dedicados para Respuesta

[^] Mensajes Transmitidos directamente de NWS/TWC

^o Agencias de primera respuesta incluye:

- Departamento de Policía
- Departamento de Bomberos
- Servicios de Emergencias Médicas
- Guardia Nacional de Puerto Rico
- Autoridad de Energía Eléctrica de Puerto Rico

Actualización 2019

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Appendix H-1:2: TsunamiReady Program

The TsunamiReady® Program was established in 2001 by the National Weather Service of the National Oceanic and Atmospheric Administration (NOAA) and the National Tsunami Hazard Mitigation Program to promote community preparedness for this type of natural phenomenon. It supports the communities to minimize the risks posed by tsunamis by developing risk analysis, planning, education, and alerts communications. Through these community assistance strategies, the TsunamiReady Program conducts its primary goal of improving public safety before, during and after tsunami emergencies.

For a community be recognized as TsunamiReady, it must comply with the activities established by the program guides. These guides include activities such as:

- ❖ Define flood and evacuation zones resultant of a tsunami, create evacuation maps, and install evacuation routes signage.
- ❖ Support continued and prolonged education and public participation, including schools in tsunami flood zones.
- ❖ Establish 24-hour operations warning point and support the operations of emergency operations centers.
- ❖ Have a minimum of three ways of receiving tsunami alerts and disseminating them to the public.
- ❖ Develop a formal tsunami operation plan and conduct exercises annually.

In Puerto Rico, all the coastal municipalities (44) and two non-cost municipalities are recognized as TsunamiReady communities by the National Weather Service. These municipalities are mentioned below as per cardinal region and in alphabetical order.

Table 4: Municipalities per cardinal region

North		
Arecibo	Dorado	San Juan
Barceloneta	Hatillo	Toa Baja
Camuy	Isabela	Vega Alta
Carolina	Manatí	Vega Baja
Cataño	Quebradillas	Guaynabo
South		
Arroyo	Juana Díaz	Salinas
Guánica	Patillas	Santa Isabel
Guayama	Peñuelas	Yauco
Guayanilla	Ponce	

East		
Ceiba	Loíza	Río Grande
Culebra	Luquillo	Vieques
Fajardo	Maunabo	Yabucoa
Humacao	Naguabo	
West		
Aguada	Cabo Rojo	Rincón
Aguadilla	Mayagüez	
Añasco	Lajas	

The map below illustrates in blue the municipalities that are in the TsunamiReady Program, as identified by the National Weather Service. The other two municipalities included in the Program are Bayamon and Canovanas.

Source: National Weather Service’s <https://www.weather.gov/tsunamiready/pr-tr>.

Figure 4: Map of TsunamiReady Municipalities in Puerto Rico

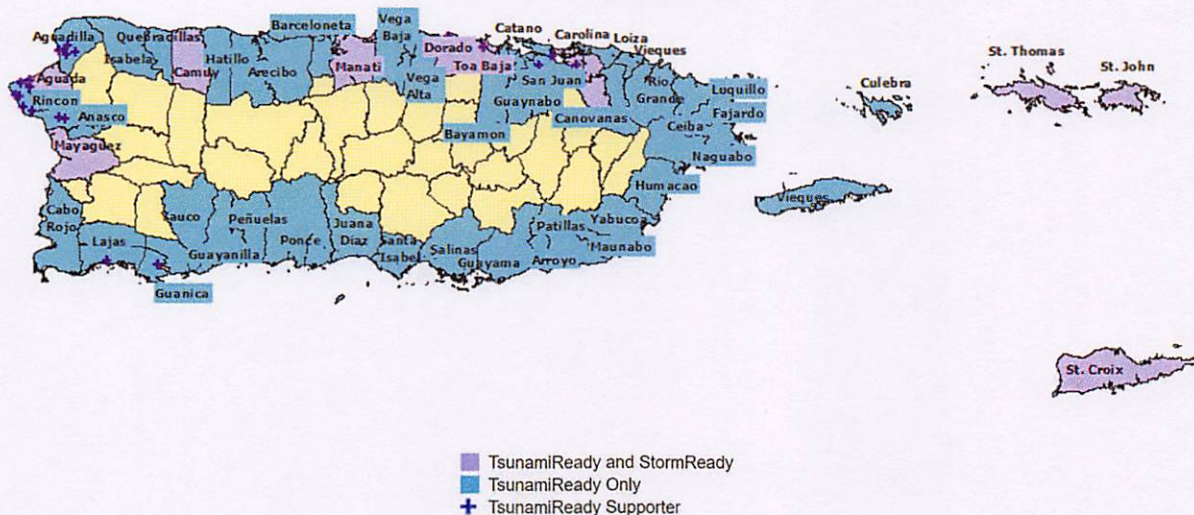
TsunamiReady® in Puerto Rico/U.S. Virgin Islands

[Weather.gov > TsunamiReady®](https://www.weather.gov/tsunamiready) > TsunamiReady® in Puerto Rico/U.S. Virgin Islands

TsunamiReady®
National Program

49 TsunamiReady Communities*:
46 Municipios (Puerto Rico), 3 Islands (U.S. Virgin Islands)
15 Supporters

[Back to TsunamiReady Communities](#)



Note: Municipalities in light violet or lilac are identified as TsunamiReady and Storm Ready by the National Weather Service. The edition of the map included the U.S. Virgin Islands, St. Thomas, St. Croix and St. John, who also have both recognitions.

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Appendix H-1:3: Tsunami Information Signage

The signage or location of information signage is one of the activities that allows to recognize a community as TsunamiReady. Through these visual means of information, the community is alerted about strategies to be adopted, as well as direction routes to protect their lives from the occurrence of this type of hazard. The signage are part of the evacuation routes and maps used by emergency management agencies to ensure the safety of citizens by guiding them through high areas to established meeting points. Below are some of the commonly used signage with their respective description.

Figure 5: Information Tsunamis Signage

	<p>Entering Tsunami Hazard Zone - Notifies the public they are entering a flood zone if a tsunami occurs.</p>
	<p>Leaving Tsunami Hazard Zone - Notifies the public they are leaving flood zone if a tsunami occurs.</p>
	<p>Tsunami Evacuation Route - Notifies the public about the route to evacuate the tsunami hazard zone.</p>
	<p>Danger Zone - Notifies the public they are in a flood zone if a tsunami occurs and must move to a higher place or away from the coast.</p>
	<p>Assembly Point –Identifies assembly place or meeting point where the authorities will give needed assistance if a tsunami occurs.</p>

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