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LOCAL HAZARD MITIGATION PLAN

Municipality of
San Germán



LOCAL HAZARD
MITIGATION PLANS

Protect Through Planning

PROFESIONAL LICENSED PLANNER CERTIFICATION

As per Act 160-1996, as amended (20 L.P.R.A § 3501 - 20 L.P.R.A § 3515), I _____, who bears Puerto Rico professional planning license number ____, certify that this document has been prepared using the best available sources and is in accordance with the best practices of the planning profession as of _____, 2026. And I certify this herewith my professional seal.

DRAFT

STATEMENT OF FUNDING

This Local Hazard Mitigation Plan (LHMP) for the Municipality of San Germán is funded with a grant given to the Puerto Rico Planning Board by the Central Office for Recovery, Reconstruction and Resiliency.

This LHMP was prepared by the consulting firm AtkinsRéalis Caribe, LLP as per the stipulations of contract number 2026-000032.

LANGUAGE REQUIREMENT

In Accordance with Presidential Executive Order #14224, the 2026 version of San Germán Local Hazard Mitigation Plan has been prepared in English for submission and consideration of FEMA. A non-certified translation of the final draft for public discussion and the final approved LHMP to Spanish was prepared for the benefit of the population that is not English proficient. Should any discrepancy arise between the English and the Spanish text, the English one shall prevail.

STATEMENT ON MAPS

The maps presented on this document are related to a planning exercise. It is not the intention of these maps to establish any regulatory requirement, procedure or benefit.

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LIST OF COMMONLY USED ACRONYMS

AMMED	Municipal Agency for Disaster and Emergency Management, by its Spanish Acronym
CEACC	Comité de Expertos y Asesores sobre Cambio Climático
DHS	Department of Homeland Security
DNER	Department of Natural and Environmental Resources
DPS	Department of Public Safety
DTPW	Department of Transportation and Public Works
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IFRC	International Federation of the Red Cross
IRRM	Interim Risk Reduction Measures
LHMP	Local Hazard Mitigation Plan
LUMA	Luma Energy
mph	Miles per hour
NDRF	National Disaster Recovery Framework
NIMS	National Incident Management System
NIST	National Institute of Standards and Technology
OPM	Municipal Public Works, by is Spanish acronym
PRASA	Puerto Rico Aqueduct and Sewers Authority
PREMB	Puerto Rico Emergency Management Bureau
PREPA	Puerto Rico Electric Power Authority

PRHTA	Puerto Rico Highway and Transportation Authority
PRPB	Puerto Rico Planning Board
PRSN	Puerto Rico Seismic Network
PT	Territorial Plan, by its Spanish acronym
PUT-PR	Puerto Rico Land Use Plan, by its Spanish acronym
SFLA	Southern Federal Land Assessment
UHI	Extreme Heat Island
USACE	United States Army Corps of Engineers
USDOT	United States Department of Transportation
USGS	United States Geological Survey

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EXECUTIVE SUMMARY

This document is the 2026 update of the Local Hazard Mitigation Plan (LHMP) for the Municipality of San Germán, Puerto Rico. It is prepared to reduce risks associated with natural hazards and enhance community resilience by identifying hazards, assessing risks, and proposing mitigation strategies. The plan complies with federal regulations, including the Stafford Act and Disaster Mitigation Act of 2000, and incorporates public participation and interagency coordination. It is funded by a grant from the Puerto Rico Planning Board and prepared by AtkinsRéalis Caribe, LLP.

Introduction and Background

The Municipality of San Germán and the Puerto Rico Planning Board are committed to protecting residents by updating the LHMP, which provides a structured approach to hazard mitigation consistent with federal, state, and local policies. The plan identifies natural hazards, evaluates risks, and supports land use planning to achieve sustainability and resilience. It also complies with FEMA requirements to maintain eligibility for federal funding and is regularly updated to reflect evolving conditions.

This plan follows the following objectives

- Identify and evaluate natural hazards threatening the municipality.
- Establish strategies to reduce risks to life, property, and services.
- Promote interagency coordination and community involvement

Public Policy

The plan aligns with federal, Puerto Rico, and municipal policies guiding hazard mitigation and resilience for example.

- The Stafford Act and its Hazard Mitigation Grant Program provide funding for cost-effective mitigation.
- The Disaster Mitigation Act of 2000 requires LHMP adoption for federal funding eligibility.
- The National Flood Insurance Act establishes the NFIP to provide flood insurance and encourages floodplain management.

- FEMA's regulations (44 CFR Part 201) and planning guides outline requirements and procedures for mitigation planning.
- The National Disaster Recovery Framework guides recovery coordination.
- The National Earthquake Hazards Reduction Program and National Incident Management System that support seismic risk reduction and emergency response.

Puerto Rico Policies

- Act No. 161-2009 reforms the permitting system to improve efficiency.
- Act No. 33-2019 mandates mitigation and resilience measures in response to changing weather patterns.
- Act No. 107-2020 (Municipal Code) which gives municipalities some powers for to regulate land use.
- The Puerto Rico Land Use Plan (that PUT-PR) classifies land and guides sustainable development.
- The Puerto Rico State Natural Hazard Mitigation Plan (2021) provides a jurisdiction-wide framework.
- The Puerto Rico Mitigation Action Plan (CDBG-DR MIT) directs federal mitigation funds post-hurricanes Irma and María.
- The San Germán LHMP (2020) and Municipal Recovery Plan establishes prior mitigation frameworks and recovery priorities.

Planning Process

The 2026 LHMP update follows FEMA guidelines and includes a Planning Committee with municipal officials, public outreach through meetings and notifications, and stakeholder involvement. Public participation included three community meetings with opportunities for feedback. The plan integrates FEMA Lifelines (Safety and Security, Food, Hydration and Shelter, Health and Medicine, Energy, Communications, Transportation, Hazardous Materials, Water Systems) to prioritize critical services.

Municipal Profile

San Germán is a landlocked municipality in southwest Puerto Rico, with 19 wards (barrios). It has a rich historical background from Indigenous Taíno culture through Spanish colonial times, with a historic urban core featuring significant architectural heritage. Geography includes the Sabana Grande Valley and surrounding hills, influencing settlement and hazard exposure. The municipality covers about 141.2 km².

Key findings of the municipal assessment include:

Demographics

According to the 2024 ACS, the Municipality of San Germán has an estimated population of 31,305 residents, composed of 48.57 percent males and 51.43 percent females. The municipality's demographic profile reflects important considerations for hazard mitigation planning, particularly because 34.3 percent of the population is considered vulnerable due to being under 19 years of age or over 65 years of age. The age distribution also indicates a declining youth population and a growing elderly population, a trend that may increase the demand for targeted emergency preparedness, evacuation assistance, health services, and long-term resilience measures.

Socioeconomic Conditions

Socioeconomic conditions further shape the municipality's exposure and capacity to prepare for, respond to, and recover from hazard events. Labor force participation is estimated at 35 percent, with an unemployment rate of 8.2 percent. Major employment sectors include education, healthcare, retail trade, and professional services. At the same time, 49.6 percent of individuals live below the poverty level, the median household income is \$18,317, and 27.5 percent of households earn less than \$10,000 annually. These conditions indicate that a substantial portion of the population may have limited financial resources to undertake preparedness measures, retrofit homes, relocate from hazard-prone areas, or recover after disasters.

Additional indicators of social vulnerability include the increase in the number of individuals living with disabilities, which rose to 4,563 people, representing a 39.35 percent increase. In addition, 52.5 percent of households receive food assistance and approximately 5 percent of the population is uninsured. These factors underscore the importance of prioritizing mitigation actions that strengthen access to essential services, improve continuity of operations, and address the needs of residents who may require additional support before, during, and after emergency events.

Housing

Housing and infrastructure conditions are also central to the municipality's risk profile. San Germán has 16,255 housing units, of which 27 percent are vacant. A significant share of the housing stock was constructed before the adoption of current building

codes, with 97.6 percent of units built prior to 2011. This condition may increase structural vulnerability to earthquakes, tropical cyclones, flooding, and other hazards. Transportation access is another important consideration, as 15.8 percent of households have no vehicle available, which may affect evacuation capacity and access to emergency services.

Critical Infrastructure and FEMA Lifelines

The LHMP assesses municipal infrastructure in alignment with FEMA Lifelines, including safety and security; food, hydration, and shelter; health and medical services; energy; communications; transportation; hazardous materials; and water systems. Critical facilities such as hospitals, police facilities, emergency centers, shelters, and related assets are mapped and evaluated to understand their exposure and role in supporting emergency response and community recovery. This lifeline-based approach helps identify where mitigation investments can protect essential services and reduce cascading impacts during hazard events.

Recent Development

Recent development patterns were also reviewed as part of the municipal profile. From 2020 through mid-2026, construction permits averaged approximately 55 permits per year, with development activity distributed primarily near the historic center and other urbanized areas. Understanding where recent development has occurred allows the municipality to evaluate whether new growth is taking place in or near hazard-prone areas and to integrate mitigation considerations into land use, permitting, infrastructure planning, and future investment decisions.

Hazard Profiles and Risk Assessment

The LHMP evaluates eight prioritized hazards: earthquake, landslides, flooding, tropical cyclones/extreme winds, extreme heat, drought, wildfire, and pandemic/epidemic. Each hazard is described with its characteristics, affected areas, risk magnitude, past events, future probabilities, risk analysis, social vulnerabilities, and impacts on natural and cultural resources.

Earthquake

Puerto Rico is located within a tectonically active region characterized by multiple fault systems, making earthquake risk a significant concern for San Germán. The

assessment considers earthquake intensity, magnitude, spectral acceleration, and ground motion as key indicators of potential impacts. The highest spectral acceleration zones are located in the northern portion of the municipality, including areas near the historic urban core, where older structures and cultural resources may be especially vulnerable.

Estimated annualized earthquake losses are approximately \$6.7 million, reflecting the potential for substantial damage to buildings, infrastructure, and essential services. Earthquakes may affect all FEMA Social vulnerability is heightened by poverty, aging infrastructure, limited household resources, and the presence of residents who may require additional assistance during response, and recovery.

Recent seismic activity, including the significant 2020 southwestern Puerto Rico earthquake sequence, demonstrates that earthquake hazards remain an ongoing concern for the municipality. Because of Puerto Rico's tectonic setting, future earthquake risk is expected to remain high, requiring continued attention to structural resilience, emergency preparedness, critical facility protection, and mitigation measures that reduce potential damages and service disruptions.

Landslides

Landslides in San Germán are primarily triggered by intense rainfall and are influenced by slope conditions, soil characteristics, geology, land cover, drainage patterns, and human activity. The most susceptible areas are generally located in the mountainous northern wards, where steep terrain and infrastructure access constraints can increase both exposure and response challenges.

Although precise monetary loss estimates are not available for landslides, the hazard can disrupt transportation corridors, utility systems, emergency access, and other essential services. Social vulnerability is closely tied to geographic isolation, road access limitations, infrastructure fragility, and the ability of residents to receive timely assistance during and after hazard events.

Past landslide impacts were notably observed after Hurricane María in 2017, when intense rainfall produced slope failures across many areas of Puerto Rico. Given the municipality's terrain, rainfall patterns, and the presence of development in susceptible areas, landslide risk is expected to continue and should remain a priority for mitigation, land use planning, infrastructure maintenance, and emergency response coordination.

Flooding

Flooding in San Germán includes both general flooding and flash flooding, most often associated with tropical weather systems and intense rainfall events. Flood hazard areas are mapped extensively along the Guanajibo River Valley, where floodwaters can affect residential areas, infrastructure, transportation routes, and critical services. The risk assessment identifies flooding as a high-probability hazard with the potential to cause significant property damage, health risks, and infrastructure impacts. Estimated flood exposure includes more than \$263 million in building value. While flood control projects are present and the municipality participates in the NFIP with 137 policies in force, including some repetitive loss properties, flooding remains a persistent concern that requires continued mitigation, floodplain management, and public preparedness actions.

Social vulnerability to flooding is especially high among low-income residents, mobility-limited populations, and households with limited access to transportation or financial resources. These conditions can affect the ability of residents to evacuate, protect property, obtain insurance, or recover after flood events. As a result, flood mitigation remains a central priority for reducing losses, protecting public health, and strengthening community resilience.

Tropical Cyclones/Extreme Winds

Tropical cyclones and extreme wind events represent some of the most frequent and damaging hazards affecting San Germán. These events range from tropical storms to Category 5 hurricanes, as classified by the Saffir-Simpson Hurricane Wind Scale. The entire municipality is considered exposed to their impact.

Historic hurricanes, including Irma and María in 2017, demonstrate the municipality's exposure to severe wind that can cause power outages, infrastructure damage, economic disruption, and extended recovery needs. The risk assessment maps estimated building damage and economic losses for both 100-year and 500-year events, illustrating the potential severity of future hurricane impacts.

Because tropical cyclones can affect all FEMA Lifelines, including energy, communications, transportation, safety and security, health and medical services, food and shelter, water systems, and hazardous materials, their impacts can cascade across the community. Social vulnerability is considered widespread due to the

municipality-wide exposure of residents, housing, infrastructure, and essential services.

Extreme Heat

Extreme heat is defined as prolonged periods of temperatures above 90 degrees Fahrenheit combined with high humidity, conditions that can increase health risks and place stress on infrastructure systems. Developed areas may experience higher temperatures due to the urban heat island effect, increasing exposure for residents in more urbanized portions of the municipality.

Extreme heat can affect public health, energy demand, transportation systems, communications, and other essential services. Older adults and other vulnerable populations may face elevated risk, particularly when risk perception is low or when access to cooling, medical care, or reliable transportation is limited. Health impacts may include heat-related illness and increased mortality among sensitive populations.

Future projections indicate that temperatures and the frequency of extreme heat events are expected to rise, reinforcing the need for mitigation actions such as public outreach, urban greening, shade improvements, cooling strategies, and infrastructure adaptation. These measures can reduce exposure, improve preparedness, and protect vulnerable residents during periods of excessive heat.

Drought

Drought in San Germán is characterized by prolonged precipitation deficits that can affect water supply, agricultural activity, economic conditions, and the continuity of essential services. This hazard may occur as a meteorological, agricultural, hydrological, or socioeconomic drought. All these types of droughts can impact water availability and community functions.

Drought conditions can lead to water rationing, affect economic and agricultural activities, increase stress on households and businesses, and contribute to increased wildfire potential. Previous drought events have been documented through federal declarations, demonstrating that the hazard has affected Puerto Rico in the past and remains relevant to local mitigation planning.

Future drought frequency is expected to increase, reinforcing the need to strengthen

water conservation, emergency water supply planning, infrastructure resilience, public awareness, and coordination with regional water providers. Social vulnerability is particularly important for elderly residents and low-income households, which may have fewer resources to adapt to water interruptions, higher utility costs, or related public health and economic impacts.

Wildfire

Wildfire consists of uncontrolled fires that may occur in vegetated or dry forest areas and may be intensified by drought conditions and long-term climate trends. Wildfire behavior may include surface fires, crown fires, ground fires, and interface fires where developed areas meet wildland vegetation, creating potential risks to residents, structures, infrastructure, and natural resources.

San Germán has historically experienced a relatively low incidence of wildfire; however, some areas near municipal borders present higher potential risk. Wildfires can threaten natural ecosystems, cultural resources, public infrastructure, transportation access, and nearby communities. Recent 2024 wildfire data identified multiple small incidents, indicating that the hazard should continue to be monitored as part of the municipality's risk profile.

Social vulnerability to wildfire is associated with poverty, disability prevalence, limited evacuation capacity, and constraints on household preparedness. Although current wildfire incidence is comparatively low, future risk may increase as dry conditions become more frequent and vegetation stress intensifies. Mitigation measures such as public education, defensible space practices, vegetation management, emergency access improvements, and interagency coordination can reduce potential impacts.

Pandemic/Epidemic

Pandemic and epidemic hazards include localized disease outbreaks as well as widespread events that can extend across regions, nations, or globally. For planning purposes, the entire municipality is considered vulnerable because infectious disease impacts can affect residents, institutions, workplaces, schools, healthcare providers, and essential services throughout San Germán.

Puerto Rico has experienced several historic outbreaks, including cholera in 1855, measles in 1917, the Spanish Flu in 1918, polio in 1960, as well as, dengue, chikungunya, Zika, and COVID-19 in recent years. The COVID-19 pandemic produced significant

health, economic, and social impacts locally and illustrated how disease events can disrupt normal community functions, increase demand for public health services, and affect vulnerable populations.

During pandemic and epidemic events, the healthcare lifeline is typically the most directly affected; however, other FEMA Lifelines may also experience disruptions, including communications, transportation, food supply, shelter operations, public safety, and continuity of government functions. Future pandemic risk remains elevated due to changing environmental conditions, population characteristics, travel patterns, and the continued emergence of infectious diseases. Mitigation and preparedness efforts should therefore emphasize public health coordination, risk communication, continuity planning, support for vulnerable populations, and sustained emergency management capacity.

Hazard Prioritization

The Planning Committee used the results of the hazard profiles and risk assessment to establish mitigation priorities for the Municipality of San Germán. Based on the analysis, earthquakes, landslides, flooding, tropical cyclones and extreme winds, extreme heat, drought, and wildfire were identified as high-priority hazards. Pandemic and epidemic hazards were categorized as mid-priority. This prioritization exercise conducted with the planning committee was a qualitative exercise which takes into consideration the municipality's exposure, potential impacts to people and property, effects on critical infrastructure and FEMA Lifelines, and the needs of socially vulnerable populations.

Municipal Capabilities

The LHMP is supported by a range of planning mechanisms, regulatory frameworks, and municipal capacities that guide land use, permitting, floodplain management, infrastructure investment, emergency response, and long-term resilience. These include the Karst Special Planning Area Plan, the Joint Regulation for Permits, the Special Flood Hazard Areas Regulation, the Puerto Rico Building Code, the Stormwater Systems Regulation, the San Germán Territorial Plan, and the San Germán Emergency Operation Plan. The municipality also participates in the National Flood Insurance Program and complies with the Clean Water Act's NPDES program. In addition, the plan recognizes the value of green infrastructure and nature-based solutions for stormwater management, while the Four-Year Investment Program (PICA) serves as a tool to align public investment with hazard mitigation priorities.

San Germán's technical and administrative capacity is supported by municipal offices with responsibilities related to planning, land use, emergency management, and federal programs. These include a staffed Planning and Land Use Office, Emergency Management Office, and Federal Programs Office, with engineering and specialized technical expertise procured as needed. The municipality's financial capacity is strengthened by positive fund balances and access to federal funding sources, including FEMA's Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Building Resilient Infrastructure and Communities (BRIC), and HUD's CDBG-DR and CDBG-MIT programs.

Public outreach and capacity development are also central components of the LHMP. The municipality uses social media, printed materials, and community meetings to inform residents, gather input, and promote public participation in the mitigation planning process. Capacity-building efforts include staff training and collaboration with academic institutions, supporting the municipality's ability to implement mitigation actions and strengthen institutional knowledge. The plan emphasizes clear, inclusive, and accessible communication to improve hazard awareness, encourage preparedness, and increase community participation.

Mitigation Action Plan

The Mitigation Action Plan establishes goals and objectives to reduce hazard impacts, protect life and property, strengthen infrastructure, increase public knowledge, and improve recovery capacity. Its objectives include preventing loss of life and property, improving municipal program implementation, educating residents and businesses about hazard risks, and strengthening emergency response and intergovernmental coordination. Mitigation strategies are organized into categories such as prevention, property protection, natural resource protection, structural mitigation, emergency services, and public awareness and outreach. These strategies include updating land use and emergency management plans, improving stormwater management, conducting hazard drills, supporting infrastructure resilience, and addressing extreme heat through urban greening and response planning among others.

Overall, the 2026 San Germán LHMP update integrates hazard assessments, policy frameworks, municipal capabilities, community input, and actionable mitigation strategies into a comprehensive planning tool. Through this integrated approach, the municipality seeks to reduce risk, protect essential services, guide future investments, and strengthen resilience to natural hazards and public health emergencies over the

coming years.

DRAFT

1. INTRODUCTION AND BACKGROUND

The Municipality of San Germán and the Puerto Rico Planning Board (PRPB) are committed to protecting the well-being of Puerto Ricans by fostering cultural, social, and economic growth while prioritizing public health and safety. As part of this commitment, the Municipality and the PRPB have agreed to jointly update the Municipality's Local Hazard Mitigation Plan (LHMP). The LHMP provides a structured and comprehensive approach to reducing risks associated with natural hazards and strengthening overall community resilience.

In recent years, San Germán has faced considerable impacts from natural disasters, emphasizing the urgent need for proactive actions to reduce vulnerabilities and safeguard critical infrastructure. These experiences highlight the importance of implementing a coordinated and systematic hazard mitigation strategy that is consistent with federal, state, and local policies.

A LHMP identifies and evaluates potential natural hazards and defines actions designed to reduce or eliminate risks to people, property, and the environment. The plan supports the municipality's land use planning efforts by establishing measures that assist San Germán in achieving its long-term sustainability and resilience objectives.

This LHMP complies with the requirements set forth by the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) and the federal regulations derived from it. Under this legislation, local governments in states and territories are required to develop and formally adopt a hazard mitigation plan as a condition for eligibility to receive certain types of funding administered by the Federal Emergency Management Agency (FEMA).

Risk mitigation plays a critical role in guiding future development and enhancing existing municipal infrastructure. To ensure an effective mitigation strategy, the LHMP is updated every five years to reassess natural hazards that may threaten the lives and property of residents and to incorporate appropriate and responsive mitigation measures.

The development of this plan was conducted through a coordinated process that incorporated input from state and local agencies, non-governmental organizations, and the public. The overarching goal is to enhance the municipality's capacity to

anticipate, reduce, and effectively respond to natural hazards that may affect its jurisdiction.

The primary objectives of the LHMP are to:

- Identify and evaluate natural hazards that pose risks to the municipality.
- Establish strategies and actions to reduce or eliminate long-term threats to life, property, and critical services.
- Encourage interagency coordination and promote community involvement in disaster preparedness and mitigation initiatives.

1.1 APPLICABLE PUBLIC POLICIES

This section outlines the relevant federal, state and municipal public policies that guide the development of the 2026 San Germán LHMP. The overview provided is not intended to be comprehensive. Additional public policies are referenced throughout the document, particularly in Section 4.15.

1.1.1 FEDERAL POLICIES

The following federal policies establish the framework for hazard mitigation planning and resilience efforts

1.1.1.1 FEDERAL LAWS

Stafford Act

The Stafford Act¹ is primarily aimed at reducing loss of life and property, alleviating human suffering, minimizing economic impacts, and lowering the costs associated with disaster assistance. In 1988, Congress amended the Act to create the Hazard Mitigation Grant Program (HMGP), which became the principal source of federal mitigation funding following a disaster declaration by the President of the United States. Through this program, funds are made available to states and territories to implement cost-effective measures that reduce the risk of damage and losses from future hazard events.

¹ 42 U.S. Code § 5121 et. seq

Disaster Mitigation Act of 2000

Enacted on October 30, 2000, the Disaster Mitigation Act of 2000 (DMA 2000) further amended the Stafford Act to enhance disaster planning, response, and recovery at all levels of government. This legislation establishes eligibility requirements for municipalities to access federal mitigation funding, including the preparation and adoption of a Local Hazard Mitigation Plan (LHMP). A LHMP demonstrates a jurisdiction's commitment to reducing risks associated with natural hazards and serves as a decision-making tool for implementing preventive and mitigation actions. It also provides a framework for the State to deliver technical assistance and establish funding priorities.

In accordance with DMA 2000 requirements, this LHMP is comprehensive and coordinated, incorporating the participation of state, local, and regional agencies, non-governmental organizations, and members of the public.

National Flood Insurance Act

The National Flood Insurance Act² established the National Flood Insurance Program (NFIP) to provide affordable flood insurance coverage to homeowners, businesses, and renters located in flood-prone areas. The program was designed to reduce the financial burden on individuals and the federal government in the aftermath of flood-related disasters.

The Act also encourages participating communities to adopt and enforce minimum floodplain management standards aimed at reducing future flood risks. Communities that comply with these requirements become eligible for NFIP benefits and programs. Access to flood insurance enables property owners to recover more rapidly following flood events without relying solely on federal disaster assistance. Supporting legislation, such as the Flood Disaster Protection Act of 1973, further requires federally regulated lenders to mandate flood insurance coverage for properties located in high-risk flood zones and financed through federally backed mortgages.

The Federal Emergency Management Agency (FEMA) has recognized the Municipality

² 42 U.S. Code § 4001 et. seq.

as part of the region that is within the PRPB's coverage within the National Flood Insurance Program. The municipality can request updates and amendments to flood hazard maps utilized by the NFIP through the PRPB.

Additionally, through participation in the Flood Mitigation Assistance Program, the municipality has identified specific mitigation strategies to reduce flood-related risks. Funding has also been allocated for the acquisition of structures located in high-risk flood areas as part of ongoing efforts to decrease vulnerability and exposure to future flood events.

1.1.1.2 FEDERAL REGULATIONS

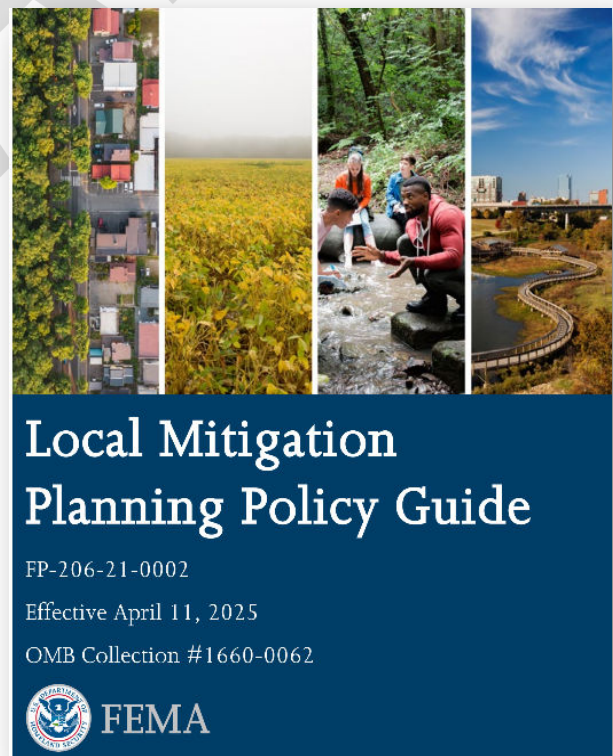
Mitigation Planning – 44 CFR Part 201

This section of the Code of Federal Regulations describes the rules and procedures governing hazard mitigation planning as mandated under the Stafford Act. It outlines the requirements for the preparation and adoption of mitigation plans, which serve as the primary tool for reducing risks posed by natural hazards at the local level. Additionally, this section establishes the policies and planning processes that guide hazard mitigation efforts, underscoring the role of mitigation plans in directing the effective allocation of resources for disaster risk reduction.

FEMA Local Hazard Mitigation Planning Guide

The Local Hazard Mitigation Planning Policy Guide published by FEMA establishes the official framework and guidance that local governments are required to follow when preparing, reviewing, and updating their Local Hazard Mitigation Plans (LHMPs). This guidance is designed to ensure compliance with the requirements set forth in the Code

Figure 1. Cover of FEMA's Local Mitigation Planning Policy Guide



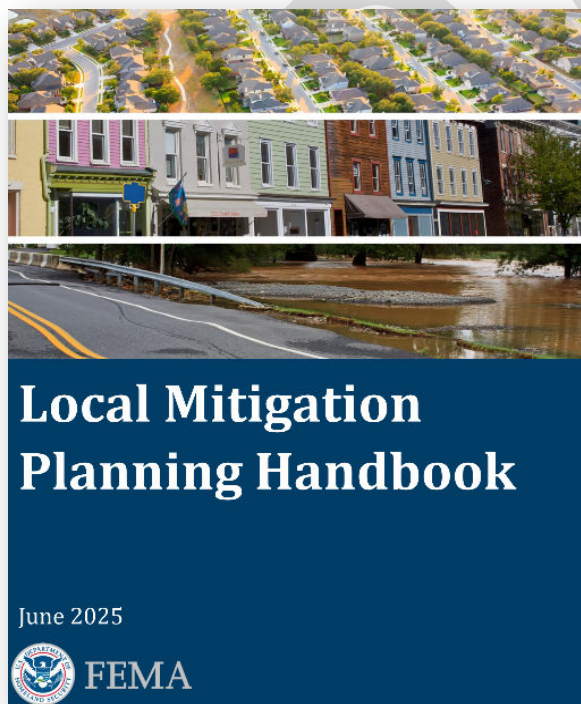
of Federal Regulations (44 CFR Part 201).

The policy guide emphasizes data-driven planning tailored to local capacities, while prioritizing community participation and inclusive stakeholder participation. It encourages communities to integrate hazard mitigation into broader planning and decision-making processes, thereby strengthening long-term resilience and reducing vulnerability to natural hazards (FEMA, Local Mitigation Planning Policy Guide, 2025).

The guide identifies the essential components that every mitigation plan is required to address. In addition, it provides practical resources such as resolution templates, checklists, and plan review criteria to support local governments throughout the planning process. The guide also explains FEMA's plan review and approval process, which may result in full approval, conditional approval pending formal adoption, or return of the plan for revisions and corrections.

Local Mitigation Planning Handbook

Figure 2. Cover of FEMA's Local Mitigation Planning Handbook



The Local Mitigation Planning Handbook is a resource developed by FEMA to assist local governments, including municipalities and special districts, in the development or update of their Local Hazard Mitigation Plans. This handbook serves as a companion to FEMA's mitigation planning policy guidance and offers a detailed, step-by-step methodology for complying with the requirements outlined in Title 44 of the Code of Federal Regulations, Part 201.

The primary purpose of the handbook is to support communities in identifying the natural hazards they face, evaluating institutional and administrative capabilities, and formulating effective strategies to reduce disaster-related impacts (FEMA, 2025). Ultimately, the handbook promotes the creation of safer

and more resilient communities that are better prepared to anticipate, withstand, and

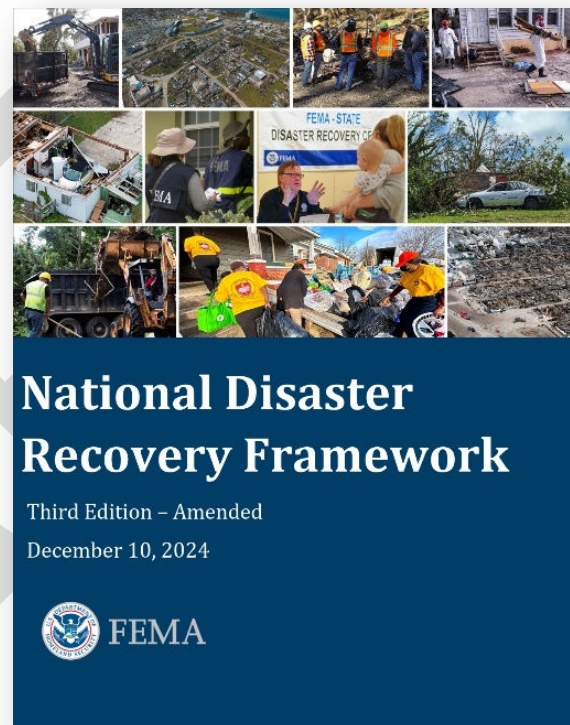
recover from adverse events.

National Disaster Recovery Framework

The National Disaster Recovery Framework (NDRF) is a guide created by FEMA in the United States that establishes how recovery should be organized and coordinated after a disaster. Its main objective is to help affected communities rebuild in a stronger, more equitable, and more resilient way, involving all levels of government—local, state, tribal, territorial, and federal—along with private and community organizations.

This framework promotes recovery that not only restores what was lost but also improves pre-disaster conditions. To achieve this, the NDRF defines guiding principles, specific roles for the actors involved, and coordination structures that facilitate collaboration among agencies. It also emphasizes the importance of planning before a disaster occurs and ensuring that recovery goals are defined by the affected communities themselves.

Figure 3. National Disaster Recovery Framework



National Flood Insurance Program

The National Flood Insurance Program (NFIP), administered by FEMA, provides affordable flood insurance coverage to property owners, renters, and businesses while encouraging effective floodplain management practices to reduce future flood risks. Established in 1968, the NFIP supports communities in minimizing flood-related losses by requiring the adoption and enforcement of local floodplain management regulations. The program also offers insurance coverage for both structures and their contents in more than 22,000 participating communities nationwide.

Because most standard homeowners' insurance policies do not cover flood damage, the NFIP plays a critical role in protecting lives and property while reducing long-term disaster recovery costs. Additional information regarding the Municipality of San

Germán's participation in the NFIP is provided in Section 4.7 of this plan.

National Earthquake Hazards Reduction Program

The National Earthquake Hazards Reduction Program (NEHRP) was established under the Earthquake Hazards Reduction Act of 1977 to advance the development, dissemination, and application of knowledge, tools, and practices that reduce risks associated with seismic events. This objective is achieved through coordinated, multidisciplinary, and interagency collaboration among NEHRP's participating federal agencies and partners, including local jurisdictions such as the Municipality of San Germán.

The National Institute of Standards and Technology (NIST), within the U.S. Department of Commerce, serves as the lead agency for NEHRP. The program is further supported by three cooperating federal agencies: the Federal Emergency Management Agency (FEMA), the National Science Foundation (NSF), and the United States Geological Survey (USGS). Each agency contributes expertise and complementary activities related to research, preparedness, mitigation, and public safety.

National Incident Management System

The National Incident Management System (NIMS) is a standardized framework developed by the U.S. Department of Homeland Security and administered by FEMA to guide incident management across the nation. Its purpose is to enable effective coordination and cooperation among governmental agencies, private sector organizations, and community-based entities at all jurisdictional levels during the prevention, preparedness, response, and recovery phases of emergencies and disasters.

NIMS establishes a common organizational structure, terminology, and set of processes to ensure seamless coordination regardless of the incident's type, size, or complexity. Core components of the system include resource management, interoperable communications, ongoing preparedness activities, and the Incident Command System (ICS), which defines clear roles, responsibilities, and command structures during emergency operations.

Implementation of NIMS is also a prerequisite for jurisdictions seeking access to certain federal preparedness and response funding. By adopting NIMS, jurisdictions enhance operational efficiency, reduce duplication of efforts, and promote the effective and

coordinated use of available resources.

1.1.2 GOVERNMENT OF PUERTO RICO POLICIES

The following Government of Puerto Rico policies provide guidance for the development and implementation of the 2026 San Germán LHMP.

1.1.2.1 PUERTO RICO LAWS

Act No. 161-2009, as Amended

Act No. 161-2009³ known as the *Puerto Rico Permits Reform Act*, establishes a modern legal and administrative framework designed to comprehensively restructure the Commonwealth's permitting system. The primary goal of the Act is to create a transparent, efficient, and streamlined process for the submission, evaluation, approval, or denial of permits issued by the Government of Puerto Rico.

To accomplish this objective, the law created the Office of Permits Management (OPM), consolidating permitting responsibilities that were previously distributed across multiple agencies. This centralization reduced procedural delays and improved consistency in the application of permitting standards. The Act also introduced specialized roles—including Authorized Professionals, Permit Managers, Service Representatives, and Permit Officers—each with defined responsibilities intended to expedite reviews and professionalize the permitting process.

A further objective of Act No. 161-2009 is to enhance oversight, accountability, and transparency within the permitting system. By strengthening internal controls and standardizing procedures, the Act seeks to ensure compliance while reducing administrative inefficiencies.

From a public policy perspective, the Act aims to promote economic development while safeguarding environmental protection. Legislative intent emphasizes that an efficient permitting system is essential to attract investment, encourage construction activity, support long-term job creation, and eliminate bureaucratic barriers that previously hindered economic growth. Analyses of the Act also highlight its role in centralizing governmental functions and implementing an Integrated Permitting

³ 23 L.P.R.A. § 9011 et. seq.

System to reduce fragmentation, improve interagency coordination, and ensure regulatory uniformity throughout Puerto Rico.

Act No. 33-2019, as Amended

Act No. 33-2019⁴, establishes the public policy of the Government of Puerto Rico regarding mitigation, adaptation, and resilience in response to observed variations in temperature and precipitation patterns. The legislation formally recognizes the need for integrated governmental action, including at the municipal level, to address the impacts of environmental instability.

This Act calls for the incorporation of concrete mitigation, adaptation, and resilience measures into territorial and land use planning instruments. By doing so, it promotes a proactive approach that strengthens communities' capacity to withstand environmental stressors and reduces long-term risks to public safety, infrastructure, and natural resources.

As provided by the Act, a panel of experts developed a adaptation plan, but as the preparation of this LHMP, it has not been formally adopted.

Act No. 107-2020, as Amended

Act No. 107-2020⁵, as amended, known as the *Puerto Rico Municipal Code*, significantly expands the authority, responsibilities, and operational autonomy of municipal governments. The Code promotes local self-governance and enhances municipalities' capacity to manage their own affairs, including disaster preparedness and risk reduction.

Among the responsibilities granted to municipalities is the authority to design and implement programs and measures to prevent, respond to, and recover from emergencies, natural disasters, catastrophic accidents, and other hazardous events. This expanded role reinforces the importance of municipal governments in protecting public safety and community well-being.

The Municipal Code also grants municipalities that qualify enhanced autonomy over

⁴ 12 L.P.R.A. § 8011 et. seq.

⁵ 21 L.P.R.A. § 7001 et. seq

land use regulation within their jurisdictions. This authority includes the application of tools such as the transfer of development rights and the evaluation and issuance of construction permits, enabling municipalities to incorporate hazard mitigation principles directly into development decisions. These powers are essential for reducing exposure to natural hazards and safeguarding lives and property. Overall, the Municipal Code recognizes territorial planning as a critical instrument for risk mitigation and establishes a legal framework that enables municipalities to take proactive, locally tailored actions to protect their communities from natural hazards and other adverse events.

1.1.2.2 PUERTO RICO REGULATIONS

Puerto Rico Land Use Plan (PUT-PR by its Spanish acronym) – 2015

In compliance with Act No. 550-2004, as amended, the Puerto Rico Land Use Plan (PUT, by its Spanish acronym) constitutes the primary territorial planning instrument prepared by the Puerto Rico Planning Board. The Plan is intended to direct land use, development, and conservation activities throughout the island in a coordinated, sustainable, and resilient manner, guided by a long-term planning horizon of ten (10) years (PRPB, 2015).

One of the primary functions of the Puerto Rico Land Use Plan (PUT) is to classify land throughout the Commonwealth into specific land use categories. Land classification serves as a land administration framework that establishes the types of zoning districts and allowable uses that may be applied to individual parcels. Under the PUT, land is classified according to the following scheme:

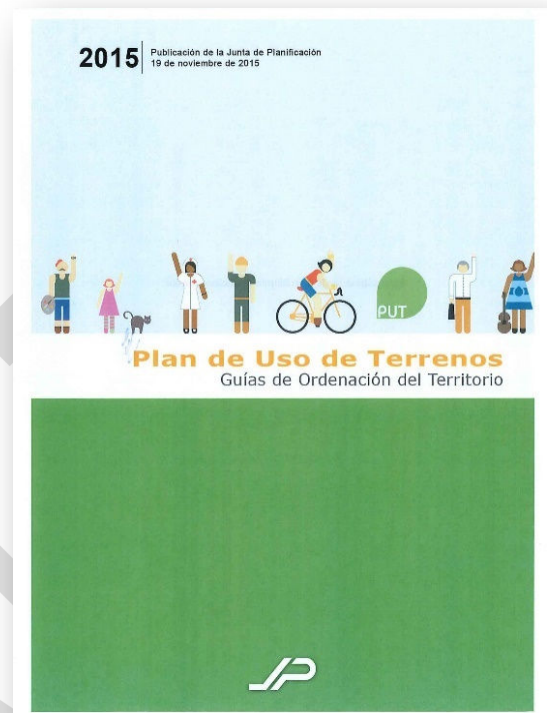
- Urban Land (SU, by its Spanish acronym): This category includes areas that are already developed and served by the necessary infrastructure and public services.

- Land for Development: This classification applies to land identified as suitable for future development and is subdivided into two categories:

- Programmed Development Land (SUP, by its Spanish acronym): Land scheduled for development under established programs or plans.
- Non-Programmed Development Land (SUNP, by its Spanish acronym): Land available for development that has not yet been assigned to a specific development program.

- Rustic Land: Rustic lands are designated for protection, conservation, or limited use due to their environmental, agricultural, or ecological value. This classification is further subdivided into:
 - Common Rustic Land (SRC, by its Spanish acronym): Areas suitable for limited, low-intensity uses.
 - Specially Protected Rustic Land (SREP, by its Spanish acronym): Areas subject to heightened protection due to their environmental, natural, or cultural significance.

Figure 4. Puerto Rico PUT Coversheet



The PUT-PR aims to coordinate and harmonize land use planning efforts among state agencies and municipalities. It serves as the foundation for the preparation of municipal Land Use Plans (*Planes Territoriales*, PT, by its Spanish acronym), which are adopted for an eight-year planning period (PRPB, 2015).

Currently, the PUT-PR is in the process of being updated for the 2026 -2036 planning cycle. This revision will incorporate robust citizen participation, clearly defined compliance and performance metrics, and an inclusive planning approach that integrates economic development, green infrastructure, sustainable transportation systems, and the conservation of natural resources.

Puerto Rico State Natural Hazard Mitigation Plan (2021)

Similar to requirements for local jurisdictions, the Stafford Act mandates that states and territories develop a hazard mitigation plan covering their entire jurisdiction. In the case of Puerto Rico, the most recent State Hazard Mitigation Plan was completed in 2021. The Puerto Rico 2021 State Hazard Mitigation Plan outlines long-term strategies to address natural hazards that have the potential to disrupt daily activities, damage property, and threaten human life. These hazards—which in many cases are intensified by changing environmental conditions—can escalate into disasters that affect not only individuals, but entire communities, with wide-ranging impacts on public health, infrastructure, economic stability, and natural ecosystems (NMEAD, 2021).

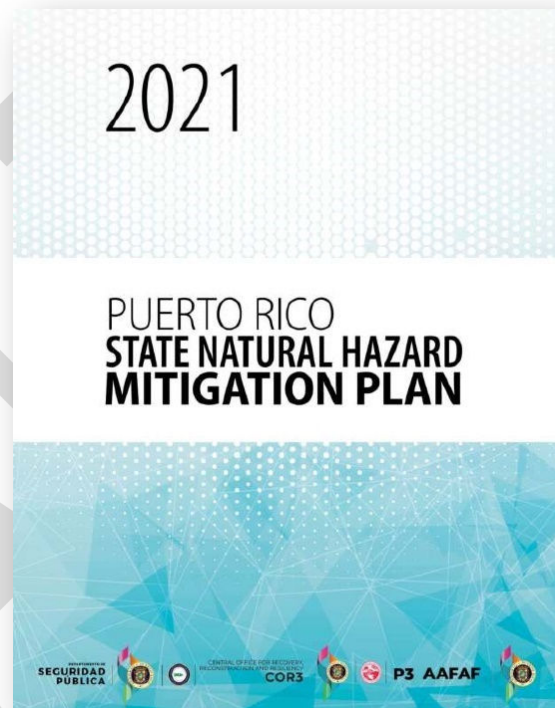
This plan provides a comprehensive framework for identifying risks and implementing actions aimed at reducing vulnerability to these hazards. Through its emphasis on mitigation, the plan seeks to enhance community resilience, safeguard critical infrastructure and systems, and promote sustainable development across Puerto Rico (NMEAD, 2021).

State hazard mitigation plans, like their local counterparts, are approved for a five-year period. Puerto Rico's current State Hazard Mitigation Plan is presently undergoing its required five-year update process and is scheduled to expire on July 28, 2026.

Puerto Rico Mitigation Action Plan, CDBG-DR MIT (2021, 2025)

Originally approved by the U.S. Department of Housing and Urban Development (HUD) in 2021 and subsequently amended in August 2025, the Puerto Rico Mitigation Action Plan for the Community Development Block Grant–Mitigation (CDBG-MIT) Program is a strategic planning document prepared by the Puerto Rico Department of Housing

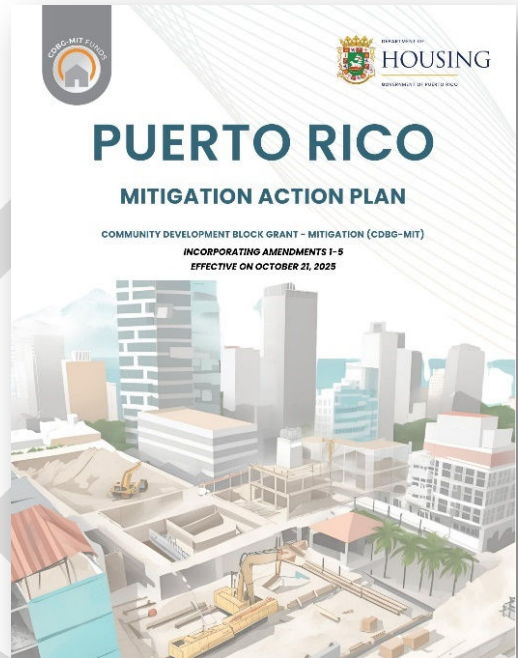
Figure 5. Puerto Rico SHMP Cover



(PRDOH). The plan establishes the framework for the administration and management of federal mitigation funds allocated by HUD under the CDBG-MIT program.

Figure 6. Puerto Rico Mitigation Action Plan Cover

Its primary objective is to reduce risks and vulnerabilities to future disasters by enhancing the resilience of infrastructure, communities, and critical systems. Although these funds were appropriated by Congress to Puerto Rico following Hurricanes Irma and María in 2017, CDBG-MIT funding differs from CDBG-Disaster Recovery (CDBG-DR) in that it is specifically focused on preventing and mitigating future impacts. Accordingly, CDBG-MIT resources are directed toward sustainable, high-impact mitigation projects and are not required to be directly linked to disaster recovery activities associated with the 2017 hurricanes (PRDOH, 2025). Overall, this plan is designed to reduce exposure to hazards, safeguard lives and property, and enhance emergency response capabilities through targeted investments in infrastructure, housing, and land-use planning (PRDOH, 2025).



1.1.3 MUNICIPAL POLICIES

San Germán Local Hazard Mitigation Plan (2020)

Adopted on December 4, 2020, the San Germán Local Hazard Mitigation Plan (LHMP) complies with the federal Disaster Mitigation Act of 2000 and establishes a comprehensive framework to reduce risks to life and property from natural hazards.

The planning process included active participation from municipal officials, agencies, and the public. A Mitigation Planning Committee led outreach efforts through public meetings, public notices, and the publication of draft documents for community review, ensuring stakeholder input throughout the plan's development.

The LHMP identifies the primary natural hazards affecting the municipality as: extreme temperatures, drought, earthquakes, flooding, landslides, strong winds (tropical cyclones), and wildfires.

The plan also includes a quantitative vulnerability analysis to evaluate potential impacts on people, infrastructure, and municipal operations, supporting the prioritization of mitigation strategies and focusing attention on the areas of greatest risk. Based on the risk assessment, the hazards with the highest impact classification for San Germán are earthquakes (including liquefaction), flooding, and strong winds associated with tropical cyclones.

Mitigation strategies are organized into key categories, including prevention, property protection, natural resource protection, structural projects, emergency services, and public education. The largest number of actions falls under structural projects, with particular emphasis on addressing flooding and landslides.

Some of the mitigation strategies proposed by the San Germán LHMP (2020) are:

- Flooding: Construction of new stormwater drainage systems, as well as cleaning and maintenance of existing drainage infrastructure to prevent overflow during heavy rainfall.
- Hurricanes / Strong Winds (Tropical Cyclones): Retrofitting of critical facilities to ensure operational continuity during and after hazard events and strengthening infrastructure resilience.
- Landslides: Construction of retaining walls and implementation of slope stabilization measures in high-risk areas

Figure 7. San Germán All Hazard Mitigation Plan Cover



- Earthquakes: Retrofitting and rehabilitation of critical infrastructure, including bridges and essential facilities, to reduce structural vulnerability
- Droughts: Integration of mitigation planning measures and long-term resource management strategies (addressed within broader planning and prevention actions).
- General/multi-hazard measures: Integration of hazard mitigation into municipal land use planning, reconstruction of infrastructure to improve resilience, and implementation of structural projects to reduce risk across multiple hazards.

San Germán Municipal Recovery Plan

As part of the CDBG-DR funds assigned by Congress to Puerto Rico in the aftermath of hurricanes Irma and María, municipalities were able to develop a recovery plan to guide recovery efforts and resiliency in the event of future stressors. In essence the Municipal Recovery Plans:

- Identify local post-disaster needs created or worsened by Irma and María
- Establish short-, medium-, and long-term recovery priorities
- Integrate resilience and hazard mitigation strategies
- Serve as a policy and project roadmap for future funding decisions

Figure 8. San Germán Recovery Plan



Each Municipal Recovery Plan has a list of recovery and resiliency projects that might be considered as new mitigation strategies for the LHMP.

1.2 SCOPE AND PREVIOUS VERSIONS

1.2.1 PRIMARY OBJECTIVES

The primary objectives of the LHMP are to:

- Identify and assess natural hazards that pose a risk to the municipality.
- Develop strategies and actions to reduce or eliminate long-term risks to life, property, and essential services.
- Promote interagency coordination and community engagement in disaster preparedness and mitigation efforts.

1.2.2 PREVIOUS FEMA COMMENTS

The following recommendations and requirements were made by FEMA upon approving the previous 2020 LHMP for San Germán.

Element A.2

- *Recommendation – “It is very important to include the neighboring communities in the early drafting stage of the plan, since there are similar risks that may impact and benefit several of these municipalities. On the next update identify the importance of including Neighboring communities in the early stages of the plan update. Example: River restoration / access or prone landslide areas that may be affecting city limits. Both agencies and municipalities should have same level of participation in the worktables.”*
- Municipality’s response – Update efforts have been coordinated with the Puerto Rico Planning Board to ensure participation from other neighboring jurisdictions and input from Commonwealth agencies. Some neighboring jurisdictions are now beginning the process to update their LHMP. San Germán LHMP can be used to determine the need for hazard mitigation project, especially among share resources like the Guanajibo River. Municipalities were invited to review the plan, comment and participate in the public discussion of the draft LHMP.

Element B4

- Recommendation – “The municipality will need to amend plan to include updated RL and SRL, NFIP information as soon as is available as mentioned in section 4.5.4.3, pg. 87.”
- Municipality’s response – NFIP information has been updated with the available information data set as of May 29, 2026.

Element D1

- Recommendation – “Now that the vulnerability assessment and the probability analysis is complete, we recommend that the municipality takes an active role in establishing processes to provide building endorsements prior to building permits. This potentially can be of great advantage for the municipality to save lives in the communities by identifying vulnerabilities and avoid constructions in high-risk areas.”
- Municipality’s Response – The Municipality engages the permitting process through its Planning and Land Use Office. The central government’s Permits Management Office (OGPe, by its Spanish acronym) request recommendations from the municipality, when evaluating the issuance of a construction permit or any other land use permits request.

Element E1

- Requirement – “The jurisdiction approved the Executive Order Number 15, Serie 2020-2021 on November 23, 2020. That Executive Order adopts the Mitigation Plan for Municipality of San Germán. Executive Order should be incorporated to the Plan when final version is submitted to FEMA.”
- Municipality’s response – Executive Order No. 15 Series 2020-2021 was included as part of Appendix A in the 2020 San Germán LHMP.

1.3 LHMP ORGANIZATION

The following table shows the layout for the 2026 of San Germán LHMP. To help LHMP reviewers and the public understand compliance, the table includes a column

specifying which FEMA-required element (FEMA, 2025) is addressed by each section.

Table 1. LHMP Organization

Chapter #	Title	Description	Review Tool Elements met
N/A	Executive Summary	This section summarizes the most important findings from the planning process and explains how they are addressed in the LHMP.	Local Element
Chapter 1	Introduction and Background	This chapter discusses the planning background for San Germán. It explains the organization of the LHMP, the most significant changes in the 2026 version compared to the 2020 version, and the public policies relevant to the update of the LHMP.	E2-a, A1-a, A1-b, A4-a, A2-a, A3-a
Chapter 2	Planning Process	This chapter describes the planning process used to develop the 2026 San Germán LHMP, including regulatory requirements, plan development activities, planning committee participation, public outreach efforts, citizen participation, and stakeholder involvement.	E1-a
Chapter 3	Municipal Profile	The municipal profile describes the municipality's relevant characteristics, including physical features, infrastructure, and demographic and socioeconomic traits.	B-1a, B-1b, B1-c, B1-d, B-e, B2-a, B2-b, E1-a
Chapter 4	Hazard Profiles and Risk Analysis	This section is the most extensive in the plan. It covers the hazards identified for San Germán and examines the risks associated with each one.	B-1a, B-1b, B1-c, B1-d, B-e, B2-a, B2-b, E1-a
Chapter 5	Mitigation Capabilities	This chapter elaborates on the municipality's capabilities to implement the mitigation strategies that will be proposed in Chapter 6.	C1-a, C-1b
Chapter 6	Mitigation Action Plan	This chapter establishes the mitigation goals of the Plan and the actions the municipality will take to reduce the risks associated with the identified natural events. It also serves to update the status of the mitigation actions included in the 2020 Plan.	C3-a, C4-a, C4-b, C5-a, C5-b, E2-b
Chapter 7	Plan	This chapter addresses the process for	D1-a, D2-a, D2-

Chapter #	Title	Description	Review Tool Elements met
	Maintenance	evaluating the effectiveness of the plan. It also explains the procedure for making modifications or updates to the plan.	6, D2-c, E2-c
Chapter 8	Adoption and Approval	This section includes information on the adoption of the plan by the municipality, FEMA's approval, and the expiration date of the 2026 Local Hazard Mitigation Plan.	F1-a, F1-b
N/A	References	This section presents the sources used in updating the plan.	A4-a
N/A	Appendixes	This section includes all appendices and supplementary information related to the planning process of the Plan.	

1.4 CHANGES TO THE SAN GERMÁN LHMP (E2-A)

The following table shows the most significant changes that the 2026 version has from the 2020 version.

Table 2. Changes to the San Germán LHMP

Element	Justification
Plan Language	Following Presidential Executive Order #14224, the 2026 version of San Germán LHMP has been originally prepared in English for submission and consideration of FEMA. An official translation of the final draft for public discussion and the final approved LHMP to Spanish will be prepared for the benefit of the population that are not English proficient.
Plan organization	The organization and chapters of the document generally follow Puerto Rico Planning Board 2019 LHMP template. However, there has been adaptation to it in response to changes in federal policy or need improvements in readability for the general public.
Discussion of FEMA Lifelines	As per the Local Hazard Mitigation Policy, FEMA Lifelines are discussed as well as the strategies to mitigate hazard impacts on them.
Improvements to the Public Policy section	Relevant public policies that were not previously considered have been added.
Change to the name of extreme	The hazard identified in the 2020 Plan as "Extreme wind" has been changed to "Tropical Cyclones/Extreme Winds" due to the current

Element	Justification
winds	HAZUS capability to model tropical cyclones for Puerto Rico.
Update of census data	The municipality and PRPB have chosen to use the most recent version of the American Community Survey for evaluating demographic data. In this case it has chosen to evaluate the data sets from the 2024 five-year American community survey.
Action Plan	A new strategy identification number has been added to help municipalities and commonwealth agencies keep track of them.
All the LHMP	Attention has been given to ensure that the content of the Plan does not reveal any personally identifiable information (PII).

2. PLANNING PROCESS

2.1 PLANNING PROCESS REGULATIONS

This LHMP was updated following the applicable public policies and procedures mentioned in Chapter 1.

2.2 GENERAL DESCRIPTION OF THE 2026 LHMP

This LHMP seeks to assist the municipality in the task of preventing loss of life and property caused by the effects of natural hazards. Chapter 1 provides a general introduction, while Chapter 2 outlines the planning process followed, including stakeholder and public participation. The LHMP identifies a general profile of the Municipality using information from the US Census, such as population distribution, employment, housing stock, and other relevant data (see Chapter 3 for more information).

After establishing the Municipality's general profile, the Plan evaluates all identifiable natural hazards that may affect the municipality and its population, including impacts on lifelines, properties, population exposure, natural resources (see Chapter 4 for more information).

Chapter 5 outlines the capabilities the Municipality possesses for implementing the LHMP. While Chapter 6 establishes the mitigation actions the municipality will carry out over the next five years. Chapter 7 describes the provisions for LHMP maintenance, and Chapter 8 addresses the adoption and approval of the LHMP. The various appendices contain supporting information.

2.3 HISTORY OF THE LHMP

This document represents the latest revision of the LHMP for the Municipality of San Germán. The original plan received FEMA approval in October 2014, followed by the first update approved in November of 2020 (Municipio de San Germán, 2020). This 2026 update reflects evolving conditions and circumstances that have influenced the municipality over the past five years and incorporates newly enacted laws, programs,

and regulatory requirements. Through this update, San Germán aims to preserve its eligibility for federal mitigation funding prior to future catastrophic events and to present a strengthened plan aligned with current standards and best practices.

2.4 PLAN PREPARATION, REVISION SCHEDULE AND METHODOLOGY (A1-A)

Following federal law, LHMPs must be updated every five (5) years for the municipality to remain eligible for federal mitigation funding. The planning process for the 2026 update of the San Germán Local Hazard Mitigation Plan (LHMP) officially began with the execution of a Letter of Agreement between the Municipality of San Germán and the Puerto Rico Planning Board (PRPB), which was signed on December 16, 2025. A copy of the signed agreement is included in Appendix B. Subsequently, a kickoff meeting was held on February 9, 2026, bringing together representatives from the Municipality and the PRPB to discuss the planning process, project objectives, and coordination efforts. Later a consulting firm, AtkinsRéalis Caribe LLP, was retained by the PRPB to support the mitigation planning efforts.

The Municipality and its consultants followed the natural hazard mitigation planning process as established by FEMA in the Local Hazard Mitigation Planning Guide and the Local Hazard Mitigation Planning Handbook, as well as the recommendations provided by the mitigation planning staff of Central Office for Recovery Reconstruction and Resiliency (COR3) which has a dual role as State Hazard Mitigation Officer (SHMO). The Local Mitigation Plan Review Tool provides a summary of FEMA's current minimum standards to comply with mitigation planning requirements and identifies where each requirement is addressed within this Plan.

The revision phase reached completion upon the official delivery of the final draft to the SHMO, (COR3) on Click or tap to enter a date. Overall, the revision process lasted ___ days.

2.5 PLANNING COMMITTEE (A1-A, A1-B)

To support the revision of the San Germán LHMP, a Planning Committee was established, comprised of representatives from several municipal dependencies who were designated to guide the process. The members of the Committee are:

Table 3. LHMP Planning Committee

Name	Position
Virgilio Olivera Olivera	Mayor of San Germán
Valeria A. Cruz	Director of the Planning, Territorial Ordinance and Project Management Office
Dereck Marrero	Director of the Emergency Management Office
Pedro Ramos	Director of the Public Works Office
Braulio Torres	Municipal Police Commissioner
Ismael Madera	Director of the Finance Office
Karelys Vega	Director of the Federal Programs Office
Johaneliz Acosta	Director of Citizen Services
Ramón J. Cruz	Supervisor of Public Works
Yaritzamarely Jusino	Municipal Secretary Office

The designation letter for the Planning Committee is included in Appendix B. This appendix also compiles the meeting minutes, documentation of the materials discussed throughout the process, and accompanying photographic evidence.

2.6 CITIZEN PARTICIPATION (A3-A)

2.6.1 COMMUNITY OUTREACH AND PUBLIC PARTICIPATION STRATEGIES

The public participation approach selected for this LHMP revision incorporated the following activities:

- Distribution of notification letters to agencies, neighboring municipalities, community leaders, nonprofit organizations, neighborhood associations, business or industrial groups, and other interested stakeholders, informing them that the LHMP revision process had commenced and inviting their input. Documentation of these communications is included in Appendix D.
- Publication of notices on the Municipality's website and official social media platforms to inform the public that the LHMP revision was underway. These postings also provided an email address for submitting comments and made available a virtual survey to gather information regarding the community's experiences with natural hazards. Evidence of these public notices is also maintained on Appendix C.

- Convening an initial community meeting to introduce the LHMP revision process. This step involved:
 - Issuing a public announcement in a newspaper, on the Municipality's website, and across official social media channels at least 15 days before the meeting.
 - Confirming in the announcement that the draft plan was available for review in both printed and online versions.
- Holding a second community meeting to discuss the hazard assessment and analysis with the public. This stage included:
 - Publishing a newspaper announcement and posting notices on the Municipality's website and official social media outlets at least 10 days before the meeting.
 - Confirming in the announcement that the draft plan was available for review in printed and online versions.
 - Providing an additional 7-day comment window for the community to offer feedback, either by email or by visiting the designated address.
- Holding a third community meeting to discuss the draft LHMP and the proposed mitigation strategies. This stage included:
 - Publishing a newspaper announcement and posting notices on the Municipality's website and official social media outlets at least 10 days before the meeting.
 - Confirming in the announcement that the draft plan was available for review in printed and online versions.
 - Providing an additional 7-day comment window for the community to offer feedback, either by email or by visiting the designated address.

2.6.2 COMMUNITY OUTREACH AND PUBLIC PARTICIPATION RESULTS

First Public Meeting Results

A public meeting notification announcing the initiation of the LHMP update process was published on 2/17/2026 via "El Vocero de Puerto Rico" newspaper. The notification informed the public that the meeting would be held on 3/5/2026 in Centro Comunal Minillas, Calle Brillante en San Germán at 10:00 am.

During the meeting, participants identified concerns related to roadway instability and

landslides, vulnerabilities to electrical infrastructure caused by vegetation encroachment and severe weather, the availability of emergency shelter facilities, and the need to strengthen community preparedness and emergency response capabilities. These concerns were evaluated during the LHMP update process and are addressed through mitigation actions related to slope stabilization, emergency planning, sheltering capabilities, backup power systems, public outreach, and emergency preparedness programs.

Appendix C includes the notes documented during the activity, along with supporting evidence. All documentation complies with PII protection requirements.

Second Public Meeting Results

A public meeting notification to present the vulnerability analysis of the LHMP was published on Click or tap to enter a date. via _____. The notification informed the public that the meeting would take place on Click or tap to enter a date. in _____ at _____. It also stated that a printed copy of the draft LHMP would be available at _____ during regular work hours. Additionally, the public had the option of accessing the draft LHMP through the webpage _____. Copies of the public notification are included in Appendix C.

During this meeting, participants expressed the following concerns:

The Municipality took the following measures to address these concerns: _____. Appendix C includes the notes documented by the planning consulting firm during the activity, along with supporting evidence. All documentation complies with PII protection requirements.

The Municipality took the following measures to address citizen concerns, _____.

Appendix C holds those notes taken during the activity by the planning consulting firm, as well as documentation of the meeting. PII protection criteria apply to this documentation.

Third Public Meeting Results

A public meeting notification to present the draft of LHMP was published on Click or tap to enter a date. via _____. The notification informed the public that the meeting would take place on Click or tap to enter a date. in _____

at _____. It also stated that a printed copy of the draft LHMP would be available at

_____ during regular work hours. Additionally, the public had the option of accessing the draft LHMP through the webpage _____. Copies of the public notification are included in Appendix C.

During this meeting, participants expressed the following concerns:

_____ The Municipality took the following measures to address these concerns: _____. Appendix C includes the notes documented by the planning consulting firm during the activity, along with supporting evidence. All documentation complies with PII protection requirements.

The Municipality took the following measures to address citizen concerns, _____.

Appendix C holds those notes taken during the activity by the planning consulting firm, as well as documentation of the meeting. PII protection criteria apply to this documentation.

2.7 STAKEHOLDER INVOLVEMENT (A2-A)

The Municipality carried out outreach efforts to external stakeholders, including government agencies and neighboring municipalities, through formal correspondence addressed to agency heads and mayors. Copies of these invitation letters are provided in Appendix D. Stakeholders were encouraged to submit input either via email or by participating in the public involvement process.

Input from internal stakeholders was obtained through the Planning Committee. Appendix D also includes any written responses or correspondence received from stakeholders during this outreach process.

2.8 HAZARD ANALYSIS DATA SOURCES

The following table presents the datasets utilized for the evaluation of each hazard. Table 4 identifies the hazards considered in this LHMP and the corresponding data sources used to support their assessment.

Table 4. Hazard and Risk Assessment of Data Sources

Hazard	Data Sources	Comments
Earthquake	United States Geological Survey (USGS), FEMA	HAZUS 6.1 used
Landslides	USGS	
Flooding	FEMA	HAZUS 6.1 used
Tropical Cyclone/Extreme Winds	FEMA	HAZUS 6.1 used
Extreme Heat	National Oceanic and Atmospheric Administration (NOAA)	
Drought	National Drought Index Monitor (NDIM)	
Pandemic/Epidemic	PR Department of Health	
Wildfire	Puerto Rico Fire Bureau	

2.9 FEMA LIFELINES

The *Local Mitigation Planning Handbook* and the *Local Hazard Mitigation Planning Policy Guide* highlight the importance of integrating critical lifelines into the hazard mitigation planning process. FEMA defines lifelines as essential services that sustain public safety, economic stability, and the continuity of government and daily life before, during, and after an emergency or disaster. These lifelines serve as a framework for prioritizing resources and actions that are essential to reducing loss of life and property and supporting efficient and rapid recovery following hazard events (FEMA, 2023).

FEMA identifies eight (8) primary lifelines:

- **Safety and Security:** Includes law enforcement, fire services, search and rescue operations, government services, and community safety functions.
- **Food, Hydration, and Shelter:** Encompasses food systems, water access, emergency shelter, and agricultural resources.
- **Health and Medical:** Includes medical care, public health services, patient movement, medical supply chains, and healthcare facility management.
- **Energy:** Covers the electrical power grid and fuel supply systems.
- **Communications:** Includes communications infrastructure, responder communications, alert and warning systems, financial services, 911 operations, and emergency dispatch.
- **Transportation:** Encompasses highways, motor vehicle systems, mass transit, railways, aviation, and maritime transportation.
- **Hazardous Materials:** Includes facilities and systems associated with hazardous materials, pollutants, and contaminants.
- **Water Systems:** Includes potable water infrastructure and wastewater collection and treatment systems.

Each of these lifelines is supported by sub-lifelines that allow jurisdictions to more precisely identify vulnerabilities and prioritize recovery actions. Together, they enable emergency managers and decision-makers to rapidly assess conditions, focus response operations on the most critical needs, and coordinate actions that directly affect human life and community stability.

By monitoring the status and functionality of lifelines, jurisdictions can respond more effectively during emergencies, minimize cascading impacts, and accelerate a more

resilient recovery. A detailed discussion of lifelines and their relevance to the Municipality of San Germán is provided in Section 3.5.

3. MUNICIPAL PROFILE

The Municipality of San Germán is a landlocked municipality located in the southwest of Puerto Rico. San Germán borders the following municipalities: to the north, Mayagüez and Maricao; to the east, Sabana Grande; to the south, Lajas; and to the west, Hormigueros and Cabo Rojo.

San Germán is subdivided into nineteen (19) wards (*barrios*): Ancones, Caín Alto, Caín Bajo, Cotuí, Duey Alto, Duey Bajo, Guamá, Hoconuco Alto, Hoconuco Bajo, Maresúa, Minillas, Retiro, Rosario Alto, Rosario Bajo, Rosario Peñón, Sabana Eneas, Sabana Grande Abajo, Tuna, and San Germán barrio-pueblo.

Map 1 shows the geographical area of Municipality of San Germán and its adjacent municipalities. Map 2 shows the distribution of its wards.

3.1 DATA SOURCES FOR MUNICIPAL PROFILES

The San Germán LHMP has been updated using the most current demographic and socioeconomic data available. Municipal profiles and risk assessments rely primarily on the 2020–2024 Five-Year American Community Survey (ACS).

In addition, the plan reflects the most up-to-date knowledge on hazards and mitigation practices. References to relevant plans, studies, and technical reports are provided in page-level footnotes and consolidated in the References section.

Geographic Information System (GIS) layers included in Chapter 3 were mostly provided by the PRPB's GIS Office.

3.2 BRIEF HISTORICAL BACKGROUND

Long before Spanish settlement, the territory that is today the Municipality of San Germán formed part of a vibrant Taíno cultural and ecological landscape, characterized by well-established settlements, conuco agriculture, and extensive use of river corridors for mobility and exchange. The Sabana Grande Valley, its surrounding hills, and the Guanajibo River basin were inhabited and managed by Indigenous communities whose land-use practices emphasized soil conservation, hydrological stability, and adaptation to the region's varied topography. These longstanding Indigenous relationships with the land shaped the ecological foundations upon which later colonial development took place (Cotidiano, 2024).

Currently San Germán is one of Puerto Rico's oldest and most historically significant municipalities, with origins dating back to the early sixteenth century. The first Spanish colonization settlement associated with San Germán was established on the western coast around 1511–1512, becoming one of the earliest European footholds on the island. However, the coastal town suffered repeated attacks by French corsairs in 1528, 1538, and 1554, forcing residents to relocate inland for better protection. This relocation culminated in the formal founding of the inland town, known as *Nueva Villa de Salamanca*, during the 1570–1573 period, although residents continued to call it simply San Germán. Today, the municipality is widely recognized as Puerto Rico's second-oldest city, after San Juan (Britannica, 2026).

During the sixteenth and seventeenth centuries, San Germán played a decisive organizational role within the island's colonial structure. Puerto Rico was effectively divided into two jurisdictions: San Juan in the north and San Germán in the west. From San Germán, Spanish authorities administered land distribution, oversaw settlement formation, and coordinated economic and military activities throughout the region. This centrality earned the town its enduring historic designation as the “Ciudad Fundadora de Pueblos” (“City Founder of Towns”), reflecting its regional influence and its involvement in the establishment of numerous neighboring municipalities (EnciclopediaPR, 2010).

San Germán's historic urban core remains one of the most intact examples of Spanish colonial architecture in Puerto Rico. Key landmarks include Porta Coeli, a seventeenth-century convent and church considered one of the oldest religious structures in the Americas, and the Church of San Germán de Auxerre (1688). Together with surrounding civic and residential structures, these edifices form the San Germán Historic District, which preserves centuries of architectural and urban development.

This built heritage illustrates the municipality's continuous role as a regional hub for commerce, religion, education, and governance. (Discover Puerto Rico, 2026)

The 2012 Municipal Land Use Plan underscores San Germán's longstanding function as the principal urban center of the southwest region. It documents how the early Indigenous landscape, followed by Spanish-era transportation routes and agricultural expansion, shaped the municipality's territorial structure. San Germán's development was influenced by its strategic location in the Sabana Grande Valley, facilitating regional movement and agricultural productivity. The Plan Territorial highlights the town's dense historic core, its surrounding barrios, and the spatial relationships that connect San Germán with the broader region—insights that remain crucial for understanding present-day exposure to natural hazards. (Cotidiano, 2024)

Beginning in the early twentieth century, San Germán entered a new period of transformation. The founding of the Polytechnic Institute of Puerto Rico in 1912, later renamed the Inter-American University of Puerto Rico, established the municipality as one of the island's foremost educational centers. Economic activity gradually diversified beyond agriculture—once dominated by sugar cane, coffee, and minor crops—toward manufacturing, services, and education. These economic shifts paralleled broader changes throughout Puerto Rico while deepening San Germán's role as a cultural and academic hub for the southwestern region.

San Germán's evolution from an Indigenous cultural landscape to a colonial administrative center, and later to a modern regional city—continues to shape its relationship with natural hazards. The combination of a historically dense urban core, expansion into hillside terrain, and settlement along hydrological systems requires careful integration of historical patterns into contemporary hazard mitigation strategies. Understanding this layered history is essential for building resilience that honors both the municipality's deep cultural heritage and its complex environmental context.

3.3 GEOGRAPHY

The Municipality of San Germán covers an area of 29,343 *cuerdas*⁶ (approximately 141.2 km² or 54.5 miles²). Its morphology is characterized by a valley-to-hillside pattern

⁶ In Puerto Rico, a cuerda is a traditional unit of land measurement. It's similar to an acre but slightly smaller. 1 cuerda = about 3,930 square meters (m²). In acres, that's roughly 0.97 acres. In hectares, it's about 0.393 hectares.

shaped primarily by the Sabana Grande Valley and the surrounding foothills of the southwestern interior, a landform configuration documented in the *Plan Territorial – Memorial (2012)* as a defining physical feature influencing municipal spatial development. San Germán is a landlocked municipality in the southwest region of Puerto Rico, bordered by Mayagüez and Maricao to the north; Sabana Grande to the east; Lajas to the south; and Hormigueros and Cabo Rojo to the west. The *Plan Territorial – Memorial (2012)* identifies San Germán as one of the principal urban centers of the region, noting that its geographic setting historically facilitated mobility between interior settlements and the western lowlands, guiding urban consolidation around its historic core. This combination of valley floors, rolling hills, and historic transport corridors continues to shape present-day exposure patterns and supports the municipality’s role as a regional service, education, and health hub. (Municipality of San Germán, 2012)⁷.

⁷ Many of the resources used for the preparation of LHMP update are in Spanish. For uniformity the bibliographical entries and citations of the sources will be translated to English.

GEOGRAPHIC AREA

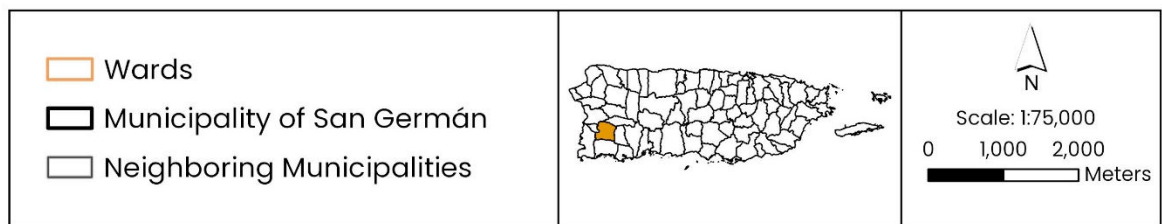


Source: Puerto Rico Planning Board

SPCS PR & VI NAD83



WARDS BOUNDARIES

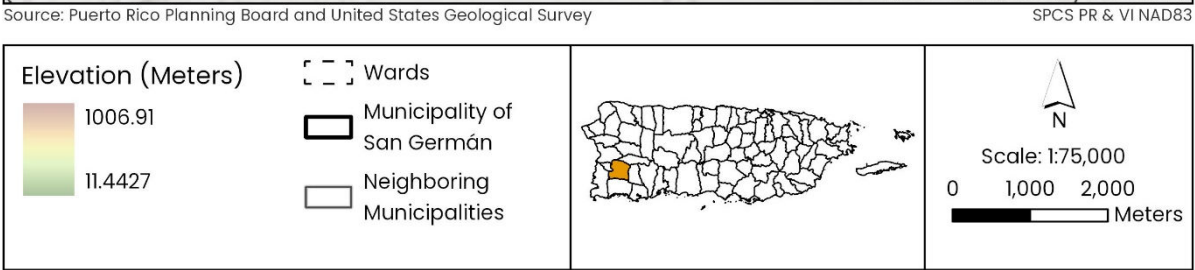


3.3.1 PHYSIOGRAPHY

San Germán exhibits a varied topographic structure shaped by the Sabana Grande Valley lowlands and adjoining hilly to mountainous terrain. Regional descriptions indicate elevations that rise toward the foothills between San Germán and Maricao, where the broader region includes prominent landforms such as elevations associated with the Cordillera Central's southwestern outliers. (EnciclopediaPR, 2010)

The *Plan Territorial – Memorial* (2012) emphasizes that this valley-to-hillside gradient historically influenced settlement choices, agricultural patterns, and regional circulation routes. These gradients produce areas of high slope, variable soil stability, and complex runoff behavior, which today are directly relevant to hazard mitigation, particularly for landslide susceptibility, limited access in hillside barrios, and increased runoff velocities entering valley neighborhoods. Map 3 shows the physiography of the municipality.

PHYSIOGRAPHY



3.3.1.1 GEOLOGY

San Germán's geological composition reflects a combination of alluvial valley deposits and older bedrock/colluvial materials on the surrounding slopes. According to the *Plan Territorial – Memorial*, the valley floor's alluvium historically supported agriculture and settlement, while the upland areas mixed geological units generated a mosaic of erosion-prone slopes, weathered materials, and locally unstable embankments. These subsurface characteristics are directly relevant to slope stability evaluations for road corridors and hillside communities. (Municipality of San Germán, 2012)

While detailed geotechnical mapping is not covered in this LHMP, the municipality's combination of fine-grained alluvium, colluvial deposits, and fractured bedrock points to the need for site-specific assessments when planning mitigation projects involving excavation, retaining structures, or expansions of critical facilities.

3.3.2 HYDROGRAPHY

San Germán lies within the hydrologic system of the Guanajibo River basin, with multiple tributaries crossing the municipality, including Caín, Duey, Rosario, Hoconuco, and Guamá rivers, all of which define local flood exposure and convey runoff from the surrounding hillsides into the valley floor. (EnciclopediaPR, 2010).

A defining hydrologic feature of the urban core is the historic San Germán Underground Tunnels, a vaulted brick storm-sewer system—built beginning in 1835 to channel the Quebrada Manzanares beneath the town center. The system extends for approximately 842 meters and is listed as a contributing property to the National Register of Historic Places (Oficina Estatal de Conservacion Histórica (OECH)).

Historical documentation shows these tunnels were built to reduce recurrent flooding and to enable safe passage toward Lajas by conveying stormwater underground. Their varied construction phases (1842–1912) and differing brick vaulting techniques reflect local engineering responses to high runoff and flooding within the urban basin.

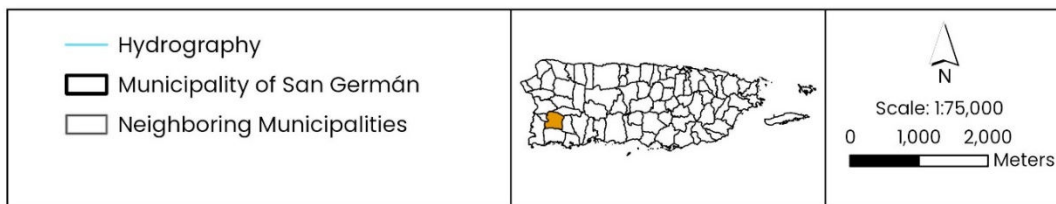
Given San Germán's valley-focused hydrology and hillside runoff, the Land Use Plan, highlights the need for hydrologic interventions that combine upstream green infrastructure, culvert modernization, and stormwater conveyance improvements across barrios and through the historic center.

Map 4 illustrates the hydrographic system of the Municipality of San Germán, with major rivers and creeks identified by name. Map 5 presents the watersheds basins of San Germán, and Map 6 shows the sub-watershed basins.

DRAFT

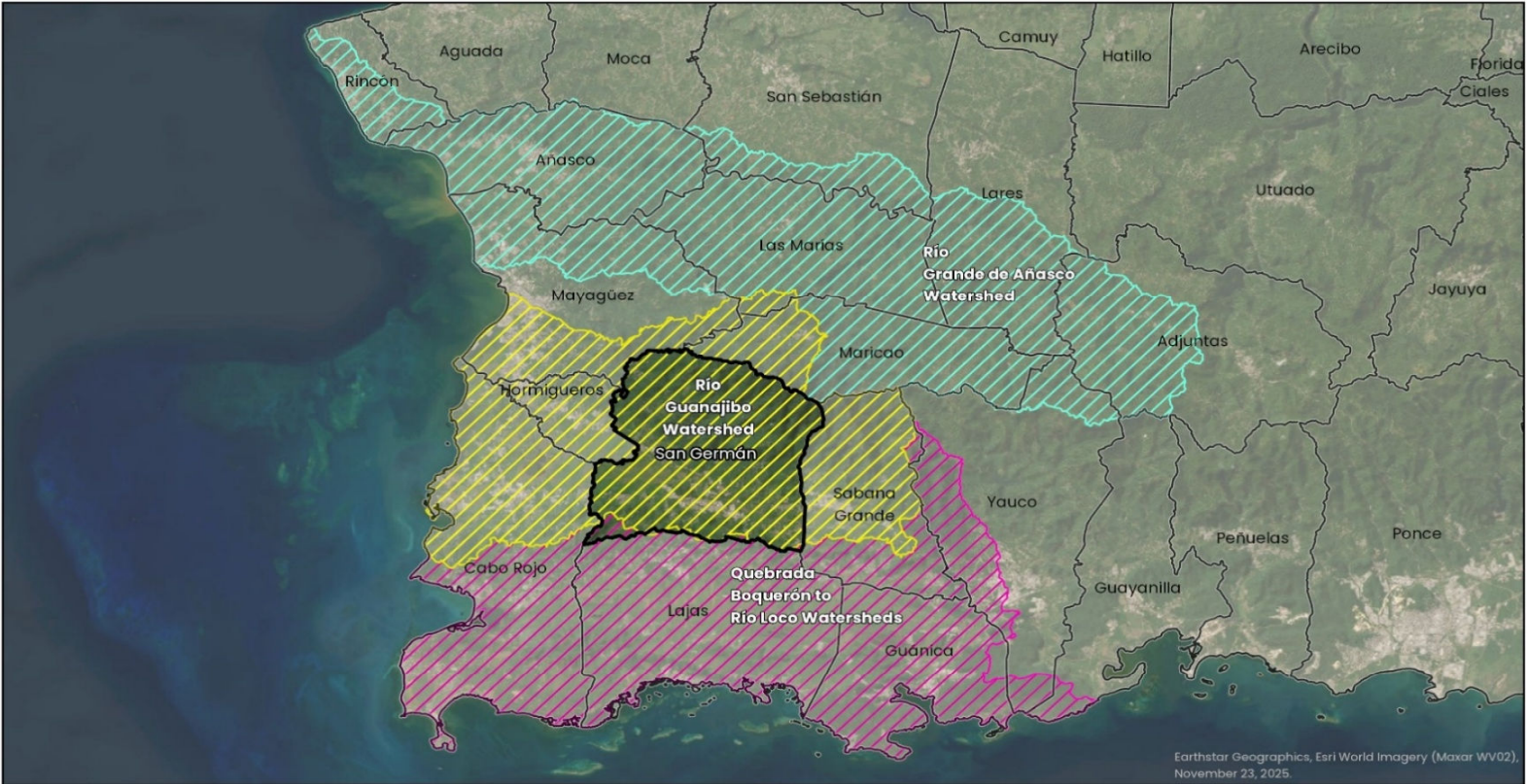
Map 4. Hydrography

HYDROGRAPHY



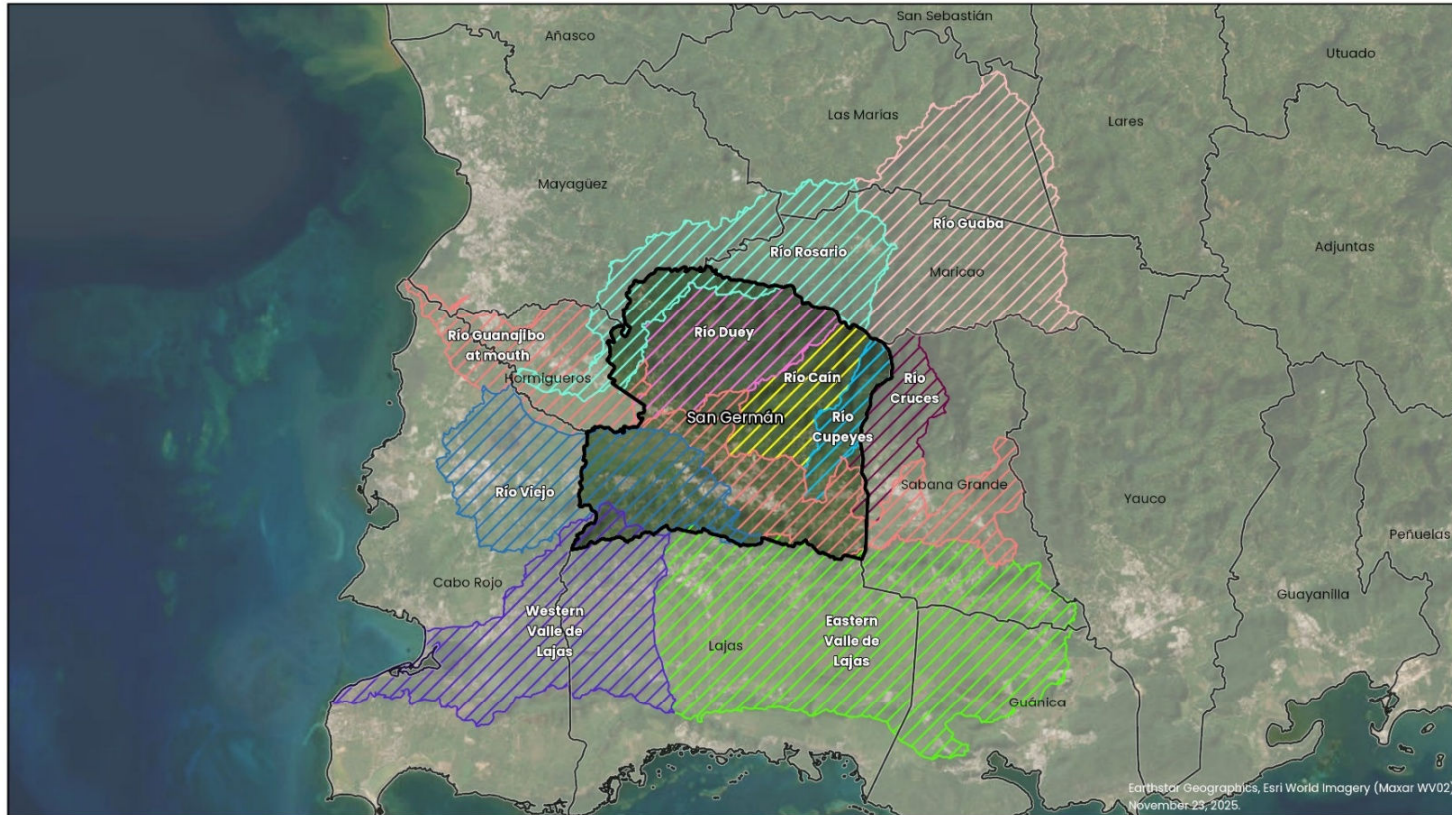
Map 5. Watersheds

HYDROGRAPHIC WATERSHEDS



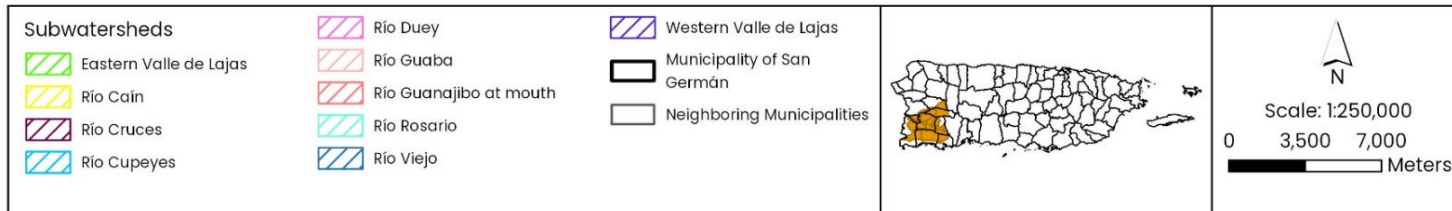
Map 6. Sub Watersheds

HYDROGRAPHIC SUBWATERSHEDS



Source: Puerto Rico Planning Board and United States Geological Survey

SPCS PR & VI NAD83



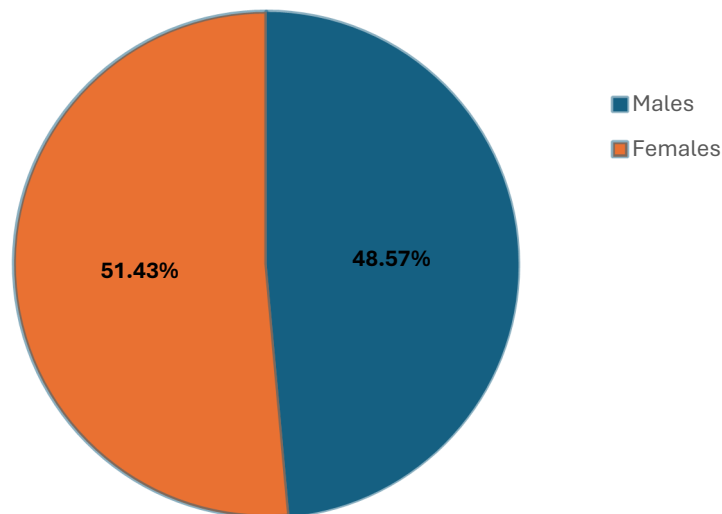
3.4 DEMOGRAPHICS

3.4.1 CURRENT POPULATION

According to the 2020–2024 American Community Five-Year Survey (ACS 2024) ⁸, the total population of San Germán is 31,305. Of these, 15,204 individuals are male and 16,101 are female, representing a distribution of 48.57% male and 51.43% female. The sex ratio is of 94 males per 100 females (US Census Bureau, 2025).

Figure 9. San Germán Population by Sex (2024 ACS)

San Germán Population by Sex



3.4.2 AGE

Regarding the younger age groups, San Germán has 5,853 individuals (18.70%) who are under 19 years of age. Of these, 2,029 individuals (6.50%) are 9 years old or younger. This LHMP considers people younger than 19 and older than 65 as vulnerable. As such we find that 14,569 residents of San Germán (34.30% of the population) are especially vulnerable to the effects of a natural disaster.

⁸ Unless otherwise stated, all data and analysis are from the 2020 – 2024 Five-Year American Community Survey (ACS) Data Set for San Germán.

The following table distributes the current population of San Germán by age groups as established in the 2020 - 2024 Five-year ACS. The table also compares the data of the 2024 ACS with that of the 2015-2019 ACS (2019 ACS).

Table 5. Population by Age Group 2024 ACS vs 2019 ACS

Age Cohort	Population 2024	Percentage 2024	Population 2019	Percentage 2019	Rate of change
< 5 years	926	3.00%	1,402	4.50%	-33.95%
5 - 9 years	1,103	3.50%	1,867	5.90%	-40.92%
10- 14 years	1,964	6.30%	1,520	4.80%	29.21%
15 - 19 years	1,860	5.90%	2,159	6.90%	-13.85%
20 - 24 years	2,044	6.50%	2,300	7.30%	-11.13%
25 -29 years	1,931	6.20%	1,899	6.00%	1.69%
30-34 years	1,757	5.60%	1,563	5.00%	12.41%
35 - 39 years	1,429	4.60%	1,430	4.50%	-0.07%
40- 44 years	1,783	5.70%	1,977	6.30%	-9.81%
45 - 49 years	1,745	5.60%	1,871	6.00%	-6.73%
50 - 54 years	1,920	6.10%	1,958	6.20%	-1.94%
55 -59 years	2,033	6.50%	2,120	6.70%	-4.10%
60-64 years	2,094	6.70%	1,900	6.00%	10.21%
65 - 69 years	1,919	6.10%	2,069	6.60%	-7.25%
70 - 74 years	2,188	7.00%	1,959	6.20%	11.69%
75 - 79 years	2,000	6.40%	1,647	5.20%	21.43%
80 - 84 years	1,418	4.50%	1,061	3.40%	33.65%
85 years and above	1,191	3.80%	740	2.40%	60.95%
Total	31,305		30,702		

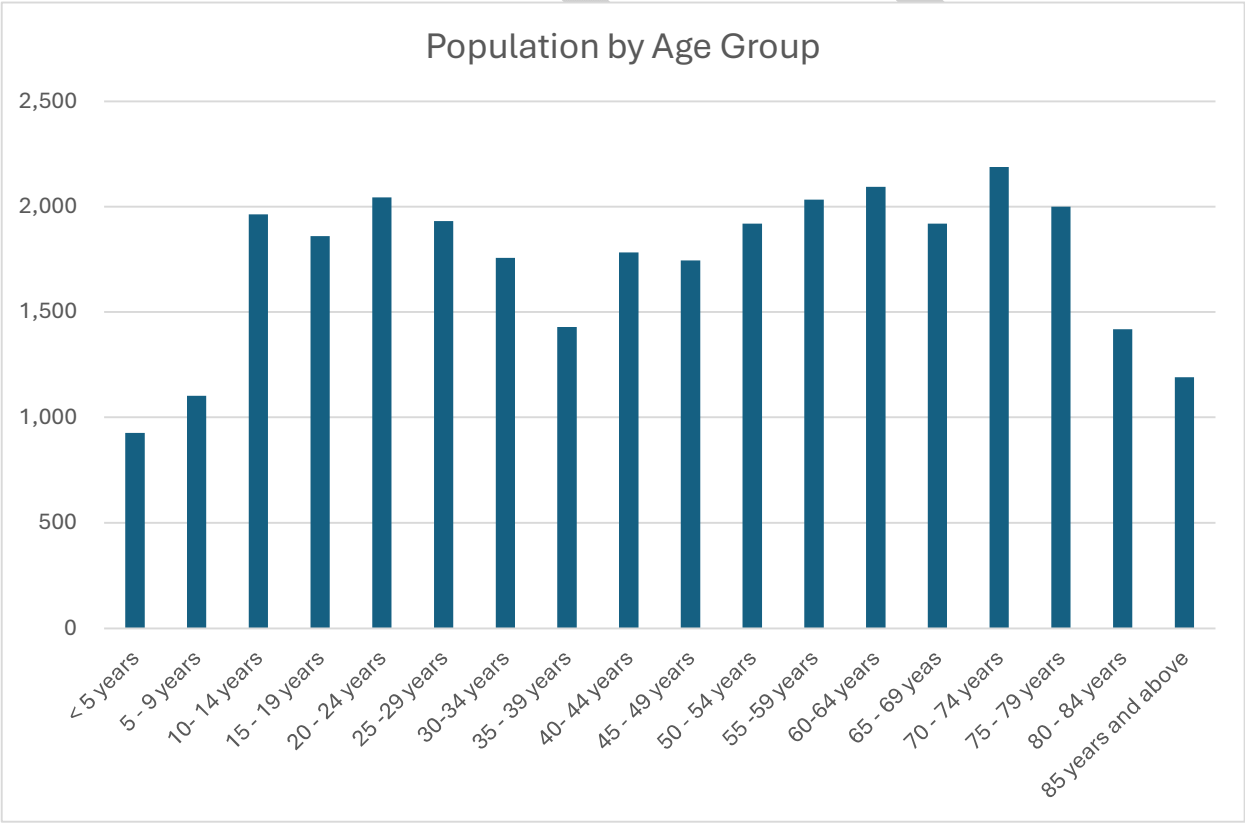
Source: US Census ACS 2020-2024 and ACS 2015-2019

The previous table shows that in San Germán the largest negative rate of change by age occurred in children 5-9 years (-40.92%), followed by children under 5 (-33.95%) and late teens 15-19 years (-13.85%). The largest positive rate of change occurred among adults 85 years and over (+60.95%), adults 80-84 (+33.65%), and adolescents 10-14 (+29.21%). Overall, the municipality's total population increased by 603 people (+1.96%) between the 2019 ACS and the 2024 ACS.

According to the 2024 ACS, a total of 8,716 individuals in San Germán were 65 or older. This group constitutes over a quarter (27.80%) of the municipality's total population. Additionally, 4,609 individuals-representing 14.70% of the population-were 75 years of age or older.

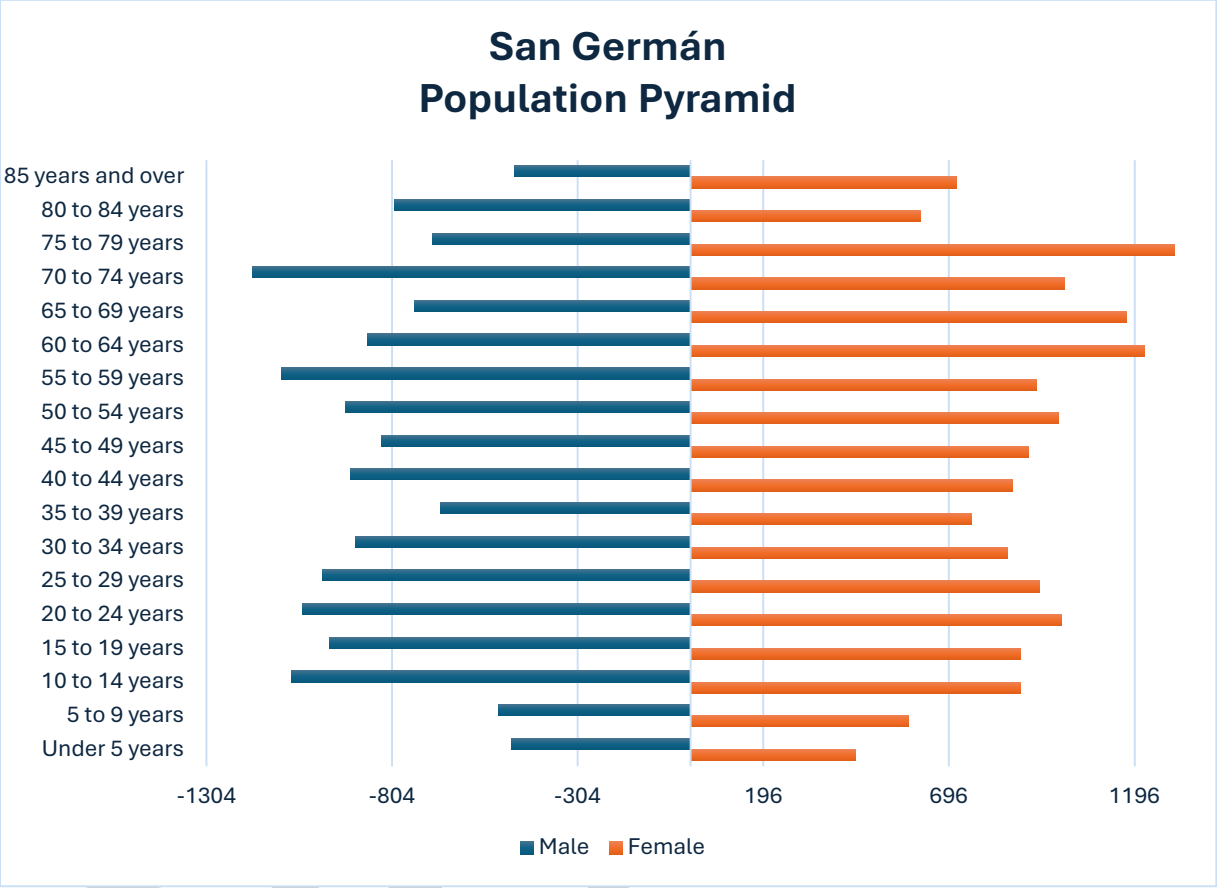
Figure 10 shows the same age group distribution in a bar chart form and Figure 11 displays the population pyramid, illustrating the distribution of males and females across age cohorts. As shown in Figure 11, the pyramid reveals an irregular structure, with a noticeably larger proportion of older adults compared to younger groups, highlighting the municipality’s ongoing demographic aging. Map 7 indicates the population density of San Germán by census tract. Population density is highest in the urbanized areas surrounding Barrio Pueblo, Retiro, Ancones, and Maresúá, where densities range from approximately 664 to 740 persons per square kilometer. In contrast, the northern and northeastern census tracts exhibit lower population densities, reflecting the municipality’s more rural and mountainous areas.

Figure 10. San Germán Population by Age Group (2024 ACS)



Source: US Census ACS 2020–2024

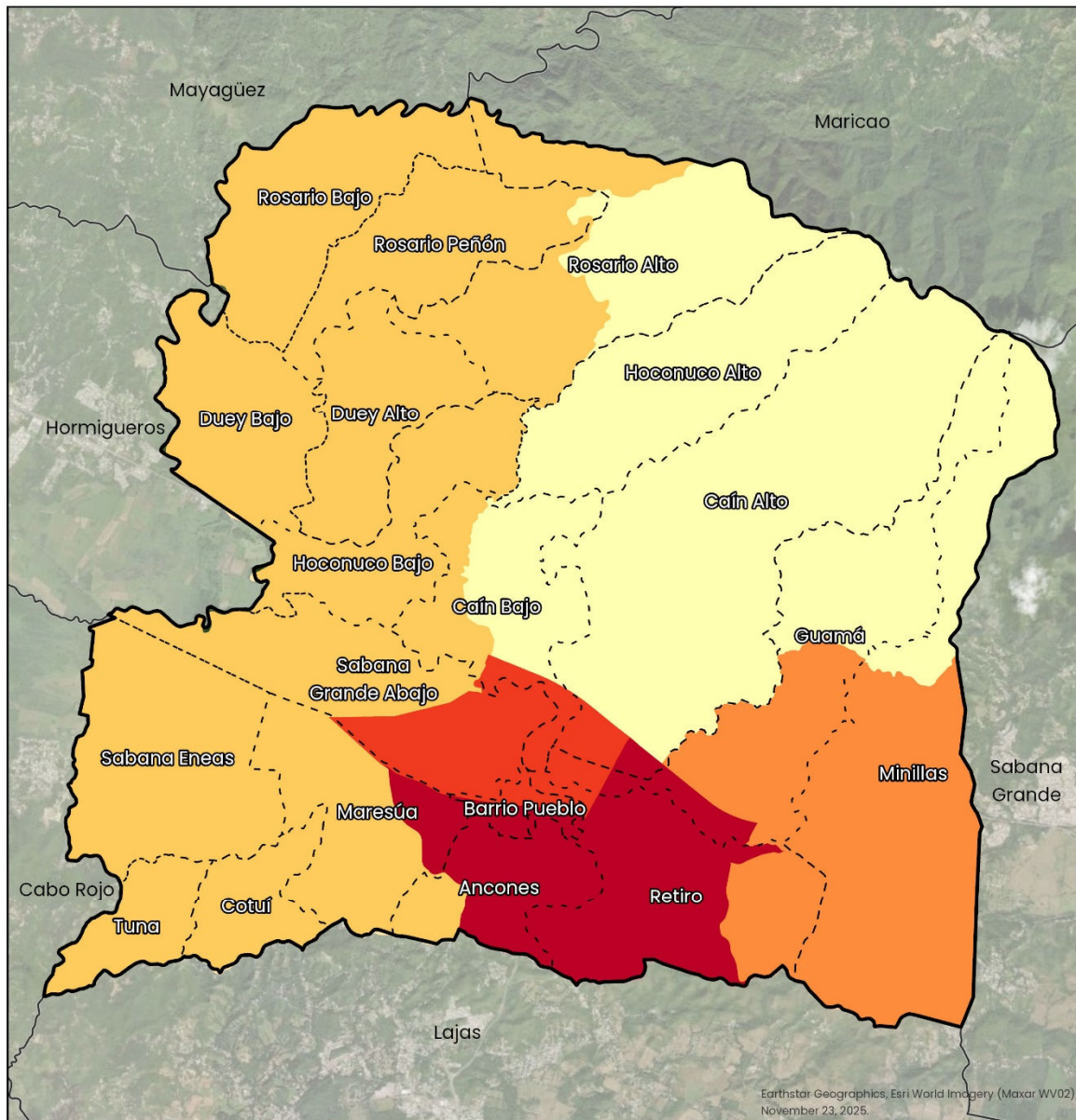
Figure 11. San Germán Population Pyramid (2024 ACS)



Source: US Census ACS 2020-2024

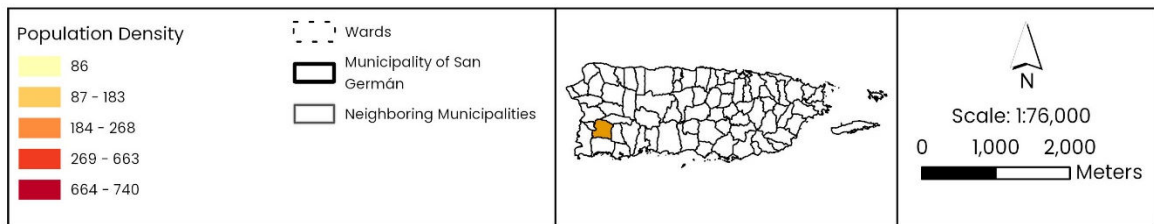
Map 7. Population Density by Census Tract

POPULATION DENSITY



Source: Puerto Rico Planning Board and Census Tract for Puerto Rico

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3.4.3 SOCIO-ECONOMIC CHARACTERISTICS

3.4.3.1 EMPLOYMENT

The following table shows the employment status for the municipality according to the 2020 –2024 Five-Year ACS.

Table 6. San Germán – Current Labor Force Statistics

Variable	Estimate	Percentage
Population 16 years and over	26,864	
In Labor Force	9,402	35.00%
Civilian Labor Force	9,380	34.90%
Employed	8,615	32.10%
Unemployed	765	2.80%
Armed Forces	22	0.10%
Not in Labor Force	17,462	65.00%
Unemployment rate		8.20%

Source: US Census ACS 2020–2024 ACS 2020–2024

The census data shows that the population in the labor force for San Germán is lower than population that is not in the labor force (35.00% in labor force vs 65.00% not in labor force). When comparing with the 2015–2019 Five-Year ACS the percentage of population in the labor force has increased (35.00% in 2024 vs 31.50% in 2019). In comparison with the Commonwealth of Puerto Rico the municipal population in the labor force is lower (35.00% for San Germán vs 46.40% for Puerto Rico).

The 2024 ACS showed an unemployment rate for the municipality of 8.20%. This represents an increase regarding the 2015–2019 Five-Year ACS (8.20% in 2024 vs 6.60% in 2019). In comparison to the whole Commonwealth of Puerto Rico the unemployment rate is lower (8.20% for San Germán vs 10.70% for Puerto Rico).

3.4.3.2 EMPLOYMENT BY INDUSTRY

The following table presents employment by industry within the municipality, comparing data from the 2020–2024 Five-Year ACS with the 2015–2019 Five-Year ACS. The final column reflects the percentage change in employment by industry between the two survey periods.

Table 7. Employment by Industry 2024 ACS vs 2019 ACS

Industry	ACS 2024 Five Year	Percentage 2024	ACS 2019 Five Year	Percentage 2019	Rate of Change between 2024 and 2019 ⁹
Agriculture, Forestry, fishing and hunting and mining	155	1.80%	267	3.4%	-41.95%
Construction	664	7.70%	247	3.2%	168.83%
Manufacturing	1,242	14.40%	907	11.7%	36.93%
Wholesale Trade	90	1.00%	317	4.1%	-71.61%
Retail Trade	1,100	12.80%	831	10.7%	32.37%
Transportation and warehousing, and utilities	158	1.80%	448	5.8%	-64.73%
Information	47	0.50%	95	1.2%	-50.53%
Finance and Insurance, and real estate and rental and leasing	400	4.60%	205	2.6%	95.12%
Professional, scientific, and management, and administrative and waste management services	892	10.40%	436	5.6%	104.59%
Educational services, health care and social assistance	2,273	26.40%	2,280	29.4%	-0.31%
Arts, entertainment, recreation, and accommodation and food services	738	8.60%	886	11.4%	-16.70%
Other services, except public administration	316	3.70%	153	2.0%	106.54%
Public administration	540	6.30%	677	8.7%	-20.24%
Total employee Population 16 years and over	8,615		7,749		

Source: US Census ACS 2020-2024 and ACS 2015-2019

This table shows the following employment characteristics for San Germán:

- The industry with the highest level of employment in San Germán in 2024 is “Educational services, healthcare and social assistance”, representing 26.40% of the municipality’s workforce. This aligns with the numerous healthcare

⁹ Rate of percentage change is calculated as $Percentage\ Change = \frac{new\ value - original\ value}{original\ value} \times 100$

facilities identified within the jurisdiction in the analysis of the Health and Medicine Lifeline in section 3.5.3.

- Compared with the 2019 survey, *“Educational services, health care and social assistance industry”* remained the industry with the highest employment. However, it did experience the highest net negative growth; its change was -7 individuals (-0.31%) between 2019 and 2024.
- The other two industries employing more than 10% of the workforce are *Retail Trade* (12.80%) and *Professional, scientific, and management, and administrative, and waste management* (10.40%).
- Industries that experienced negative growth between the 2019 and the 2024 surveys include:
 - Wholesale Trade (-227 individuals).
 - Transportation and warehousing, and utilities (-290 individuals).
 - Information (-48 individuals).
 - Agriculture, Forestry, fishing and hunting and mining (-112 individuals).
 - Public Administration (-137 individuals).
 - Arts, entertainment, recreation, accommodation and food services (-148 individuals).
 - Educational services, health care and social assistance (-7 individuals).
- The industry with the highest net growth was *“Professional, scientific, and management, and administrative and waste management services”* with a net increase of +456 individuals, representing a percentage change of +104.59%.
- Other industries that increased, or experienced a positive percentage change rate, are:
 - “Construction” (+417 individuals).
 - “Other services, except public administration” (+163 individuals).
 - “Finance and Insurance, and real estate and rental and leasing” (+195 individuals).
 - “Manufacturing” (+335 individuals).
 - “Retail trade” (+269 individuals).
- Overall, the employed population of the municipality increased by +866 individuals, representing a rate change of +11.18% between 2019 and 2024.
- An interesting outlier is the *“Agriculture, forestry, fishing and hunting, and mining”* industry which had a rate change of -41.95%. However, even in 2024, this industry only employs 155 individuals (≈1.80% of the workforce).

3.4.3.3 POVERTY LEVEL

According to the U.S. Census Bureau, 15,365 residents of San Germán (49.60%) live in poverty over the past 12 months, as determined by income thresholds that vary according to household size and composition. This information is used to evaluate the economic well-being of individuals and families. The table is essential for understanding the economic conditions of different groups and for guiding the development and implementation of policies aimed at reducing poverty as well as the vulnerability of the population.

Table 8. Municipality of San Germán 2024 ACS Poverty Level

Total Population ¹⁰	Number of Individual below the poverty level during the last 12 months	Percentage of the Population below the poverty level in the last 12 months
30,996	15,365	49.60%

Source: US Census ACS 2020–2024

3.4.3.4 INCOME

According to the 2024 ACS the median household income for San Germán was \$18,317, while the mean household income was of \$29,612. The following table shows the estimated income and benefits for households in the municipality.

Table 9. 2024 ACS Income and Benefits per Household

Category	Number of Households	Percentage
Less than \$10,000	3,260	27.50%
\$10,000 to \$14,999	1,679	14.20%
\$15,000 to \$24,999	2,334	19.70%
\$25,000 to \$34,999	1,391	11.70%
\$35,000 to \$49,999	1,214	10.20%
\$50,000 to \$74,999	1,014	8.50%
\$75,000 to \$99,999	403	3.40%
\$100,000 to \$149,999	351	3.00%
\$150,000 to \$199,999	148	1.20%
\$200,000 or more	66	0.60%

¹⁰ Note that the census data has a slight discrepancy in the number of total populations reported in this dataset and other data sets.

Total households	11,860	100%
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Source: US Census ACS 2020–2024

This table shows that slightly more than a quarter of all households (26.00%) in San Germán earn less than \$10,000 per year. While 61.40% of households earn less than \$25,000 per year. In comparison, according to the 2015–2019 ACS, 33.00% of households earned less than \$10,000 and 65.50% earned less than \$25,000.

3.4.3.5 POPULATION WITH DISABILITIES

The following table shows data on individuals living with disabilities based on the 2020–2024 and 2015–2019 Five-Year American Community Survey datasets. There was a net increase of 1,288 individuals living with a disability in the municipality. All age groups experienced an increase except the “Under 5 years” group, which remained at zero in both periods. The largest proportional increase occurred in the 75 years and over group, which showed a 52.64% rate of change, followed by the 18 to 34 years group (87.10%) and the 65 to 74 years group (27.41%). This information is particularly important for the LHMP update, as the relevant literature consistently demonstrates that people with disabilities are especially vulnerable to the impacts of natural hazard events.

Table 10. San Germán Population living with disabilities

Age Group	2024	2019	Net change	Rate of change
Under 5 years	0	0	0	0%
5 to 17 years	284	235	49	20.85%
18 to 34 years	406	217	189	87.10%
35 to 64 years	1,341	1,075	266	24.74%
65 to 74 years	688	540	148	27.41%
75 years and over	1,844	1,208	636	52.64%
Total Population living with a disability	4,563	3,275	1,288	39.35%

Source: US Census ACS 2020–2024

3.4.3.6 POPULATION RECEIVING SUPPLEMENTAL NUTRITIONAL SUPPORT

The following table shows information on households in San Germán that receive food assistance, based on data from the 2020–2024 and 2015–2019 American Community Survey (US Census Bureau, 2025).

Table 11. Population receiving food aid

Data Set	2024	2019	Net Change	Rate of Change
Total Households in the municipality	11,860	11,722	138	1.18%
Households receiving food assistance	6,225	5,298	927	17.50%
Percent of Households receiving food assistance	52.50%	45.20%	–	–

Source: US Census ACS 2020–2024

Based on the table, San Germán has a total of 11,860 households, of which 6,225 households receive food assistance, representing an increase of 17.50% compared to the 2019 ACS. Overall, 52.50% of all households in the municipality receive food assistance, indicating a significant level of food insecurity within the community.

3.4.3.7 HEALTH INSURANCE COVERAGE

The following table shows the 2020–2024 health insurance coverage for the municipality.

Table 12. 2025 ACS Health Insurance Data

Variable	Estimate	Percentage
Civilian noninstitutionalized population	31,106	
With health insurance coverage	29,565	95.00%
With private health insurance	9,459	30.40%
With public coverage	22,351	71.90%
No health insurance coverage	1,541	5.00%

Source: US Census ACS 2020–2024

The data shows that 1,541 people (5.00%) in San Germán have no health insurance at all. While almost three quarters (71.90%) depend on public health coverage. This data will be revisited when discussing the hazard of Pandemic/Epidemic.

3.4.3.8 HOUSING STOCK AND OTHER RELATED DETAILS

According to the 2024 ACS San Germán had a total of 16,255 housing units of those a total of 4,395 were vacant. This constitutes more than a quarter (27.00%) of the total housing stock of the municipality. According to the 2024 ACS of the 11,860 occupied housing units, 7,707 units were occupied by owners and 4,153 by renters.

The following table shows the year of construction of the housing units by range.

Table 13. 2024 ACS – Housing Units Year of Construction

Year Structure Built	Housing Units	Percentage
Built 2020 or later	23	0.10%
Built 2010 to 2019	373	2.30%
Built 2000 to 2009	1,602	9.90%
Built 1990 to 1999	2,424	14.90%
Built 1980 to 1989	3,033	18.70%
Built 1970 to 1979	3,869	23.80%
Built 1960 to 1969	2,626	16.20%
Built 1950 to 1959	1,302	8.00%
Built 1940 to 1949	619	3.80%
Built 1939 or earlier	384	2.40%
Total	16,255	100%

Source: US Census ACS 2020–2024

The 2024 ACS shows that more than half of the housing stock was built between 1970 and 1999. The latest Building Code was adopted by the government of Puerto Rico in 2018, before that the most recent version of the Building Code was adopted in 2011. This means that at least 97.60% of the housing stock was built before the current and immediately previous building code.

The following table shows the vehicle available per occupied housing units.

Table 14. 2024 ACS – Vehicle per occupied housing unit

Variable	Occupied Housing Units	Percentage
No vehicle available	1,873	15.80%
1 vehicle available	5,156	43.50%
2 vehicles available	2,937	24.80%
3 or more vehicles available	1,894	16.00%
Total Occupied Housing Units	11,860	

Source: US Census ACS 2020–2024

The 2024 ACS shows that there are 1,873 housing units that do not have available vehicles. This represents a critical matter since the development pattern in the municipality is rural and/or suburban, where vehicular transportation is necessary for mobility.

3.5 INFRASTRUCTURE

Infrastructure refers to the essential physical and organizational systems that support the effective functioning of a society or economy. It includes critical networks such as transportation systems (roads, bridges, railways), energy generation and distribution, water supply, telecommunications, and other services that sustain economic activity and daily life. Collectively, infrastructure serves as the foundational framework that enables communities and economies to operate reliably and efficiently (NIST, n.d.). Infrastructure is commonly classified into two categories: hard infrastructure and soft infrastructure.

Hard infrastructure refers to the physical facilities and networks that underpin the functioning of a modern society and economy. This includes transportation systems such as roads, bridges, railways, and airports, as well as water systems, electrical grids, and telecommunications networks. These tangible assets enable the movement of people and goods, the distribution of energy and water, and the transmission of information.

Soft infrastructure refers to the institutions, services, and systems that support economic stability, public health, social order, and cultural development. This category includes educational institutions, healthcare systems, law enforcement agencies, emergency response services, parks, and recreational facilities. Unlike hard infrastructure, soft infrastructure is characterized by organizational frameworks and human-centered services that contribute to community well-being and effective governance.

As described in Section 2.8 FEMA defines Community Lifelines as the most essential services and systems necessary to sustain the uninterrupted operation of critical government and business functions, while also protecting public health, safety, and economic security. These lifelines constitute the fundamental components of a community and once stabilized, enable all other sectors of society to function effectively. During disaster events, any disruption to these lifelines requires immediate and coordinated action to restore stability and reduce cascading impacts. Accordingly, the assessment of existing infrastructure will be conducted in alignment with FEMA's Community Lifelines framework.

3.5.1 LIFELINE: SAFETY AND SECURITY

The purpose of the Safety and Security Lifeline is to protect life and property while maintaining social stability during emergency situations. This lifeline focuses on reducing immediate risks to public safety and personal security through the operation of public safety agencies, controlled access to affected areas, and the prevention of crime, civil unrest, and violence. It also encompasses ensuring safety and security at emergency shelters, distribution centers, and other critical facilities during disaster response and recovery operations.



FEMA indicates that disruption of this lifeline can result in social disorder and heightened community vulnerability, making rapid restoration a critical priority. Response actions require close coordination among federal, state, and local agencies, the deployment of security personnel, the implementation of traffic control measures, and the protection of critical infrastructure.

Map 8 shows a municipal scale location of the Safety and Security related infrastructure. This map shows that most of the Safety and Security Lifeline is near the town center. For example, the State Police is located along PR-122 coming from PR-2, while the Emergency Management Center and the Municipal Police station are in the intersection of roads PR-360/PR-362. The fire station is located to the north of the town center across the PR-2 highway. Another smaller fire station is in Poblado El Rosario near the border with Hormigueros. The Municipality's City Hall is located in the town center.

3.5.2 LIFELINE: FOOD, HYDRATION AND SHELTER



The Food, Hydration, and Shelter Lifeline is intended to ensure that disaster-affected populations have prompt access to essential necessities, including food, potable water, and safe shelter. This lifeline encompasses the provision of ready-to-eat meals, water distribution, the establishment of temporary shelters, and coordination with governmental and volunteer organizations to meet basic human needs. Disruptions to this lifeline pose an immediate threat to life; therefore, rapid response actions are prioritized to restore food availability and housing stability as quickly as possible. The main shelters in the municipality are the Arquelio Torres Coliseum and the Old National Guard Headquarters.

Map 8 shows a municipal scale location of the Food, Hydration and Shelter Lifeline.

3.5.3 LIFELINE: HEALTH AND MEDICINE

The purpose of this lifeline is to ensure the continuity of essential medical services and the protection of public health during emergencies and disasters. It focuses on stabilizing healthcare delivery, ensuring access to hospitals, clinics, medications, and healthcare personnel, and maintaining the capacity to respond effectively to life-threatening conditions.



FEMA indicates that disruption of this lifeline can have serious consequences; therefore, priority actions focus on restoring medical facilities, deploying emergency response teams, ensuring the availability of critical medical supplies, and coordinating efforts among federal, state, and local agencies.

Map 8 shows the healthcare facilities inside of the municipality of San Germán. A regional health facility, named La Concepción Hospital, is located in the intersection of roads PR-2/PR-360 in Caín Alto ward.

3.5.4 LIFELINE: ENERGY



Energy Lifeline is designed to ensure the reliable and safe delivery of electricity, gas, and essential fuels during emergencies and disaster events. This lifeline is vital to sustaining the operation of critical facilities and services, including hospitals, water and wastewater systems, telecommunications, and other infrastructure that depend on uninterrupted energy supply.

FEMA recognizes that disruptions to energy services pose a direct threat to life safety and community stability. Accordingly, priority response actions include the rapid restoration of the electrical grid, the deployment of generators to critical facilities, coordination with fuel suppliers, and the implementation of temporary measures to maintain service continuity. Map 11 illustrates the distribution of gas stations within the municipality and indicates a notable lack of fueling facilities in the southwestern

portion of the jurisdiction.

Map 8 identifies critical facilities associated with the Energy Lifeline within the Municipality of San Germán. These facilities represent infrastructure that supports the provision of power and fuel services and are part of the municipality's critical infrastructure network. The location and distribution of these assets are important for maintaining essential services and supporting emergency response and recovery operations following hazard events. Energy Lifeline remains vulnerable to disruptions caused by hurricanes, severe storms, and damage to transmission and distribution infrastructure. Because many critical facilities depend on a reliable power supply, power outages may affect healthcare services, telecommunications, water systems, and emergency operations. Continued investment in system maintenance, hardening, and modernization of Puerto Rico's electric transmission and distribution network is essential to improve reliability, reduce service interruptions, and strengthen community resilience to future hazard events.

3.5.5 LIFELINE: COMMUNICATIONS

The purpose of this lifeline is to ensure the availability and reliability of essential communication systems during emergencies and disaster events. These systems include telephone networks, internet services, radio, television, and public alert and warning platforms, all of which are critical for coordinating response activities, disseminating timely information, and maintaining communication between authorities and the public.



FEMA indicates that disruption of the Communications Lifeline can severely impair life-saving operations and effective resource management. Accordingly, priority actions include the restoration of telecommunications infrastructure, deployment of temporary communication solutions such as satellite systems, ensuring redundancy within critical networks, and maintaining accessible communication channels for the public.

3.5.6 LIFELINE: TRANSPORTATION



equipment.

The purpose of the Transportation Lifeline is to ensure the safe and efficient movement of people, goods, and essential services during emergencies and disaster events. This lifeline supports the continued operation or rapid restoration of land, air, and maritime transportation routes, enabling access to critical resources such as food, potable water, medical care, and emergency response

FEMA indicates that disruptions to transportation systems directly affect the ability to save lives and distribute essential supplies. Accordingly, priority actions include reopening roadways, repairing damaged bridges, restoring airport and port operations, and coordinating with state and private entities to maintain the logistics chain.

The municipality's transportation network is centered on PR-2, the primary roadway corridor traversing San Germán from west to east and providing regional connectivity to neighboring municipalities and the broader southwestern region of Puerto Rico. The municipality is also served by several secondary routes, including PR-102, PR-114, PR-122, PR-166, PR-318, and PR-101, which connect Barrio Pueblo with surrounding wards and neighboring municipalities such as Hormigueros, Cabo Rojo, Lajas, Sabana Grande, Maricao, and Mayagüez.

The roadway network converges around Barrio Pueblo, which serves as the municipality's principal transportation hub and provides access to government facilities, commercial areas, critical infrastructure, and residential communities. Road density is generally greater within the central and southern portions of the municipality, while the northern and northeastern sectors contain fewer major roadways due to more mountainous terrain. Maintaining the functionality of these transportation corridors is essential for emergency response, evacuation, and post-disaster recovery operations, as disruptions caused by flooding, landslides, fallen trees, or storm debris may limit access to portions of the municipality during hazard events.

Bridges are also an important component of the Transportation Lifeline. According to the 2050 Puerto Rico Multimodal Transportation Plan in San Germán the following bridges are slated for improvements.

- Bridge #809, PR-348, Km. 17.20, Nueve Pasos River
- Bridge #2899, PR-2, Km. 173.62, Hospital Conception Access

Map 9 illustrates the roadway network of the Municipality of San Germán. The primary transportation corridors within the municipality are described below.

3.5.7 LIFELINE: HAZARDOUS MATERIALS

The purpose of this lifeline is to prevent hazardous material releases, control spills, and protect communities located near industrial facilities, chemical plants, and hazardous materials transportation corridors.



FEMA indicates that disruption or failure of the Hazardous Materials Lifeline can result in severe consequences, including widespread contamination and the impairment of essential services. Accordingly, priority actions include identifying hazardous materials, activating specialized Hazardous Materials (HazMat) response teams, coordinating with federal and state agencies, and implementing rapid response protocols. Although hazardous materials may be present throughout the municipality, incidents involving hazardous materials are more likely to occur within industrial areas.

In the data provided there are no hazardous waste materials lifelines identified in San Germán. However, there are various major industrial sites throughout the municipality such as the PR-362 that is zoned with a light industrial zoning district and in the PR-122 corridor near the intersection with PR-2.

3.5.8 LIFELINE: WATER SYSTEMS



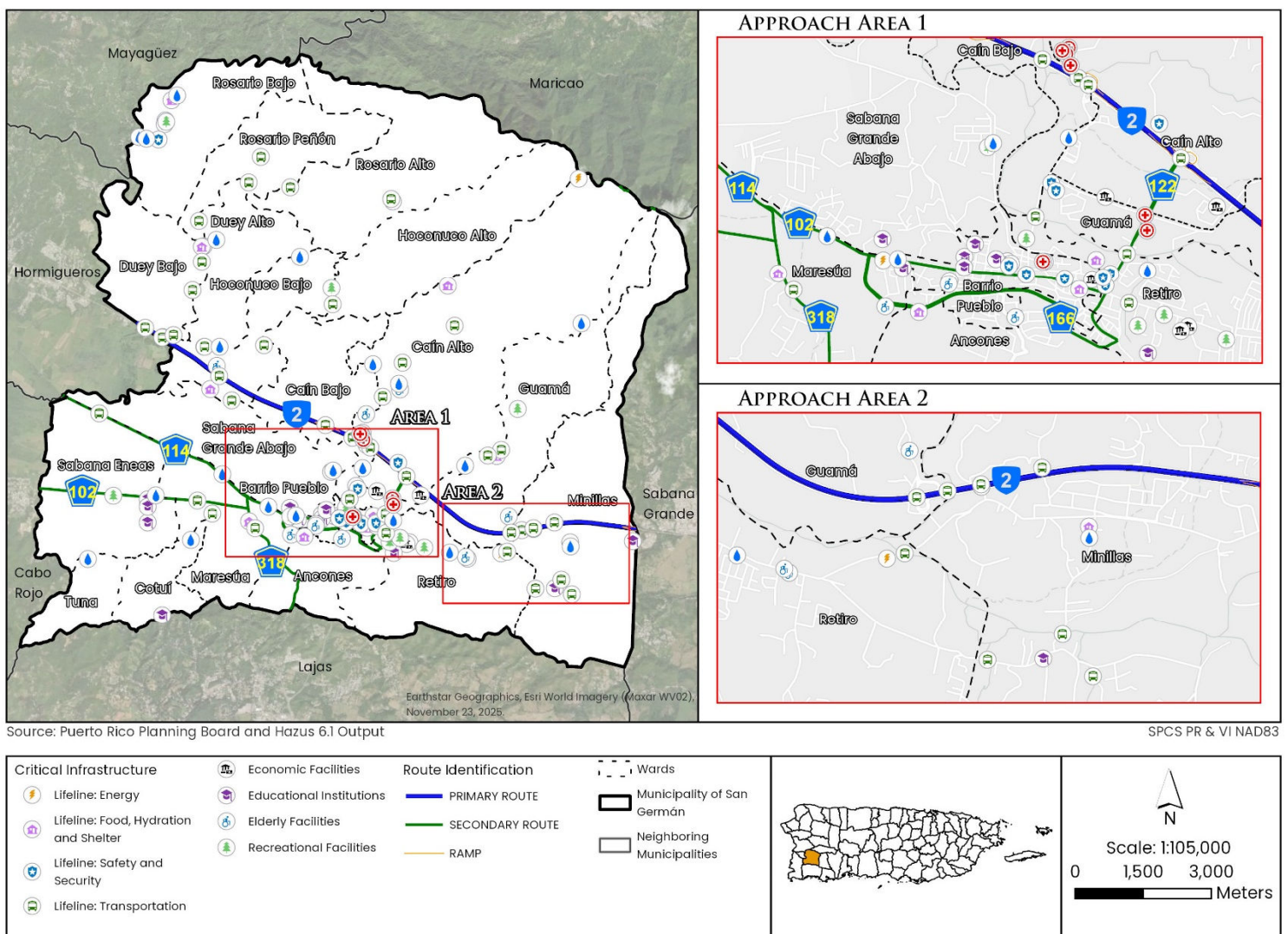
This lifeline highlights the critical role of water infrastructure in disaster response and recovery. Its primary objective is to ensure reliable access to and the timely restoration of drinking water and wastewater services, which are essential to public health, safety, and economic stability. The Water Systems Lifeline is structured around two core components: Potable Water Infrastructure, which includes water intake, treatment, storage, and distribution; and Wastewater Management, encompassing the collection, storage, treatment, and discharge of wastewater. By prioritizing the protection and functionality of water systems, FEMA seeks to maintain

sanitation, support healthcare services, and minimize cascading impacts on food safety and overall community resilience.

Map 8 shows the infrastructure in San Germán related to the water system lifeline.

Map 8. Critical Infrastructure by Lifelines

CRITICAL INFRASTRUCTURE BY LIFELINE



ROADS



Source: Puerto Rico Planning Board

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3.6 RECENT DEVELOPMENT (E1-A)

Hazard mitigation planning must also account for future development conditions. To assess anticipated development trends within the municipality, historical patterns were evaluated using data on construction permits approved between 2020 and 2026. This period begins with the year of approval of the previous hazard mitigation plan. It should be noted that data for 2026 are completed by June 30, 2026.

The data indicates fluctuating construction activity between 2020 and 2026. Permit approvals increased from 50 in 2020 to a peak of 76 in 2021 and remained relatively high in 2022 with 73 permits. Construction activity declined in 2023, when 43 permits were approved, but rebounded in 2024 with 68 permits before decreasing again in 2025 to 51 permits. As of June 30, 2026, 24 permits had been approved. Based on the available data, the Municipality of San Germán records an average of approximately 55 construction permits approved per year during the 2020–2025 period. Table 15 and Figure 12 present the number of constructions permits approved between 2020 and 2026. Maps 10 and 11 illustrate the spatial distribution of these permits. To enhance legibility, the permits are depicted on two separate maps: one showing permits issued from 2020 to 2022, and another showing permits issued from 2023 to 2025.

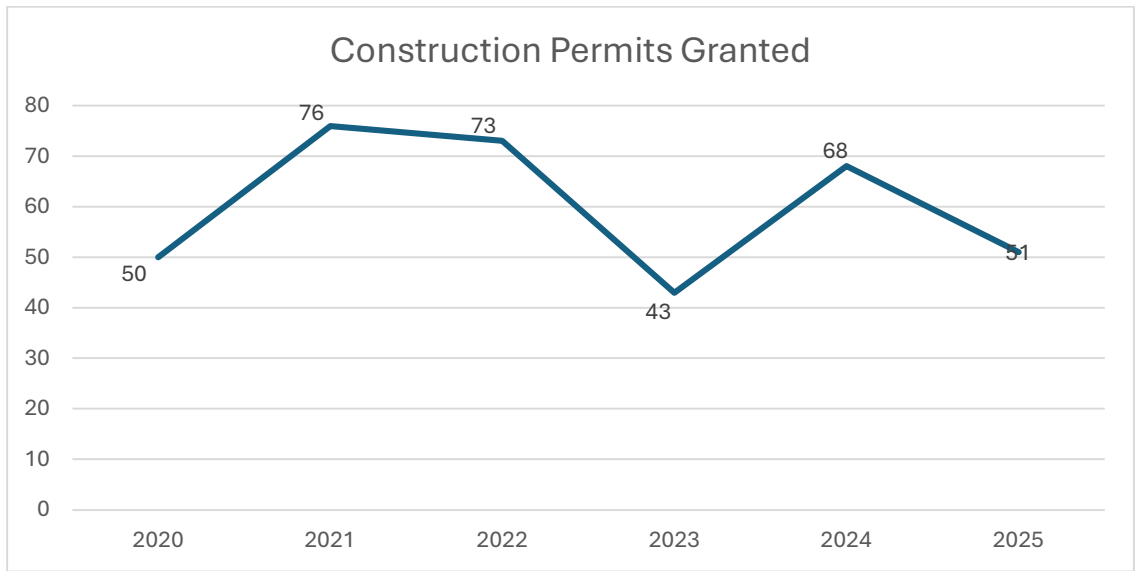
Table 15. San Germán: Approved Construction Permits 2020–2026¹¹

Approved Construction Permits 2019–2026	
Year	Permits Approved
2020	50
2021	76
2022	73
2023	43
2024	68
2025	51
2026	24

Source: Puerto Rico Planning Board

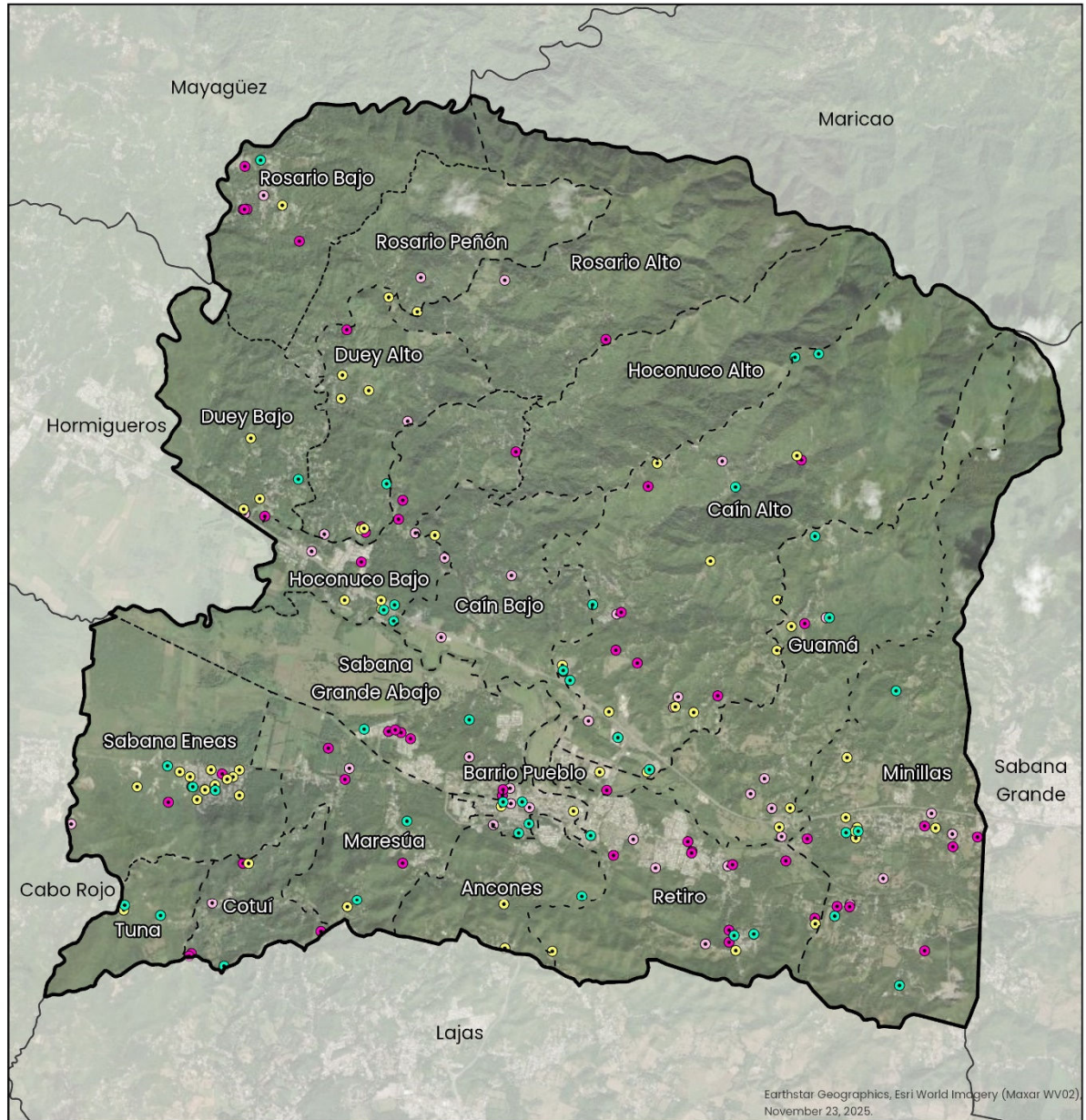
¹¹ 2026 total only accounts for permits granted up to June 30, 2026.

Figure 12. San Germán Approved Construction Permits 2020–2025



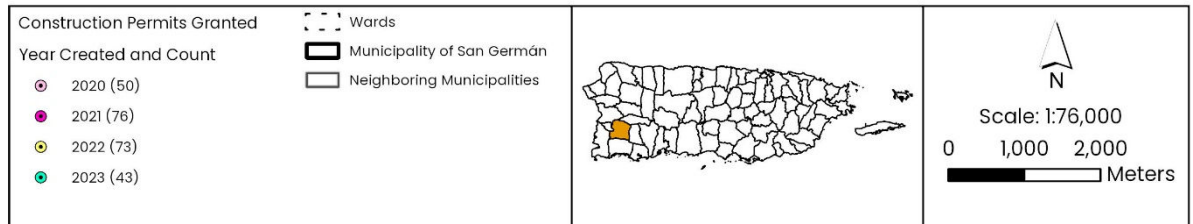
Source: Puerto Rico Planning Board

RECENT DEVELOPMENT 2020 -2023

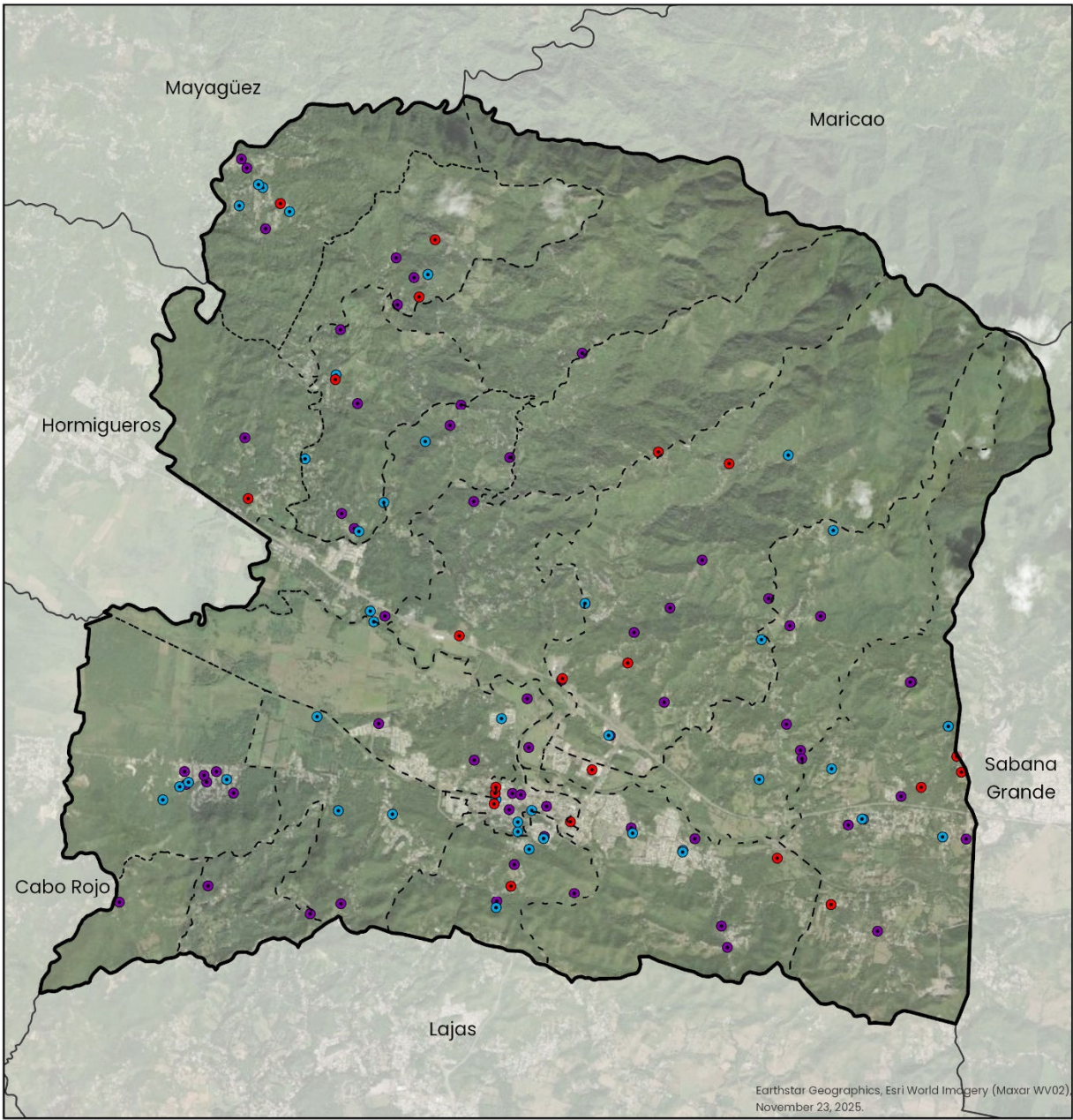


Source: Puerto Rico Planning Board and Hazus 6.1 Output

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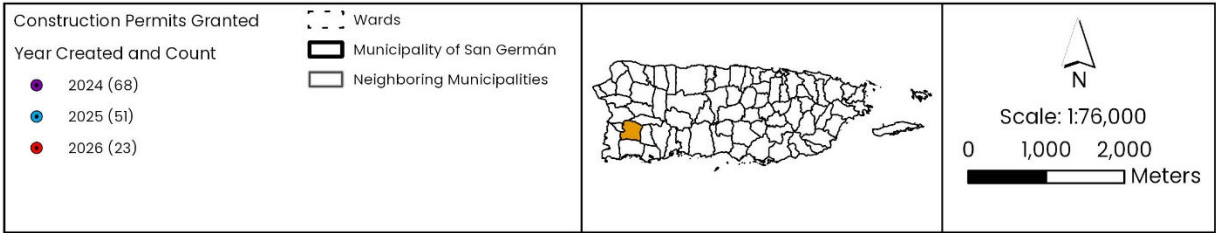


RECENT DEVELOPMENT 2024 -2026



Source: Puerto Rico Planning Board and Hazus 6.1 Output

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4. HAZARD PROFILES AND RISK ASSESSMENT

4.1 NOTE ON THE DISCUSSION OF HAZARDS

The 2020 LHMP divided the discussion of the considered hazards into two separate and non-continuous sections. This arrangement made the analysis of the hazard cumbersome since the reader had to go back and forth between two different sections of this large document. To improve this, this new LHMP discusses both the profile of the hazard and the risk associated in one single section.

4.2 REGULATORY REQUIREMENTS

Federal regulation 44 C.F.R. § 201.6(c)(2) establishes the requirements related to hazard identification and risk assessment for a LHMP. The LHMP must include the following:

- An assessment that provides the basis for identifying the proposed activities aimed at reducing losses associated with the identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses related to the identified hazards. The hazard assessment must include:
 - A description of the type, location, and extent of all natural hazards that may affect the jurisdiction. It must contain information on previous occurrences of hazard events and the probability of future hazards.
 - A description of the jurisdiction's vulnerability to the identified hazards. This description must include a comprehensive summary of each hazard and its impact on the community. This Plan must describe vulnerability in terms of:
 - The number of existing structures, infrastructure, and critical facilities located within identified hazard areas;
 - An estimate of the potential monetary losses to structures identified as vulnerable, along with a description of the methodology used to prepare the estimate; and, lastly,
 - A general description of land use and development patterns within the community so that mitigation options can be considered in future land-use decisions.

- A description of all structures insured under the National Flood Insurance Program (NFIP) that have experienced repetitive damage from different flood events. It must explicitly indicate whether the community participates in the NFIP and complies with its regulations. It must also include a table showing repetitive property losses along with a table of NFIP claims and losses.

4.3 HAZARDS THAT CAN AFFECT THE MUNICIPALITY

To determine the hazards to be addressed in this LHMP, the Municipality reviewed and integrated information from the 2021 Puerto Rico State Hazard Mitigation Plan, the 2020 San Germán Local Hazard Mitigation Plan, and the latest LHMP's of the municipalities that share a boundary with San Germán. The following table summarizes the hazards addressed in these Hazard Mitigation Plans. A check mark "✓" indicates that the hazard was included in the corresponding plan, while an "✗" denotes that it was not.

Table 16. Historical Hazards Inventories

Hazard	2021 PRSHMP	2020 San Germán LHMP	Neighboring Municipalities
Earthquake/Liquefaction	✓	✓	✓
Landslides	✓	✓	✓
Tsunami	✗	✗	✓
Flooding	✓	✓	✓
Storm Surge	✗	✗	✓
Coastal Erosion	✗	✗	✓
Sea Level Rise	✗	✗	✓
Extreme Winds Hazard	✓	✓	✓
Extreme Heat	✗	✓	✓
Drought	✓	✓	✓
Wildfire	✗	✓	✓
Pandemic/Epidemic	✗	✗	✗

After reviewing the hazard profiles contained in these documents, the Municipality of San Germán determined that the following hazards shall be assessed and evaluated as part of the 2026 LHMP:

Table 17. Hazards to be included in the San Germán 2026 LHMP

Hazard	Included in San Germán 2026 LHMP?	Comments
Earthquake	✓	It is included given Puerto Rico's location among major fault lines and the 2020 Seismic activity.
Landslides	✓	It is included given the high propensity for landslides in San Germán's territory.
Tsunami	✗	Tsunami impact does not reach the municipality,
Flooding	✓	It is included given the presence of extensive flood zones in the municipality that host critical infrastructure.
Tropical Cyclones/Extreme Winds	✓	It is included given that the southeastern region of Puerto Rico has been the most recurrent point-of-entry for hurricanes that make landfall in Puerto Rico in recorded history. (National Oceanic and Atmospheric Administration, 2026)
Storm Surge	✗	Storm Surge impact does not reach the municipality,
Long – Term Coastal Modification	✗	Municipality is a landlocked municipality.
Extreme Winds Hazard	✗	Included as part of the discussion on tropical cyclones.
Extreme Heat	✓	Included in the previous LHMP. Higher temperatures than usual merits the inclusion again.
Drought	✓	It is included given the 2014-2016 droughts and recent periods of moderate drought
Wildfire	✓	Periods of drought, high temperatures, and combustible vegetation have demonstrated the municipality's vulnerability to fires that threaten public safety, property, and natural resources
Pandemic/Epidemic	✓	The municipality of San Germán included this in the previous AHMP. It will be considered by the LHMP update given the COVID -19 emergency declaration of 2020.
High Hazard Potential Dam	✗	This risk was not evaluated in this plan as the municipality has no direct risk exposure

Hazard	Included in San Germán 2026 LHMP?	Comments
		within its territory or from neighboring municipalities.

For the rest of this document, the hazards shall be evaluated in the following order:

Table 18. Order of Hazards to be Assessed

Classification	Hazard
Geological Hazards	Earthquake
	Landslides
Hydrological Hazards	Flooding
Meteorological Hazards	Tropical Cyclone/ Extreme Winds
	Extreme Heat
	Drought
Environmental Hazards	Wildfire
Biological Hazards	Pandemic/Epidemic

4.4 CHRONOLOGY OF EVENTS

To prevent duplication of data and for easy reference in the discussion of each hazard profile, the reader will find a chronology of events in the discussion of the hazard itself.

4.5 RISK ASSESSMENT METHODOLOGY

This section describes the methodologies employed to evaluate the identified hazards. Given that each hazard presents distinct characteristics, data needs, and levels of uncertainty, multiple analytical approaches were utilized to ensure a thorough, accurate, and comprehensive risk assessment.

4.5.1 HAZUS 6.1

HAZUS is a Geographic Information System (GIS)–based risk assessment tool developed by FEMA to estimate potential losses associated with natural hazards. The software applies scientific modeling and spatial datasets to evaluate the impacts of events such as earthquakes, floods, and hurricanes on buildings, infrastructure, population, and the local economy. HAZUS generates detailed estimates of physical

damage, economic losses, and social consequences, thereby supporting hazard mitigation planning, emergency preparedness, and recovery efforts. By integrating data on hazard intensity, exposure, and vulnerability, HAZUS enables decision-makers to prioritize mitigation strategies and allocate resources effectively. The following hazards were evaluated using the HAZUS 6.1 platform:

- Earthquake
- Tropical Cyclone/ Extreme Wind
- Flooding

4.5.2 ALTERNATIVE GIS MODELING

Certain hazards are not currently modeled in HAZUS; however, they can be evaluated using alternative GIS-based techniques. ESRI® ArcGIS Pro™ 3.6 was utilized to assess hazard vulnerability by incorporating digital risk datasets and the hazard information database previously described. Using these spatial data layers, vulnerability was estimated by identifying the number of critical facilities and buildings located within hazard-prone areas. It is important to note that this method may overestimate exposure levels. In this LHMP, the following hazards were assessed using this GIS-based approach:

- Landslides

4.5.3 STOCHASTIC RISK ASSESSMENT

The stochastic risk assessment methodology was applied to evaluate hazards that are not addressed by existing hazard models or GIS-based analyses. This method is particularly appropriate for hazards that lack defined geographic boundaries and therefore cannot be reliably examined through spatial analysis. The approach allows for the incorporation of estimated annual losses and impact data; however, the accuracy of the results is highly dependent on the availability and quality of the underlying datasets.

In the case of this LHMP, the hazards evaluated using this methodology are:

- Extreme Heat
- Drought
- Wildfire
- Pandemic/Epidemic

This methodology is particularly appropriate for hazards that lack clearly defined

geographic boundaries and therefore cannot be evaluated through GIS-based analysis. It allows for the incorporation of estimated annual losses and impact data; however, the accuracy of the assessment is highly dependent on the availability and quality of the underlying datasets.

4.6 EARTHQUAKE

4.6.1 DESCRIPTION (B1-A)

An earthquake is a sudden movement of the Earth's crust generated by seismic waves that propagate outward in all directions from the focus, or point of origin (FEMA, 1997). The focus is the location within the Earth where the displacement of rocks along a fault initiates, while the epicenter refers to the point on the Earth's surface situated directly above the focus (Puerto Rico Seismic Network, 2019). Earthquakes may occur due to changes in pressure within the Earth's crust, including tectonic plate movement, rock rupture, volcanic activity, landslides, or the collapse of underground cavities.

Most earthquakes result from the release of accumulated stress generated by the displacement of rocks along faults within the Earth's outer crust. These faults are generally located along the boundaries of the planet's major tectonic plates. The highest levels of tectonic instability occur at plate margins where slow, opposing movements create substantial pressure due to plates traveling in different directions and at varying speeds. This deformation along plate boundaries causes stress to build in the surrounding rock. When the accumulated stress surpasses the strength of the rock, a rupture occurs, releasing stored energy in the form of seismic waves that propagate outward and produce an earthquake (NMEAD, 2021).

Earthquakes can impact extensive geographic areas, causing tens of billions of dollars in property damage, significant loss of life, numerous injuries, and widespread disruption to the social and economic stability of affected communities. Most structural damage and earthquake-related fatalities result from building collapse triggered by ground shaking (NMEAD, 2021). The severity of impacts depends on the amplitude and duration of seismic shaking, which are influenced by factors such as earthquake magnitude, proximity to the fault rupture, and the local and regional geologic conditions (NMEAD, 2021). Additional hazards associated with earthquakes include landslides where soil and rock masses move downslope and liquefaction, a process in which saturated soils lose their rigidity and behave like a fluid. Liquefaction can cause foundations and structures that rely on soil stability to shift, tilt, or collapse. Puerto Rico is located near the boundary between the North American and Caribbean

tectonic plates, within a subduction zone where one plate gradually descends beneath the other. This tectonic environment is characterized by significant seismic activity and lateral displacement. The relative movement between these two plates is approximately 2 centimeters per year (Puerto Rico Seismic Network, 2019). According to the Puerto Rico Seismic Network, seismic activity in the region is concentrated in eight (8) primary zones:

- The Puerto Rico Trench to the North,
- The North and South Slope Faults of Puerto Rico,
- The “Sombrero Zone”, to the Northeast,
- The Mona Passage to the West
- The Mona Canyon to the West,
- The Virgin Islands and Anegada depressions to the East,
- The Muertos trough to the South,
- In the southwest of Puerto Rico

To describe earthquake size, scientists use three (3) primary terms: intensity, magnitude, and ground acceleration. Intensity measures the level of shaking experienced by structures and the natural environment at a specific location. It varies based on the distance from the earthquake’s focus and the duration of the shaking. Magnitude refers to the amount of energy released during the event, as recorded by seismometers. Ground acceleration expresses the force of the seismic waves acting on the ground and is commonly used to characterize the severity of an earthquake (PRSN, 2019).

Earthquakes can generate a variety of secondary hazards, including liquefaction, landslides, seismic wave amplification, and tsunamis. In the 2020 LHMP the discussion in the section focused on liquefaction since the HAZUS software used on that occasion did not include data for Puerto Rico. For this LHMP this discussion will focus on the spectral acceleration effects of earthquakes. However, it is relevant to have a quick discussion regarding liquefaction.

Liquefaction refers to the process in which certain saturated soils temporarily lose their structural strength and behave like a dense fluid, significantly reducing their load-bearing capacity (PRSN, 2019). Liquefaction typically occurs in areas underlain by medium- to fine-grained sandy soils that are saturated with water and of relatively recent geologic origin. These conditions are most found along river margins and within Quaternary (Q) alluvial deposits. Another secondary hazard associated with earthquakes is the amplification of seismic waves. Seismic wave amplification occurs

in thick alluvial deposits where seismic waves decelerate, increasing their oscillation and causing the ground to experience stronger and more prolonged shaking. The previous LHMP focused on the analysis of liquefaction, because a HAZUS analysis for Puerto Rico was not possible with the HAZUS version that was available at that time. For this LHMP this analysis can be done due to updated to the HAZUS software. As such this LHMP will focus on the analysis of ground acceleration.

4.6.1.1 AFFECTED AREA (B1-B)

The following maps measure the spectral acceleration and spectral displacement in HAZUS 6.0 run scenarios.

Spectral Acceleration

Spectral Acceleration is measure used mainly in earthquake engineering to describe how strongly the ground motion from an earthquake would accelerate a structure with a specific natural period. This measure answers the question “If a building (or any structure) vibrates naturally at a certain period, how much acceleration would it experience during an earthquake?” or how hard the ground is pushing on the building at a specific vibration period? The higher the spectral acceleration, stronger the forces acting on the structure will be, which can cause structural failure if the building isn't designed for it (USGS, 2019).

Spectral Displacement

Spectral Displacement measures how far a structure is expected to move (deform) during an earthquake, based on its natural vibration period and damping in other words, it answers: “For a building with a given natural period, what is the maximum displacement it would experience during earthquake shaking?” (National Institute of Building Sciences, 2020).

Furthermore, the maps below show the Hazus scenario for .03 seconds and 1.0 seconds. The difference relates to how an earthquake impacts different types of structures based on the natural vibration period the building. The maps showing the 0.3-second scenario can affect buildings that are short, stiff structures like 1 or 2-story buildings. These buildings are rigid, so they vibrate quickly when the ground shakes. While the 1.0-second scenario is more important for buildings are taller, more flexible structures, like mid- to high-rise buildings. These buildings are taller and less stiff and therefore sway more slowly (over a longer period) during an earthquake (FEMA, Hazus

Earthquake Model User Guidance, 2024). The maps are considered by census tract.

As shown on Map 12, spectral acceleration at a 1.0-second period is higher in the northern portion of the municipality than in the southern areas. The highest spectral acceleration values (0.129654 – 0.155000 g) are concentrated in the northwest quarter of the municipality (Hoconco Alto, Caín Alto wards etc.) This zone of spectral acceleration also goes near the town center (Barrio Pueblo, parts of Sabana Grande Abajo and Maresúa wards).

Residential communities located within this zone include Colinas de Vista Linda, Quintas de Guamá, Sector Los Guilardo, among others. This data shows that the highest level of spectral acceleration and the second highest level cover the mountainous northern half of the municipality. As can be seen from Map 12, the highest level of spectral acceleration is located in the least population dense area of the municipality. The lowest levels of spectral acceleration are found in the southwest corner of the municipality (parts of Guamá, Minillas and Retiro wards).

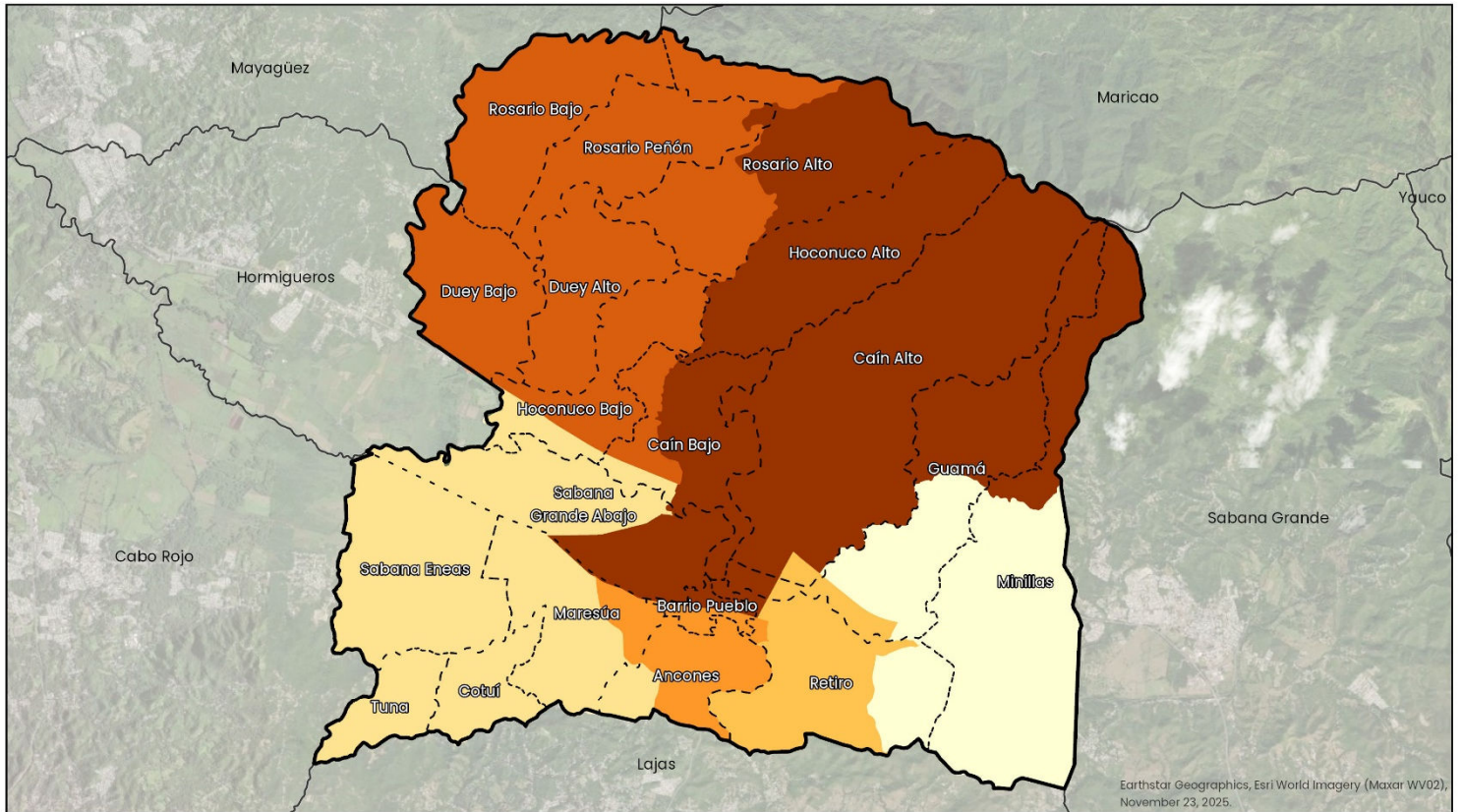
Map 13 illustrates an additional earthquake scenario based on spectral acceleration at 0.3 seconds. In this scenario, the highest vulnerability again appears in the northwest quadrant of municipality. Contrary to other municipalities, the scenarios for 1.0 and 0.3 accelerations are the same. As such the analysis for the 0.3 acceleration scenario is the same as the 1.0 scenario.

Maps 14 and 15 illustrate the spectral displacement expected during an earthquake, which represents the degree of movement or sway that buildings may experience. The spatial distribution of displacement closely mirrors the patterns observed in spectral acceleration, as higher acceleration levels generally correspond to greater structural sway. The spectral acceleration model provides the same analysis as the spectral displacement.

The wards that are of most concern are; Caín Alto, Hocunuco Alto as well as large sections of Guamá, Minillas, Caín Bajo, Rosario Alto, Sabana Grande Abajo, Barrio Pueblo and small sections of Rosario Peñon and Retiro.

Map 12. Earthquake: Spectral Acceleration at 1.0 sec (g)

EARTHQUAKE: SPECTRAL ACCELERATION AT 1.0 SEC (G)



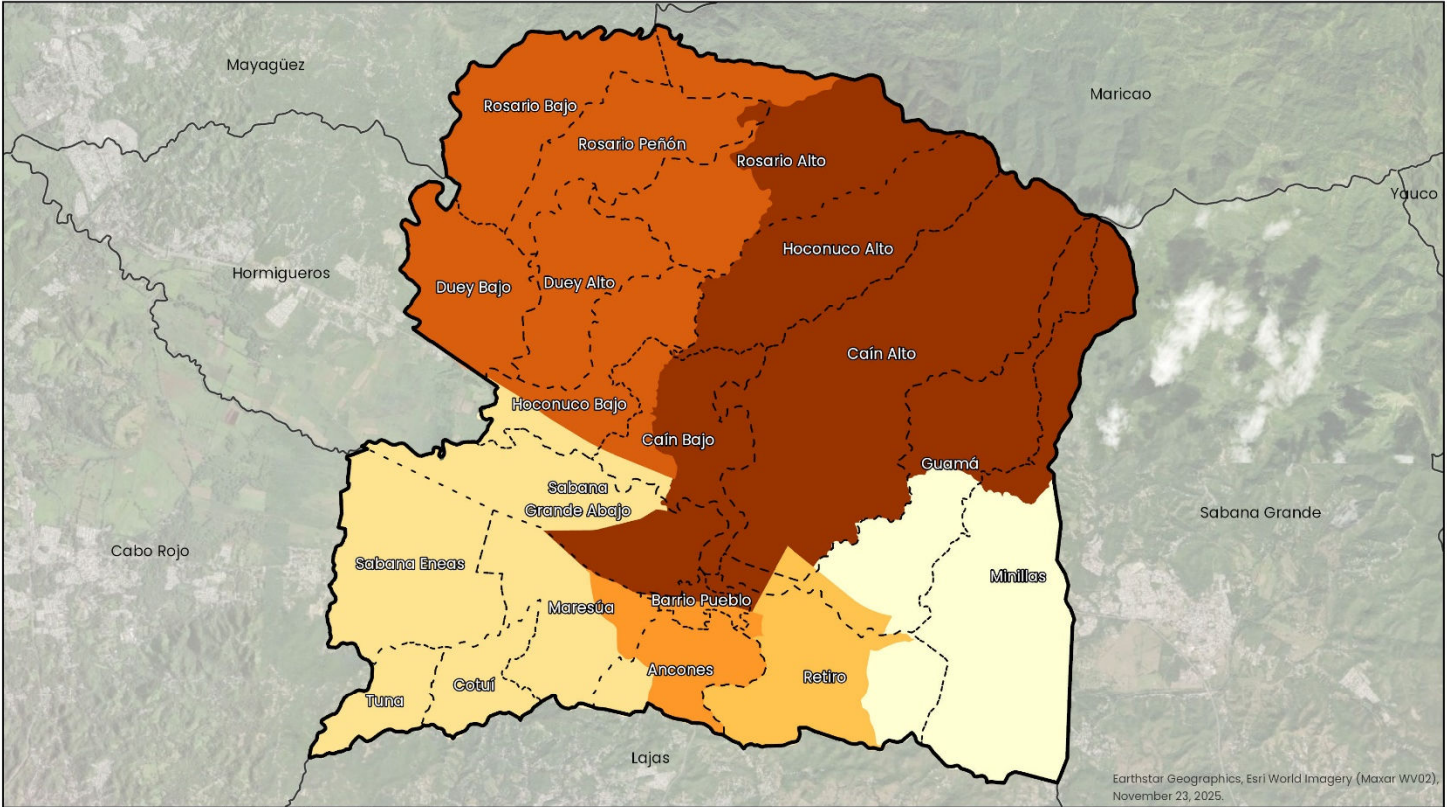
Source: Puerto Rico Planning Board and Hazus 6.1 Output

SPCS PR & VI NAD83



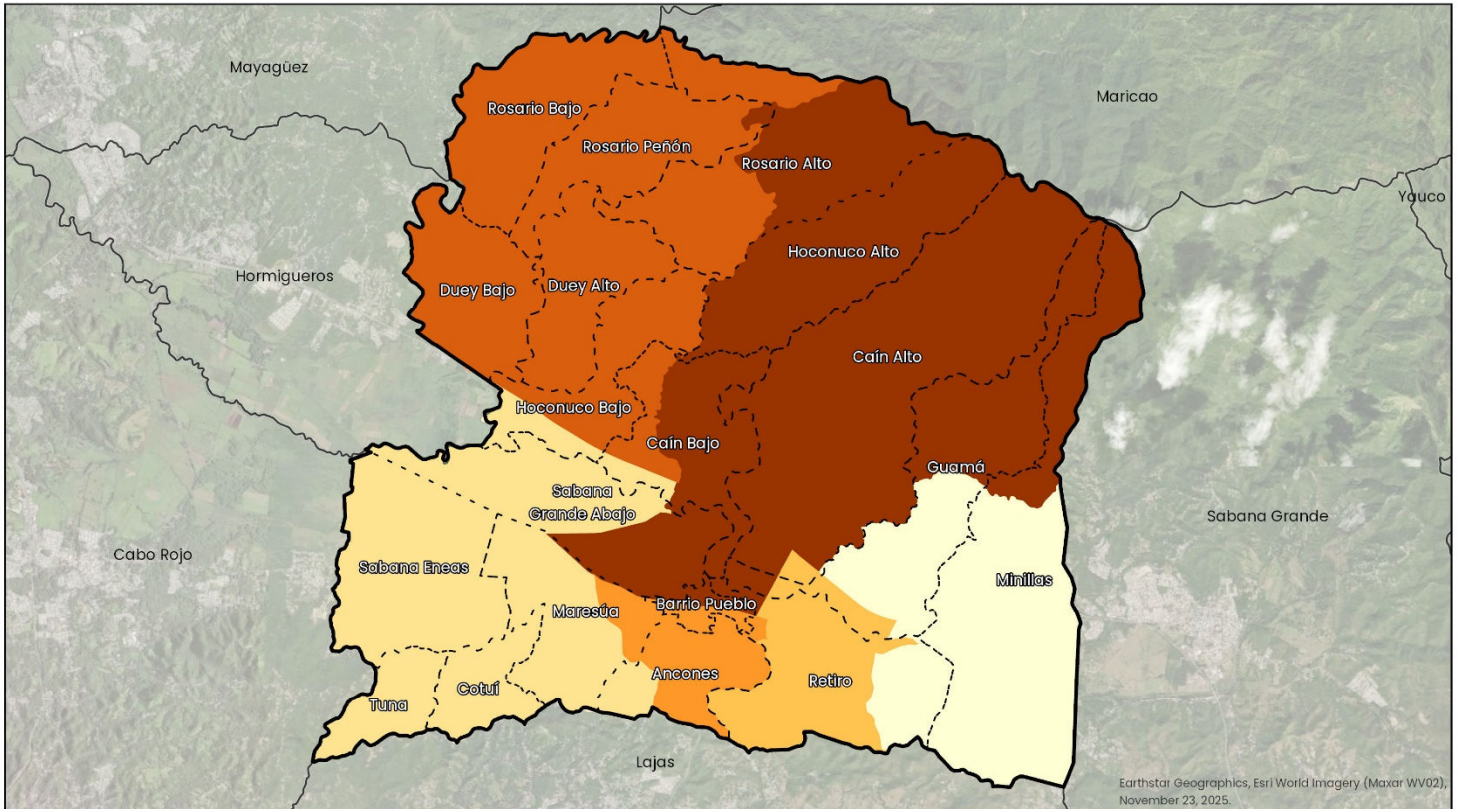
Map 13. Earthquake: Spectral Acceleration at 0.3 sec (g)

EARTHQUAKE: SPECTRAL ACCELERATION AT 0.3 SEC (G)



Map 14. Earthquake: Spectral Displacement at 1.0 sec (in)

EARTHQUAKE: SPECTRAL DISPLACEMENT AT 1.0 SEC (IN)



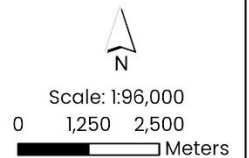
Source: Puerto Rico Planning Board and Hazus 6.1 Output

SPCS PR & VI NAD83

Spectral Displacement (in)

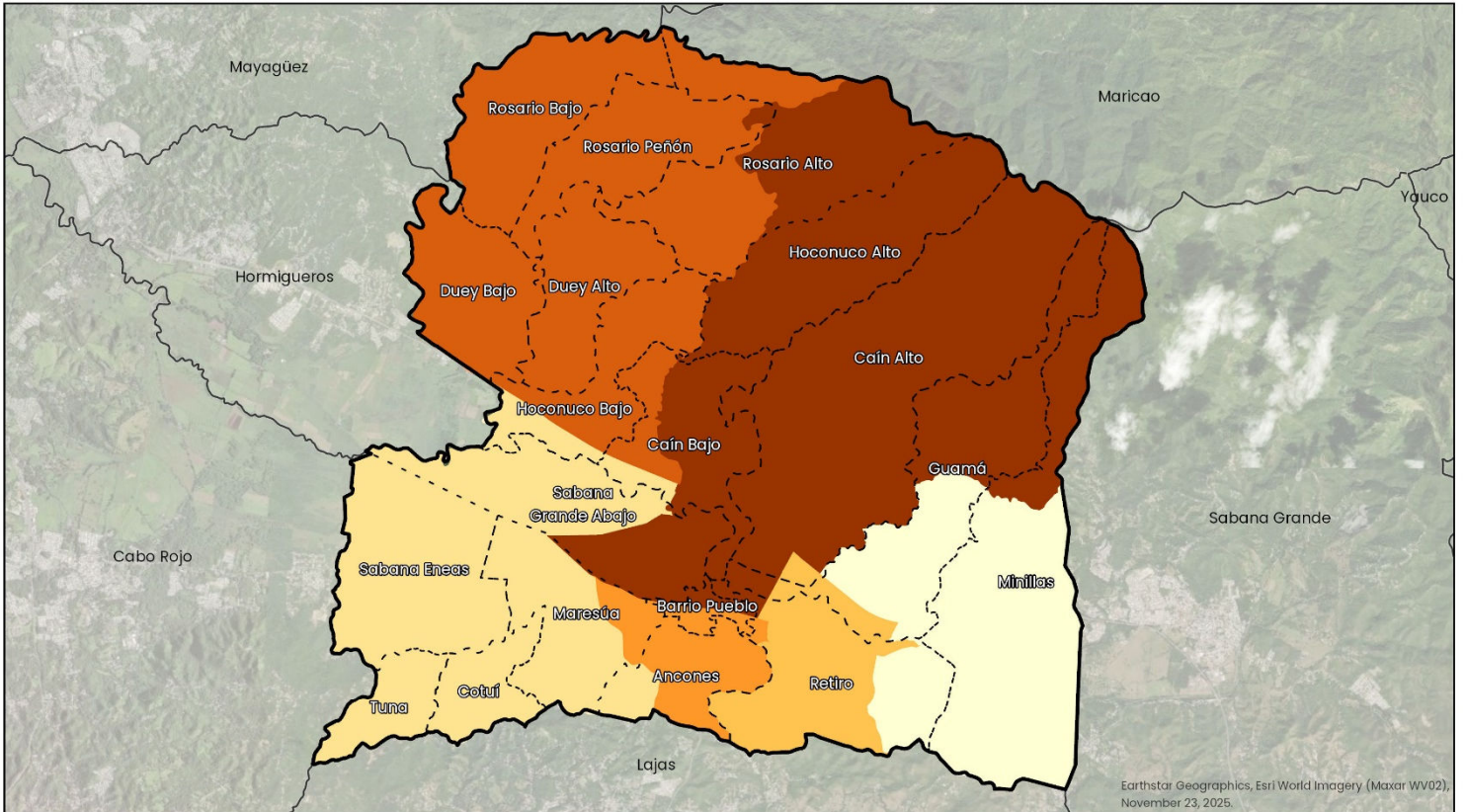
- 0.801628
- 0.801629 - 0.942753
- 0.942754 - 1.071082
- 1.071083 - 1.145142

- 1.145143 - 1.270596
- 1.270597 - 1.523897
- Wards
- Municipality of San Germán
- Neighboring Municipalities



Map 15. Earthquake: Spectral Displacement at 0.3 sec (in)

EARTHQUAKE: SPECTRAL DISPLACEMENT AT 0.3 SEC (IN)



Source: Puerto Rico Planning Board and Hazus 6.1 Output

SPCS PR & VI NAD83



4.6.1.2 *RISK MAGNITUDE (B1-C)*

The size of an earthquake, commonly associated with the Richter Scale, is widely recognized but often misunderstood. The concept of a logarithmic magnitude scale was first introduced by Charles Richter in the 1930s to measure earthquakes in Southern California using high-frequency recordings from nearby seismograph stations. This original scale, designated as ML where “L” stands for “local” eventually became known as the Richter magnitude.

As global seismic monitoring networks expanded, it became evident that the Richter method was accurate only within specific frequency and distance ranges. To accommodate a broader range of seismic signals recorded worldwide, additional magnitude scales were developed as extensions of Richter’s original concept, including the body-wave magnitude (M_b) and the surface-wave magnitude (M_s). Each of these scales applies to a particular frequency range and type of seismic waves, and within their respective valid ranges, they provide magnitudes equivalent to the Richter scale. (USGS, 2024)

Due to the limitations of the ML, M_b , and M_s scales, a more universally applicable scale moment magnitude (M_w) was developed. For large-magnitude earthquakes, M_w provides the most accurate and reliable estimate of earthquake size.

Moment is a physical quantity proportional to the amount of slip that occurs along a fault multiplied by the area of the fault surface that undergoes rupture. It reflects the total energy released by an earthquake. Moment can be derived from seismogram data and geodetic measurements and subsequently converted into a magnitude value using a standardized formula. The resulting measure, known as moment magnitude, provides a consistent and comparable estimate of earthquake size across the full range of magnitudes a capability that earlier scales do not offer (USGS, 2024). Table 19 below shows the Moment – Magnitude.

Table 19. Moment - Magnitude Scale¹²

Range	Description
Mw < 3.0	Usually not felt by people.
Mw 3.0 – 4.9	Minor earthquakes, often felt but rarely cause damage.
Mw 5.0 – 5.9	Moderate can cause slight damage to poorly built structures.
Mw 6.0 – 6.9	Strong can cause significant damage in populated areas.
Mw 7.0–7.9	Major, serious damage over large areas.
Mw ≥ 8.0	Great earthquakes, catastrophic damage over very large regions.

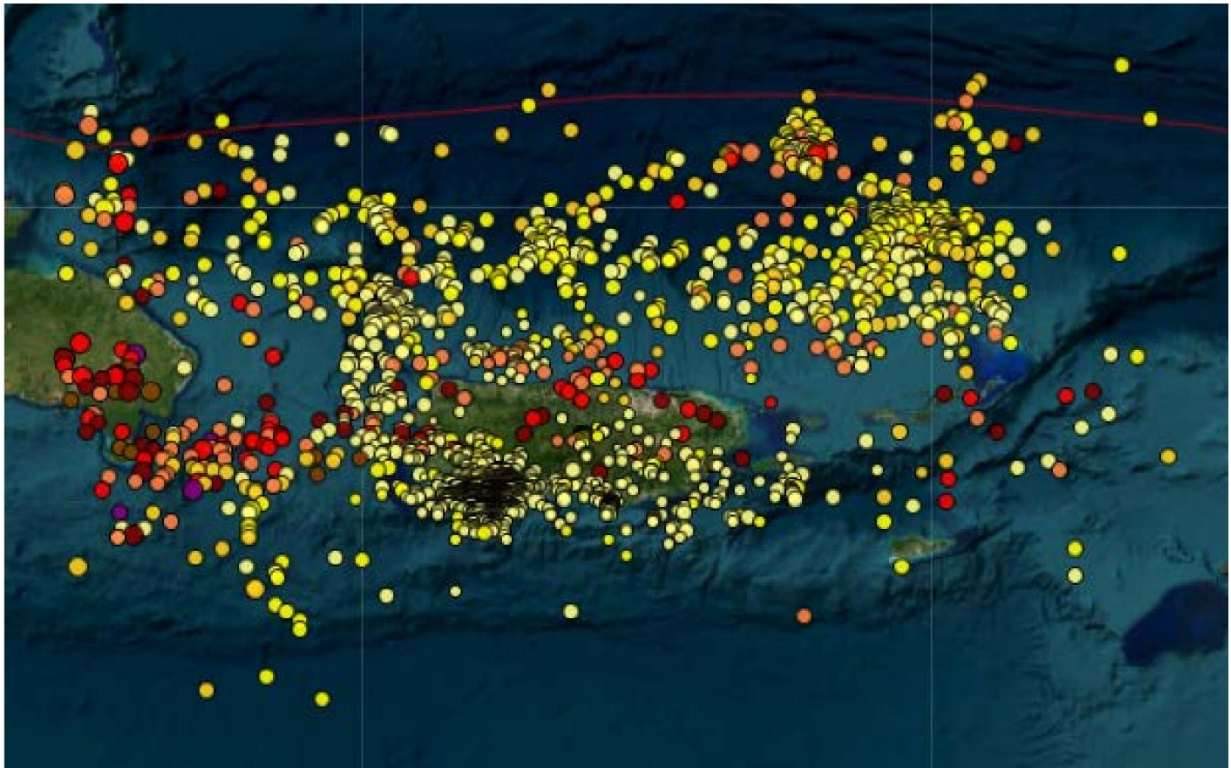
4.6.1.3 PAST EVENTS (B1-D)

Earthquakes occur naturally daily, and their impacts increase significantly with greater magnitude. High-magnitude events can be particularly destructive, causing extensive property damage, loss of life, and severe disruption to affected regions. Puerto Rico is located near several active seismic zones including the Puerto Rico Trench, the Mona Canyon, the Anegada Trough, the Muertos Trough, and the southern fault system placing the island at heightened risk for seismic events. Seismicity in the southeastern region of Puerto Rico is primarily associated with faults in the Virgin Islands and Anegada depressions. In the southwestern region, activity is influenced by the Punta Montalva fault (Roig Silva, 2010), an area that has experienced a notable increase in seismic activity in recent years (Weilert & Laó-Dávila, 2023).

Figure 13, is a screengrab sourced from a report published by the Puerto Rico Seismic Network (in Spanish). This report illustrates the epicenters of earthquakes recorded in the Puerto Rico and U.S. Virgin Islands region in 2024 (PRSN, 2025). The darker the symbol the stronger was the earthquake felt.

¹² Source: USGS, 2025

Figure 13. PRSN - 2024 Earthquakes Epicenter screengrab (PRSN, 2025)



Earthquake Chronology

Table 20 below shows the chronological list of the seismic activity in Puerto Rico for the period of 2012 to 2024¹³ as reported by the PRSN (PRSN, n.d.).

Table 20. Puerto Ric Seismic Activity 2013–2024

Year	Description of seismic events
2024	The largest earthquake of 2024 occurred on May 14, 2024, at 8:30: p.m. (Puerto Rico local time). The magnitude 5.6 MI earthquake was located 94.3 km north-northwest of Aguadilla (PR) at a depth of 7 km. This moderate earthquake was widely felt throughout Puerto Rico, with a maximum intensity of V (Modified Mercalli Intensity Scale, MMI) in Aguadilla (PR). During 2024, aftershocks from the South-Southwest Puerto Rico seismic sequence continued. This sequence began on December 28, 2019, with a magnitude 4.7 MI

¹³ At the moment of preparation of this table, data was not published for 2025.

Year	Description of seismic events
	earthquake. The main event of this sequence occurred on January 7, 2020, in the southern region of Puerto Rico, 12.7 km south of Guayanilla, with a magnitude of 6.4 Mw. This strong earthquake, at a depth of 7 km, had a maximum intensity of VIII in Guánica, Puerto Rico, and caused major damage across the island. From the start of the South-Southwest Puerto Rico seismic sequence in 2019 through April 2024, 27,497 earthquakes associated with this sequence have been processed. More than 1,688 felt earthquakes and over 492 significant events with magnitudes greater than 3.5 have been recorded. Of these, 42 earthquakes had magnitudes greater than 4.5.
2023	The largest earthquake of 2023 occurred on December 9, 2023, at 10:27:22 a.m. (Puerto Rico local time). The magnitude 5.7 MI earthquake was located 192.28 km east-northeast of San Juan, PR, at a depth of 7 km. This moderate earthquake was widely felt throughout Puerto Rico and the Virgin Islands, with a maximum intensity of V (Modified Mercalli Intensity Scale, MMI) in St. Thomas (USVI). During 2023, aftershocks from South-Southwest Puerto Rico seismic sequence continued. This sequence began on December 28, 2019, with a magnitude 4.7 MI earthquake. The main event of this sequence occurred on January 7, 2020, in the southern region of Puerto Rico, 12.7 km south of Guayanilla, with a magnitude of 6.4 Mw. This strong earthquake, at a depth of 7 km, had a maximum intensity of VIII in Guánica, Puerto Rico, and caused major damage across the island.
2022	The seismic sequence in the South-Southwest region of Puerto Rico, which began on December 28, 2019, continues. From its onset until the March 2022 report by the Puerto Rico Seismic Network, a total of 19,436 earthquakes associated with this sequence had been recorded. In that report, 1,502 events were documented for 2022, of which 30 were reported as felt. The regions with the highest seismic activity during March 2022 were in the southern area of Puerto Rico.
2021	The largest earthquake of 2021 occurred on January 24, 2021, at 7:21:41 p.m. (Puerto Rico local time). The magnitude 5.4 MI earthquake was located 44.82 km southeast of Virgin Gorda, BVI, at a depth of 94 km. This moderate earthquake was widely felt throughout Puerto Rico and the Virgin Islands, with a maximum intensity of V (Modified Mercalli Intensity Scale, MMI) in Tortola, British Virgin Islands.
2020	The year 2020 was marked by significant seismic activity. An earthquake of magnitude 5.8 was recorded on January 6, 2020, followed by another of 6.4 on January 7, 2020, located 8 km from Indios, Puerto Rico. It is important to clarify that, starting from the 4.7 magnitude event recorded on December 28, 2019, up to October 22, 2020, approximately over 1,200 earthquakes of magnitude 2.0+ have been felt on the island. Tectonic activity in Puerto Rico is dominated by the convergence between the North American and Caribbean plates, with the island compressed between the two. To

Year	Description of seismic events
	the north of Puerto Rico, the North American plate subducts beneath the Caribbean plate along the Puerto Rico Trench. To the south of the island, and south of the January 7 earthquake, the upper crust of the Caribbean plate subducts beneath Puerto Rico in the Muertos Trough. However, the January 6 earthquake and other recent events are occurring in the offshore deformation zone, connected by the Punta Montalva fault on land and the Guayanilla Canyon offshore. Between December 28, 2019, and January 23, 2020, southern Puerto Rico recorded 90 seismic events of magnitude 4.0 or greater, including the 6.5 magnitude earthquake on January 7, 2020, according to the USGS. These seismic movements led state authorities to request a disaster declaration from the President of the United States. This Disaster Declaration was issued on January 16, 2020, under number DR-4473. The Municipality of San Germán was included among those designated to receive Individual Assistance funds from FEMA.
2019	During 2019, the Puerto Rico Seismic Network (PRSN) located a total of 6,510 earthquakes in the Puerto Rico and Virgin Islands region (our seismic responsibility area, between latitudes 17°N–20°N and longitudes 63.5°W–69°W). Compared to 2018 (3,974 earthquakes), the detected and located seismicity in 2019 increased. The year 2019 ended with 2,536 more earthquakes than the previous year. In 2019, the month with the highest activity was December with 1,291 earthquakes, while August had the lowest seismicity with 303 earthquakes. The region with the highest recorded seismicity during 2019 was the Mona Canyon with 1,288 seismic events, followed by the southern region of Puerto Rico with 885 earthquakes. Earthquake depths ranged from 1 km to 191 km, and magnitudes varied from 0.34 Md to 6.0 Mw. Of the total earthquakes in 2019, 70 were reported as felt. On December 28, 2019, an active period of seismic activity began, with a 4.7 magnitude earthquake, followed several hours later by another 5.0 magnitude south of the island.
2018	During 2018, the Puerto Rico Seismic Network (PRSN) located a total of 3,974 earthquakes in the Puerto Rico and Virgin Islands region (our seismic responsibility area, between latitudes 17°N–20°N and longitudes 63.5°W–69°W). Compared to 2017 (3,129 earthquakes), the detected and located seismicity increased by 845 more earthquakes than the previous year. In 2018, the month with the highest activity was December with 549 earthquakes, while February had the lowest seismicity with 227 earthquakes. The region with the highest recorded seismicity during 2018 was the southern region of Puerto Rico with 412 seismic events, followed by the 19°N Fault Zone with 349 earthquakes. Earthquake depths ranged from 2 km to 185 km, and magnitudes varied from 0.63 Md to 4.67 Md. Of the total earthquakes in 2018, 29 were reported as felt within our area of responsibility.
2017	During 2017, the Puerto Rico Seismic Network (PRSN) located a total of 3,129 earthquakes in the Puerto Rico and Virgin Islands region (our seismic responsibility area, between latitudes 17°N–20°N and longitudes 63.5°W–69°W). Compared to 2016

Year	Description of seismic events
	(3,948 earthquakes), the detected and located seismicity decreased by 20%, which means 819 fewer earthquakes than the previous year. In 2017, the month with the highest activity was April with 518 earthquakes, while October had the lowest seismicity with 48 seismic events. The region with the highest recorded seismicity during 2017 was the Sombrero Seismic Zone with 856 seismic events, followed by the Virgin Islands Platform with 327 earthquakes. Earthquake depths ranged from 1 km to 180 km, and magnitudes varied from 0.85 Md to 4.8 Mb. Of the total earthquakes in 2017, 24 were reported as felt within our area of responsibility.
2016	During 2016, the Puerto Rico Seismic Network (PRSN) located a total of 3,947 earthquakes in the Puerto Rico and Virgin Islands region (our seismic responsibility area, between latitudes 17°N–20°N and longitudes 63.5°W–69°W). Compared to 2015 (3,235 earthquakes), the detected and located seismicity increased by 22.0%, or 712 more earthquakes than the previous year. In 2016, the month with the highest activity was September with 566 earthquakes, while March had the lowest seismicity with 169 earthquakes. The region with the highest recorded seismicity during 2016 was the Sombrero Seismic Zone with 973 seismic events, followed by the Virgin Islands Platform with 497 earthquakes. Earthquake depths ranged from 1 km to 177 km, and magnitudes varied from 0.76 Md to 4.6 Ml. Of the total earthquakes in 2016, 28 were reported as felt within our area of responsibility.
2015	During 2015, the Puerto Rico Seismic Network (PRSN) located a total of 3,235 earthquakes in the Puerto Rico and Virgin Islands region (our seismic responsibility area, between latitudes 17°N–20°N and longitudes 63.5°W–69°W). Compared to 2014 (3,420 earthquakes), the detected and located seismicity decreased by 5.4%, or 185 fewer earthquakes than the previous year. In 2015, the month with the highest activity was July with 473 earthquakes, while April had the lowest seismicity with 157 earthquakes. The region with the highest recorded seismicity during 2015 was the Sombrero Seismic Zone with 588 seismic events, followed by the 19°N Fault Zone with 477 earthquakes. Earthquake depths ranged from 1 km to 211 km, and magnitudes varied from 0.80 Md to 4.80 Md (duration magnitude). Of the total earthquakes in 2015, 23 were reported as felt within the area of responsibility.
2014	During 2014, the Puerto Rico Seismic Network (PRSN) located a total of 3,420 earthquakes in the area of responsibility (AOR) known as the Puerto Rico and Virgin Islands Region (latitude 17.00° to 20.00°N and longitude 63.50° to 69.00°W). Compared to 2013 (2,293 earthquakes), the detected and located seismicity increased by 49%, which is 1,127 more earthquakes than the previous year. In this year, the month with the highest seismicity was January with 709 earthquakes, and the month with the lowest seismicity was November with 192 earthquakes. Of the total seismicity in 2014, 29 earthquakes (0.85%) were reported as felt, all located within our AOR. The magnitudes (Md) of the seismic events calculated for

Year	Description of seismic events
	this year by PRSN ranged from 1.0 to 6.4, although for felt events they ranged from 2.53 Md to 6.4 Mwp. During 2014, depths varied between 1 km and 182 km, while for felt earthquakes they ranged from 6 km to 134 km. Earthquakes with depths of 0 to 25 km were the most frequent with 1,385 events, while those between 175 km and 200 km were the least frequent this year. The region with the highest recorded seismicity during 2014 was the 19°N Fault Zone with 905 seismic events, followed by the Sombrero Seismic Zone with 483 earthquakes.
2013	During 2013, the Puerto Rico Seismic Network (PRSN) located a total of 2,293 earthquakes in the Puerto Rico and Virgin Islands region (latitude 17.00° to 20.00°N and longitude 63.50° to 69.00°W). Compared to 2012 (2,852 earthquakes), the detected and located seismicity decreased by 20%, which is 559 fewer earthquakes than the previous year. In this year, the month with the highest seismicity was September with 272 earthquakes, and the month with the lowest seismicity was February with 114 earthquakes. Of the total seismicity in 2013, 44 earthquakes (1.92%) were reported as felt, all located within the Puerto Rico and Virgin Islands region. The magnitudes of the seismic events calculated for this year by PRSN ranged from 1.0 to 5.12, although for felt events they ranged from 2.36 to 5.12. During 2013, depths varied between 1 km and 182 km, while for earthquakes they ranged from 4 km to 112 km. The region with the highest recorded seismicity during 2013 was the Sombrero Seismic Zone with 504 seismic events, followed by the Virgin Islands Platform with 246 earthquakes. Through its educational program, PRSN reached 14,099 people in Puerto Rico and the U.S. and British Virgin Islands during 2013.

2020 Seismic Sequence

In early January 2020, Puerto Rico experienced a significant seismic sequence that began with a series of foreshocks and culminated in a major earthquake on January 7. The main shock registered a magnitude of 6.4 Mw and struck along the island's southern coast, severely affecting the municipalities of Guayanilla, Ponce, and Yauco. This event was preceded by a magnitude 5.8 Mw earthquake on January 6, which had already caused widespread concern and notable structural damage (USGS, n.d.). The seismic activity was associated with the complex interaction between the Caribbean and North American tectonic plates, a region characterized by active subduction zones and fault systems. The resulting shaking was felt across the island, causing power outages, school closures, and the collapse of numerous structures, including residential and public buildings.

The aftermath of the earthquake resulted in extensive damage to homes and critical

infrastructure, displacing thousands of residents and prompting a federal emergency declaration. The southern region experienced prolonged aftershocks—some exceeding magnitude 5.0, which continued for weeks, intensifying public concern and creating sustained disruption. This event underscored Puerto Rico’s heightened vulnerability to seismic hazards and highlighted the importance of preparedness measures and resilient construction practices. The incident received a Presidential Disaster Declaration under the Stafford Act (DR-4473-PR)(FEMA, n.d.). San Germán was included in this Presidential Disaster Declaration. Puerto Rico’s location along active tectonic boundaries place all jurisdictions at risk of seismic events capable of causing millions of dollars in damages and significant disruptions to daily life.

According to the Puerto Rico Seismic Network (PRSN), from the onset of the South–Southwest Puerto Rico seismic sequence in 2019 through April 2024, a total of 27,497 earthquakes associated with this sequence were recorded and processed. Of these events, more than 1,688 were reported as felt, and over 492 registered magnitudes greater than 3.5. Additionally, 42 earthquakes reached magnitudes exceeding 4.5 (PRSN, 2025)

4.6.1.4 FUTURE EVENT PROBABILITIES (B1-E)

Unlike atmospheric hazards, earthquakes cannot be predicted with current scientific capabilities. However, advances in seismology allow for the development of probabilistic forecasts. Historical records indicate that Puerto Rico has experienced four major destructive earthquakes since 1670—specifically in 1670, 1787, 1867, and 1918. This sequence suggests a recurrence interval ranging from 51 to 117 years, with an average interval of approximately 83 years for significant events. It is important to note, however, that each of these earthquakes originated on different fault systems; therefore, this record alone cannot be used to establish a precise recurrence rate.

In the case of Puerto Rico, the PRSN cites a probabilistic seismic hazard study conducted in 1987 by Dr. William McCann, which estimated a 33–50% probability of a strong earthquake (Intensity VII or higher on the Modified Mercalli Scale) occurring in various parts of the island within a 50-year period (PRSN, 2025).

Further research conducted by the U.S. Geological Survey in 2003 identified an area west–southwest of Puerto Rico as the region most likely to experience strong earthquakes on the island. This probabilistic analysis does not account for secondary hazards such as tsunamis, liquefaction, or seismic wave amplification, which predominantly affect low-lying coastal areas and high-elevation zones susceptible to

landslides.

4.6.2 RISK ANALYSIS (B2-A, B2-B)

4.6.2.1 ESTIMATED LOSES

Municipal Exposure

Table 21 presents the exposure to earthquake hazards. It is important to note that, although assigning an exact monetary value to human life is inherently complex, FEMA guidance converts population loss into an economic estimate using a “population equivalence” methodology based on the Value of Statistical Life (VSL). Under this approach, each fatality—or the equivalent of ten injuries—is assigned an economic loss value of \$13.7 million, reflecting FEMA’s inflation-adjusted VSL estimate. All historical loss figures are subsequently adjusted to December 2024 dollars to account for inflation.

The following table shows the total exposure data to an earthquake event according to FEMA National Risk Index (NRI data).

Table 21. Exposure to Earthquake Hazard

Exposure Impacted Area (sq mi)	Exposure Value - Building	Exposure Population	Exposure - Population Equivalence	Exposure - Total
55.60	\$4,098,901,000	31,879	\$369,796,400	\$373,895,301,000

Source FEMA’s NRI

Annual Expected Loss

The Federal Emergency Management Agency’s HAZUS Earthquake Analysis provides estimates of Annualized Earthquake Losses defined as the long-term average annual economic impact of earthquakes on the general building stock within a given geographic area as well as annualized estimates of population loss.

The Annualized Earthquake Loss is calculated using the Riemann Sums Method, which averages the annual losses associated with multiple return periods and then multiplies each average loss by its corresponding differential probability to produce a single loss estimate for each Census tract. (FEMA, National Risk Index Data - Technical

Documentation, 2025).

The expected annual loss for the jurisdiction represents the average yearly economic impact, expressed in dollars, anticipated from natural hazard events. Table 22 presents the expected annual earthquake-related losses for both buildings and population for the whole municipality

Table 22. Expected Annual Loss to Earthquake

Expected Annual Loss - Building Value	Expected Annual Loss - Population	Expected Annual Loss - Population Equivalence	Expected Annual Loss -Total
\$3,587,227	0.271175	\$3,145,621	\$6,732,849

Source FEMA's NRI

4.6.2.2 LIFELINES AND CRITICAL INFRASTRUCTURE

Earthquakes can affect a community's lifelines in the following ways:

- **Safety and Security** – An earthquake can cause the structural failure of critical facilities such as police stations and fire stations, generate increased demand for search-and-rescue operations, and result in population displacement requiring emergency sheltering. Such conditions may also create challenges in maintaining public order and ensuring community security.
- **Food, Hydration, and Shelter** – A seismic event can cause damage to water treatment plants and distribution systems, resulting in contamination or loss of potable water. Disruptions to transportation routes and storage facilities may also interrupt food supply chains. Widespread structural damage can increase the demand for temporary shelters. Additionally, the loss of refrigeration capacity may lead to significant spoilage of perishable goods.
- **Health and Medicine** – Hospitals and clinics may experience structural damage or a reduction in operational capacity during an earthquake. A surge in injuries requiring emergency medical attention can overwhelm existing healthcare facilities. Disruptions to pharmaceutical supply chains and medical logistics may also occur. Additionally, compromised sanitation conditions in emergency shelters can elevate the risk of disease outbreaks.
- **Energy** – Damage to power plants, substations, and transmission lines can result in widespread power outages. Ruptures in gas lines may create fire and explosion hazards. Interruptions in the fuel supply chain can also impede the operation of generators and emergency response vehicles.

- Communications - Damage to cell towers, fiber-optic cables, and communication hubs can result in significant loss of connectivity. Emergency call surges may overload telecommunications networks, further degrading service availability. These disruptions can impair coordination among emergency response agencies and hinder the timely dissemination of critical information.
- Transportation - Collapse or severe damage to roads, bridges, and tunnels can significantly restrict mobility. Airports and seaports may become inoperable due to damage to runways or docks. Rail systems, including the Tren Urbano, may also be disrupted because of track deformation or landslides.
- Hazardous Materials - An earthquake may cause spills from industrial facilities, chemical plants, or storage tanks, increasing the risk of environmental contamination affecting air, soil, and water resources. Additionally, damage to sites containing hazardous materials may result in fires or explosions.
- Water Systems - Breakage of water mains and sewer lines can result in localized flooding and contamination. Such damage may also reduce firefighting capacity due to diminished water pressure and lead to long-term disruptions in wastewater collection and sanitation services.

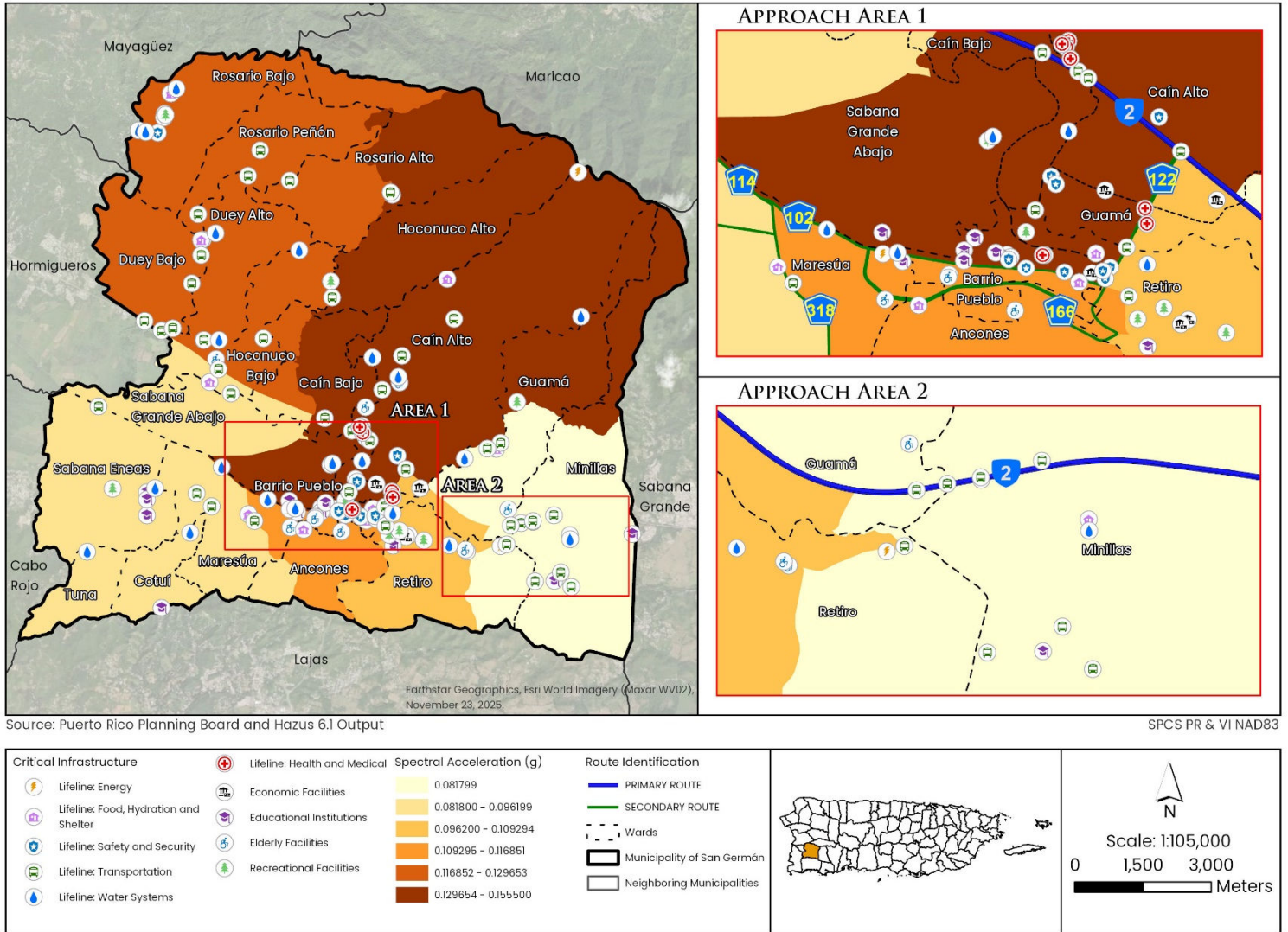
Maps 16 and 17 show the identified critical infrastructure location in respect to the spectral acceleration areas shown in section 4.5.1

These maps show that many critical facilities are located in areas of high spectral acceleration, such as La Concepcion Hospital and related medical facilities. Also, the Interamerican University, various grade level schools in the town center, Municipal Police Station and Emergency Management Center are located in this section.

In the case of San Germán there is no difference in the areas covered by the highest spectral acceleration for both the 1.0 and the 0.3 scenarios.

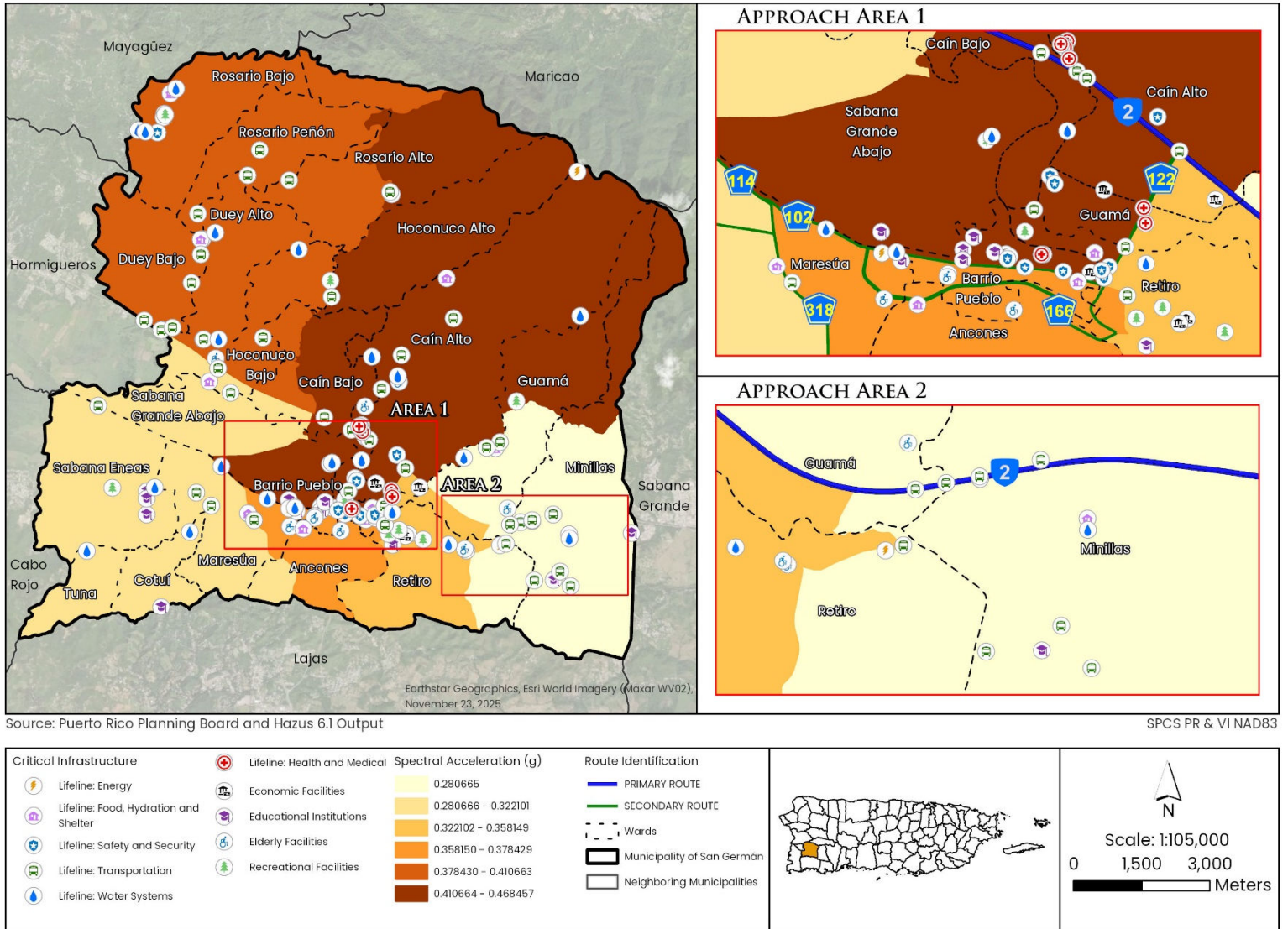
Map 16. Earthquake: Critical Facilities Exposure to Spectral Acceleration at 1.0 sec (g)

EARTHQUAKE: CRITICAL FACILITIES EXPOSURE TO SPECTRAL ACCELERATION AT 1.0 SEC (G)



Map 17. Earthquake: Critical Facilities Exposure in Spectral Acceleration at 0.3 sec(g)

EARTHQUAKE: CRITICAL FACILITIES EXPOSURE TO SPECTRAL ACCELERATION AT 0.3 SEC (G)



4.6.2.3 SOCIAL VULNERABILITIES

Social vulnerability to earthquakes in Puerto Rico is shaped by high levels of poverty, aging infrastructure, and limited access to essential resources, all of which disproportionately affect the ability of communities to withstand and recover from seismic events. Many residents face compounding disadvantages—such as disability,

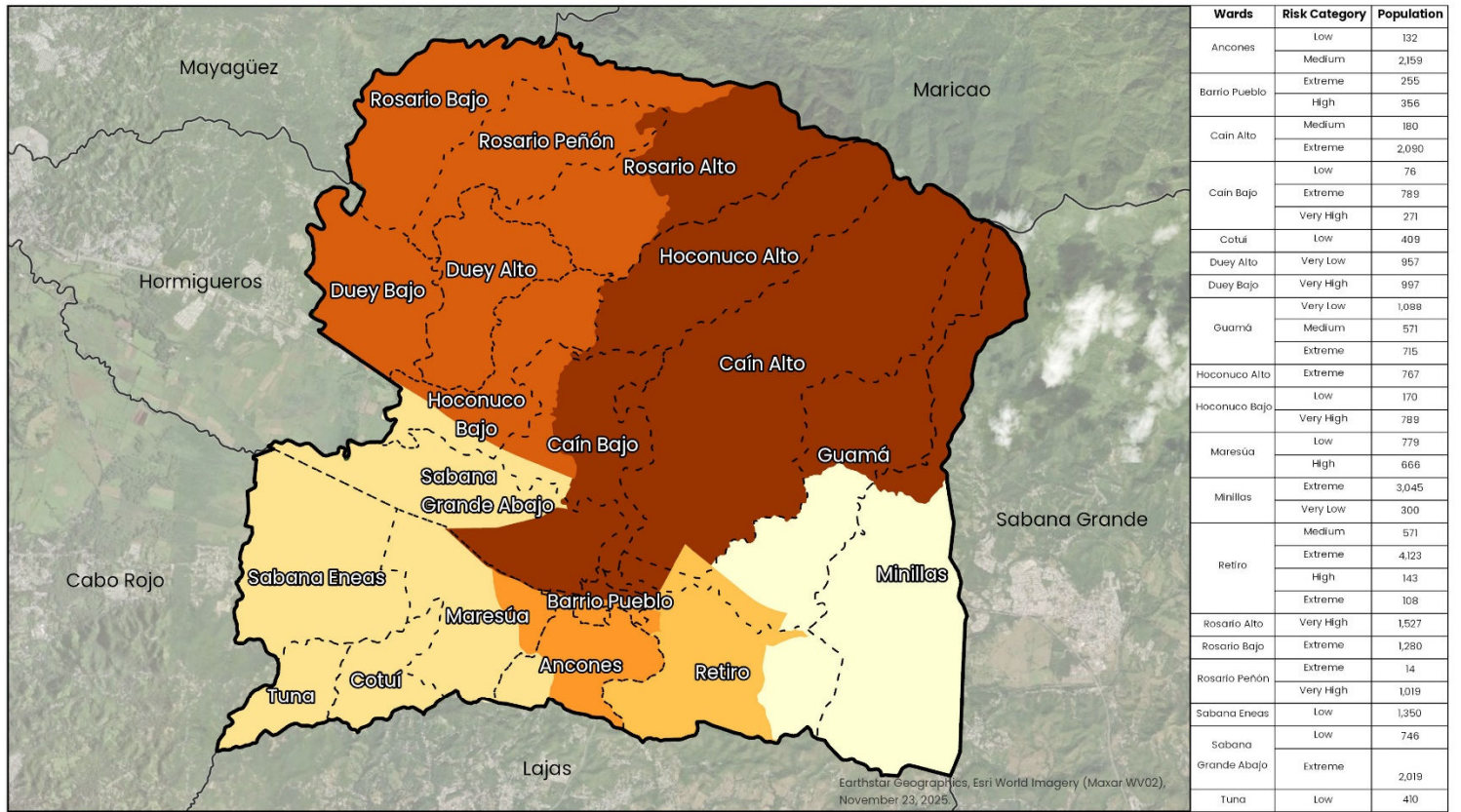
low educational attainment, and limited vehicle access—that reduce their capacity to evacuate, access information, or secure aid after a damaging earthquake. Research on disaster governance also shows that systemic governmental neglect and energy insecurity intensify the impacts of disasters, leaving communities with fewer resilience mechanisms in the aftermath of earthquakes.

Puerto Rico’s disaster research literature identifies long-standing structural inequities that heighten vulnerability, including political and economic marginalization that limit long-term recovery and exacerbate risk accumulation across hazard types. Federal assessments further find that many census tracts exhibit high social vulnerability scores (US Census Bureau, 2024), (US Census Bureau, 2025), meaning that an earthquake’s impacts are likely to intersect with broader socio-economic fragility. Overall, these combined factors demonstrate that earthquakes in Puerto Rico pose not only a physical hazard but also a deep social challenge tied to historical, economic, and infrastructural conditions that shape uneven disaster outcomes.

Map 18 and 19 show the municipality’s exposure to an earthquake by ward for an spectral acceleration event of 1.0 sec. (g) and 0.3 sec (g). These maps show that the wards where there is the most vulnerability to the population are; Caín Alto, the northern half of Minillas Rosario Alto, the northern half of Guamá, and Hoconuco Alto. The area where there is less exposure are the southern half of Minillas, the southern half of Guamá and the eastern area of Retiro.

Map 18. Earthquake: Population Exposed to Spectral Acceleration at 1.0 sec(g)

EARTHQUAKE: POPULATION EXPOSURE TO SPECTRAL ACCELERATION AT 1.0 SEC (G)



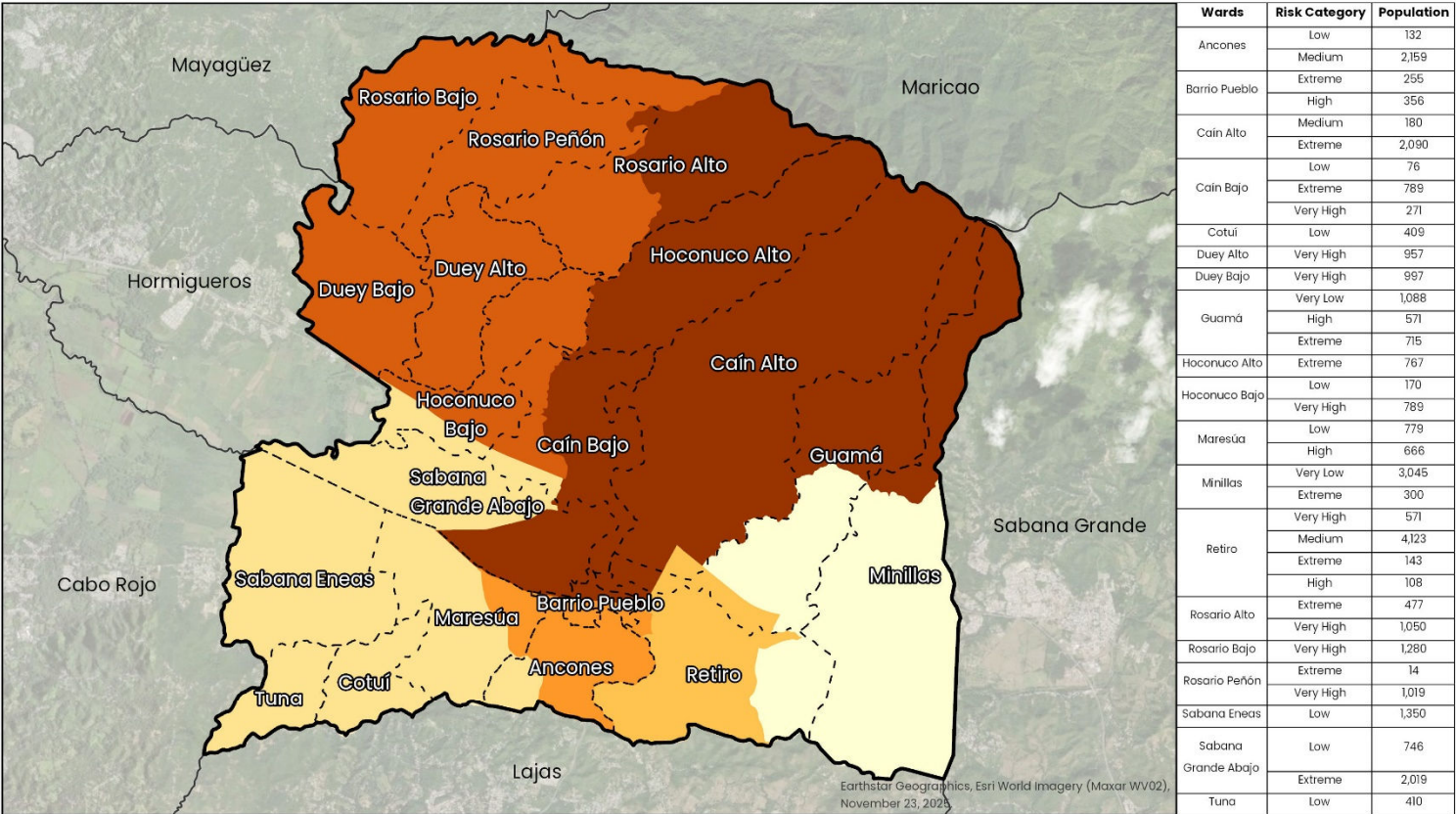
Source: Puerto Rico Planning Board, Hazus 6.1 Output and Census Tract for Puerto Rico

SPCS PR & VI NAD83



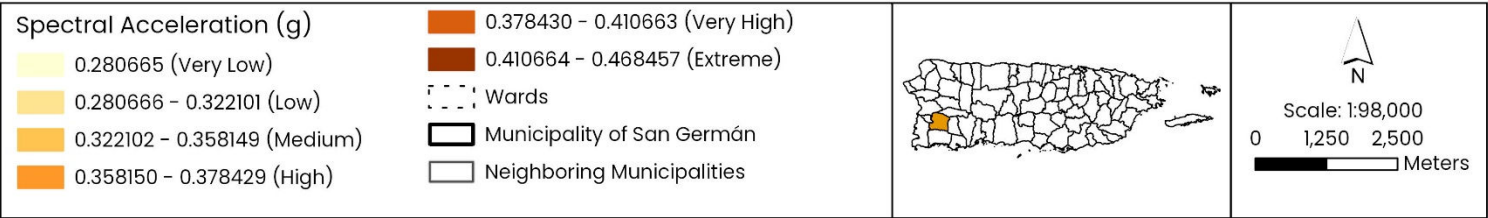
Map 19. Earthquake: Population Exposed to Spectral Acceleration at 0.3 sec(g)

EARTHQUAKE: POPULATION EXPOSURE TO SPECTRAL ACCELERATION AT 0.3 SEC (G)



Source: Puerto Rico Planning Board, Hazus 6.1 Output and Census Tract for Puerto Rico

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4.6.2.4 NATURAL AND CULTURAL RESOURCES

Earthquakes can produce a wide range of impacts on natural and cultural resources:

- **Landslides and Soil Instability:** Seismic activity can trigger landslides, rockfalls, and soil liquefaction, altering natural landforms and damaging ecological habitats.
- **Water Quality and Hydrology:** Ground shaking may modify river pathways, impair aquifers, and increase sedimentation in water bodies, which can degrade water quality and disrupt aquatic ecosystems.
- **Vegetation and Wildlife:** Ground deformation and related secondary hazards such as flooding or fires can lead to habitat loss, fragmentation, and adverse effects on biodiversity.
- **Coastal and Marine Environments:** Submarine earthquakes may generate tsunamis, resulting in coastal erosion, coral reef degradation, and the deterioration of marine and estuarine ecosystems.

While the following damage can happen to Cultural Resources:

- **Seismic forces** can cause significant structural damage or the complete collapse of heritage structures, archaeological sites, and monuments.
- **Museums and Archives:** Earthquakes may lead to the loss, damage, or deterioration of artifacts, archival materials, and collections due to structural failures or insufficient seismic protection.
- **Community Identity and Tourism:** Damage to culturally important sites can undermine community identity and reduce tourism activity, thereby affecting local economic stability.

In the particular case of San Germán, the historical town center is in the area of highest spectral acceleration. This is a concern since the San Germán historical town center is one of the oldest in Puerto Rico and as such it holds many historical buildings such as the Porta Coeli Convent, City Hall and the Saint Germán Auxerre Church that may not withstand a major earthquake.

4.6.2.5 FUTURE CONDITIONS (E1-A)

Section 3.6 above discussed the number of constructions permits issued in the Municipality. Maps 20 and Map 21 highlight the areas with the highest spectral acceleration values at 0.3 and 1.0 seconds alongside the distribution of authorized

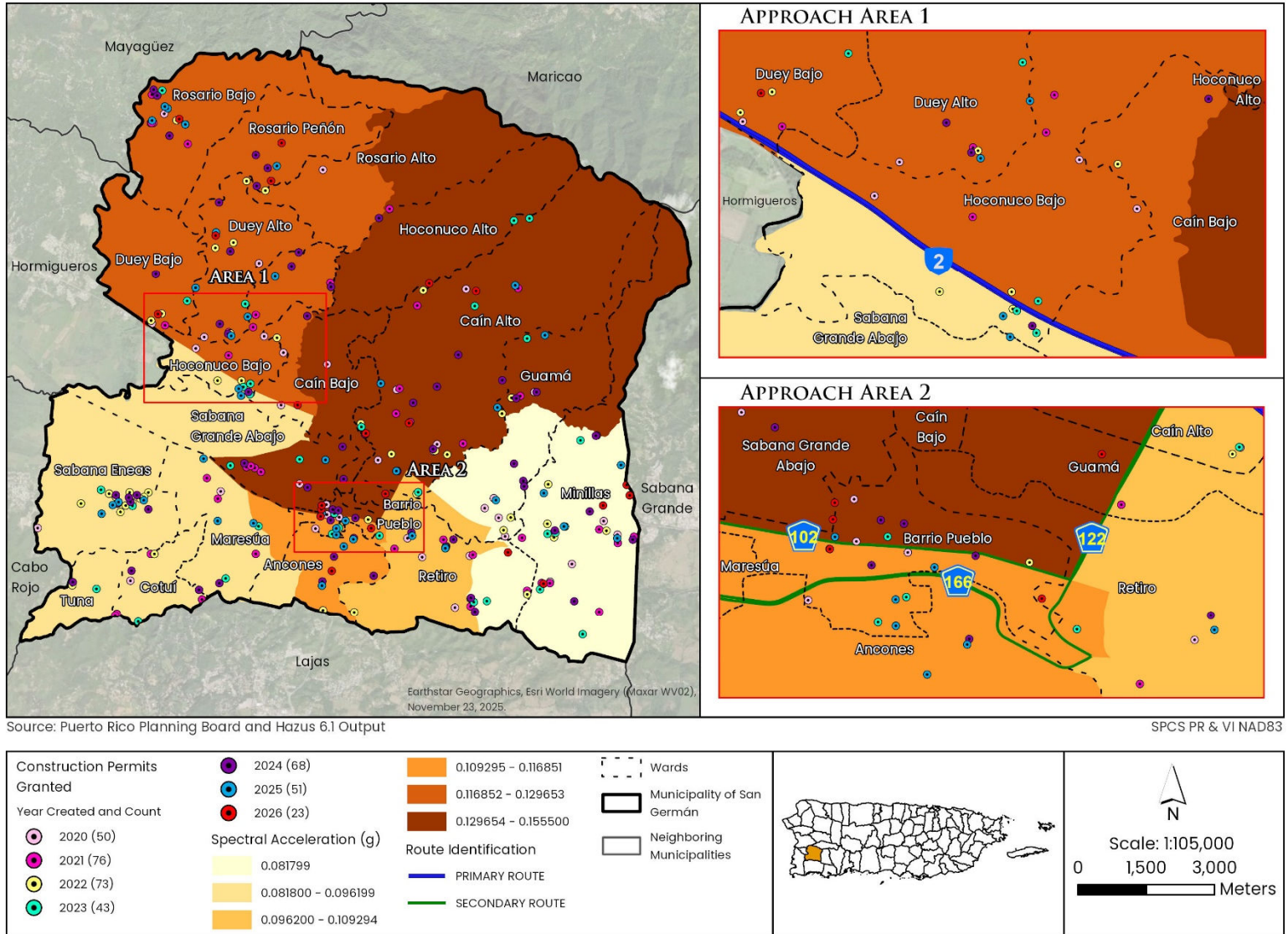
construction permits. Taken together, these findings indicate that future exposure to earthquake hazards is unlikely to diminish in the near term, as development continues to expand within zones of elevated seismic vulnerability. This is true particularly of the southern area of Cain Bajo and the southern areas of Hoconuco Bajo, Duey Bajo and Duey Alto near the PR-2 corridor

Also of concern is the Barrio Pueblo to the north of road PR-22. These maps show that there have been many permits granted along the historical town center. The data shows also that near the urbanized area of Sabana Eneas, there has also been a high level of permits granted, but this area is not in a high spectral acceleration zone.

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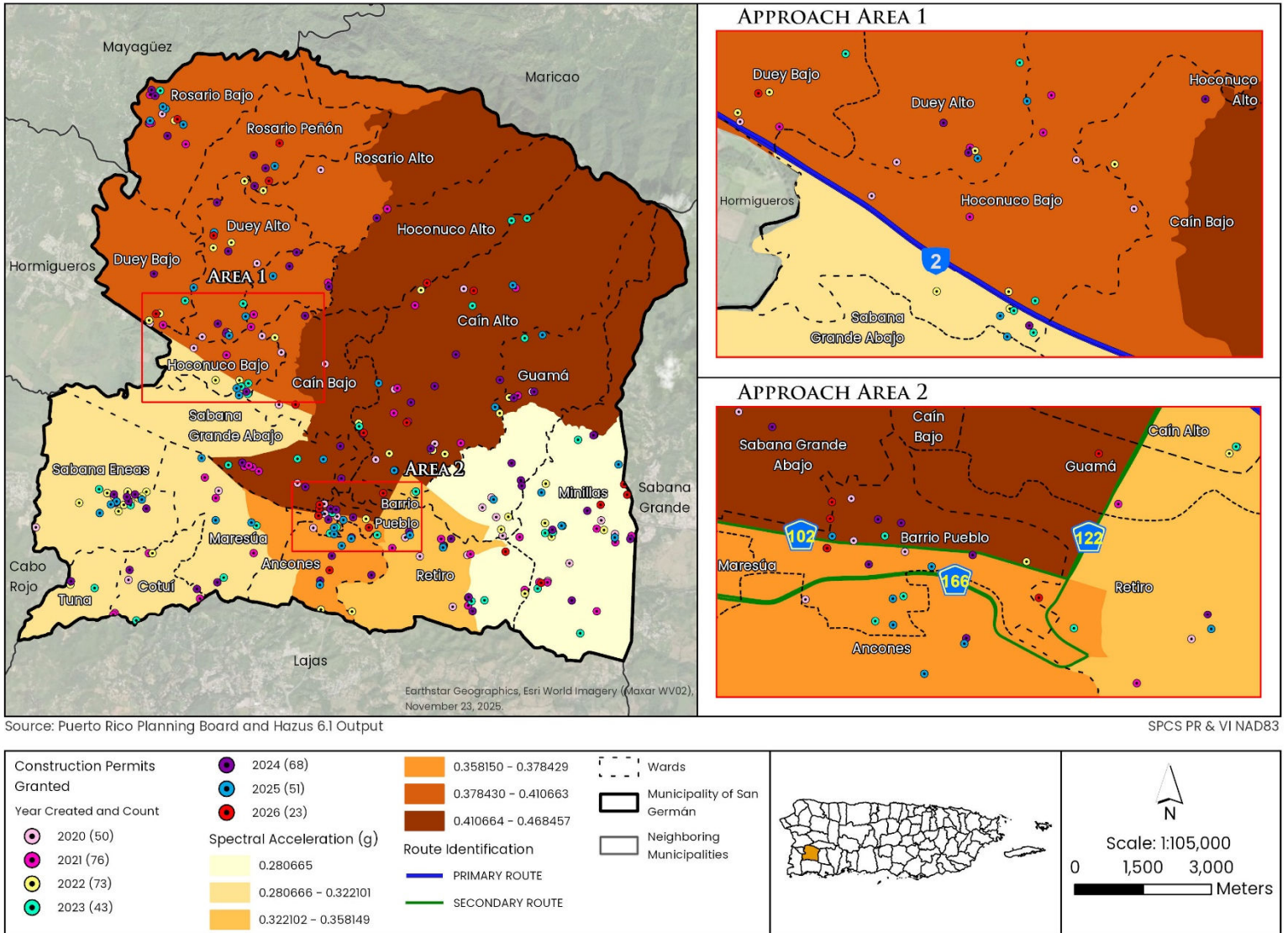
Map 20.Earthquake: Recent Development Exposure to Spectral Acceleration at 1.0 sec (g)

EARTHQUAKE: RECENT DEVELOPMENT EXPOSURE TO SPECTRAL ACCELERATION AT 1.0 SEC (G)



Map 21. Earthquake: Recent Development Exposure to Spectral Acceleration at 0.3 sec (g)

EARTHQUAKE: RECENT DEVELOPMENT EXPOSURE TO SPECTRAL ACCELERATION AT 0.3 SEC (G)



4.7 LANDSLIDES

4.7.1 DESCRIPTION (B1-A)

Landslides are a natural geomorphological process characterized by the downslope movement of soil, rock, or debris due to terrain instability. These events occur when environmental conditions align such that gravitational forces acting on surface materials exceed their natural resistance. The term landslide encompasses multiple types of ground displacement including rockfalls, slope failures, and debris flows, all of which pose significant risks to life and property. Such movements can obstruct transportation routes and carry with them vegetation, homes, bridges, vehicles, and other infrastructure, causing extensive disruption and damage (FEMA, 1997).

Prolonged and intense rainfall associated with meteorological systems such as tropical waves, troughs, and tropical cyclones is one of the primary triggers of landslide events. Additionally, population growth and the expansion of informal construction increase the municipality's exposure to landslide hazards. Potable water supply and wastewater systems including sanitary pipes, septic tanks, and storm sewers whether properly authorized or informally installed, can further exacerbate slope instability. The likelihood of landslides rises significantly when these systems leak or are inadequately sited or constructed (USGS, n.d.).

Multiple factors contribute to the development of landslides, including soil type, terrain slope, degree of soil saturation, erosion processes, the presence of depressions or subsurface voids, human activities, and seismic events. The *Building Performance Assessment Report* (BPAR) prepared after Hurricane Georges warns that "landslides will become a major problem in the future as more houses are built and more development occurs in areas susceptible to these risks." This observation underscores the increasing vulnerability associated with continued development in high-risk zones (FEMA, 1997).

Many landslides in Puerto Rico fall into a specific subtype known as debris flows. These events typically occur in mountainous areas with steep slopes during periods of intense rainfall. As rainwater infiltrates the ground, the soil becomes saturated and the underlying subsurface layer loses its cohesion. This loss of stability causes the material to detach often at the interface where the subsurface meets the bedrock resulting in a rapid downslope flow of soil, rock, and water.

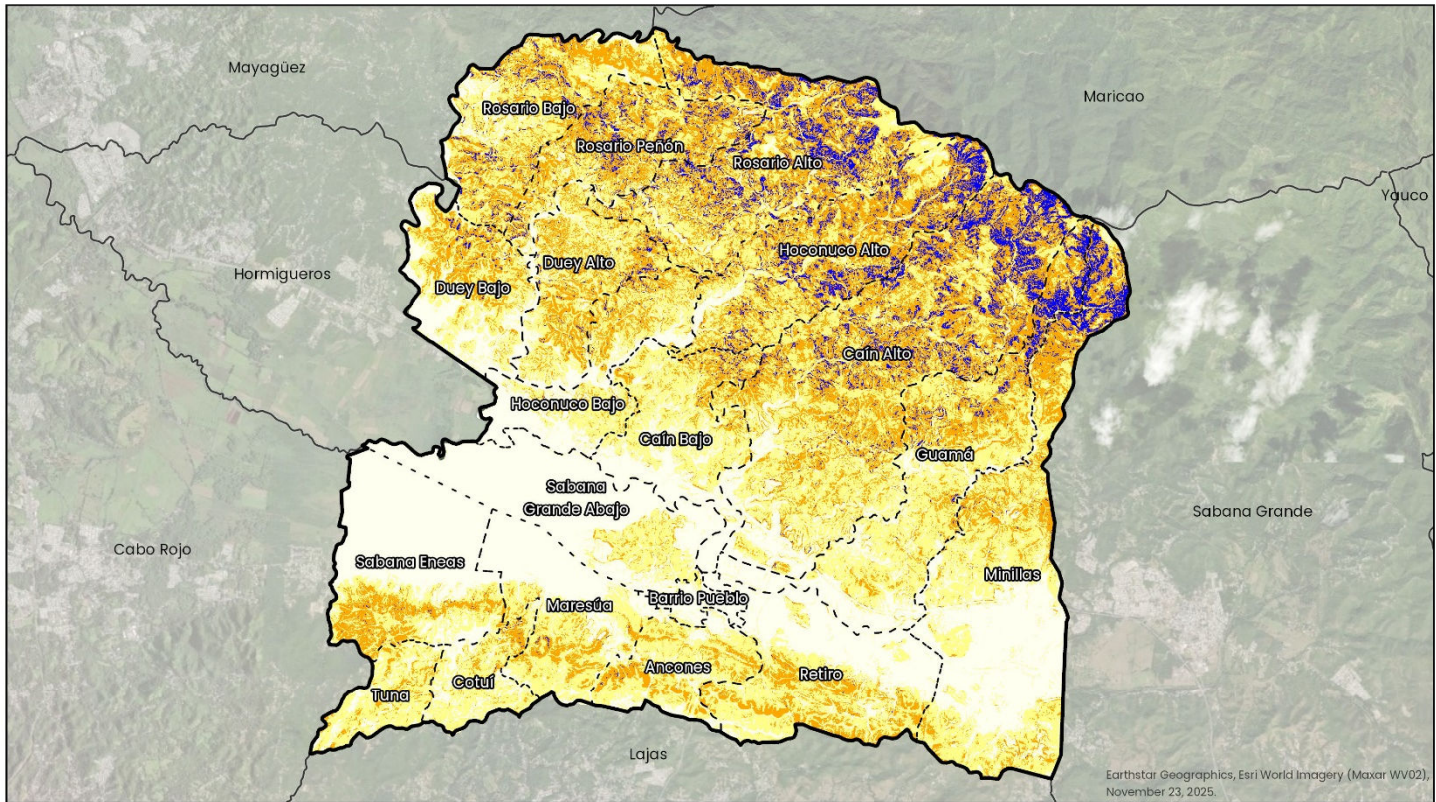
There are many types of landslides; however, those specifically linked to water-saturated soils include the following (PREMB, 2021):

- Slow Landslide: A gradual and sustained downslope movement of soil or rock. These events are often identifiable by displaced tree trunks, distorted or twisted fences and retaining walls, and leaning posts or structures.
- Debris Flow: A rapid mass movement in which loose soil, rocks, and organic material combine with infiltrated water and air to form a dense, viscous flow that travels swiftly down a hillside.
- Debris Avalanche: An extremely rapid or very fast-moving form of debris flow, characterized by high velocity and significant destructive potential.
- Mudflow: A fast-moving mass composed of water-saturated material containing at least 50 percent sand, silt, and clay particles.

4.7.1.1 AFFECTED AREA (B1-B)

According to the USGS data, the area with the highest susceptibility to landslides is in the mountainous north of the municipality in Duey Bajo, Rosario Peñon, Rosario Bajo, Rosario Alto, Hoconuco Alto, Caín Alto and the northern section of Guamá and Minillas all show areas of high susceptibility to landslide. The northwest corner of the municipality, near the municipal limits with Maricao has areas identified as very high susceptibility.

LANDSLIDE SUSCEPTIBILITY



Source: Puerto Rico Planning Board and Hazus 6.1 Output

SPCS PR & VI NAD83



4.7.1.2 RISK MAGNITUDE (B1-C)

Landslides typically occur in steep, mountainous areas during periods of intense or prolonged rainfall. As water infiltrates the ground, the soil becomes saturated, weakening natural drainage systems and reducing the structural capacity of the terrain, which can ultimately lead to slope failure. Certain areas are inherently more susceptible to landslides than others, particularly those with greater slope gradients. Vegetation plays a critical role in maintaining soil cohesion and reducing surface erosion; therefore, slopes lacking vegetation are generally more prone to instability.

Slope stability is influenced by several factors, including elevation, steepness, vegetative cover, and underlying geology. In general, increases in slope height and inclination correlate with a greater likelihood of terrain instability. Below are key factors that contribute to the occurrence of landslides:

- The base of inclined slopes
- Areas near small depressions where drainage converges
- The lower portion of slopes is composed of fill - material
- The base or crest of a very steep slope
- Locations with a history of previous landslides
- Hillsides that have been developed and where septic systems are present
- Steep slopes underlain by clay-rich soils
- Hills or slopes with inclinations greater than 12 degrees and elevations exceeding 300 meters

The hazard categories below are derived from the USGS classification index, which evaluates slope and soil characteristics as defined by that agency. Table 23 outlines these categories—low, moderate, high, and very high—and describes the corresponding levels of hazard.

Table 23. Landslide Risk Categories

Category	Description
Low	Areas with minimal slopes and stable soil; landslides are unlikely except under extreme conditions.
Moderate	Areas with some susceptibility; landslides may occur during prolonged or intense rainfall.
High	Areas with significant susceptibility; landslides are likely during heavy rain or seismic activity.
Very High	Areas extremely prone to landslides; frequent events during storms or earthquakes.

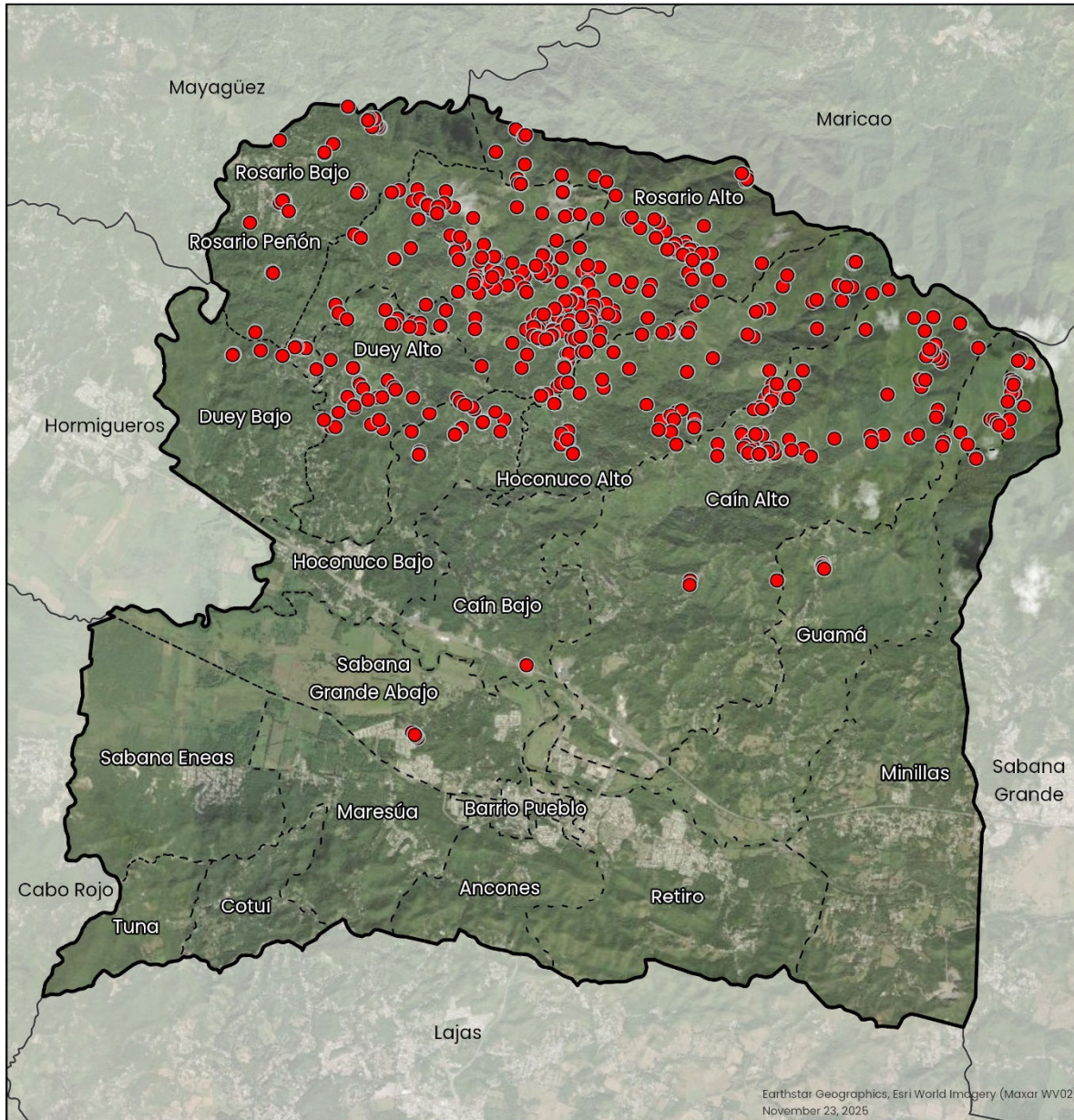
4.7.1.3 PAST EVENTS

As noted earlier, landslides are frequently associated with heavy rainfall events. Map 23 illustrates the landslides reported following Hurricane María in 2017, which align with the areas of greatest susceptibility shown in the map. The southern portion of the municipality, particularly the wards of Rosario Bajo, Rosario Alto, Rosario Peñon, Hoconuco Alto, and the northern sections of Caín Alto, Guama and Minillas. No landslide was reported in the southern karst formation.

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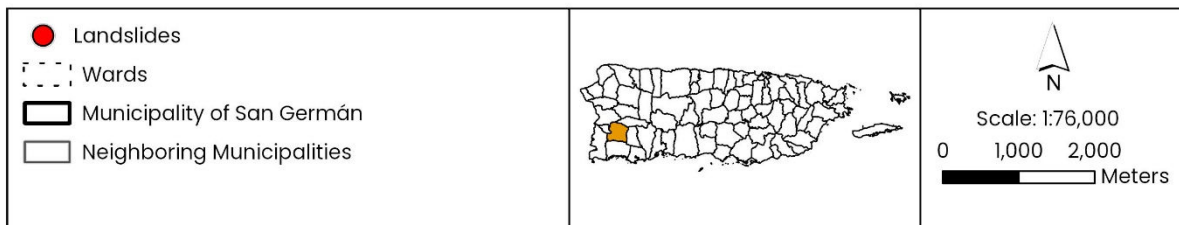
Map 23. Landslides reported in the aftermath of Hurricane María

LANDSLIDES REPORTED IN THE AFTERMATH OF HURRICANE MARÍA



Source: Puerto Rico Planning Board and United States Geological Service

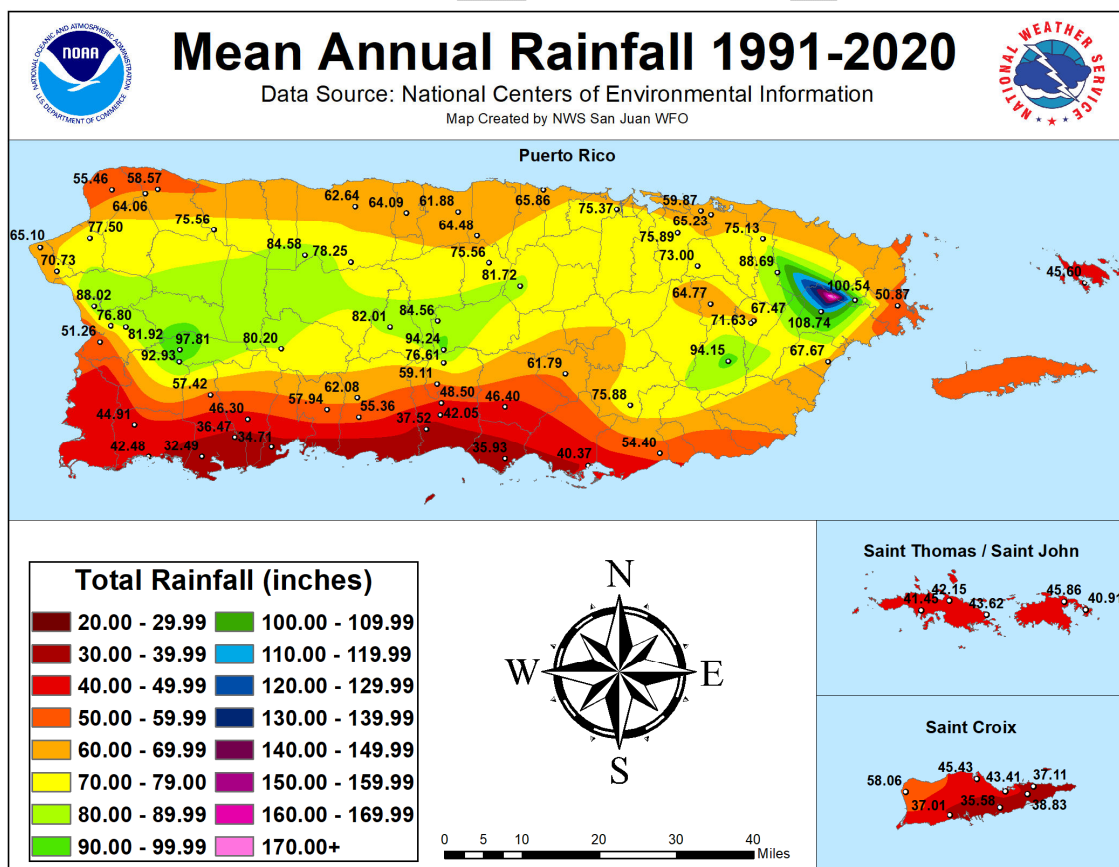
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4.7.1.4 FUTURE EVENT PROBABILITIES

Although landslides can also result from earthquakes or human activities, most landslides in Puerto Rico are triggered by rainfall. As previously discussed, these events can occur during any type of rain event. Figure 14 presents the Mean Annual Rainfall for Puerto Rico and the U.S. Virgin Islands from 1991 to 2020. The Municipality of San Germán shows variances in the total rainfall. The northeast, in the boundary with Maricao shows a total rainfall of 92.93 inches, while in the southwest corner (in the boundary with Cabo Rojo) precipitation goes down to 44.91. Given these precipitation levels, landslides are expected to continue occurring in the northeast quarter of the municipality.

Figure 14. Annual Rainfall 1991-2020 (PR & USVI)



Obtained from https://www.weather.gov/sju/climo_pr_usvi_normals

4.7.2 RISK ANALYSIS

4.7.2.1 ESTIMATED LOSSES

In the Municipality of San Germán , as in many other parts of Puerto Rico, landslides most often occur during or immediately after major storms that produce intense, prolonged rainfall. Rainfall-induced landslides are closely linked to severe weather systems or consecutive rain events that saturate steep and vulnerable soils.

At present, no standardized models exist to quantify structural or content losses resulting from landslides or other mass-movement events. Consequently, USGS susceptibility indices were applied empirically using the best available data to estimate potential impacts from these hazards in San Germán. These indices classify risk into four levels: low, moderate, high, and very high. Due to data limitations, it is not currently possible to calculate monetary losses associated with building damage.

4.7.2.2 LIFELINES AND CRITICAL INFRASTRUCTURE

Landslides can impact FEMA Lifelines in the following ways:

- **Safety and Security:** Landslides can trap and injure or kill individuals through rapidly moving debris, hinder rescue operations, and create life-safety risks when emergency services become isolated or damaged (Center for Disaster Resilient Communities, n.d.).
- **Food, Hydration, and Shelter:** Landslides can destroy homes and agricultural areas, resulting in displacement and increased food insecurity. They may also disrupt local water and sanitation systems, heightening contamination risks, especially within temporary shelter environments (IFRC, 2023).
- **Health and Medicine:** Landslides can cause direct injuries such as trauma or suffocation, while longer-term impacts may include outbreaks of waterborne and vector-borne diseases, as well as psychological distress and trauma among survivors (Center for Disaster Resilient Communities, n.d.).
- **Energy:** Landslides can severely damage power lines, electrical substations, and fuel supply infrastructure, resulting in widespread power outages that hinder both public services and emergency response operations.
- **Communications:** Damage to communication cables, fallen utility poles, and restricted access to telecommunications infrastructure can disrupt alert and

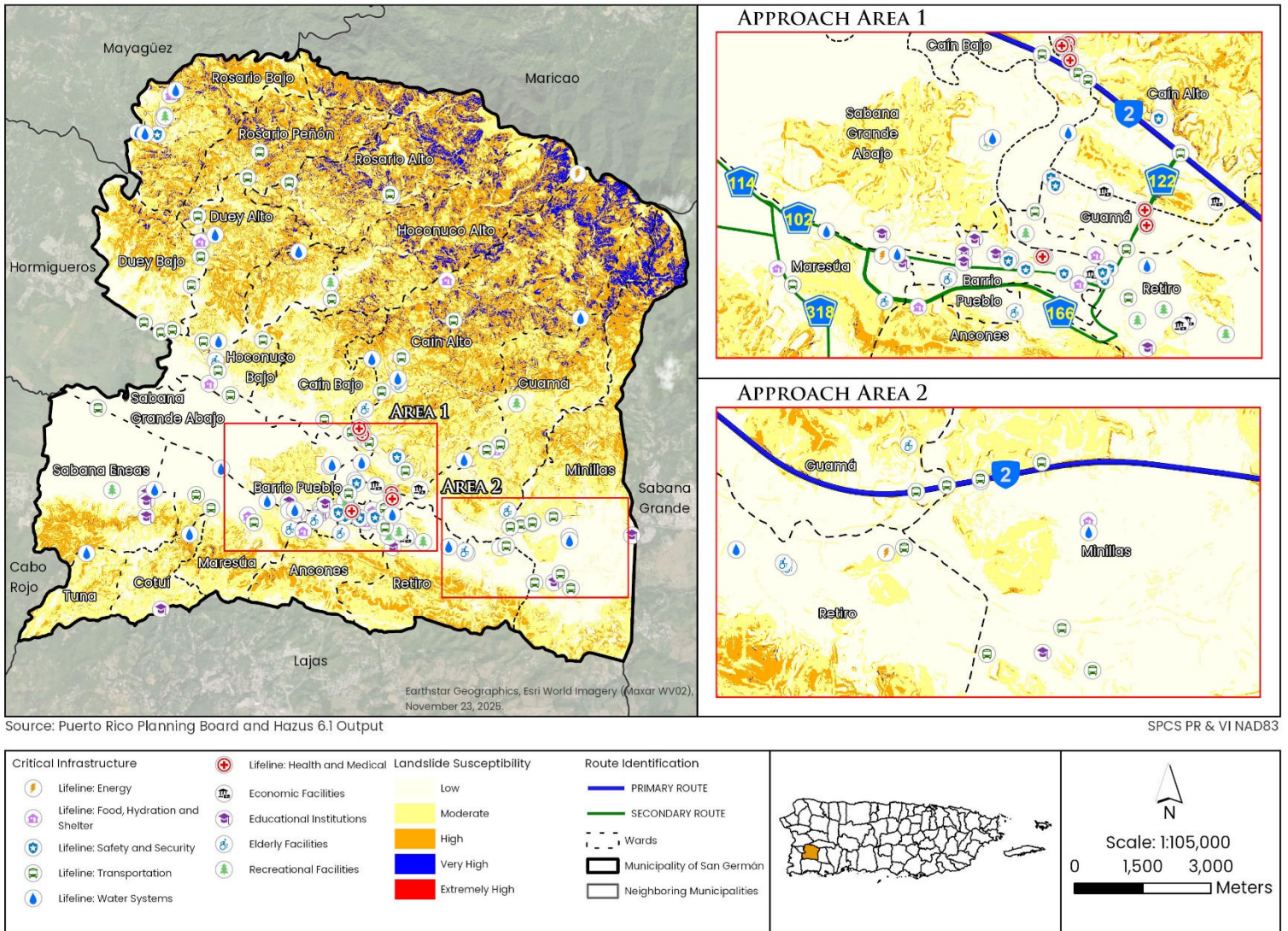
warning systems, hinder coordination among emergency responders, and impair public information networks.

- **Transportation:** Landslides can render roads, railways, bridges, and tunnels impassable or destroy them entirely as debris obstructs critical routes, severely limiting mobility for the public and restricting access for emergency response services.
- **Hazardous Materials:** Landslides can rupture containment structures, pipelines, storage tanks, or industrial facilities, leading to the release of hazardous chemicals or pollutants and potentially triggering HAZMAT emergencies (FEMA, 2024).
- **Water Systems:** Landslides can damage water intakes, treatment plants, distribution lines, and wastewater collection and treatment facilities, leading to contamination, reduced water pressure, and significant service interruptions (IFRC, 2023).

Map 24 shows the identified critical infrastructure that could be affected by Landslides. Most of the municipality's critical infrastructure is located in the Guanajibo River Valley on or near the town center. The most vulnerable lifeline in case of landslide is that of Transportation, as landslides can block the roads that connect the town center and PR- 2 with the wards in the northern part of the municipality.

Map 24.Landslide: Critical Infrastructure Exposure

LANDSLIDE: CRITICAL INFRASTRUCTURE EXPOSURE



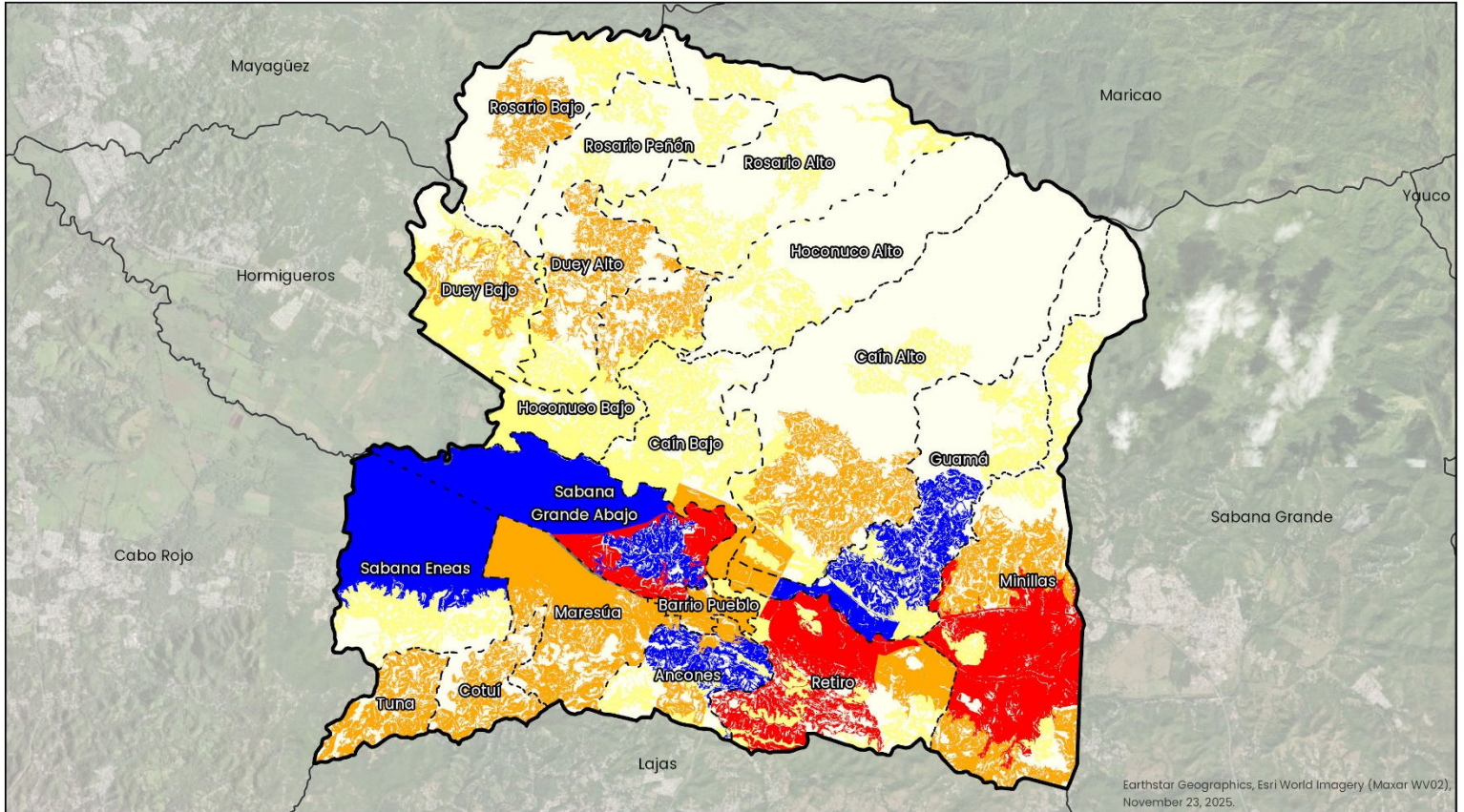
4.7.2.3 *SOCIAL VULNERABILITIES*

Social vulnerability to landslides in Puerto Rico is the product of topography, poverty, aging populations, fragile infrastructure, and geographic isolation, all of which shape the severity of impacts after major storms or seismic events. Academic and federal analyses consistently show that landslides disproportionately burden communities that already struggle with access to transportation, healthcare, income stability, and emergency response. Addressing these vulnerabilities requires hazard mitigation strategies that integrate geospatial risk analysis, social vulnerability indicators, community-based planning, and infrastructure reinforcement tailored to rural and mountainous municipalities (West, Rodríguez Cruz, & Hughes, 2023).

Of particular concern, rural residents often depend on a single road that can be destroyed or blocked by slope failures, isolating entire communities. Although not for San German, focus groups on the municipality of Utuado highlighted that landslides cut-off access to medical facilities, emergency response, and even water and food, sometimes for months. This situation can also happen in San German, especially in the mountainous north where a landslide can cut off rural areas from the historical town center area where all the services are located. This creates immediate life-threatening conditions for people with health conditions, mobility limitations, or emergency medical needs (West, Rodríguez Cruz, & Hughes, 2023).

According to Map 25 the areas of high susceptibility to landslides coincide with the sections that have lower population densities.

LANDSLIDE: POPULATION EXPOSURE



Source: Puerto Rico Planning Board, Hazus 6.1 Output and Census Tract for Puerto Rico

SPCS PR & VI NAD83



4.7.2.4 NATURAL AND CULTURAL RESOURCES

Landslides are among the most destructive natural hazards, producing impacts that extend far beyond the immediate physical damage they cause (Eliot, Cloyd, & Philbin, 1994). Their effects on natural resources are profound and often irreversible. When a landslide occurs, vast areas of vegetation are uprooted or buried, leading to the loss of critical habitats and a decline in biodiversity. The displacement of soil not only strips away fertile layers essential for agriculture but also introduces large volumes of sediment into rivers and reservoirs. This sedimentation degrades water quality, disrupts aquatic ecosystems, and can compromise drinking water supplies. Furthermore, landslides frequently alter hydrological systems by blocking river channels, creating temporary dams that increase flood risk and modify groundwater recharge patterns.

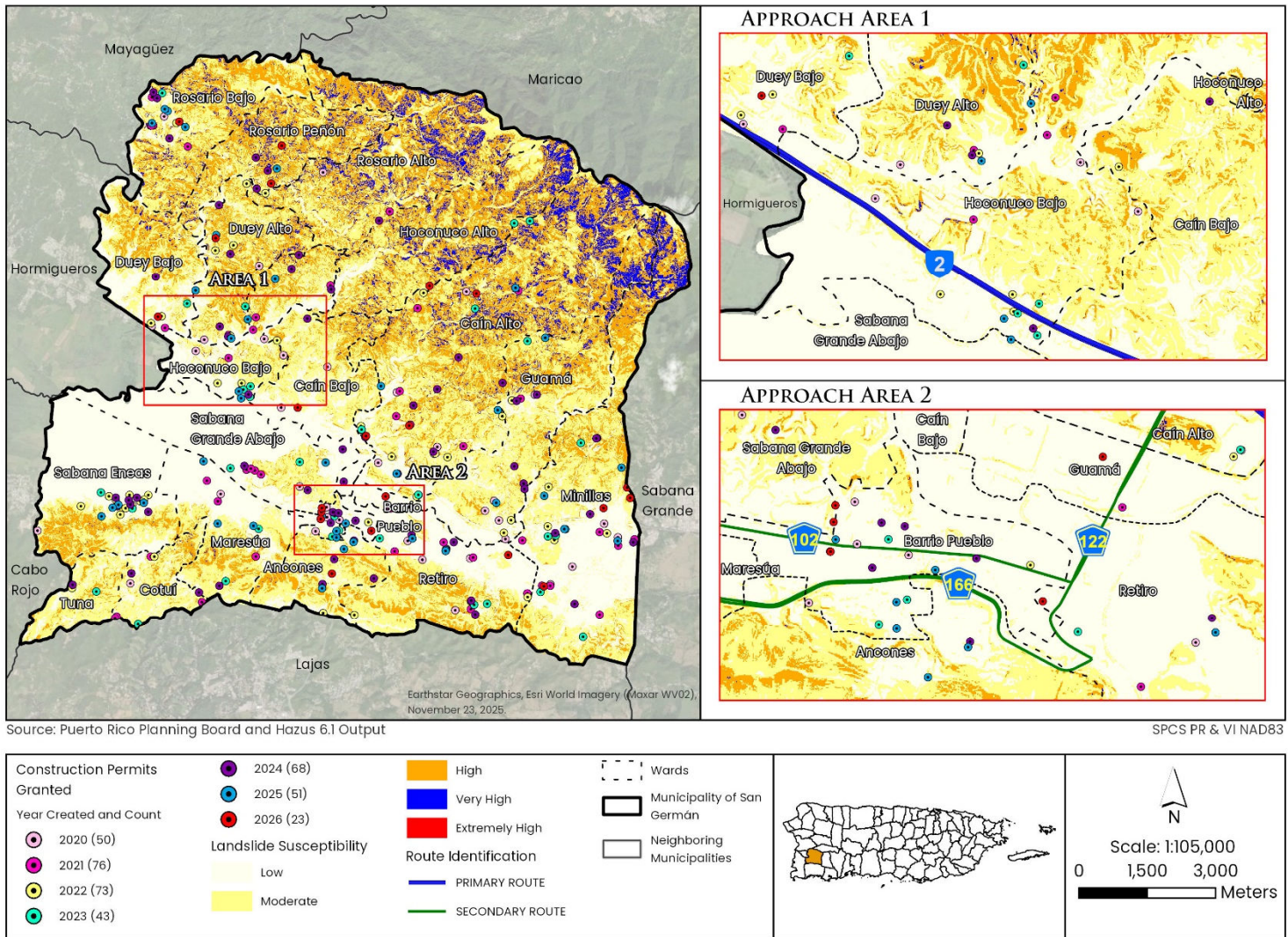
The cultural dimension of landslide impacts is equally significant. Archaeological sites, historic monuments, and culturally significant landscapes are highly vulnerable to burial or destruction during such events. These losses are irreplaceable, erasing tangible links to the past and diminishing cultural heritage. In many regions, landslides have damaged centuries-old structures, including churches, colonial buildings, and sacred sites, resulting in costly restoration efforts or permanent loss. Beyond physical damage, the alteration of cultural landscapes such as terraced fields or ceremonial grounds undermines community identity and traditions deeply tied to the land. Economically, these impacts ripple through local economies dependent on cultural tourism, reducing visitor numbers and income for communities that rely on heritage-based activities.

As for the Municipality of San Germán, although it is a municipality with a high level of cultural resources, these are not affected by landslide hazards the majority of the cultural resources are located in or near the historical town center.

4.7.2.5 FUTURE CONDITIONS

As map 26 shows, recent developments in the municipality has occurred in high susceptibility to landslides zone, particularly in the northwest of the municipality. This means that vulnerability to landslide has increased particularly in the Rosario Bajo and Rosario Peñón Wards.

LANDSLIDE: RECENT DEVELOPMENT EXPOSURE



4.8 FLOODING

4.8.1 DESCRIPTION (B1-A)

Floods, generally caused by excessive rainfall (FEMA, 1997), are classified into two main categories: general floods and flash floods.

- **General floods** are long-duration events that can last several days and include riverine, coastal, and urban floods. Coastal floods are associated with storm surges, waves, and heavy rains generated by hurricanes and tropical storms, while urban floods result from the alteration of natural drainage due to urban development. Riverine floods occur when rivers overflow due to excessive water runoff through rainfall or structural failures, causing water to spill into surrounding land. Flash floods often stem from stationary storms, hurricanes, or dam failures, affecting both mountainous areas and urbanized zones.
- **Flash floods** happen when prolonged rainfall falls over a watershed (water basin). The latter result from intense precipitation over a short period in specific areas. The magnitude of flash floods events depends on factors such as basin topography and physiography, weather patterns, soil saturation, and surface impermeability. Flash floods mainly originate from slow-moving storms over specific areas or from intense rainfall associated with hurricanes and tropical storms (NMEAD, 2021). However, they can also occur after the collapse of dams or levees within minutes or hours, due to extreme rainfall or the sudden release of water from retention basins or other stormwater control facilities. Although more frequent in mountain streams, these events can occur in urban areas where impermeable surfaces limit infiltration.

The periodic flooding of land adjacent to rivers, streams, and coasts—known as floodplains—is a predictable natural phenomenon based on recurrence intervals. These intervals represent the average time, in years, between events of equal or greater magnitude. The longer the recurrence interval, the greater the magnitude of the event, which implies a significant increase in risk and the extent of the affected area. Floodplains flood periodically according to recurrence intervals, defined as the average time between events of equal magnitude. For example, a 100-year flood has a 1% annual probability, while a 500-year flood corresponds to 0.2%. These frequencies are calculated through statistical analysis of historical flow records and extreme events.

Table 24 shows the different flood zone classifications for Puerto Rico adopted by the PRPB (PRPB, 2021).

Table 24. Puerto Rico Flood Zones

Flood Zone	Description
Zone A	Special Flood Hazard Area with a recurring period of one hundred (100) years determined by using approximate methodologies with no base flood elevation or Floodway determined.
Zone AE	Special Flood Hazard Areas with a recurring period of one hundred (100) years determined by detailed methodologies with base flood elevations indicated. According to the scope of the study, may include the Floodway determination.
Zone AO/AH	Shallow Special Flood Hazard Areas with a recurring period of one hundred (100) years with a base flood depth fluctuating between 0.30 meters (one (1) foot) and 0.91 meters (three (3) feet). The average flood depths are obtained from detailed hydraulic analysis.
Zone A99	areas prone to flooding from a flooding event with a one percent (1%) annual chance of occurring. These special areas are within a flood protection or control system where enough progress has been made in its construction, even though it has not been completed, but specific statutory progress has been reached to complete it. This zone does not detail base flood elevations or flooding depths, so it is recommended to use, if required, the previous flood elevation for Zone 99. Mandatory flood insurance purchase requirements apply.
Zone D	Flooding area that is not determined but is possible.
Zone VE	Coastal high flood hazard area with a recurring period of one hundred (100) years with velocity and energy (storm surge) and a determined base flood elevation.
Zone X Shaded	flooding area with 0.2% chance of occurring each year or the one hundred (100) year flood with a water depth of less than 0.3 meters, with drainage areas of less than 2.6 square kilometers or areas protected by levees against the one hundred (100) year flood.
Zone X (unshaded)	Area determined to be outside the five hundred (500) year storm flood.

4.8.1.1 AFFECTED AREA

Flood Rate Insurance Maps (FIRM)

Map 27 shows the affected areas by flood in San Germán as described in the official Flood Rate Insurance Map (FIRM). The areas in orange represent the 500 – year (.02%)

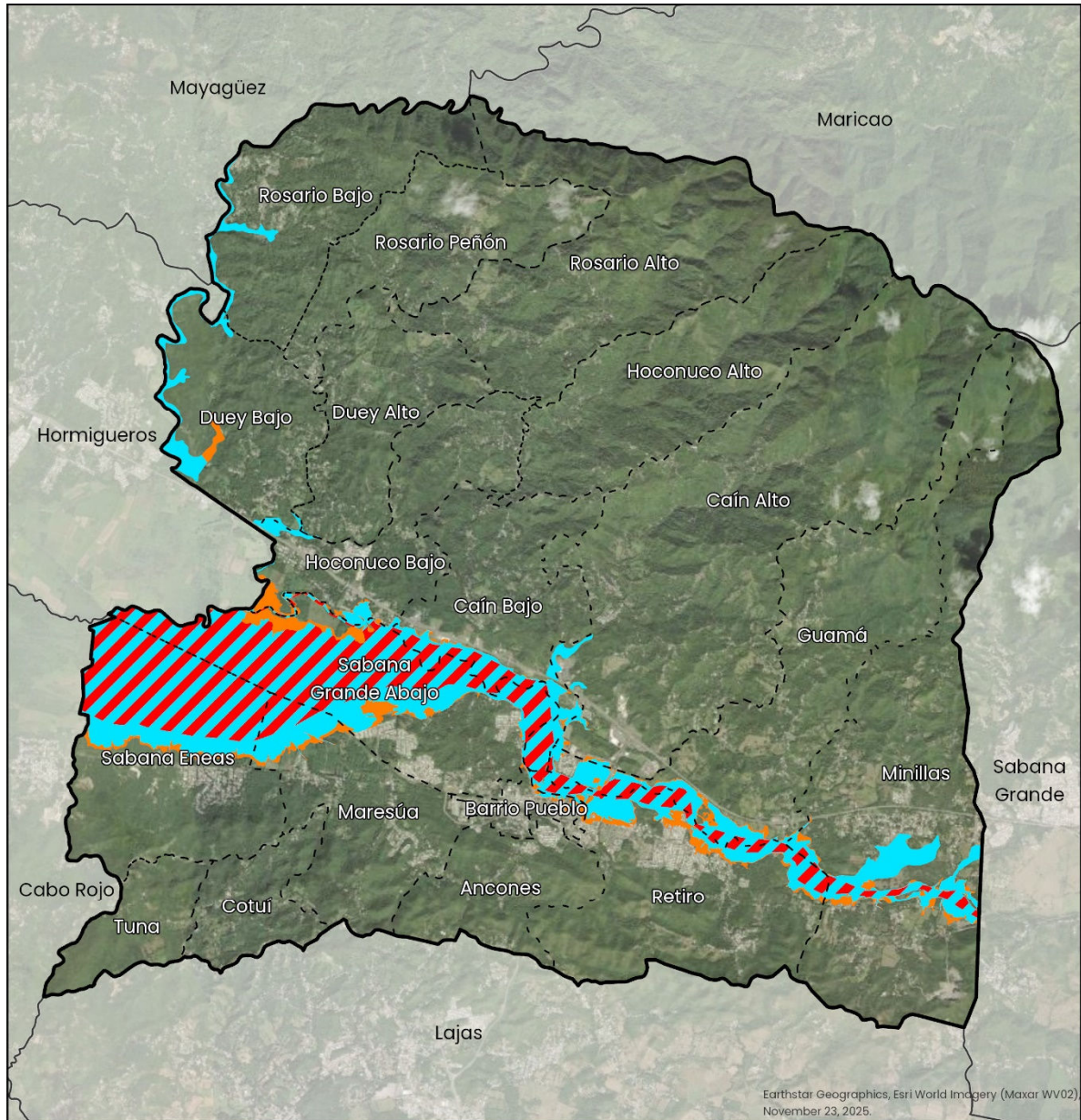
flood extent. The extent of flood hazard in San Germán is strongly influenced by the municipality's geomorphology and climatic conditions. Both the 100-year and 500-year flood events cover nearly the entire extent of the Guanajibo River Valley, demonstrating the high level of exposure present in these low-lying areas. These valleys are generally flat and sit at lower elevations, making them natural zones for water accumulation during heavy rainfall events.

Most of these alluvial valleys are bounded on three sides by steep mountainous terrain. This configuration creates a funneling effect, where runoff generated on the surrounding slopes is rapidly directed toward the valley floor. Due to the steep degree of these slopes, rainwater accelerates quickly as it flows downhill, through the Duey, Hoconuco, Cain, Cupeyes River and other minor creeks. This increases both the volume and velocity of runoff entering the valleys. As a result, the Guanajibo River Valley is prone to rapid inundation and flooding.

Figures 15 to 17 shows FIRMette maps with specific areas of flooding in the Municipality.

- Figure 15 illustrates the Guanajibo River floodplain near San Germán City Hall, the historic urban center, the municipality's primary disaster shelter (Old National Guard), and the industrial area of PR-362 as well as subdivisions such as Santa Marta, Porta Coelli and Riverview.
- Figure 16 reveals the extent of the Guanajibo River floodplain near the San Germán agricultural valley and community along PR-347.
- Figure 17 presents the extent of the Guanajibo River floodplain near residential area along PR-102 in San Germán, including parts of the Santa María subdivision.

FLOOD HAZARD ZONES



Source: Puerto Rico Planning Board and Federal Emergency Management Agency

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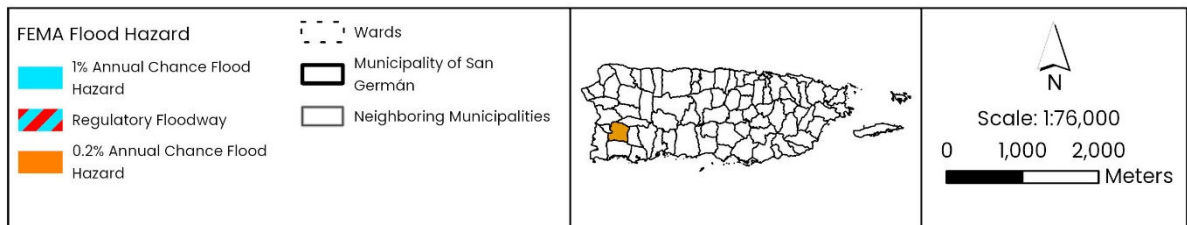
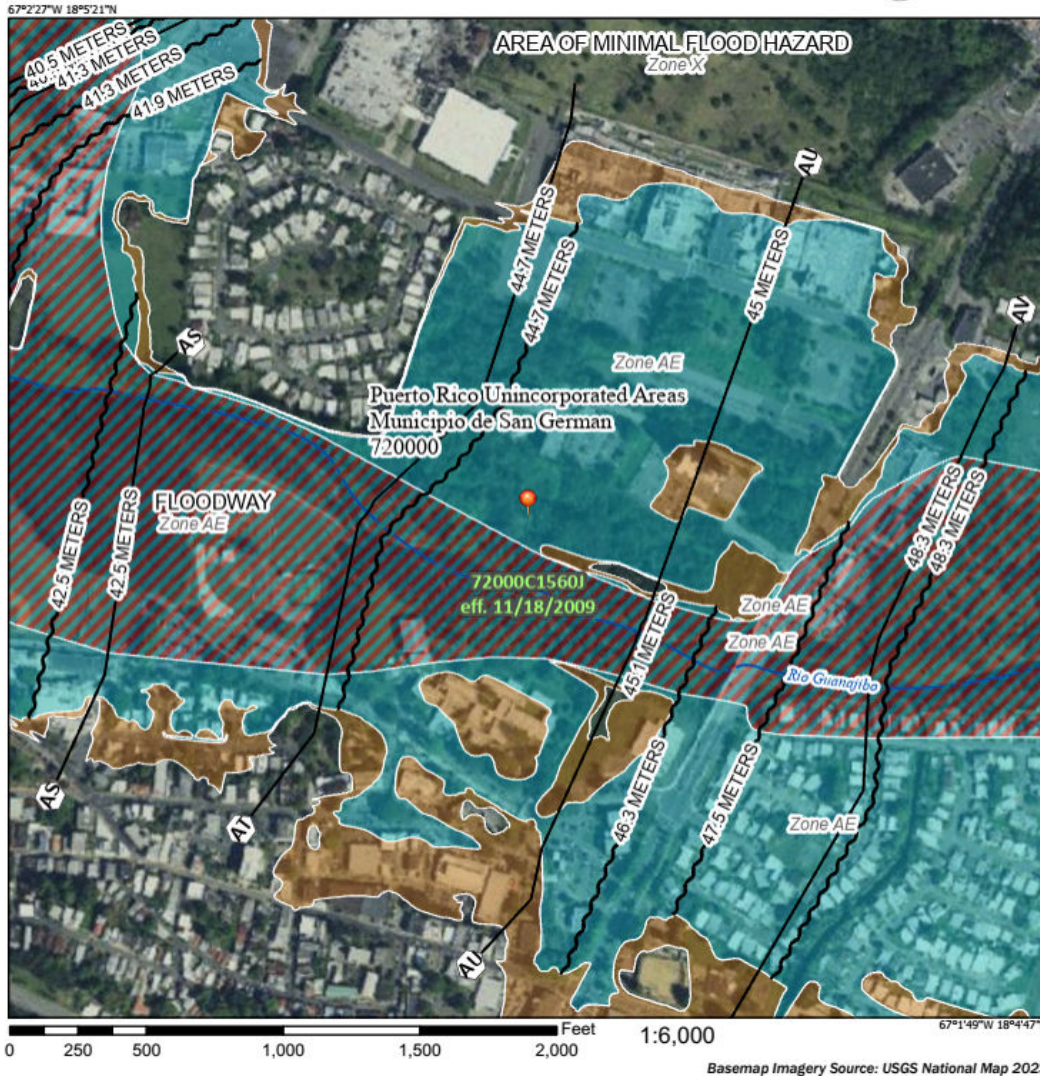


Figure 15. FEMA National Flood Hazard Layer (FIRMette) San Germán Town Center

National Flood Hazard Layer FIRMette



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) Zone A, V, A33
	With BFE or Depth Zone AE, AO, AH, VE, AR
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
	Future Conditions 1% Annual Chance Flood Hazard Zone X
	Area with Reduced Flood Risk due to Levee. See Notes. Zone X
	Area with Flood Risk due to Levee Zone D
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard Zone X
	Effective LOMRs
	Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	Cross Sections with 1% Annual Chance Water Surface Elevation 20.2 17.5
	Coastal Transect
	Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
MAP PANELS	Digital Data Available
	No Digital Data Available
	Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards.

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/13/2026 at 6:49 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Figure 16. FEMA National Flood Hazard Layer (FIRMette) – Guanajibo River/PR-347

National Flood Hazard Layer FIRMette

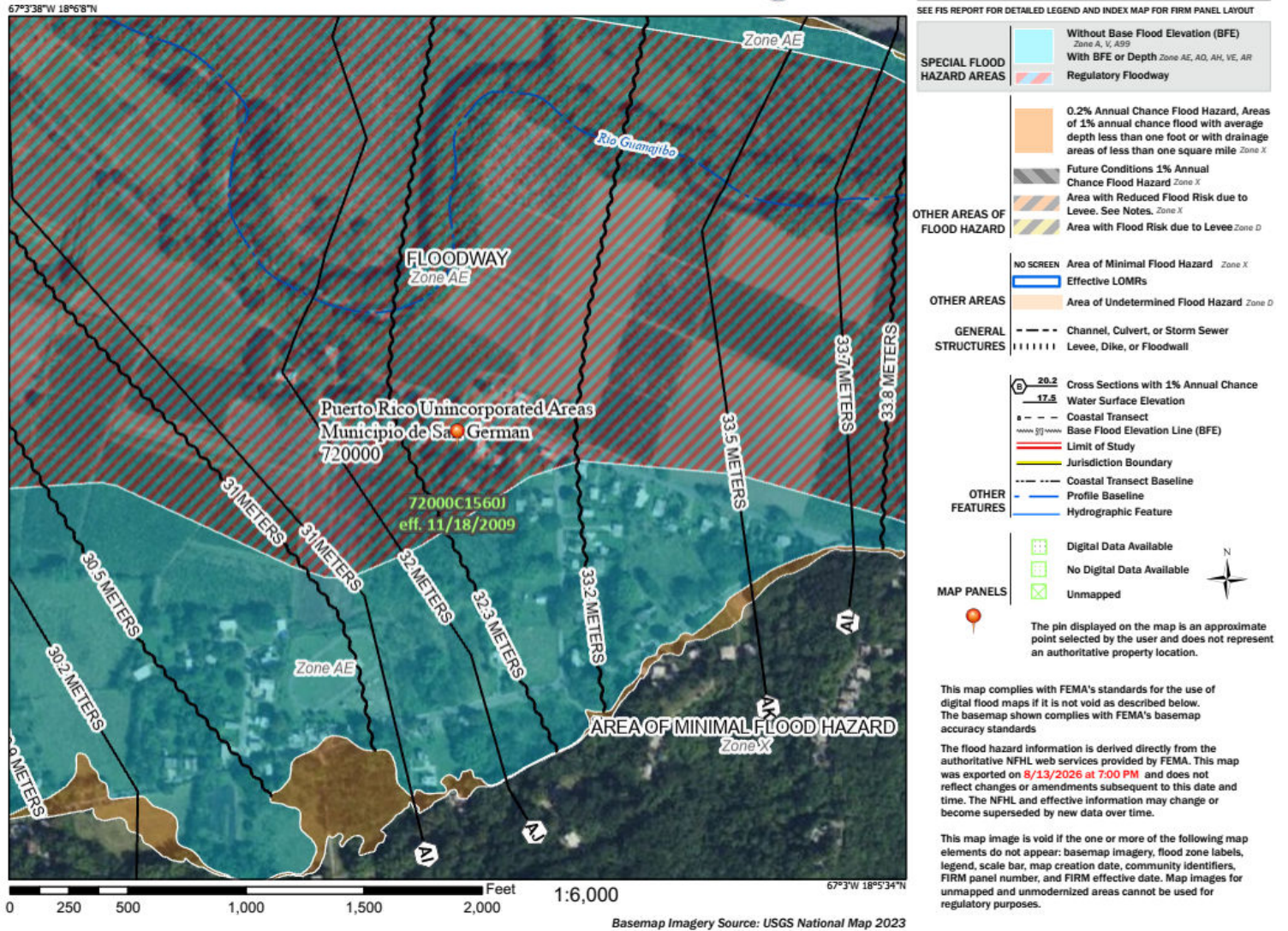
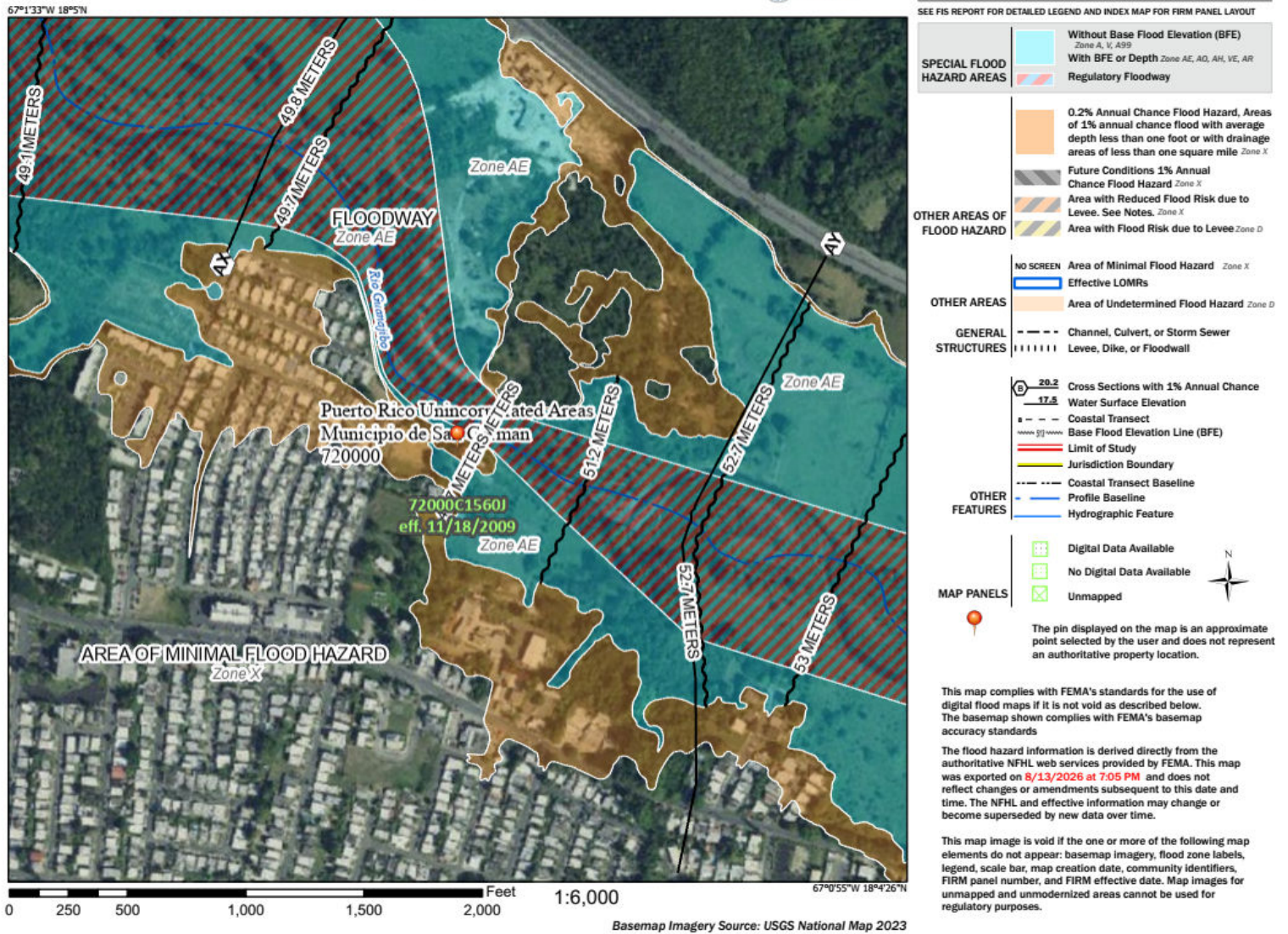


Figure 17. FEMA National Flood Hazard Layer (FIRMette) Guanajibo River and PR-102 residential areas

National Flood Hazard Layer FIRMette



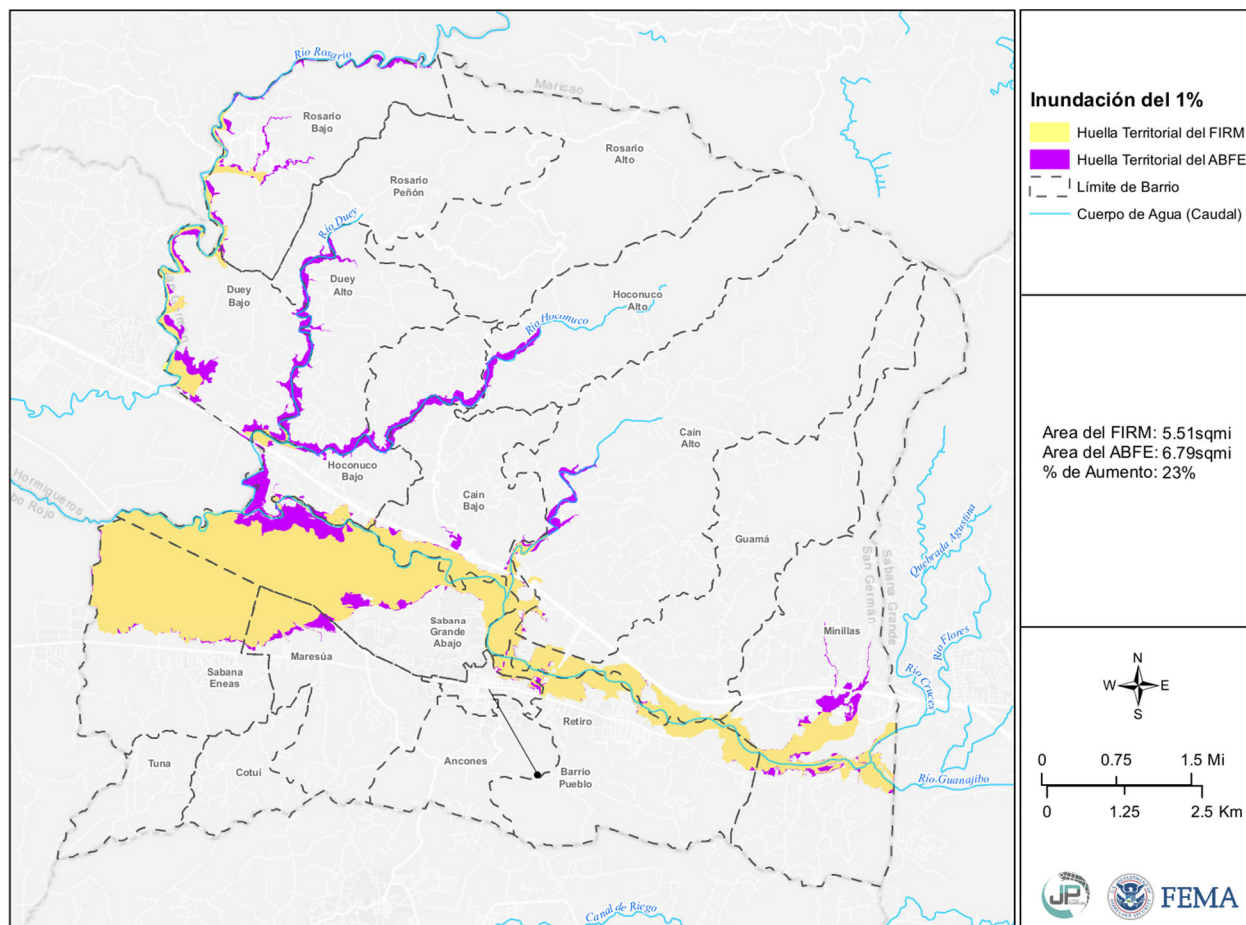
Advisory Base Flood Elevation (ABFE)

Likewise, FEMA uses another type of map for the purpose of developing regulations and construction permits known as the Advisory Base Flood Elevation Maps (ABFE). ABFEs are developed after the occurrence of a high-impact atmospheric event, and several factors related to the latest engineering analysis are taken into consideration to determine whether an analysis is necessary. Some of the factors considered in the analysis include the age of the analysis, the territory covered by the analysis, and the engineering models/data used in the analysis. ABFEs have been produced for states such as Mississippi (Hurricane Katrina), New York, and New Jersey (Hurricane Sandy). Following Hurricane María's passage through Puerto Rico in 2017, and due to the availability of better data, FEMA developed ABFEs for Puerto Rico. It should be noted that the Puerto Rico Planning Board adopted the ABFEs on an emergency basis in March 2018. At present, Puerto Rico has two (2) types of flood maps: the FIRMs (2009), which are used solely for flood insurance rates, and the ABFEs (2018), which are used to regulate construction on the Island.

For comparison purposes, this subsection includes the difference in the extent of land affected by flooding based on the FIRMs prior to Hurricane María in September 2017 and the ABFEs developed by FEMA for Puerto Rico. After Hurricane María in 2017, the areas designated as flood-prone throughout the Island increased by 20%. Thus, this reflected an increase of 41%.

The next Figure (in Spanish) shows the difference between the extent of the FIRM maps before Hurricane María and the Advisory Base Flood Elevation (ABFE) maps after the hurricane. In the Municipality of San Germán, the difference represents an increase of approximately 23%, from 5.51 square miles to 6.79 square miles, meaning that the areas exposed to flooding are more extensive than previously determined and greater than those highlighted in the municipality's previous Plan. The new areas include the expansion of previously identified areas, as well as new areas along several bodies of water in the Municipality, including the Duey, Hoconuco, Rosario, Guanajibo, Cupeyes, and Caín rivers.

Figure 18. Comparison of Flood Hazard Areas: Pre-María FIRM and Post-María ABFE Maps



As instructed by PRPB the hazard analysis was made using the ABFE maps.

HAZUS Modeling

Flooding source identification and hazard loss estimation were performed using Federal Emergency Management Agency's (FEMA) Hazus platform, a nationally standardized tool for multi-hazard risk assessment. The Hazus flood module was used to delineate streams in areas where no engineering studies have been developed and also used to estimate potential monetary losses associated with structural damage.

Input data included depth grids produced by a Base Level Engineering (BLE) study in 2018 post hurricanes Irma and Maria. This BLE study did not review all potential riverine flooding sources so additional modeling was developed with Hazus hydrology and

hydraulics to review other potential losses associated with streams with drainage areas of one square mile or more.

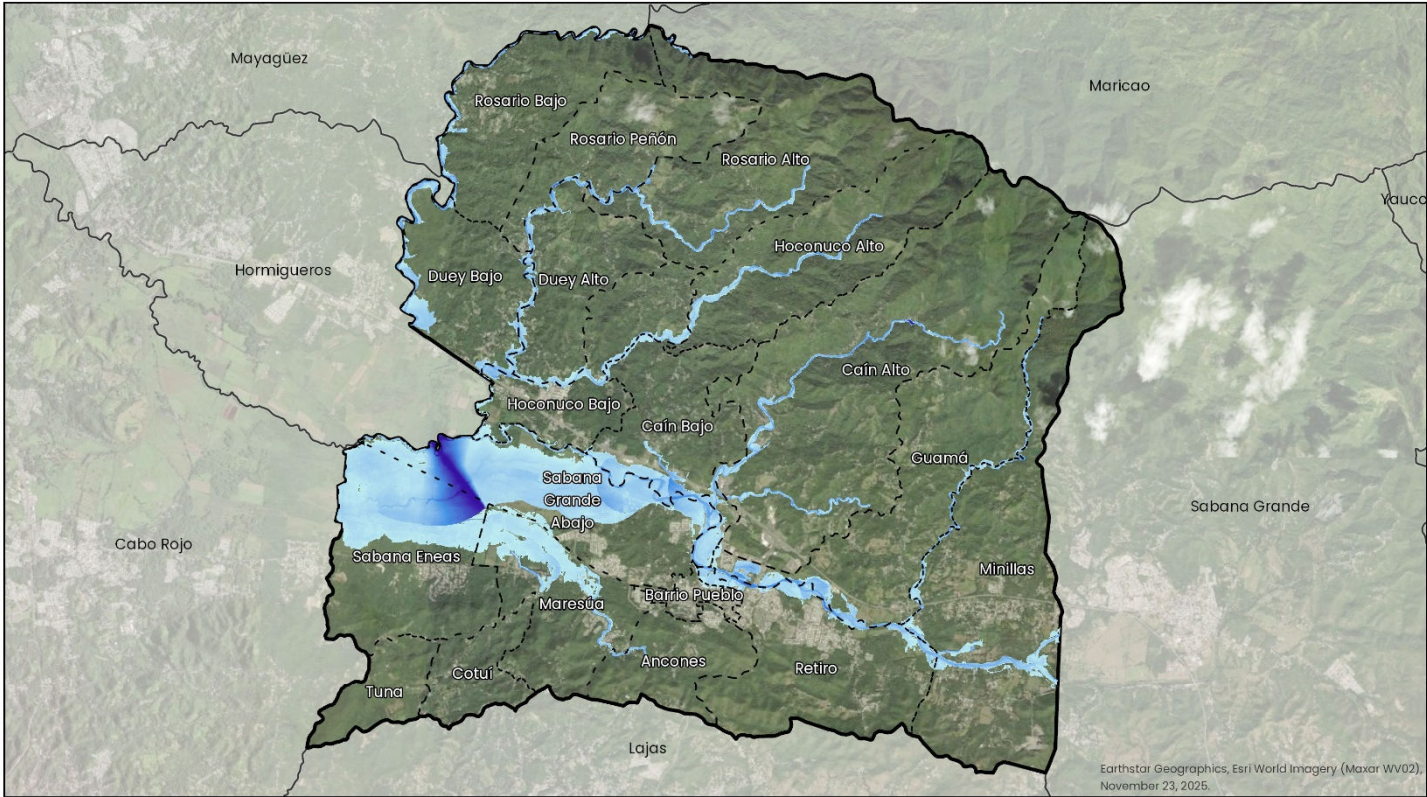
Topographic data used by Hazus for depth calculations and damage estimation was sourced from the USGS 3D Elevation Program (3DEP) seamless 1/3 arc-second Digital Elevation Model (DEM), at an approximate resolution of 10 feet. This dataset provides current coverage of Puerto Rico and its surrounding islands.

The 3DEP seamless DEM for Puerto Rico is derived from two lidar collection efforts: a 2016–2017 USGS lidar survey and a 2018 USGS post-Hurricane Maria lidar survey. The 2018 collection, conducted following the significant coastal geomorphic changes caused by Hurricane Maria, represents the most current available terrain data for the island and forms the primary basis of the 3DEP elevation layer used in this analysis.

The areas documented in the maps included within the LHMP may have streamlines represented but with no depth grids associated with them. Due to the inconsistency of available regression equations and other data necessary for computation of flood risk and losses with Hazus's hydrology and hydraulics models, some streams that were delineated were unable to be completed during modeling runs. These stream areas may need to be reviewed for future flood studies and potential flood risk identification but, due to the lack of data, they were unable to be included in the Hazus studies.

The following map shows the result of the Hazus Run. The most up to date Hazus Run shows that flooding may extend beyond what was determined in the 2018 ABFE. It particularly shows that the flooding areas of the Rosario, Duey, Hoconuco, Cain and Cupeyes rivers, reaching far north of the municipality.

HAZUS ANALYSIS FOR 500-YEAR FLOOD EVENT



4.8.1.2 RISK MAGNITUDE (B1-C)

Flood events can represent one of the most severe atmospheric threats, as there is no other event worldwide that causes greater loss of life (FEMA, 1997). This is due to the high frequency of such events and the population's lack of awareness regarding the magnitude of the damage they can cause, whether physical harm or property damage. It should be noted that most disaster declarations in the U.S. are related to flood events. Most flood-related incidents involve people being swept away by fast-moving water, along with their vehicles (FEMA, 1997). Each year, the devastation caused by floods results in billions of dollars in asset losses. Highly urbanized areas with dense populations are particularly vulnerable to flash floods, as the construction of buildings, roads, and parking lots create impermeable surfaces, reducing the land's natural ability to absorb water (NSWL, n.d.).

Floods are the most common natural disaster, occurring when water overflows and submerges land that is typically dry. They are often triggered by heavy rainfall, rapid snowmelt, or storm surges from tropical cyclones or tsunamis in coastal regions. Floods can cause extensive destruction, including loss of life and severe damage to homes, property, and critical public health infrastructure. Between 1998 and 2017, floods impacted more than 2 billion people worldwide. Those living in floodplains, in poorly constructed buildings, or without access to warning systems and hazard awareness are the most vulnerable (WHO, 2025).

Three common types of floods include:

- Flash floods: Result from sudden, intense rainfall that rapidly raises water levels, overwhelming rivers, streams, channels, or roads.
- River floods: Occur when prolonged rainfall or snowmelt causes rivers to exceed their capacity.
- Coastal floods: Caused by storm surges linked to tropical cyclones or tsunamis.

Regarding the impact on life, property, and operations, floods cause loss of life and property damage, including residences, buildings, infrastructure, agriculture, and sanitation and drainage systems. After a flooding event, the aftermath can increase the occurrence of various diseases, such as leptospirosis, and lead to rises in contaminated water (Malilay, 2000).

According to a Congressional Budget Office (CBO) report, "Over the past 10 years, damage from flooding in the United States has averaged \$46 billion per year (in 2023

dollars)” (CBO, 2024). This estimate includes costs such as:

- The replacement of residential and commercial property;
- Repairs to or rebuilding of public infrastructure;
- Emergency response measures;
- Costs associated with the continued loss of property use (for example, the provision of temporary housing);
- Commercial losses resulting from business interruptions; and
- Damage to crops, livestock, and timber” (CBO, 2024).

Although the effectiveness of adaptation projects varies, estimates by the U.S. Army Corps of Engineers indicate that approximately two-thirds of its projects—excluding those in the highest and lowest sixth of benefit–cost ratios—are expected to reduce flood damages by \$2 to \$6 for every dollar invested over a 50-year project lifespan(CBO, 2024).

The flood area classifications used by the Puerto Rico Planning Board are (PRPB, 2021):

- Zone A - 1% annual chance floodplain (100-year floodplain); Base Flood Elevation (BFE) not determined
- Zone AE - 1% annual chance floodplain with established Base Flood Elevation.
- Zone AO - Shallow sheet-flow flooding, typically 1 to 3 feet deep.
- Zone AH - Shallow ponding flood area with established flood depths.
- Zone VE - Coastal high-hazard area subject to wave action of 3 feet or more.
- Regulatory Floodway - Portion of the floodplain required to convey floodwaters without increasing flood elevations.
- X (shaded) - Moderate flood risk area outside the 1% annual chance floodplain.
- X (unshaded) - Area of minimal flood hazard.

4.8.1.3 PAST EVENTS (B1-D)

For the most part, flooding events in Puerto Rico are related to tropical systems (tropical waves, tropical depressions, tropical storms and hurricanes). Consequently, flooding hazards occur most frequently during Atlantic hurricane season, which extends from June 1 through November 30.

However, flooding events can occur outside this window as shown in the case of the April- May 2024 Floods, the February 2022 floods and the Three Kings’ Flooding of 1992. The following table summarizes the major flooding events in the period of 2010 – 2025.

Table 25. Major flooding events in Puerto Rico 2010–2025

Event	Date	Disaster Declaration Number	San Germán Included?	Description
Tropical Storm Ernesto	8/14/2025 – 8/16/2025	DR-4850- PR	Public Assistance: No Individual Assistance: No	The storm’s slow movement and moisture-rich environment contributed to prolonged precipitation, particularly in central and eastern municipalities. Parts of Central Puerto Rico recorded 12–14 inches of rainfall in localized areas. The municipality of Barranquitas measured 11.20 inches over a 48-hour period, while Villalba reported 10.20 inches. Eastern municipalities, including Vieques and Culebra, observed 8–10 inches of rain. Multiple rivers exceeded their banks, including the La Plata River, resulting in significant inundation of adjacent communities. Flash flooding occurred in urban and rural areas, rendering primary and secondary roads impassable. Floodwaters caused structural failures in bridges and washed-out critical road segments, isolating several communities. Stormwater drainage systems in metropolitan areas, notably San Juan, were overwhelmed, leading to localized urban flooding. Emergency Response and Disruptions Evacuations were conducted in flood-prone areas such as Toa Baja to mitigate loss of life.
Puerto Rico Severe Storms,	4/29/2024 – 5/10/2024	DR-4808-PR	Public Assistance: No	In April 2024, Puerto Rico was struck by a series of severe storms that delivered prolonged heavy

Event	Date	Disaster Declaration Number	San Germán Included?	Description
Flooding, Landslides, and Mudslides			Individual Assistance: No	rainfall—some areas received more than 10 inches—leading to widespread flooding and landslides. Central and western municipalities saw rivers overflow, with the Manatí and Cibuco rivers breaching their banks and inundating highways like PR-2. Urban areas, especially in the southwest (Cabo Rojo, Mayagüez, Ponce), faced flash flood warnings as heavy afternoon downpours overwhelmed drainage systems. Floodwater turned streets into torrents, trapping residents on rooftops and prompting emergency evacuations in over 20 municipalities.
Hurricane Fiona	9/17/2022 – 9/21/2022	DR-4671-PR	Public Assistance: Yes Individual Assistance: Yes	Hurricane Fiona struck Puerto Rico in September 2022, unleashing torrential rains—up to 31.22 inches of rainfall over 72 hours in Ponce, nearly matching the accumulation from Hurricane Maria. This deluge led to catastrophic flooding, with 7 to 20 inches common across most of the island and localized spots exceeding 30 inches.
Puerto Rico Severe Storm, Flooding and Landslide	2/4/2022 – 2/6/2022	DR-4649-PR	Public Assistance: No Individual Assistance: Yes	In February 2022, Puerto Rico experienced a severe storm that brought prolonged heavy rainfall, causing widespread flooding across the island. Rainfall totals ranged from 3 to 10 inches in many areas, with localized peaks reaching up to 16 inches in Toa Alta. The intense precipitation overwhelmed drainage systems, leading to urban flooding in San Juan, Guaynabo, and coastal towns such as Dorado

Event	Date	Disaster Declaration Number	San Germán Included?	Description
				and Vega Baja. Rivers swelled beyond their banks, inundating roads and isolating communities, while landslides compounded the damage in mountainous regions. Emergency responders issued flash flood warnings and conducted evacuations as homes and businesses were submerged.
Puerto Rico Severe Storm and Flooding	9/13/2020	DR-4571-PR	Public Assistance: No Individual Assistance: No	Puerto Rico was battered by a severe storm and flooding on September 13, 2020, resulting in widespread flood damage and infrastructure disruption. Torrential rains overwhelmed drainage systems and caused rivers to overtop in areas like Arecibo, where one home was destroyed, over 100 suffered major damage, and more than 20 experienced minor flooding. Roads and bridges were submerged or damaged, isolating communities and impeding emergency response efforts. Floodwaters inundated homes and public facilities, prompting evacuation orders and flash flood warnings across several municipalities.
Tropical Storm Isaiás	7/29/2020 - 7/30/2020	DR-4560-PR	Public Assistance: No Individual Assistance: No	Although the center of Tropical Storm Isaiás did not make landfall on the island, the system left a large amount of rain in its path, causing flooding throughout Puerto Rico. Rainfall accumulation of up to 10 inches was recorded around the island.
Hurricane María	9/20/2017	DR-4339-PR	Public Assistance: Yes Individual Assistance:	Widespread flooding severely affected the whole Island. For example, in San Juan, water levels reached up to 6 feet in some areas and numerous

Event	Date	Disaster Declaration Number	San Germán Included?	Description
			Yes	structures losing their roofs. The coastal neighborhood of La Perla was largely destroyed, while Cataño suffered extensive damage, with the Juana Matos community estimated to be 80% destroyed. Strong winds, heavy rains, and flash floods near the La Plata Lake dam in Toa Baja impacted thousands of residents. Survivors reported that floodwater rose 6 feet in just 30 minutes, and some areas experienced depths of up to 15 feet (4.6 m).
Hurricane Irma	9/5/2017	DR-4336-PR	Public Assistance: Yes Individual Assistance: No	On September 5, 2017, Hurricane Irma impacted Puerto Rico; an Emergency Declaration was issued for the Island. On September 6, 2017, a Major Disaster Declaration was issued following Hurricane Irma's passage. Two people died due to torrential rains before the hurricane: a man died in Orocovis after falling from his ladder while repairing his roof; another man on the coast in Capitanejo died after being struck by lightning. Wave heights in Puerto Rico reached 9 meters, and sustained winds of 111 mph were recorded in Culebra.
Tropical Storm María ¹⁴	9/8/2011 – 9/14/2011	DR-4040-PR	Public Assistance: No Individual Assistance: No	Tropical Storm (later Hurricane) Maria formed in early September 2011 and passed near Puerto Rico, bringing significant heavy rainfall and tropical storm

¹⁴ Tropical Storm María was a tropical system that pass to the northeast of Puerto Rico in 2011 and that caused flooding in the Island. Not to be confused with the 2017 Hurricane María. The name "María" was retired from the official Atlantic hurricane season list of names after 2017.

Event	Date	Disaster Declaration Number	San Germán Included?	Description
				conditions to the island. The storm caused widespread flooding that inundated numerous roadways and homes; floodwaters near Patillas destroyed several homes and bridges, and approximately 150 houses in Yabucoa were flooded and damaged.
Hurricane Irene	8/22/2011	DR-4017-PR	Public Assistance: Yes Individual Assistance: No	Total rainfall reached 22 inches over three days, with the eastern region being the most affected—the same area that had already received over 6 inches earlier in August during the close passage of Tropical Storm Emily. The Río Grande de Manatí in Manatí recorded its third-highest level in history, surpassed only during Hurricane Hortense (1996) and Hurricane Georges (1998). The Puerto Nuevo River near Hato Rey reached its fourth-highest level on record. Flooding was severe enough to cause infrastructure stress and dangerous conditions across multiple municipalities. Tragically, there was one direct fatality attributed to Irene, due to drowning.
Puerto Rico Severe Storms, Flooding. Mudslides and Landslides	5/20/2021 – 6/8/2021	DR-4004-PR	Public Assistance: No Individual Assistance: No	In May 2021, Puerto Rico experienced a series of intense rainfall events that caused flash flooding, river overflows, mudslides, and landslides, particularly in mountainous and interior regions. Although May is normally one of the wettest months of the year, several storm systems produced short-duration but high-intensity rainfall, overwhelming local drainage systems and

Event	Date	Disaster Declaration Number	San Germán Included?	Description
				destabilizing steep terrain.
Sub-Tropical Storm Otto	10/3/2010 – 10/8/2010	DR-1946-PR	Public Assistance: No Individual Assistance No	An extensive rain band covered Puerto Rico while Otto moved as a distant tropical cyclone north of the Island (NOAA). This resulted in heavy and continuous rainfall that caused serious flooding. (Eco Exploratorio).
Puerto Rico Severe Storms and Flooding	5/26/2010 – 5/31/2010	DR-1919-PR	Public Assistance: No Individual Assistance: No	In May 2010, Puerto Rico was hit by a series of severe storms that produced torrential rainfall and widespread flooding across the island. Rainfall exceeded 12 inches in some areas, overwhelming drainage systems and causing rivers to overflow their banks. Low-lying communities and urban centers experienced significant inundation, with roads submerged and bridges damaged, isolating several municipalities. Flash floods swept through residential areas, forcing evacuations and leaving homes and businesses underwater. Landslides triggered by saturated soil compounded the crisis, blocking access routes and delaying emergency response efforts. The event resulted in extensive infrastructure damage and highlighted the island's vulnerability to prolonged heavy rain events during the wet season.

In summary, between 2010 and 2025 there were a total of 13 major disaster declarations caused by flooding or events that had flood related damage. Of those, the municipality of San Germán was declared eligible for either Public Assistance or Individual Assistance in five instances.

4.8.1.4 SPECIAL CONSIDERATIONS: KARST FORMATION

The karst formation in Puerto Rico is a limestone region that covers approximately 27.5% of the island's surface encompassing northern and southern limestone areas as well as scattered limestone outcrops throughout the island. The most pronounced karst topography occurs in the northern limestone, known as the "karst belt," which spans approximately 142,544 hectares, or 65% of that region.

Tropical solution processes have shaped this belt into a landscape of mogotes, cone hills, sinkholes, blind valleys, caves, rugged canyon walls, and disappearing streams. These features were formed through the dissolution of Oligocene and Miocene limestone under tropical conditions (Lugo, et al., 2021) (PRPB, 2014). This terrain contains the island's largest freshwater aquifers, mature forests, wetlands, estuaries, and extensive cave systems, that are critical to Puerto Rico's hydrology and biodiversity. Its rugged topography and shallow soils have limited large scale agriculture and dense urban development, leaving much of the area relatively undisturbed. However, the karst region remains vulnerable to human activities such as vegetation clearing, wetland drainage, paving, groundwater extraction, and pollution. Such activities can destabilize the landscape and impair its essential ecological and hydrological functions (Lugo, et al., 2021) (PRPB, 2014).

The karst belt in northern Puerto Rico is a unique limestone landscape shaped by tropical solution processes. It is characterized by mogotes, sinkholes, caves, and underground aquifers. This region contains the island's largest freshwater reserves, supports mature forests, wetlands, and diverse ecosystems, and plays a critical role in maintaining water quality and biodiversity (Lugo, et al., 2021) (PRPB, 2014).

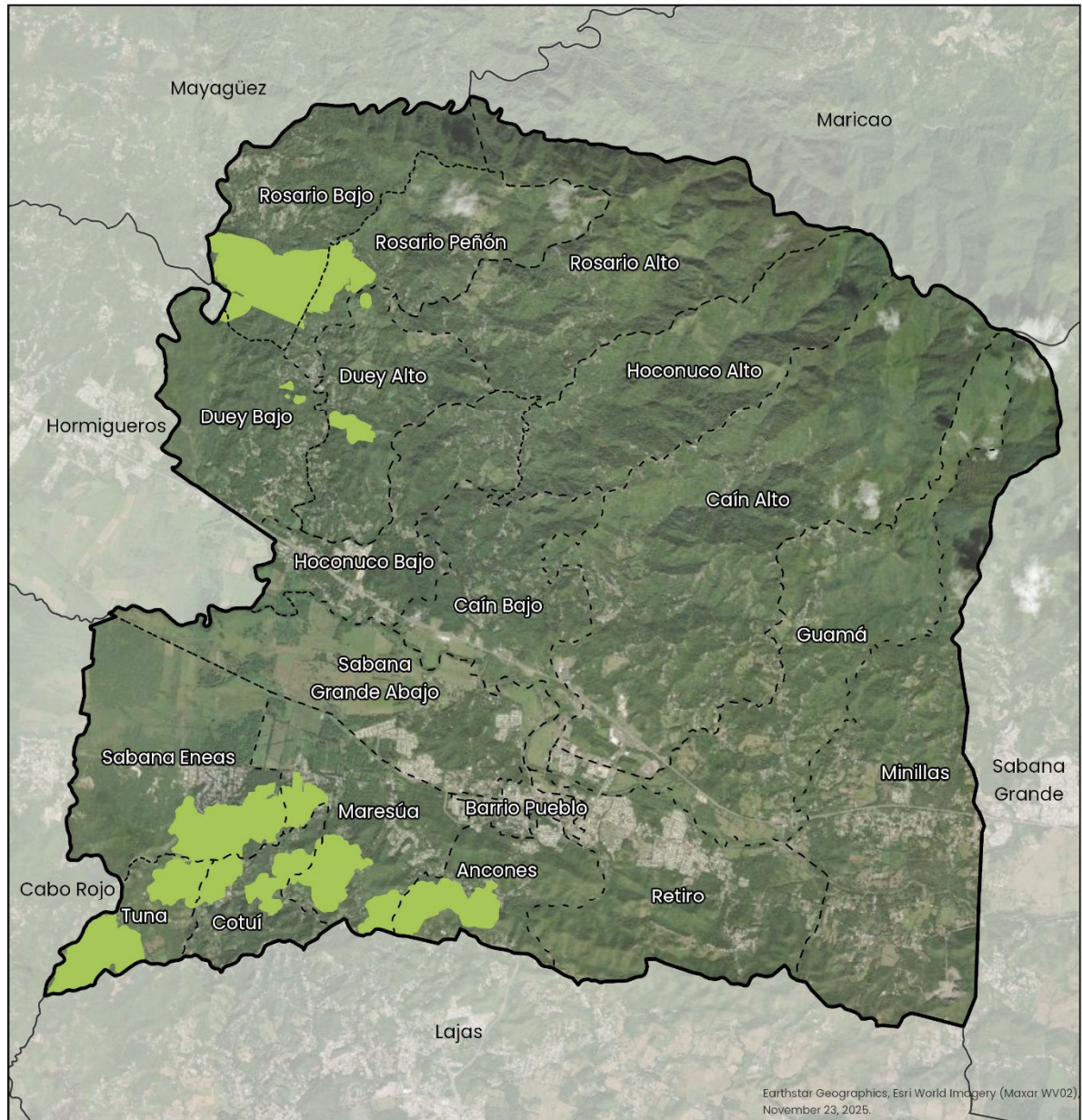
Economically and environmentally, the region reduces flood risks, sustains agriculture in surrounding areas, and offers recreational and tourism opportunities. Its rugged topography has limited intense urban development, preserving ecological integrity. However, the region remains vulnerable to deforestation, groundwater extraction, and pollution (Lugo, et al., 2021) (PRPB, 2014). According to Lugo, et al. protecting this region is essential for water security. Map 28 shows the Karst formation and Restricted Special

Planning Area of the Karst Overlaid District, which identifies the Karst Formation per se, and the Special Planning Areas Karst Zone Overlaid District.

For San German, Restricted Special Planning Area of the Karst is located in the southwest of the municipality, specifically in wards Tuna, Sabana Eneas, Maresúa, Ancones, Also Karst Formation can be identified in the northwest of the municipality in wards Rosario Bajo, Buey Bajo and Duey Alto.

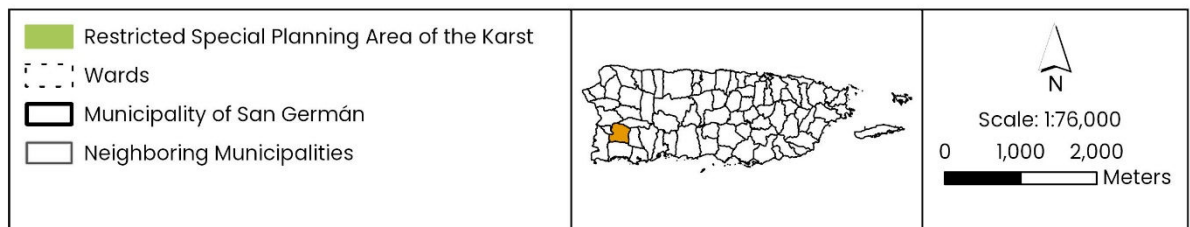
DRAFT

KARST REGION



Source: Puerto Rico Planning Board

SPCS PR & VI NAD83



4.8.1.5 SPECIAL CONSIDERATION: FLOODS BY STORMWATER MANAGEMENT DEFICIENCIES

Urban drainage systems — whether natural or constructed — are designed to convey surface water runoff to receive water bodies. When storm drains, channels, or swales become obstructed, insufficient or overwhelmed by heavy rainfall and expanding urbanization, they can overflow and flood surrounding areas. As a result, floodwaters may spread beyond FEMA's mapped floodplains, even entering zones typically considered low or moderate risk (e.g., Zones B, C, or X) (FEMA, Reducing Damage from Localized Flooding, 2025).

Puerto Rico's stormwater runoff is conditioned by the island's climate, topography and land cover. Annual rainfall varies from less than 1,000 millimeters (mm) to over 4,000 mm (40 to 157 inches). The island's watersheds are largely mountainous, with steep slopes, and stream valleys are typically narrow and well-incised. Intense but short-duration storms are common, leading to rapid flooding with peak discharges that can be several orders of magnitude higher than base flows. All of Puerto Rico's watersheds have experienced significant alterations. It is estimated that more than 11% of the island is covered by developed surfaces, within areas reaching up to 40% in regions such as the San Juan Metropolitan Area. These changes have significantly modified stormwater drainage patterns and downstream floodwater levels (FEMA, 2024).

Paved surfaces severely limit the infiltration of rainwater, increasing both the volume and velocity of surface runoff. As a result, storm drains can easily become overwhelmed. In addition, runoff from paved surfaces reaches streams and rivers much faster, exceeding their capacity to convey water and causing higher and more frequent flood levels in adjacent areas. Moreover, contaminants from both point and non-point pollution sources are more likely to reach surface water bodies when transported by runoff over paved surfaces instead of being partially or totally degraded by vegetated soils. Higher flows also have a greater capacity to remove and transport soil and other loose materials from streambanks and riverbeds, facilitating erosion and scouring (FEMA, 2024).

Paradoxically, river flow between rain events tend to decrease after urbanization. Paved surfaces act as a barrier that isolates the soil, preventing the infiltration of rainwater that otherwise would have gradually discharged from the ground and into streams days later, a process that is critical for maintaining base flows for riparian fish and wildlife species, but also to sustain public water supply. In response, various hard infrastructure measures (hard infrastructure measures such as flood-control pump

stations, concrete trapezoidal channels, and curved side gutters have been widely implemented across Puerto Rico. While effective at quickly conveying runoff, these structures often neglect ecological, social, cultural, and aesthetic considerations. These practices often involve significant operation and maintenance costs and, in many instances, can exacerbate downstream erosion, scouring and water quality problems.

A more sustainable approach would be to take advantage of the ecological services that green areas and other nature-based solutions to manage runoff flows and improve water quality. Such strategies are increasingly critical to protect communities from the growing water-related impacts of climate change in Puerto Rico (FEMA, 2024).

4.8.1.6 FUTURE EVENT PROBABILITIES (B1-E)

A sustained increase in the frequency of extreme rainfall events has been identified in recent decades. As stated above, the Island of Puerto Rico has had 13 flood – related flood major disaster declaration in the last fifteen years. This means that the average frequency of a flooding event is approximately every 14 months.

Any mitigation action adopted to reduce the effects of flooding in the Municipality of San Germán must consider, for example, that 100-year return events or those with a 1% annual probability could become 50-year return events or have a 2% annual probability in the future. This means that flood events of a certain magnitude and impact on the municipality may increase, particularly in high-risk areas. Though there are many floods control projects in San Germán, the probability of future events is considered high.

4.8.2 RISK ANALYSIS (B2-A, B2-B)

4.8.2.1 ESTIMATED LOSSES

Map 28 shows the estimated building loss by a 500 – year flood (0.2% chance of flooding in a year) in San Germán, distributed by census tract. According to the Hazus Analysis there are some areas of loss in the mountainous northern section of the municipality. As a reminder this map does not measure extent of flood, but rather the possible loss by flooding. In this northern section there are various rivers that can overtop bridges of affect nearby structures.

The following table shows the municipality's exposure according to the NRI.

Table 26. Flood Exposure

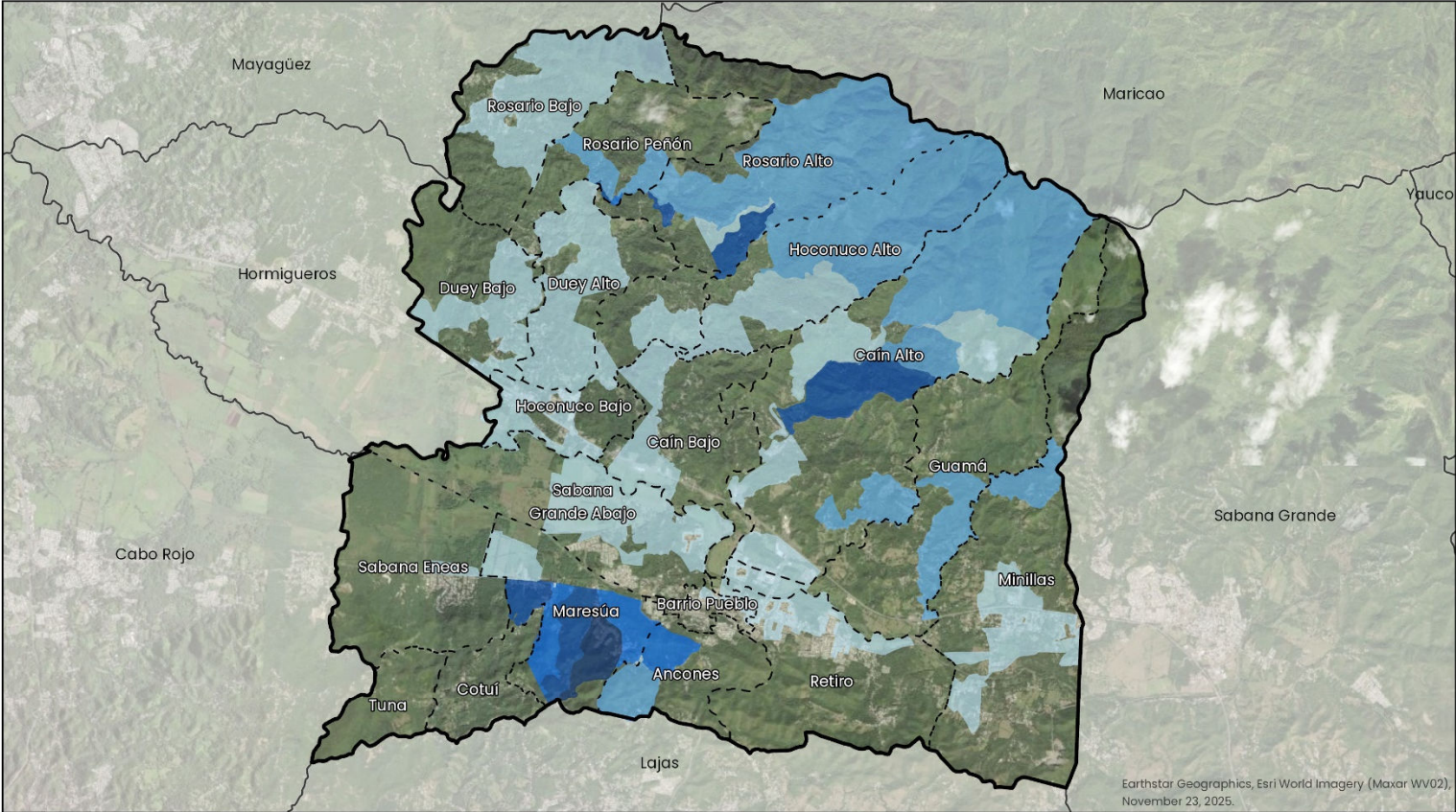
Exposure - Impacted Area (sq mi)	Exposure - Building Value	Exposure - Population	Exposure - Population Equivalence	Exposure - Total
71.91	\$263,155,394	1,515.97	\$17,585,313,245	\$17,875,950,185

The following table presents the expected annual flood-related losses for both buildings and population.

Table 27. Expected Annual Loss to Flood

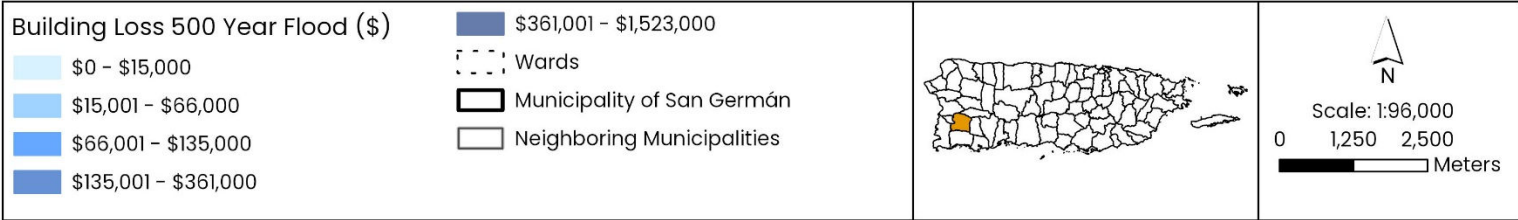
Expected Annual Loss - Building Value	Expected Annual Loss - Population	Expected Annual Loss - Population Equivalence	Expected Annual Loss - Total
\$3,655	0.001049	\$12,174	\$17,678

BUILDING LOSS TO FLOOD EXPOSURE 500-YEAR FLOOD

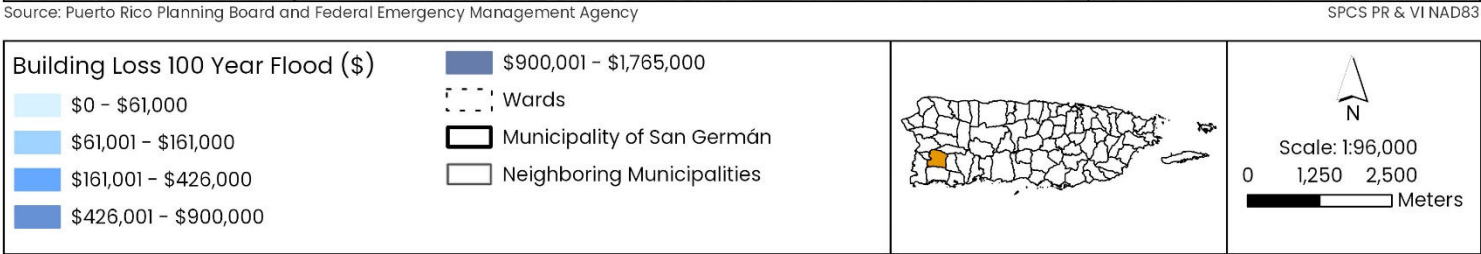
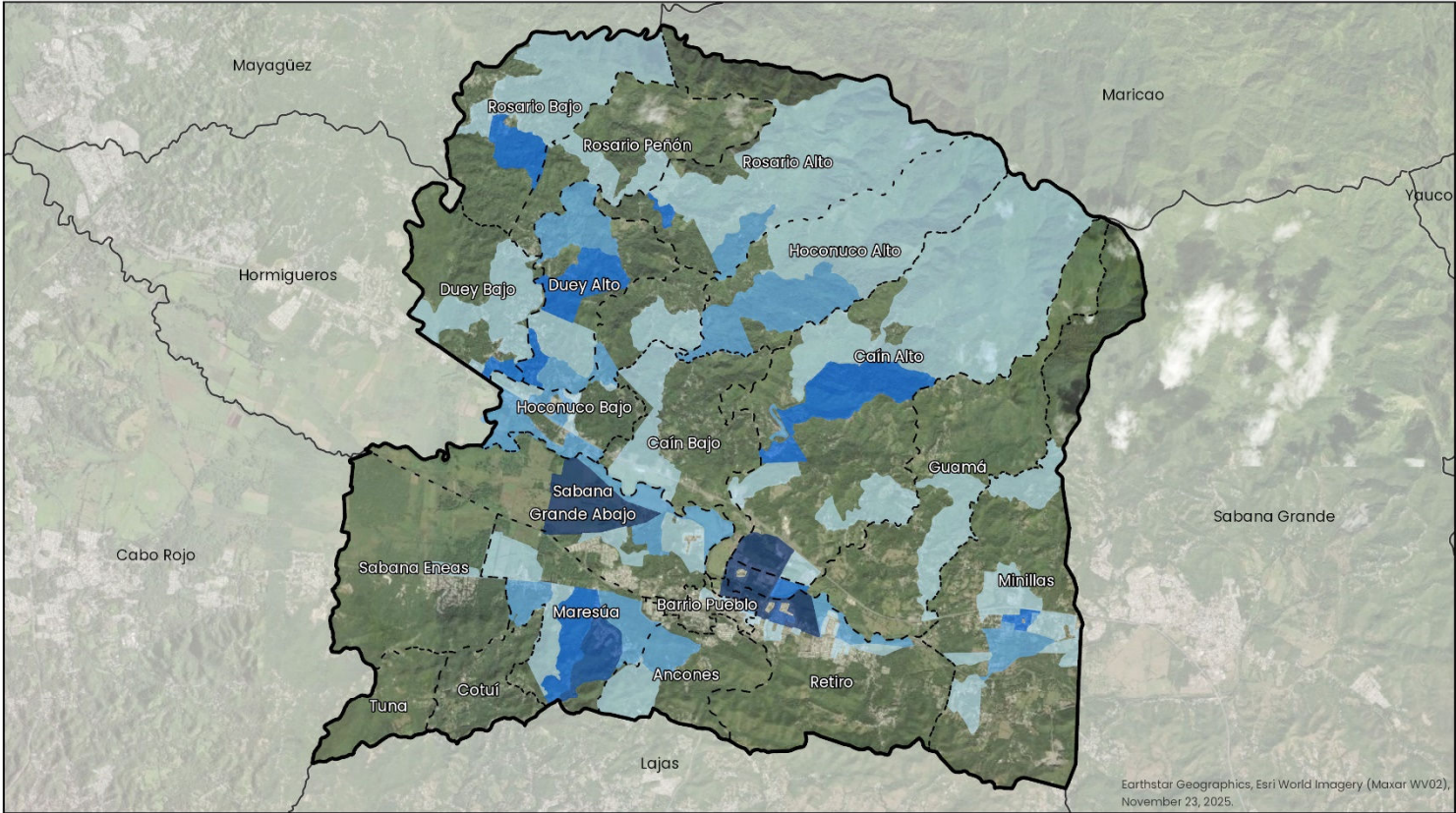


Source: Puerto Rico Planning Board and Federal Emergency Management Agency

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BUILDING LOSS TO FLOOD EXPOSURE 100-YEAR FLOOD



After running the Hazus model , the following losses were determined for flooding in San Germán

- A total of 15,688 structures would experience losses (see Table 28).
- An estimated total of \$81,155,000 in losses is projected for a 100-year event (1%) and \$88,087,000 for a 500-year event (0.2%) (see Table 29).
- Specifically, for nonresidential structures, total losses are estimated at \$14,849,000 for 100-year events (1%) and \$16,544,000 for 500-year events (0.2%) (see Table 30).
- For residential uses, losses are estimated at \$66,306,000 for 100-year events (1%) and \$71,543,000 for 500-year events (0.2%) (see Table 31).

Table 28. Total Structures at Risk

Structures	
Non-Residential	55
Residential	15,633
Total	15,688

Table 29. Total Structures Loses

Occupancy Type	Losses in Dollars. 1% Event	Losses in Dollars. 0.2% Event
Non-Residential	\$14,849,000	\$16,544,000
Residential	\$66,306,000	\$71,543,000
Total	\$81,155,000	\$88,087,000

Table 30. Non-Residential Loss by Occupancy

Occupancy	Losses in Dollars, 1% Event	Losses in Dollars, 0.2% Event
Commercial	\$4,739,000	\$5,290,000
Education	\$717,000	\$739,000
Government	\$9,393,000	\$10,515,000
Religious	\$0	\$0
Agriculture	\$0	\$0
Industrial	\$0	\$0
Total	\$14,849,000	\$16,544,000

Table 31. Detailed Residential Loss

Residential, Detailed Losses	Losses in Dollars, 1% Event	Losses in Dollars, 0.2% Event
Structure	\$23,587,000	\$26,171,000
Contents	\$13,801,000	\$15,092,000
Relocation	\$18,044,000	\$18,913,000
Rental Income	\$10,874,000	\$11,367,000
Total	\$66,306,000	\$71,543,000

4.8.2.2 LIFELINES AND CRITICAL INFRASTRUCTURE

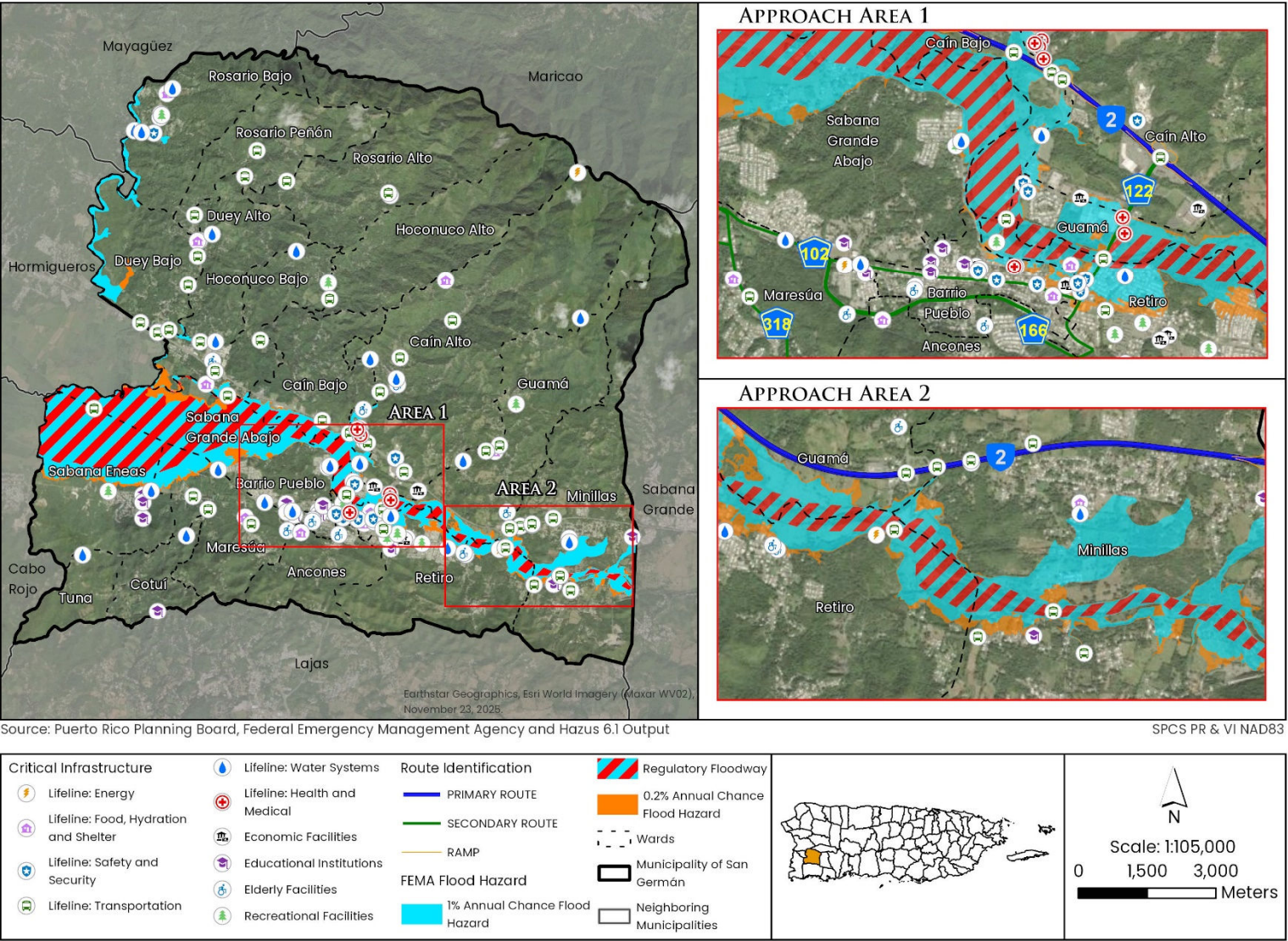
Flooding is among the most disruptive natural hazards, affecting all eight FEMA Community Lifelines. These lifelines represent essential services that support public health, safety, and economic stability. Below is an analysis of some of the impacts that flooding can have on lifelines:

- **Safety and Security** – Flooding can damage emergency services infrastructure such as police stations, fire departments, and emergency operations centers. Blocked evacuation routes and submerged roads hinder rescue efforts, while prolonged outages increase vulnerability to crime and civil unrest.
- **Food, Water, Shelter** – Floodwaters can contaminate drinking water supplies and damage water treatment facilities. Food supply chains may be severely disrupted when warehouses and grocery stores are flooded. Damage to residential structures can result in displacement, creating urgent demand for temporary shelters.
- **Health and Medical** – Hospitals and clinics may become inaccessible or experience power outages during flood events. Flood conditions can contribute to increased incidence of waterborne diseases and mold-related illnesses increase significantly. Disruptions to medical supply chains may delay both emergency care and routine treatments.
- **Energy (Power and Fuel)** – Flooding can submerge electrical substations and transformers, causing widespread outages. Fuel distribution networks may be disrupted due to impassable roads and damaged transportation routes. Prolonged power loss can significantly affect critical facilities such as hospitals and water treatment plants.
- **Communications** – Flooding can damage cell towers, fiber-optic cables, and emergency communication systems, reducing the capacity to coordinate rescue and recovery operations. This disruption can delay the dissemination of critical information.
- **Transportation** – Flooding can wash out or undermine roads, bridges, and rail lines, rendering them impassable. Airports and seaports may be forced to suspend operations, delay evacuation and the delivery of emergency supplies. Also, transportation disruptions amplify the overall impact of the disaster.

- Hazardous Materials - Floodwaters can mobilize and disperse hazardous substances from industrial sites, sewage systems, and fuel storage tanks, increasing the risk of environmental contamination. Cleanup efforts can become complex, costly and time-consuming, potentially resulting in long-term public and environmental impacts.
- Water Systems - Floodwaters can contaminate drinking water supplies and damage water treatment facilities. Excessive inflow from floodwaters may overwhelm sewer systems, causing untreated sewage to backflow into streets and homes. Flood conditions can exceed the design capacity of storm drains and retention basins, resulting in urban flooding and infrastructure damage. The accumulation of sediment and debris clog drainage systems, reducing effectiveness and increasing flood risk during subsequent storms events.

Map 30 shows the location of the critical facilities in relation to the flood zones. Approach area 1 shows that infrastructure in and around the town center is affected by flood zones. It also shows that road PR-2 can be affected by 100 years flood by the overflow of the Caín River.

FLOOD: CRITICAL INFRASTRUCTURE EXPOSURE

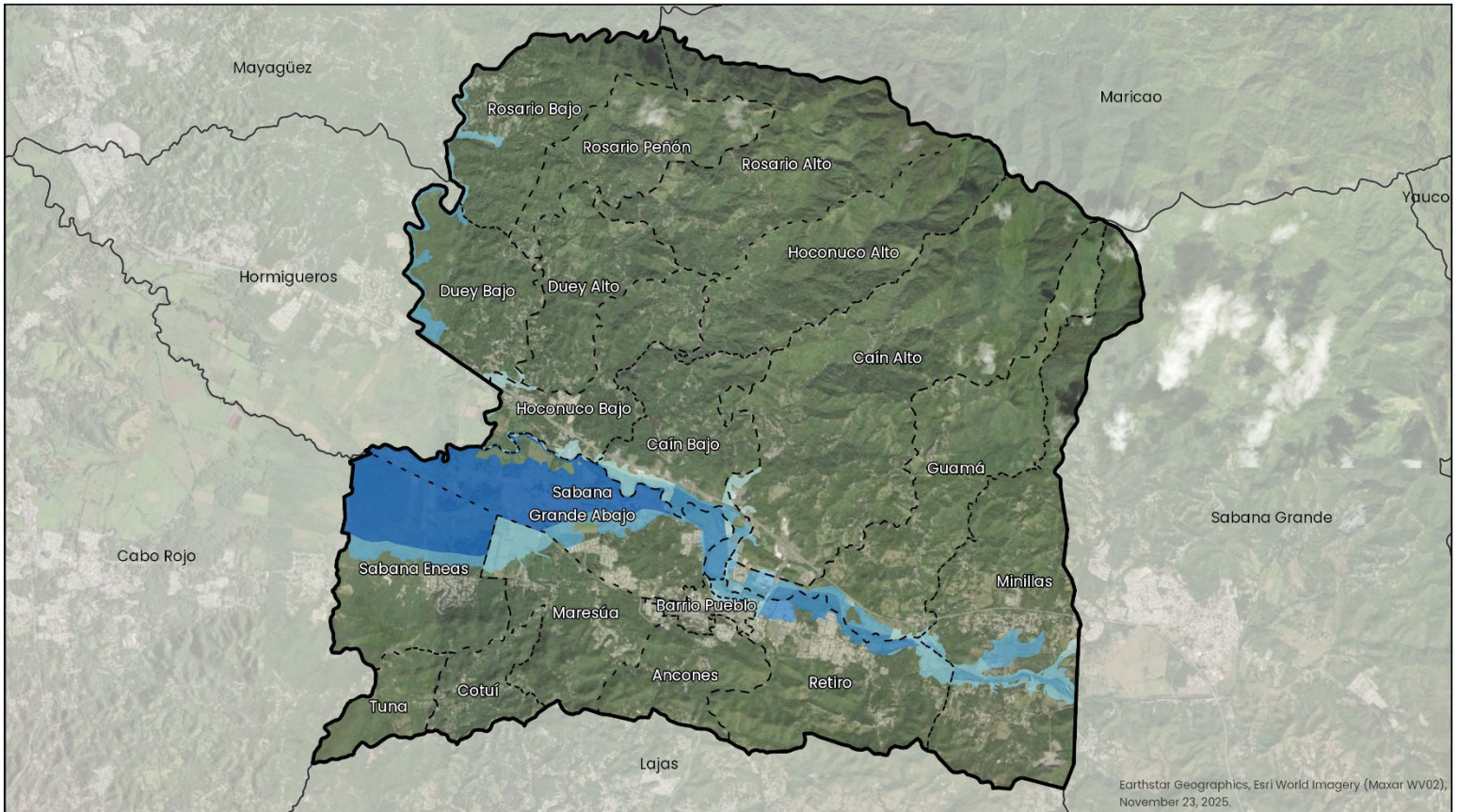


4.8.2.3 *SOCIAL VULNERABILITIES*

Map 32 shows the population at risk of displacement in the event of a 500-year return flood by census tract. The highest population exposure is concentrated along the Guanajibo River Floodway, particularly in the Sabana Eneas and Sabana Grande Abajo wards. However, flood control projects along the causeway may help mitigate the impact of flooding in this area. Other census tracts with significant populations at risk are located along the Rosario River and the Caín River.

Research in flood-prone Puerto Rican communities shows that access to economic, material, and social resources strongly influences adaptive capacity, with low-income residents facing significant barriers to elevating homes, purchasing insurance, or relocating away from high-risk zones. These same communities frequently experience “false security” due to structural flood-control measures that reduce perceived risk but do not eliminate underlying exposure, which can worsen long-term vulnerability when residents underestimate future flood potential. Flood impacts also disproportionately affect individuals with limited mobility—including older adults, disabled residents, and those with chronic medical conditions—who may be unable to evacuate rapidly or access emergency shelters during rising waters. The Census Bureau’s Community Resilience Estimates indicate that vehicle access, caregiver support, health insurance gaps, and disability prevalence are among the most widespread vulnerability components in the commonwealth, factors that directly shape whether individuals can flee or recover from flooding (US Census Bureau, 2024), (López Marrero, 2010) .

FLOOD: POPULATION EXPOSURE



Source: Puerto Rico Planning Board, Census Tract for Puerto Rico and Federal Emergency Management Agency

SPCS PR & VI NAD83



4.8.2.4 NATURAL AND CULTURAL RESOURCES

In most flood events, water resources are exposed to high levels of contaminants associated with rising water, sewage accumulation, and other hazardous or toxic substances left behind by flooding (Malilay, 2000). This contamination can facilitate the spread of diseases in municipal water bodies and adversely affect local flora and fauna, including humans. For example, prolonged stagnant water after a flood can promote diseases such as dengue and leptospirosis. Following Hurricane María, stagnant water contributed to leptospirosis outbreaks and mosquito proliferation. Leptospirosis is a bacterial disease that affects both humans and animals and can spread through urine from infected animals. These contaminated residues often remain in stagnant water after flooding events.

Floods also lead to the accumulation of debris, including structural remnants, soil, sediments, organic waste, and personal belongings. If not properly managed, this debris can contaminate land and water when burned, abandoned, buried, or dumped into water bodies.

4.8.2.5 SPECIAL CONSIDERATION: REPETITIVE LOSSES AND SEVERE REPETITIVE LOSSES

In San Germán there are properties insured under the National Flood Insurance Program (NFIP). These properties participate in the NFIP covered by the PRPB. Section 6.5 provides further details on how the municipality can use the NFIP as a mechanism for mitigation planning.

The Municipality has included properties that have experienced repetitive losses and/or severe repetitive losses located in identified flood hazard areas. These properties currently lack descriptions of the type of structures (residential, commercial, institutional, among others). Including this information helps to understand the vulnerability of properties affected by flooding within the jurisdiction and increases the likelihood of qualifying for flood control or prevention grants through programs such as Flood Mitigation Assistance (FMA), Hazard Mitigation Grant Program (HMGP), Housing and Urban Development (HUD), CDBG-DR, and others.

As of May 29th 2025, the information regarding NFIP coverage for the Municipality of San Germán are as follow:

Table 32. NFIP Policies in force and coverage

Amount of NFIP Policies	Total Disbursement for both RL and SRL Losses
137	\$39,080

Accordingly, the registered Repetitive Loss (RL) are as follows

Table 33. NFIP Repetitive Losses

Structures with Repetitive Losses (RL)	Insured structures (RL)	Total Repetitive Losses (RL)
3	0	10

While the data provided shows the following information regarding Severe Repetitive Loss (SRL)

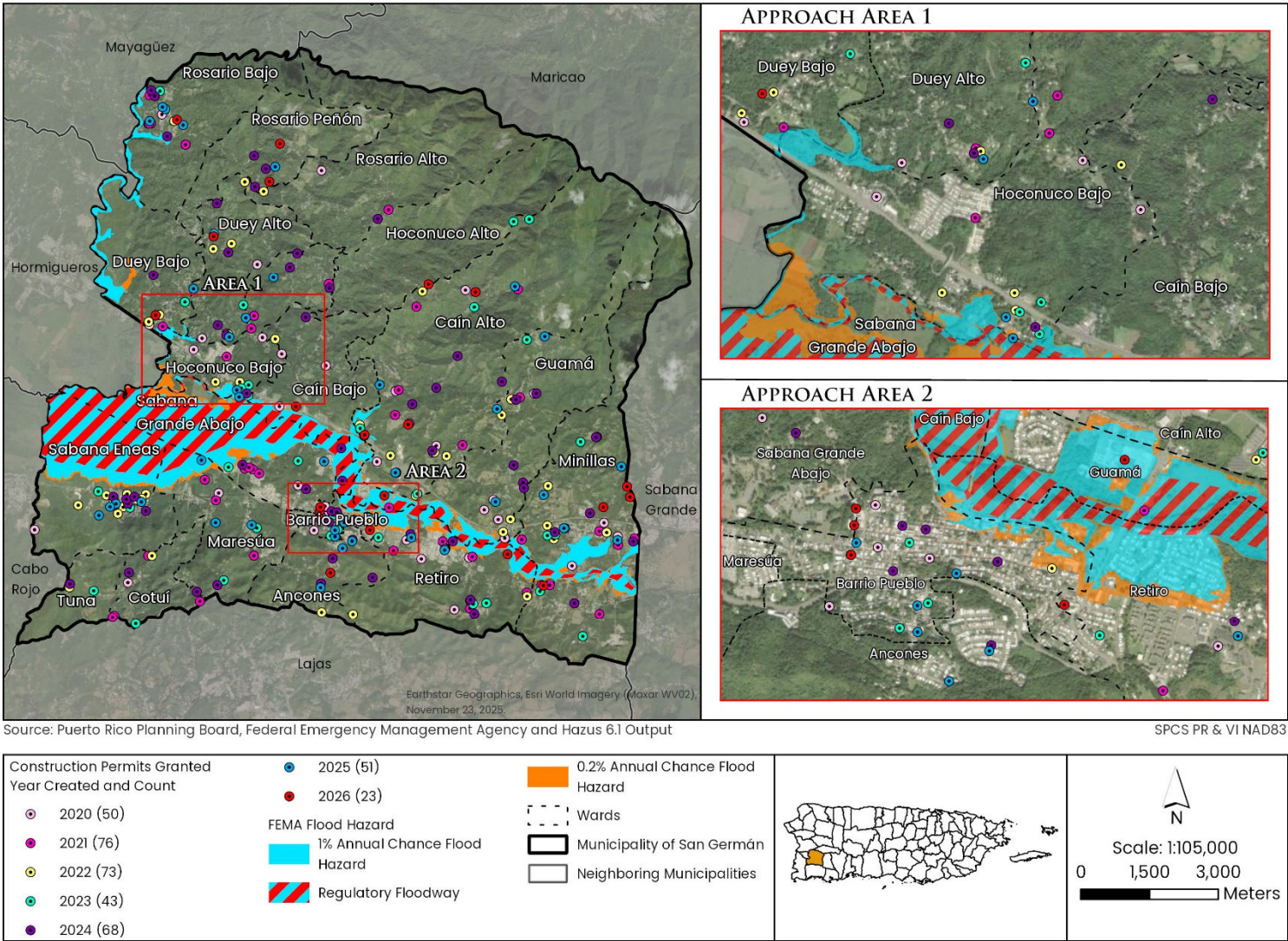
Table 34. NFIP Severe Repetitive Losses

Structures with Severe Repetitive Losses (SRL)	Insured structures S(RL)	Total Repetitive Losses (SRL)
0	0	0

4.8.2.6 FUTURE CONDITIONS (E1-A)

The following map shows the locations of recent construction permits in San Germán in relation to known flood area. This map shows that very few construction permits have been granted in flooded areas.

FLOOD: RECENT DEVELOPMENT EXPOSURE



4.9 TROPICAL CYCLONES AND OTHER EXTREME WIND EVENTS

4.9.1 DESCRIPTION (B1-A)

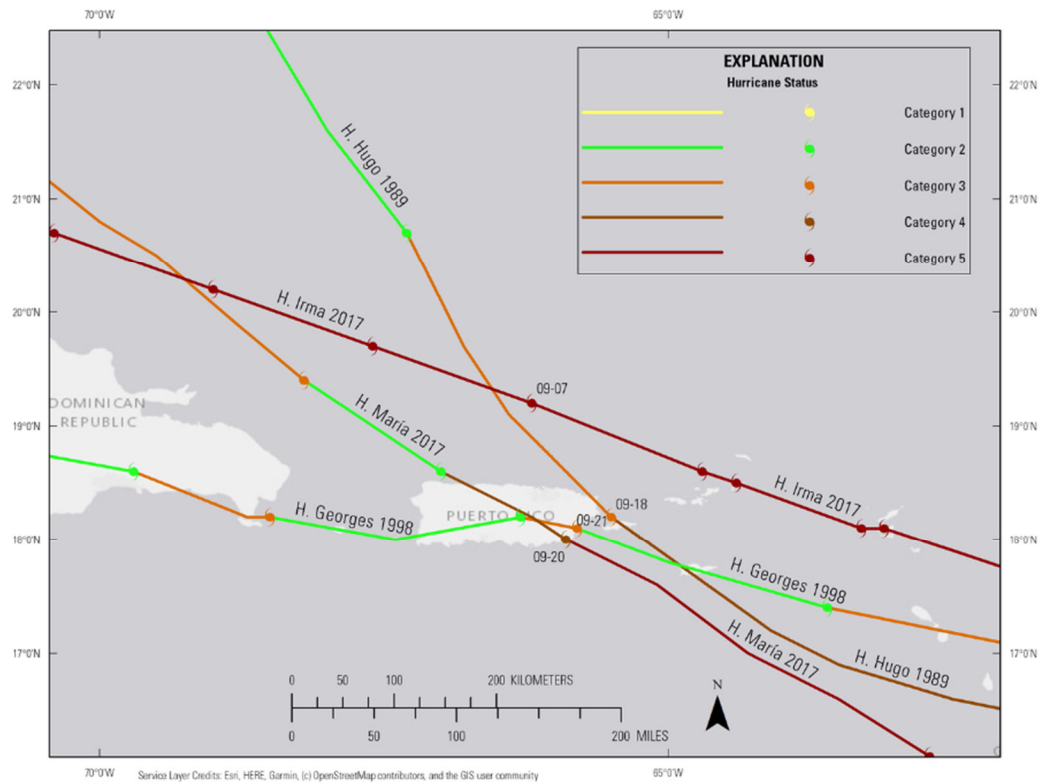
Winds consist of air currents generated in the atmosphere due to variations in pressure. Although these currents are constantly present, when their intensity increases, they can become a high-level hazard. For the purposes of this Plan, we will focus on severe wind events associated with tropical cyclones and their extreme force (Castro Rivera & López Marrero, *Cartilla de los Ciclones*, 2018).

This sub-chapter is titled Tropical Cyclones to include phenomena such as tropical storms and tropical depressions. However, hurricanes pose the greatest threat due to their high destructive potential, wide geographic impact, rapid development, and sometimes unpredictable paths. In addition, hurricanes are often accompanied by high tides, storm surges, and heavy rainfall, which may result in landslides and riverine flooding. Since these accompanying hazards are addressed in separate sections, this section will focus specifically on the impact of wind within the municipality.

Figure 19 shows the path of category 2 – 5 hurricanes that have affected Puerto Rico since 1989.¹⁵

¹⁵ Hortense (1996) and Fiona (2022) are not shown since they were category 1 hurricanes when they hit Puerto Rico.

Figure 19. Hurricane Tracks for Hugo (1989), Georges (1998), Irma (2017) and Maria (2017). Data provided by NOAA with image of ESRI.

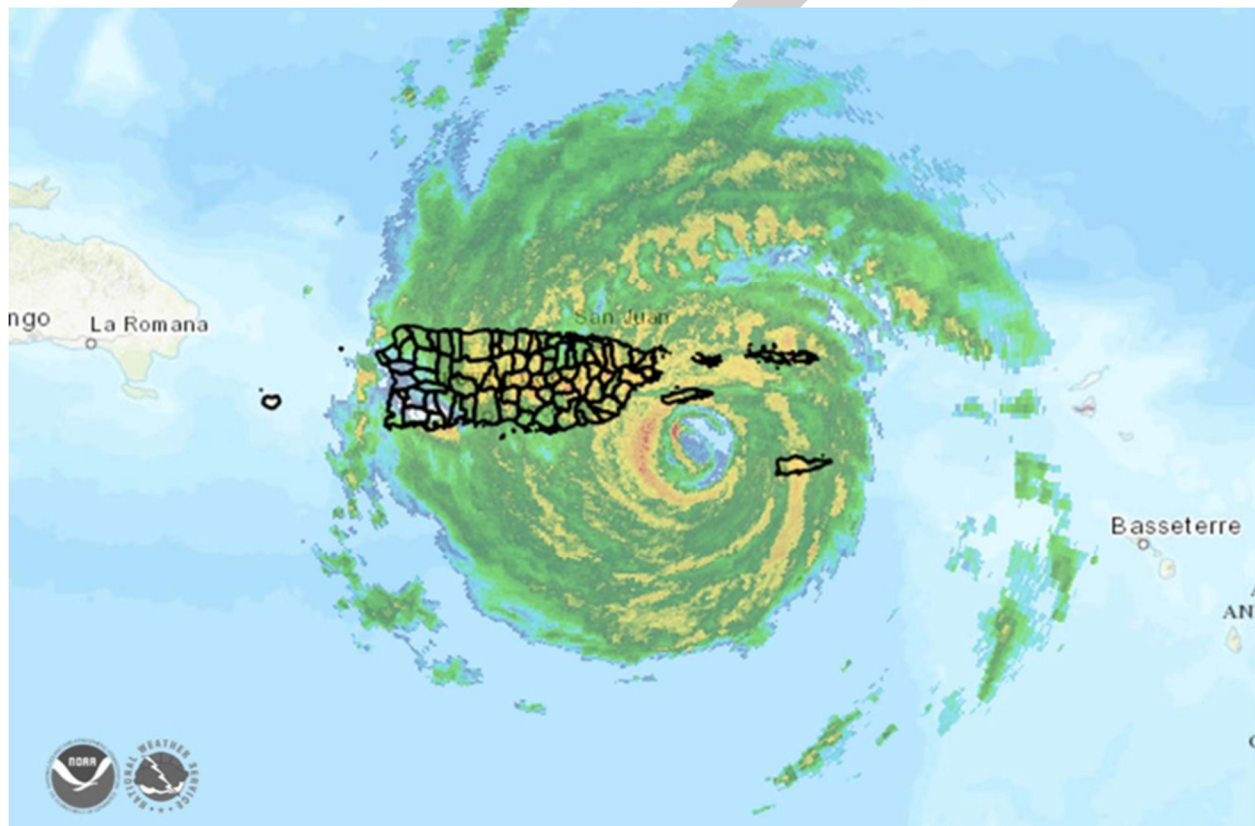


Sources/Usage: Public Domain. [View Media Details](#)

4.9.1.1 AFFECTED AREA (B1-B)

Tropical Cyclones are atmospheric systems that can affect the whole island. For example, Figure 20 shows the size of hurricane María (2017) as it approached Puerto Rico.

Figure 20. Hurricane María (2017) as it approaches Puerto Rico



4.9.1.2 RISK MAGNITUDE (B1-C)

Tropical cyclones are the most frequent natural hazard in Puerto Rico, with hurricanes being the most dangerous. Hurricanes are tropical atmospheric systems characterized by sustained wind speeds exceeding seventy-four (74) miles per hour. They develop over warm ocean waters and result from instability caused by the interaction of warm and cool air masses. Tropical cyclones are classified according to sustained wind intensity as follows:

- Tropical Depression: An organized system of clouds with a defined circulation and maximum sustained winds below 39 mph. This represents the formative stage of a tropical cyclone.
- Tropical Storm: An organized system of clouds with a defined circulation and maximum sustained winds ranging from 39 to 73 mph.
- Hurricane: The most intense form of a tropical cyclone, with sustained winds of 74 mph or greater. Hurricanes have a well-defined center with very low barometric pressure. They are categorized from one (I) to five (V), and the strongest can reach wind speeds exceeding 155 mph (Castro Rivera & López Marrero, 2018).

Table 35 shows the Saffir – Simpson Scale of hurricanes and gives historical examples of those passing through or near Puerto Rico.

Table 35. Saffir-Simpson Hurricane Scale

Category	Wind Speed	Description	Historical Example
Tropical Storm	39 – 73 mph	Strong enough to cause tree damage, power outages, and localized flooding, but generally less destructive than a hurricane.	Eloise (1975) Claudette (1979) Frederic (1979) Jeanne (2004) Irene (2011) Isaias (2020) Ernesto (2024)
1	74–95 mph	Winds can cause minor damage to roofs, siding, and trees, with potential for power outages.	Santa Clara ¹⁶ (1956) Hortense (1996) Fiona (2022)
2	96–110 mph	Strong winds can cause extensive damage to roofs and trees, leading to widespread power loss.	Marilyn (1995)
3	111–129 mph	Devastating winds can destroy roofs and walls of homes, uproot trees, and cause prolonged outages.	Hugo (1989) Georges (1998)
4	130–156 mph	Catastrophic winds can cause severe structural damage, most trees snapped or uprooted, and power outages lasting weeks.	San Ciriaco (1899) San Ciprian (1932) Donna (1960) David (1979) María (2017)

¹⁶ Officially known as Hurricane Betsy

5	157 mph or higher	Catastrophic winds can result in total roof failure and building collapse, rendering areas uninhabitable for weeks or months.	San Felipe II (1928) Irma (2017)
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To assess the vulnerability posed by hurricanes, this LHMP utilizes the 100 – year wind event and 500-year wind event as benchmark design standards. A 100-year wind event refers to a wind speed that has a 1% chance of being equaled or exceeded in any given year. Similarly, a 500-year wind event has a 0.2% annual probability of being equaled or exceeded. These terms describe statistical return periods and do not imply that such events occur only once every 100 or 500 years. Rather, they express the likelihood of occurrence in any single year. Wind returns period values are derived through statistical analysis of historical wind speed records using extreme value probability models. These analyses estimate wind intensities associated with specific recurrence intervals and are widely applied in engineering, insurance modeling, and hazard mitigation planning.

These values are critical for structural design standards like the American Society of Civil Engineers Standard 7 (ASCE 7), which specify wind loads for different risk categories, and for insurance companies assessing potential storm damage. For example, typical 3-second gust wind speeds at 33 ft above ground (Exposure Category C) are about 100 mph for a 100-year event and approximately 110–115 mph for a 500-year event. These design speeds ensure safety for buildings, bridges, and critical infrastructure, and help guide emergency planning and financial risk management.

4.9.1.3 PAST EVENTS (B1-D)

The following table shows the extreme wind events that received a disaster declaration between 1989 and 2025. One column identifies whether the Municipality of San Germán was designated for Public Assistance (PA), Individual Assistance (IA), or both under each declaration. Table 36 shows a list of presidential disaster declarations since 1987.

Table 36. Tropical Storm Disaster Declaration

Event	Date	Disaster Declaration Number	San Germán Included?	Description
Tropical Storm Ernesto	8/14/2024 – 8/16/2024	DR-4850- PR	Public Assistance – No Individual Assistance No	The storm’s slow movement and moisture-rich environment contributed to prolonged precipitation, particularly in central and eastern municipalities. Parts of Central Puerto Rico recorded 12–14 inches of rainfall in localized areas. The municipality of Barranquitas measured 11.20 inches over a 48-hour period, while Villalba reported 10.20 inches. Eastern municipalities, including Vieques and Culebra, observed 8–10 inches of rain. Multiple rivers exceeded their banks, including the La Plata River, resulting in significant inundation of adjacent communities. Flash flooding occurred in urban and rural areas, rendering primary and secondary roads impassable. Floodwater caused structural failures in bridges and washed-out critical road segments, isolating several communities. Stormwater drainage systems in metropolitan areas, notably San Juan, were overwhelmed, leading to localized urban flooding. Emergency Response and Disruptions Evacuations were conducted in flood-prone areas such as Toa Baja to mitigate loss of life.

Event	Date	Disaster Declaration Number	San Germán Included?	Description
Hurricane Fiona	9/17/2022 - 9/21/2022	DR-4671-PR	Public Assistance - Yes Individual Assistance - Yes	Hurricane Fiona struck Puerto Rico in September 2022, unleashing torrential rains—up to 31.22 inches of rainfall over 72 hours in Ponce, nearly matching the accumulation from Hurricane Maria. This deluge led to catastrophic flooding, with 7 to 20 inches common across most of the island and localized spots exceeding 30 inches.
Tropical Storm Isaías	9/29/2020-9/30/2020	DR-4560-PR	Public Assistance: No Individual Assistance; No	Although the center of Tropical Storm Isaías did not make landfall on the island, the system left a large amount of rain in its path, causing flooding throughout Puerto Rico. Rainfall accumulation of up to 10 inches was recorded around the island.
Hurricane María	9/20/2017	DR-4339-PR	Public Assistance - Yes Individual Assistance - Yes	Widespread flooding severely affected the whole Island. For example, in San Juan, water levels reached up to 6 feet in some areas and numerous structures losing their roofs. The coastal neighborhood of La Perla was largely destroyed, while Cataño suffered extensive damage, with the Juana Matos community estimated to be 80% destroyed. Strong winds, heavy rains, and flash floods near the La Plata Lake dam in Toa Baja impacted thousands of residents. Survivors reported that floodwater rose 6 feet in just 30 minutes, and some areas experienced depths of up to 15 feet (4.6 m).

Event	Date	Disaster Declaration Number	San Germán Included?	Description
Hurricane Irma	9/5/2017	DR-4336-PR	Public Assistance – Yes Individual Assistance – No	On September 5, 2017, Hurricane Irma impacted Puerto Rico; an Emergency Declaration was issued for the Island. On September 6, 2017, a Major Disaster Declaration was issued following Hurricane Irma's passage. Two people died due to torrential rains before the hurricane: a man died in Orocoviés after falling from his ladder while repairing his roof; another man on the coast in Capitanejo died after being struck by lightning. Wave heights in Puerto Rico reached 9 meters, and sustained winds of 111 mph were recorded in Culebra.
Tropical Storm María ¹⁷	9/8/2011 – 9/11/2011	DR-4040-PR	Public Assistance: No Individual Assistance: No	Tropical Storm (later Hurricane) Maria formed in early September 2011 and passed near Puerto Rico, bringing significant heavy rainfall and tropical storm conditions to the island. The storm caused widespread flooding that inundated numerous roadways and homes; floodwaters near Patillas destroyed several homes and bridges, and approximately 150 houses in Yabucoa were flooded and damaged

¹⁷ Tropical Storm María was a tropical system that pass to the northeast of Puerto Rico in 2011 and that caused flooding in the Island. Not to be confused with the 2017 Hurricane María. The name "María" was retired from the official Atlantic hurricane season list of names after 2017.

Event	Date	Disaster Declaration Number	San Germán Included?	Description
Hurricane Irene	8/22/2011	DR-4017-PR	Public Assistance: Yes Individual Assistance: No	Total rainfall reached 22 inches over three days, with the eastern region being the most affected—the same area that had already received over 6 inches earlier in August during the close passage of Tropical Storm Emily. The Río Grande de Manatí in Manatí recorded its third-highest level in history, surpassed only during Hurricane Hortense (1996) and Hurricane Georges (1998). The Puerto Nuevo River near Hato Rey reached its fourth-highest level on record. Flooding was severe enough to cause infrastructure stress and dangerous conditions across multiple municipalities. Tragically, there was one direct fatality attributed to Irene, due to drowning.
Tropical Storm Jeanne	9/14/2004 – 9/19/2004	DR-1152-PR	Public Assistance: Yes Individual Assistance: Yes	Tropical Storm Jeanne crossed Puerto Rico on September 15, 2004, as a strong tropical storm with maximum sustained winds around 70 mph (110 km/h), producing gusts up to 72 mph (≈116 km/h). The winds caused widespread power and water outages, with numerous reports of structural damage to homes, uprooted trees, fallen utility poles, and significant impacts on infrastructure across the island. The storm resulted in eight fatalities in Puerto Rico—four direct and four indirect, including deaths during preparations and carbon monoxide poisoning. Damages were estimated at approximately \$169.5 million (2004 USD), making Jeanne the most destructive tropical cyclone to impact Puerto Rico since Hurricane Georges in 1998.

Event	Date	Disaster Declaration Number	San Germán Included?	Description
Hurricane Georges	9/20/1998	DR-1247-PR	Public Assistance: Yes Individual Assistance Yes	Hurricane Georges struck Puerto Rico on September 21, 1998, making landfall near Yabucoa and Humacao as a Category 3 storm with sustained winds of approximately 115 mph (185 km/h) and gusts up to 150 mph (240 km/h). Traversing the island from east to west, it leveled homes, uprooted trees, downed thousands of utility poles, and severely damaged transport infrastructure—roads, bridges, and communication networks—leaving much of Puerto Rico without electricity, water service, and road access. Heavy rains accompanying Georges—recorded up to 26 inches in central mountain locations—triggered widespread flooding and numerous landslides, isolating towns and washing out bridges and roads across several river basins. The storm caused an estimated \$1.9–3 billion in damages, affected every municipality, and resulted in one direct and seven indirect fatalities—mostly due to carbon monoxide poisoning from generators, electrocution, and accidents related to clean-up. The scale and intensity of Georges marked it as the most destructive hurricane to traverse the entire island since 1932, severely disrupting infrastructure, utilities, housing, and public services statewide.

Event	Date	Disaster Declaration Number	San Germán Included?	Description
Hurricane Hortense	9/11/1996	DR-1136-PR	Public Assistance: Yes Individual Assistance: Yes	Hurricane Hortense impacted Puerto Rico on September 9, 1996, as a strong Category 1 hurricane with sustained winds near 80 mph (130 km/h) and higher gusts. The storm caused widespread wind damage across the island, uprooting trees, downing power lines, and damaging thousands of homes—particularly those with light construction or inadequate roofing. Many communities experienced prolonged power outages and disruptions to water service due to damaged infrastructure. In addition to structural damage, cultural and public facilities such as schools and municipal buildings suffered roof failures and broken windows, forcing closures and delaying recovery efforts. The agricultural sector was heavily affected, with banana and coffee plantations sustaining severe losses from wind-driven defoliation and crop destruction. Overall, Hurricane Hortense caused significant economic losses estimated at over \$100 million and resulted in 19 fatalities, marking it as one of the most impactful storms in Puerto Rico during the 1990s.

Event	Date	Disaster Declaration Number	San Germán Included?	Description
Hurricane Marilyn	9/17/1995	DR-1136-PR	Public Assistance: No Individual Assistance: No	Hurricane Marilyn affected Puerto Rico in September 1995, primarily as it passed near the island while intensifying toward the U.S. Virgin Islands. Although the main Island did not experience a direct landfall, the storm did impact Vieques and Culebra. The storm brought strong tropical-storm-force winds and gusts exceeding 70 mph (113 km/h) to eastern and northern parts of the island. These winds caused localized damage to roofs, power lines, and light structures, particularly in coastal communities. Numerous trees were uprooted, and debris blocked roads, leading to temporary transportation disruptions. The storm also resulted in widespread power outages and interruptions to water service in several municipalities. Agricultural areas, especially those cultivating plantains and bananas, suffered wind-related losses due to defoliation and crop destruction. While the most severe impact occurred in the Virgin Islands, Puerto Rico reported moderate structural damage, economic losses in the millions, and several injuries associated with flying debris and cleanup efforts. Hurricane Marilyn highlighted the vulnerability of eastern Puerto Rico to strong winds even from storms that do not make a direct landfall.

Event	Date	Disaster Declaration Number	San Germán Included?	Description
Hurricane Hugo	9/17/1989 – 9/18/1989	DR-842-PR	Public Assistance: Yes Individual Assistance: Yes	Hurricane Hugo struck Puerto Rico on September 18, 1989, as a powerful Category 3 hurricane with sustained winds near 120 mph (193 km/h) and higher gusts. The storm primarily impacted the eastern part of the island, including Vieques and Culebra, before moving toward northeastern Puerto Rico. Hugo's strong winds caused extensive damage to homes, schools, and public buildings, particularly those with light construction or inadequate roofing. Thousands of trees were uprooted, and power lines were downed, resulting in widespread electrical outages and disruptions to water service across affected areas.

4.9.1.4 TORNADOES

According to NOAA's National Centers for Environmental Information, there are no tornadoes reported in San Germán.

4.9.1.5 FUTURE EVENT PROBABILITIES (B1-E)

According to the Colorado State University Tropical Cyclones, Radar, Atmospheric Modeling and Software Team, the following average annual probabilities apply for storms coming ashore or passing within 50 miles of Puerto Rico: (Colorado State University, 2026)

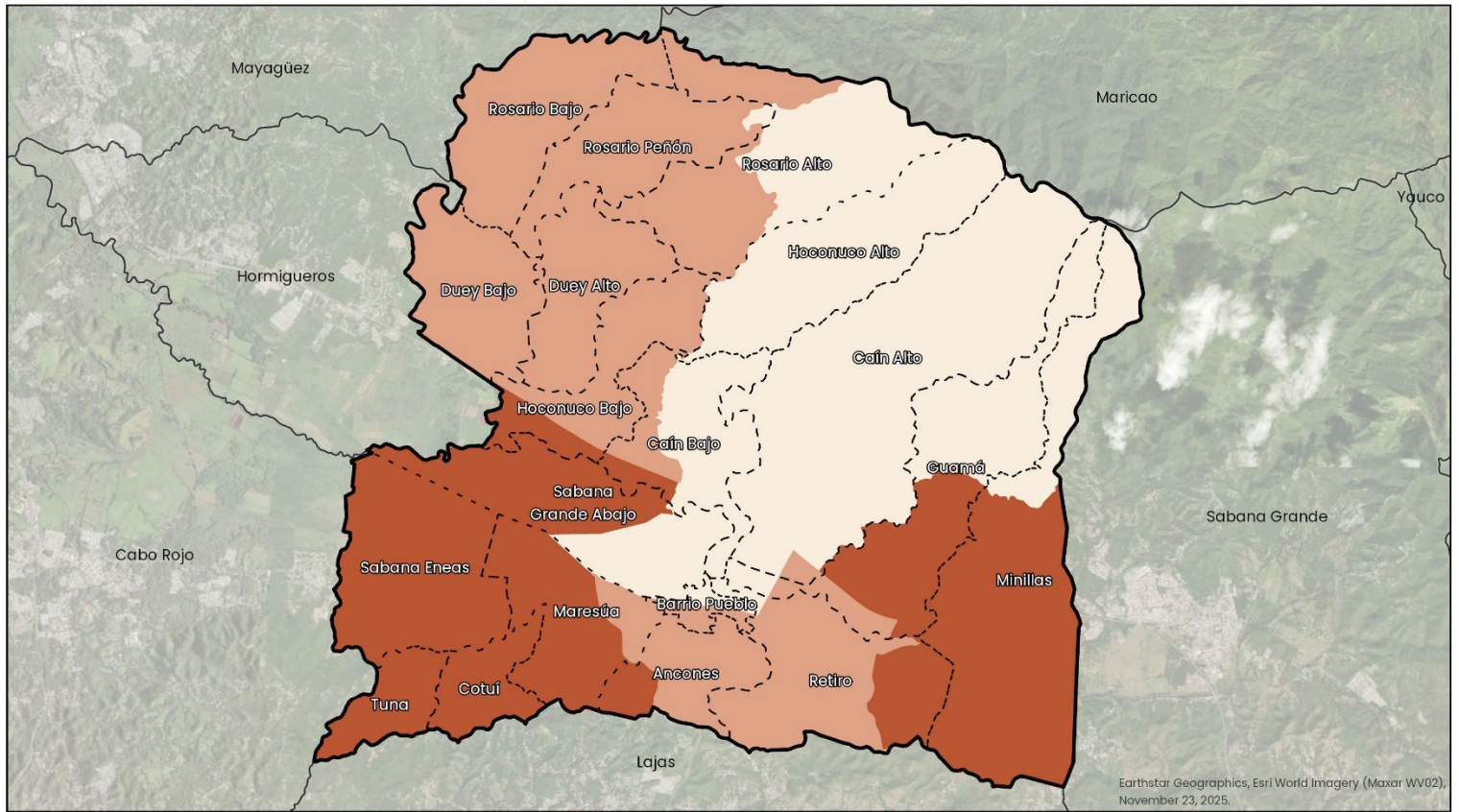
- Average probability of a named storm coming ashore or within 50 miles of Puerto Rico: 40%
- Average probability of a hurricane coming ashore or within 50 miles of Puerto Rico: 24%
- Average probability of a major hurricane coming ashore or within 50 miles of Puerto Rico: 9%

4.9.2 RISK ANALYSIS (B2-A, B2-B)

4.9.2.1 ESTIMATED LOSSES

The following maps show the expected losses resulting from the impact of a hurricane. Map 34 presents the projected total building damage associated with a 500-year (0.20%) wind event by census tract. This map shows that the greatest loss of buildings would be in the Sabana Abajo, Maresúa, Sabana Eneas, Tuna, Cotui, Guamá, Minillas, Retiro and small parts of Hoconuco Baja and Caín Bajo wards. Map 35 shows the expected total building damage in a 100-year event by census tract (1%)

TROPICAL CYCLONE: TOTAL DAMAGED BUILDING 500-YEAR EVENT

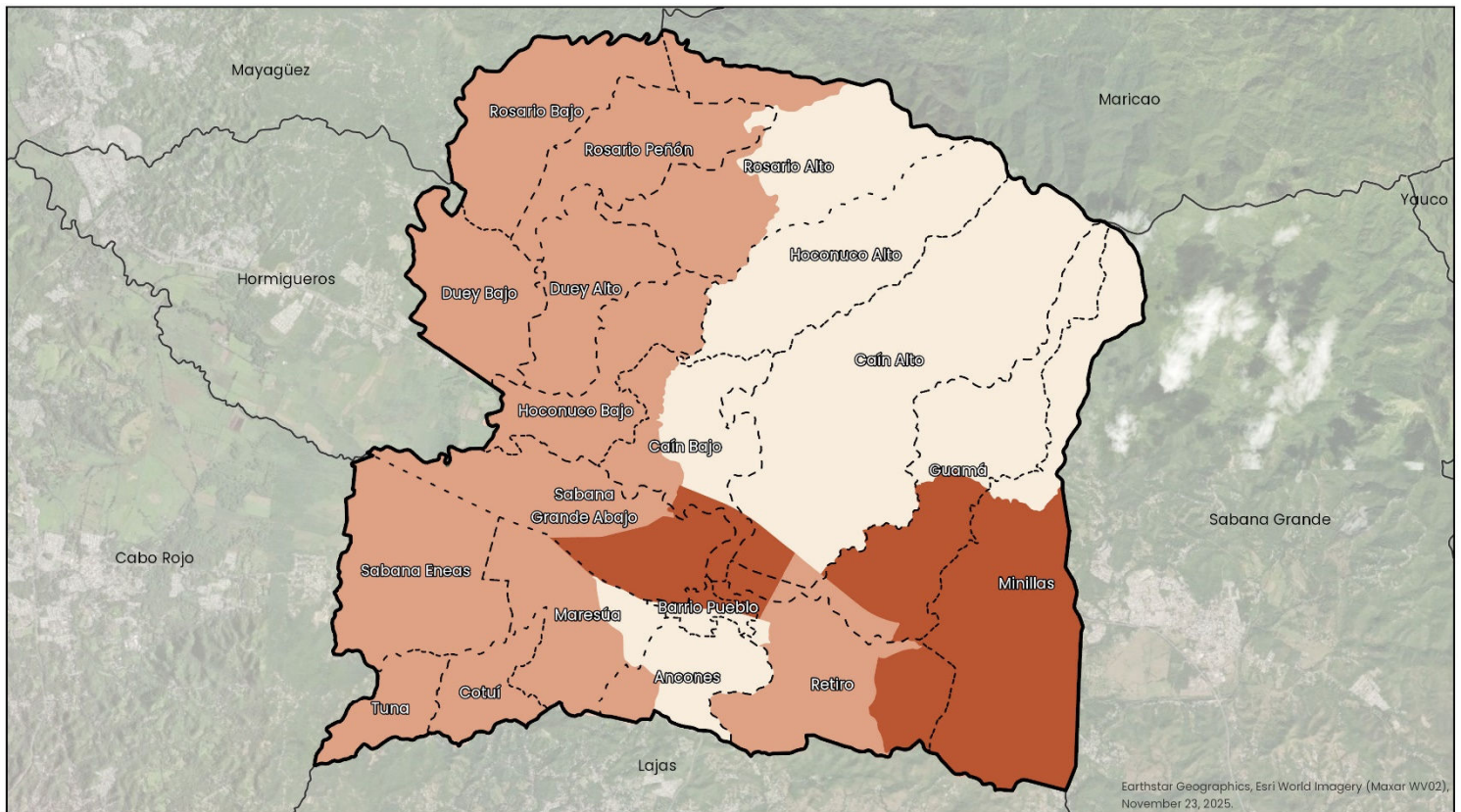


Source: Puerto Rico Planning Board and Hazus 6.1 Output

SPCS PR & VI NAD83



TROPICAL CYCLONE: TOTAL DAMAGED BUILDING 100-YEAR EVENT



Source: Puerto Rico Planning Board and Hazus 6.1 Output

SPCS PR & VI NAD83

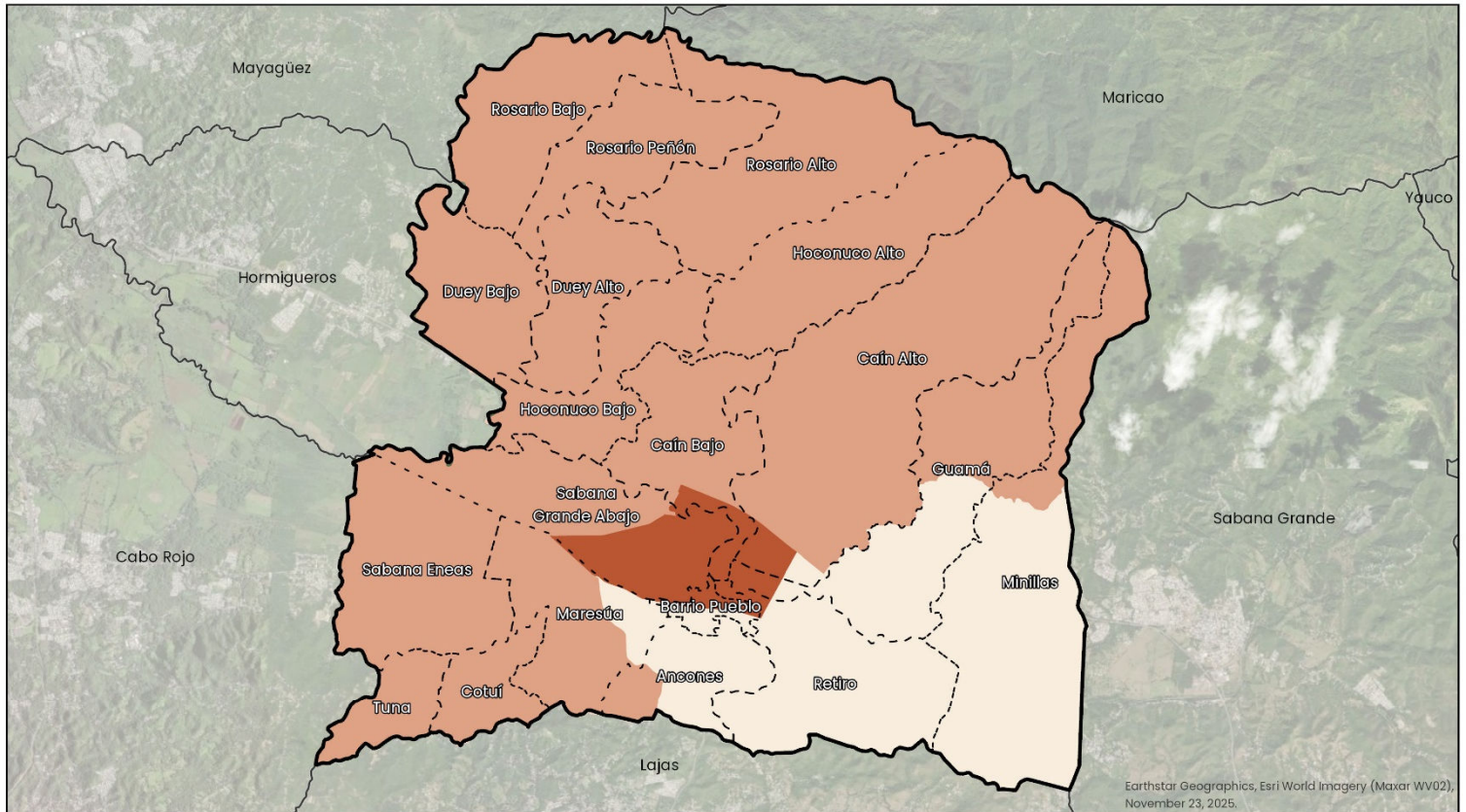


Map 36 shows the total economic loss amount in for a 100 - year (1%) event, while Map 37 shows the total economic loss for a 500 - year event (0.20%). Both maps show that the greatest economic loss (in the range of \$123,640.45 to \$169,243.02) would be in the area of the town center and surrounding areas (Sabana Grande Abajo, and parts of Cain Bajo, Cain Alto, Retiro and Guamá wards). This could be because most of the commercial and industrial establishments are in the PR-2 corridor that runs in this part of the municipality. Map 36 shows the same data as Map 35 but for a 500-year event. The expected losses are similar to the 100 - year event, but with higher losses

estimated for Retiro ward.

Map 36. Tropical Cyclone: Total Economic Loss 100-year Event (\$k)

TROPICAL CYCLONE: TOTAL ECONOMIC LOSS 100-YEAR EVENT (\$K)



Source: Puerto Rico Planning Board and Hazus 6.1 Output

Earthstar Geographics, Esri World Imagery (Maxar WV02), November 23, 2025.

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Map 37. Tropical Cyclone: Total Economic Loss 500-year Event (\$K)

TROPICAL CYCLONE: TOTAL ECONOMIC LOSS 500-YEAR EVENT (\$K)



Source: Puerto Rico Planning Board and Hazus 6.1 Output

SPCS PR & VI NAD83



4.9.2.2 LIFELINES AND CRITICAL INFRASTRUCTURE

Hurricane winds have profound effects on all eight FEMA Community Lifelines, disrupting essential services and infrastructure.

- Safety and Security systems are compromised when high winds damage police stations, fire departments, and emergency operations centers, while debris and fallen power lines obstruct emergency routes, delaying rescue efforts.
- Food, Hydration, and Shelter lifelines suffer as winds destroy agricultural fields, damage food storage facilities, and tear roofs off homes and shelters, leaving communities vulnerable and displacing thousands.
- In the Health and Medicine sector, hospitals and clinics experience roof failures and structural damage, forcing evacuations and interrupting critical care, while pharmacies and supply chains face severe disruptions.
- The Energy lifeline is particularly vulnerable, as hurricane winds topple transmission towers, snap utility poles, and damage substations, causing widespread power outages that cascade into other lifelines.
- Communications systems fail when telecommunication towers and antennas are blown down, severing cellular and internet connectivity and hindering emergency coordination.
- Transportation networks are crippled by blocked roads, damaged bridges, and wind-related destruction at airports and seaports, delaying relief efforts and supply deliveries.
- Facilities handling Hazardous Materials face increased risks when wind-driven debris ruptures tanks or pipelines, creating environmental hazards and complicating cleanup operations.
- Finally, Water Systems are disrupted as treatment plants and pumping stations sustain roof and equipment damage, while elevated storage tanks and distribution infrastructure collapse, interrupting access to clean water for drinking and sanitation. These cascading failures underscore the critical need for wind-resistant design standards and proactive planning to protect lifelines and maintain community resilience during hurricane events.

For planning purposes this LHMP shall assume that all critical infrastructure is equally exposed to this hazard.

4.9.2.3 SOCIAL VULNERABILITIES

As discussed before in Section 4.6.1.1 a tropical cyclone can impact the whole island. For this LHMP we are going to assume that all the population of San Germán is vulnerable to this hazard.

4.9.2.4 NATURAL AND CULTURAL RESOURCES

Hurricane winds caused extensive damage to both natural and cultural resources by exerting extreme mechanical forces on landscapes and built environments. In natural settings, strong winds uproot trees, strip foliage, and break branches, leading to deforestation and habitat loss. This disruption affects biodiversity and can alter ecosystem functions for years. Coastal vegetation such as mangroves is particularly vulnerable, as wind-driven forces weaken root systems and reduce their ability to protect shorelines. Agricultural areas also suffer severe losses, with crops flattened or destroyed, impacting food supply and local economies.

Cultural resources, including historic buildings, monuments, and archaeological sites, are equally at risk from hurricane winds. High wind speeds can dislodge roofing materials, collapse walls, and damage structural integrity, especially in older or unreinforced constructions. Museums, archives, and heritage sites may experience irreparable harm if protective measures are inadequate. The loss of these cultural assets not only affects community identity but also has economic implications for tourism and preservation efforts. Understanding wind speed thresholds and incorporating them into design standards and conservation planning is essential to mitigate these risks and safeguard both natural and cultural heritage.

4.9.2.5 FUTURE CONDITIONS (E1-A)

The risk of hurricane is a municipal – wide risk. Every part of the recent development approved by the municipality is equally in risk of being affected by a tropical cyclone.

4.10 EXTREME HEAT

4.10.1 DESCRIPTION (B1-A)

There is no universally accepted definition for extreme heat or heat waves. For the

purposes of this Plan, the definition adopted by the Department of Homeland Security (DHS) is used. It is defined as a prolonged period of 48 to 72 hours of intense heat and humidity, with temperatures above 90 °F. Under these conditions, evaporation is reduced and the body is forced to make a significant effort to maintain its normal temperature, which has caused the death of many people in attempts to stabilize physically. In general, extreme heat represents the highest rate of deaths among weather-related hazards.

A study titled Heat Risk Perception and Vulnerability in Puerto Rico: Insights for Climate Adaptation in the Caribbean, published in the academic journal International Journal of Environmental Research and Public Health, analyzes how Puerto Rico residents perceive health risks associated with extreme heat and how these perceptions relate to vulnerability and protective behaviors during extreme heat events that occurred in the summer of 2020 (Guzmán-Colon, Guido, Amaya-Ardilla, Cabrera-Rivera, & Méndez-Lázaro, 2025). The research was conducted through a cross-sectional telephone survey of 500 adults in metropolitan and non-metropolitan areas. This study defined the metropolitan area as the municipalities of San Germán, Carolina, Cataño, Toa Baja, and Trujillo Alto. The non-metropolitan zone consists of the remaining municipalities of Puerto Rico.

The questionnaire included sociodemographic variables, health status, prior heat exposure, risk perception, and mitigation strategies. Statistical analysis employed chi-square tests and multinomial and logistic regression models.

The results reveal that, although most participants expressed concern about climate change and high temperatures, less than half perceived heat as a high health risk, and only one-fourth considered it likely to suffer a heat-related illness in the next five years. Risk perception was significantly higher among men, people aged 50 to 64, the unemployed, individuals with fair health, multiple chronic conditions, and those who had experienced heat-related symptoms. In contrast, older adults (65+) reported low levels of risk perception despite their high vulnerability.

Forty-four percent (44%) of respondents indicated having suffered heat-related symptoms during the summer, and 68% reported nighttime thermal discomfort, a factor closely linked to health problems. The most common strategies to mitigate heat were the use of fans (84%) and air conditioning (64%), although economic limitations and instability of the electrical system reduced their effectiveness. Regional differences were also notable: residents in non-metropolitan areas showed greater risk perception than those in metropolitan zones.

The study concludes that there is a significant gap between actual vulnerability and risk perception, especially among older adults. It recommends strengthening risk communication targeted at vulnerable groups, addressing nighttime heat exposure, and improving electrical infrastructure to ensure equitable access to cooling systems. Proposed solutions include decentralized energy systems, cooling centers with backup power, and passive designs that reduce electrical dependence, thus contributing to community resilience in the face of increasing extreme heat events.

4.10.1.1 AFFECTED AREA (B1-B)

Extreme heat events can impact the entire municipality, particularly in urbanized areas where the heat island effect may occur. Based on previously presented information, adverse climate effects have been observed, including severe droughts, increased frequency of strong wind events and flooding, higher heat index levels, among others. Due to the municipality's geography and location, the entire region is highly susceptible to extreme heat conditions.

Urban heat islands refer to urbanized areas where structures such as buildings, roads, and other infrastructure absorb and emit the sun's heat more than natural landscapes such as forests and water bodies. Daytime temperatures in urban areas are about 1–7 °F higher than temperatures in outlying areas; nighttime temperatures are about 2–5 °F higher (EPA, 2025).

Heat islands develop due to a combination of factors:

- **Loss of Natural Landscapes** – Urban areas often replace trees, vegetation, and water bodies—natural elements that cool the air through shade, transpiration, and evaporation—with hard, dry surfaces like roads, rooftops, and parking lots. These surfaces provide little shade or moisture, leading to higher temperatures.
- **Properties of Urban Materials** – Common construction materials such as asphalt and concrete absorb and retain more heat than natural surfaces. They reflect less solar energy and release heat slowly, causing temperatures to remain elevated, especially after sunset.
- **Urban Design and Geometry** – The layout of buildings affects airflow and heat retention. Dense developments with narrow streets and tall structures create “urban canyons” that trap heat and block cooling winds, turning buildings into thermal masses that release heat gradually.

- Human-Generated Heat – Activities such as transportation, industrial operations, and air conditioning add waste heat to the environment, intensifying the heat island effect.
- Weather and Geographic Conditions – Clear, calm weather amplifies heat islands by maximizing solar energy absorption and limiting heat dispersion. Conversely, wind and cloud cover help reduce the effect. Geographic features like mountains can also influence wind patterns, either blocking cooling breezes or channeling heat through urban areas (EPA, 2025).

4.10.1.2 RISK MAGNITUDE (B1-C)

Local NWS offices often work with community agencies to decide when heat alerts should be issued. Because the United States is so geographically and culturally diverse, heat tolerance varies by region. For example, residents of Puerto Rico are generally more accustomed to temperatures above 90°F than those living in Alaska.

Nevertheless, the NWS uses the following standard alerts (NWS, n.d.):

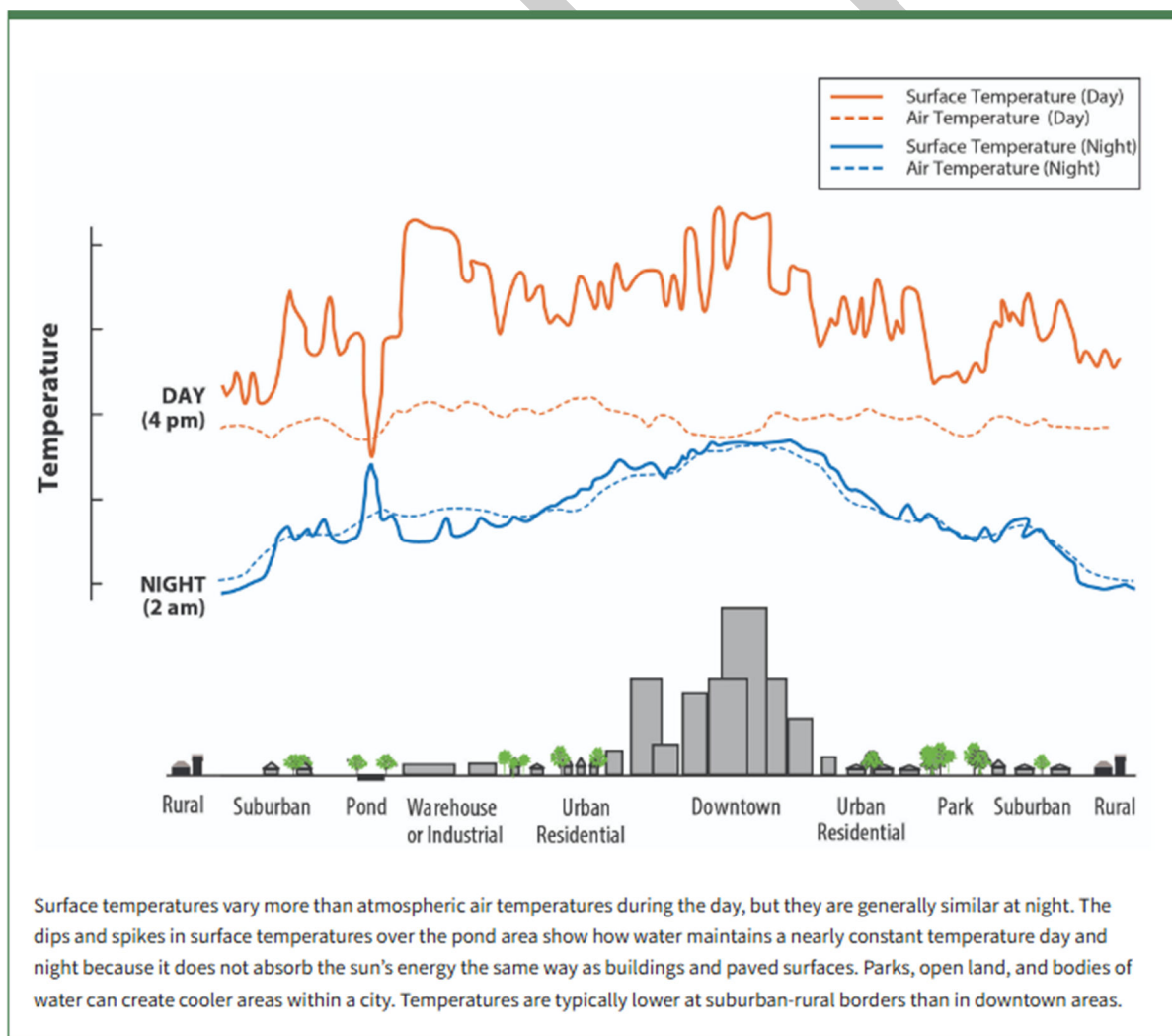
- Excessive Heat Warning – Issued 12 hours before dangerous heat conditions are expected. This occurs when the heat index is forecast to reach 105°F or higher for more than three hours over two consecutive days, or 115°F or higher for any period.
- Excessive Heat Watch – Issued when an extreme heat event is possible within the next 24 to 72 hours.
- Heat Advisory – Issued 12 hours before conditions where the heat index is at least 105°F but less than 115°F for three consecutive days.
- Extreme Heat Outlook – Issued when there is potential for extreme heat within the next three to seven days, providing advance notice for those who need extra time to prepare.

It must be emphasized that Urban Heat islands (UHI) phenomena can occur regardless of whether there is an extreme heat warning event. UHI is a relative temperature difference between urban and surrounding rural areas caused by factors like heat-absorbing surfaces, lack of vegetation, and human activities. It exists year-round, even during mild or cool weather, because cities consistently retain more heat than natural landscapes. Extreme heat events can amplify UHI, making UHI effects more dangerous, but UHI does not require extreme heat to form—it simply means urban areas are warmer than their surroundings under similar conditions.

UHIs are typically assessed by comparing temperatures in urban areas to those in surrounding regions. Even within a city, temperatures can vary significantly. Some neighborhoods are hotter due to dense concentrations of heat-absorbing surfaces like buildings and pavements, while areas with trees and greenery remain cooler. These variations create what are known as intra-urban heat islands. In diagrams illustrating this effect, urban parks, ponds, and residential zones generally appear cooler than central downtown districts.

The following diagram, taken from an EPA website, shows a diagram of how a heat island effect behaves in temperature.

Figure 21. Heat Island Effect Diagram (EPA, 2025)



4.10.1.3 PAST EVENTS (B1-D)

Méndez Lázaro et al. (2015) identified several years in which extreme heat temperatures were recorded in the San Juan metropolitan area. According to their findings, periods of extreme heat occurred in 1983, 1995, 2012, and 2013. Notably, the summer of 2012 was the hottest in a century, with 42 days of extreme temperature values. During June, July, and August, the maximum heat index reached 98.06° F, 98.96° F, and 102.02° F, respectively (Méndez Lázaro et al., 2015).

4.10.1.4 FUTURE EVENT PROBABILITIES (B1-E)

Official NOAA assessments in the 2018 Puerto Rico and U.S. Virgin Islands State Climate Summary report an increase in both average temperature ($\approx 1.5^{\circ}\text{F}$ since 1950) and the frequency of extreme heat events (NOAA, 2022). Additionally, climate projections from CMIP6 (via the World Bank's Climate Change Knowledge Portal) show steady rises in summer and annual maximum temperatures for Puerto Rico, further indicating elevated future risk for heat waves (World Bank, n.d.).

4.10.2 RISK ANALYSIS (B2-A, B2-B)

4.10.2.1 ESTIMATED LOSSES

Extreme Heat primarily causes material and system stress rather than immediate structural failure. For example:

- Roads and Pavements: Asphalt can soften and deform under prolonged high temperatures, leading to rutting and surface damage (Highways Industry, n.d.) (EPA, 2012).
-
- Rail Systems: Steel tracks expand in extreme heat, which can cause buckling and derailment risks (USDOT - FRA, 2013).
- Power Infrastructure: Electrical grids experience higher loads from air conditioning demand, and transformers or cables can overheat, reducing efficiency or causing outages.
- Building Materials: Expansion and contraction of concrete, steel, and glass can lead to cracks or joint failures over time. Roofing materials may degrade faster under intense heat.
- Cooling Systems: HVAC systems work harder, increasing energy consumption and risk of failure, which can compromise indoor comfort and safety.

While heat waves rarely cause buildings to collapse, they accelerate wear and tear, increase maintenance costs, and can lead to system failures that disrupt essential services. As of now the municipality does not have a method to calculate losses from extreme heat events.

4.10.2.2 LIFELINES AND CRITICAL INFRASTRUCTURE

Extreme heat poses systemic risks across energy, transportation, and communications systems, creating compound failures precisely when demand for services peaks. In Energy Lifeline, high temperatures drive sharp increases in electricity demand for cooling while simultaneously decreasing generation and delivery efficiency. Thermoelectric plants may be forced to curtail output when cooling water is too warm, solar panels produce less electricity at elevated module temperatures, and transmission lines lose carrying capacity as conductors heat and sag—conditions that heighten the likelihood of voltage drops and blackouts during heat waves (Jessen, 2025). The combination of record cooling loads and diminished supply underscores a growing “peak risk” problem for grids that were not designed for today’s heat extremes (Jessen, 2025) (American Society of Civil Engineers, 2024).

Similarly, the Transportation Lifeline is similarly vulnerable. Prolonged high surface temperatures soften asphalt, accelerating rutting and deformation; steel rails thermally expand and can buckle, prompting heat-related slow orders that disrupt service; and catenary or other overhead lines can sag in the heat, further constraining operations. Airports face dual constraints: runway pavements can deform under extreme heat, and reduced air density on hot days impairs aircraft performance, affecting takeoff weight and scheduling. These effects are now commonly observed across U.S. systems during sustained heat events, requiring operational restrictions and emergency maintenance that ripple through supply chains and passenger mobility (American Society of Civil Engineers, 2024)

Communication Lifeline also faces mounting heat stress. Data centers, switching facilities, and network nodes rely on continuous cooling; overheating elevates outage risks and can degrade equipment lifespans. Heat-related disruptions to power supply and localized microclimate conditions compound these risks, with cascading impacts across other lifeline sectors that depend on connectivity for operations and emergency response. Federal assessments underscore that extreme weather—including extreme heat—can interrupt fiber networks, degrade wireless performance, and limit access to data centers, affecting each of the other critical infrastructure

sectors and complicating disaster response coordination (Public-Private Analytic Exchange Program, 2025).

Overall, extreme heat acts as a stress multiplier: it pushes materials beyond design thresholds, reduces equipment efficiency, and narrows operational safety margins, all while increasing demand for services. The evidence from engineering organizations and energy market observers indicates that without targeted adaptation—such as heat-resilient design standards, strategic grid reinforcement, enhanced thermal management for digital infrastructure, and heat-aware operations—systems will face more frequent service disruptions and higher lifecycle costs as heat events intensify (American Society of Civil Engineers, 2024).

4.10.2.3 SOCIAL VULNERABILITIES

A recent academic study examines the relationship between heat stress and mortality in Puerto Rico (Méndez - Lázaro, et al., 2025). Researchers analyzed hourly 2-meter air temperature data from ERA5 reanalysis for 2015–2020 and derived daily minimum, maximum, and mean values to calculate two heat stress indices: the Heat Index (HI) and the Universal Thermal Climate Index (UTCI). Findings show that extreme heat conditions are common for eight months of the year, with August and September being the hottest months, and that urban heat island effects exacerbate exposure in metropolitan areas. (Méndez - Lázaro, et al., 2025) Mortality risk increased significantly on days with high heat stress: deaths were 23% higher in the highest HI tertile and 47% higher in the highest UTCI tertile compared to the lowest. Cardiovascular and cerebrovascular diseases, heart failure, and respiratory conditions were among the leading causes of death associated with heat stress. The study highlights Puerto Rico's socio-economic vulnerabilities, aging population, and limited infrastructure amplifying health risks during extreme heat events (Méndez - Lázaro, et al., 2025).

4.10.2.4 NATURAL AND CULTURAL RESOURCES

Extreme heat, specifically Urban Heat Islands can pose the following impacts on the natural resources:

- Increased Energy Consumption – Heat islands increase electricity demand for air conditioning and peak energy demand. Increased electricity demand for air conditioning ranges from 1–9% for each 2°F increase in temperature, with the

highest increase in countries where most buildings have air conditioning, such as the United States.[3] This increased demand contributes to higher electricity expenses. Peak demand generally occurs on exceptionally hot afternoons, when offices and homes are running air-conditioning systems, lights, and appliances. This increased demand can overload systems and require a utility to institute controlled brownouts or blackouts to avoid power outages.

- **Elevated Emissions of Air Pollutants** – To meet electricity needs, utility companies typically rely on fossil fuel power plants as a power source. Increased use of fossil fuels increases emissions of air-borne pollutants, such as carbon dioxide, which can have health concerns, especially in people living with respiratory diseases.
- **Compromised Human Health and Comfort** – Hot weather events contribute to heat-related deaths and heat-related illnesses. Areas experiencing heat islands further contribute to higher daytime temperatures and reduced nighttime cooling. Heat is of greatest concern for groups such as older adults, young children, populations with low-income, people who work outdoors, and people with chronic health conditions, disabilities, mobility constraints, or taking certain medications. From 2004 to 2018 the Centers for Disease Control and Prevention recorded an average of 702 heat deaths per year.
- **Impaired Water Quality** – High temperatures of pavement and rooftop surfaces can heat stormwater runoff, which drains into storm sewers. This runoff raises water temperatures as it is released into streams, rivers, ponds, and lakes. Water temperature affects the metabolism and reproduction of many aquatic species.

Rapid temperature changes can also be stressful, and even fatal, to aquatic life. One study found that urban streams have more frequent temperature surges than streams in forested areas. Temperature surges in urban streams were as much as 18°F higher due to heated runoff from urban areas, higher discharge volumes due to impervious surfaces, and warmer baseline stream temperatures (EPA, 2025).

4.10.2.5 FUTURE CONDITIONS

The approved construction permits map (Section 3.6) shows that many of the recent developments in San Germán are in the already built-up area of the city. This means that the urban heat island effect will continue to be present in the municipality in the near future.

4.11 DROUGHT

4.11.1 DESCRIPTION (B1-A)

Drought is described as a temporary irregularity in rainfall or natural water flow, where a prolonged lack of precipitation leads to a significant hydrological imbalance. This condition may or may not result in interruptions to regular drinking water service, crop failures, and adverse effects on wildlife and vegetation. The severity of a drought is determined by the level of moisture deficiency, its duration, and the geographic extent of the affected area (Colón, 2009).

Drought represents one of the most complex climatological risks and one of the most severe events (DRNA, 2016). Drought is the result of a natural reduction in the expected amount of precipitation over a prolonged period, usually a season or longer. High temperatures, strong winds, and low humidity levels can exacerbate the effects of drought in areas where they are already prevalent. Likewise, drought can lead to severe wildfires (FEMA, 1997). Human actions and the demands they place on water resources can accelerate drought-related impacts. Droughts occur in different forms across the island, meaning that some regions may experience greater impact while others remain normal.

According to FEMA there are four types of droughts (FEMA, 1997):

Table 37. Types of Droughts

Meteorological Drought	A period characterized by a significant deficiency in precipitation compared to normal conditions over a specific timeframe (e.g., monthly, seasonal, yearly)
Agricultural Drought	Occurs when soil moisture becomes insufficient to support crops or livestock needs, typically following meteorological drought.
Hydrological Drought	Defined by reduced water levels in streams, rivers, reservoirs, and groundwater systems, often lagging behind meteorological drought
Socioeconomic Drought	Reflects the impact on human systems and the economy, arising when water supply shortages—due to any form of drought—fail to meet societal demand for water and other resources

In 1999, the Federal Drought Monitor program was implemented. This program is a tool that publishes data and maps on drought conditions in the United States, including

Puerto Rico and Hawaii. This system integrates information from various agencies, such as NOAA, the United States Department of Agriculture (USDA), and the National Drought Mitigation Center at the University of Nebraska–Lincoln. In addition, the monitor has developed standardized indicators that allow drought categories to be classified at the national level, providing a uniform reference for risk assessment and management.

The short-term drought indicator focuses on precipitation over 1–3 months. The long-term drought indicator focuses on a period of 6–60 months. Additional indices used, especially during the growing season, include the “USDA/NASS Topsoil Moisture,” the Keetch–Byram Drought Index (KBDI), and NOAA/NESDIS satellite vegetation health indices. Other indicators include groundwater levels, reservoir capacity, and pasture conditions.

In Puerto Rico, the Puerto Rico Aqueduct and Sewer Authority (PRASA), the Puerto Rico Electric Power Authority (PREPA), and the Department of Natural and Environmental Resources (DNER) are responsible for constantly monitoring the dams and reservoirs used for potable water supply. Once critical levels are reached, the first strategy adopted at the supply system level is reducing water pressure. If adequate levels are not restored, water rationing begins. This is implemented in phases lasting 12 hours and, in extreme cases, up to 48 hours. The affected area is divided into sectors, and the different rationing phases of a given duration are initially implemented locally, usually in municipalities with the highest consumption. In extreme circumstances, several municipalities and entire regions may be affected.

4.11.1.1 AFFECTED AREA

Droughts are not limited by geographical boundaries. For example, a period of drought in the Guanajibo River Valley could affect many residents of San Germán and nearby agricultural uses. For this analysis it will be assumed that the whole municipality can be affected by the drought hazard with the caveat that the municipality can be affected by a drought regardless of whether there is a decrease of rainfall within the municipality.

4.11.1.2 RISK MAGNITUDE (B1-C)

Drought is a slow-onset hazard, but over time, it can have highly detrimental effects on crops, municipal water supplies, recreational uses, and wildlife. If drought

conditions persist for several years, the direct and indirect economic impact can be significant. Drought can also potentially provide favorable conditions for another hazard to occur, wildfire.

The National Drought Monitoring Center uses the following categories to describe the magnitude of drought conditions (US Drought Monitor, 2025).

Table 38. US Drought Monitor Categories

Category	Description	Typical Impacts
None	Normal/Wet Conditions	No drought impacts
D0 - Abnormally Dry	Early signs of dryness may slow planting, affect surface water	Short-term dryness; minor stress
D1 - Moderate Drought	Noticeable soil moisture depletion; low water; voluntary restrictions	Crop stress; reduced streamflow
D2 - Severe Drought	Common water shortages; likely crop/pasture losses	Mandatory restrictions possible
D3 - Extreme Drought	Major crop/pasture losses; widespread restrictions	Fire bans; severe water stress
D4 - Exceptional Drought	Exceptional and widespread losses; water emergencies	Emergency measures; critical impacts

4.11.1.3 PAST EVENTS (B1-D)

Puerto Rico has a humid tropical climate characterized by two well-defined seasons: a rainy season, which extends from May to November, and a dry season, which runs from December to April. The eastern and western interior regions record the highest annual rainfall, while the northern zone receives significantly more rain than the south.

USGS identified that major drought conditions have occur in 1967 – 1969, 1974, 1994, 1994, 1997, 2001–2002 and 2013 –2016 (USGS, 2014), (DNER, 2016). According to historical records the federal government has activated its resources to deal with drought conditions;

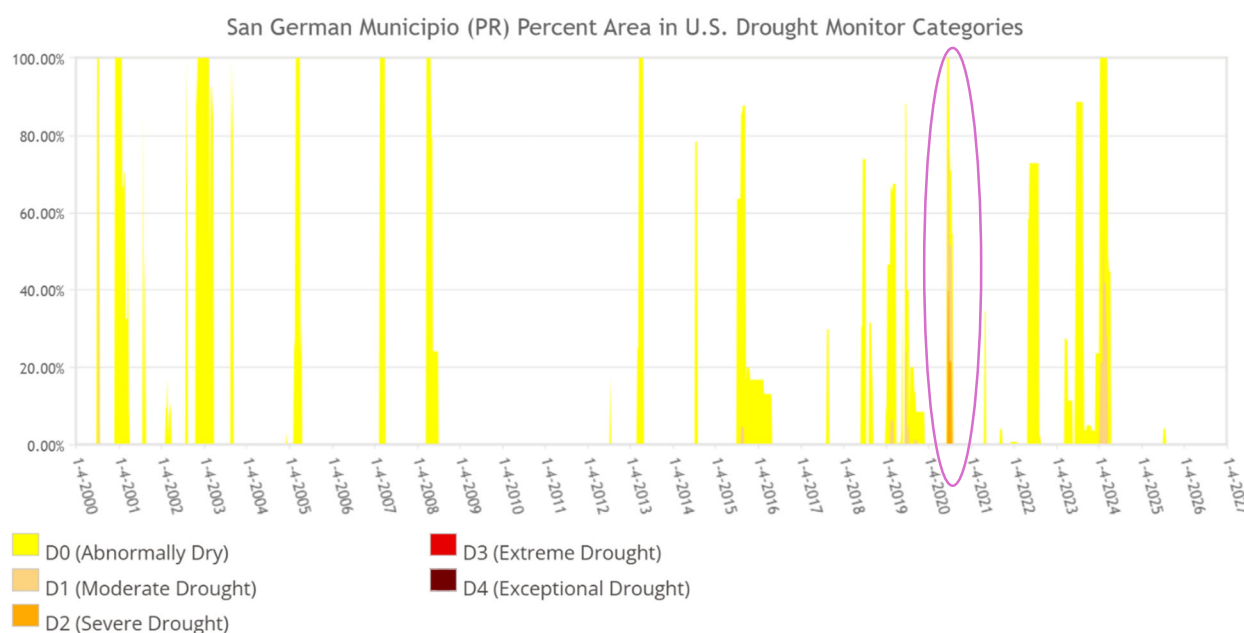
- Puerto Rico Extreme Drought Conditions (DR-170-PR) – Date of Declaration May 26, 1964

- Puerto Rico Impact of Drought (EM-3002-PR) – Date of Declaration August 29, 1974

During the rainy season, precipitation mainly comes from local convection processes, orographic effects, tropical waves, and cyclones. In contrast, rainfall during the dry season is mostly associated with the influence of cold fronts and troughs (CEACC, 2024).

Figure 22 shows the Municipality's Area in US Drought Monitor Categories for the period of January 2020 to January 2026 (US Drought Monitor, 2025). The series shows that in 2020 there was small period of severe drought (refer to purple oval).

Figure 22. Municipality's Percent Area in U.S. Drought Monitor Categories



From the U.S. Drought Monitor website, <https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx>, 2-19-2026

Source US Drought Monitor



Figure 22 also shows that the occurrences of D1 – Moderate Drought has become more recent in San Germán since 2019.

4.11.1.4 FUTURE EVENT PROBABILITIES (B1-E)

USGS reports that in Puerto Rico, drought has an occurrence of 15 of 18 years (USGS,

2016), (USGS, 2014). Recent scientific data shows that the Caribbean region faces increased vulnerability to drought hazards. (USGCRP, 2018). The probability of drought occurrence is difficult to forecast or foresee in a long-term perspective. Though as Figure 20 shows, moderate droughts periods have become more prevalent since 2018.

4.11.2 RISK ANALYSIS (B2-A, B2-B)

If drought results in potable water rationing, the municipality could experience economic losses to the extent that services are immediately affected by the partial or total closure of schools, businesses, industrial areas, and public and private offices.

The potential economic impact of a prolonged drought would arise from the need to mobilize the municipality to meet the basic needs of its population during the emergency period. This cost is associated with mobilizing resources such as personnel and equipment for the distribution of water to communities and municipal facilities. However, the municipality has not been able to quantify the economic impact of this expense, nor the impact on agriculture, due to a lack of information. Since drought is a hazard that does not directly affect structures, no dollar estimate of structural losses is generated.

Among other effects, it results in increased food prices, loss of agricultural production, impacts on the industrial, commercial, and service sectors, losses in hydroelectric energy, and losses in the tourism industry, whether domestic tourism or foreign visitors.

4.11.2.1 *ESTIMATED LOSSES*

Documenting the fiscal impact of a drought is a complex process due to the wide range of ways this climate event affects society (DNER, 2015).

For the 2015–2016 drought that affected the northern area of Puerto Rico the local Department of Agriculture documented that there was a net cost of \$14,000,000.00 of impact on the agricultural sectors.

4.11.2.2 *LIFELINES AND CRITICAL INFRASTRUCTURE*

Drought can place significant strain on critical infrastructure by reducing water availability for municipal systems, often leading to rationing measures and service interruptions. Extended water shortages can disrupt essential operations in schools,

hospitals, and businesses, resulting in economic losses and reduced access to public services. Energy infrastructure may also be affected, particularly where hydroelectric generation declines due to low reservoir levels, increasing reliance on more expensive or less sustainable energy sources. Transportation systems can experience indirect impacts, such as road damage caused by soil shrinkage and heightened wildfire risk along highways. Emergency response and communication services may face additional challenges when limited water supplies constrain cooling systems and firefighting capabilities. Collectively, drought conditions can trigger cascading impacts across interconnected infrastructure systems, increasing vulnerabilities and underscoring the need for coordinated mitigation and response strategies.

As noted above, drought events that require potable water rationing can lead to economic losses for the municipality by disrupting normal government operations. Partial or complete closures of schools, businesses, industrial zones, and public or private offices may occur when water availability is reduced. These impacts primarily affect the day-to-day functioning of municipal assets, as the services they provide are directly limited by water shortages or service interruptions. As droughts become more frequent or prolonged, their cumulative effects on operations are likely to intensify. However, while drought significantly affects service delivery and operational capacity, it does not directly damage the municipality's critical facilities and physical assets.

4.11.2.3 SOCIAL VULNERABILITIES

As mentioned in Section 3.4.2 the estimated vulnerable population of San Germán is of 34.30% %. If the pattern that began in 2019 continues, the vulnerable population of San Germán will continue to face major challenges regarding access to potable water. Communities will experience a decrease in water availability, which is essential for industrial and agricultural production, as well as for personal use by residents. It can also affect public health. This results in a reduction in quality of life, mental and physical stress, and social discomfort, with potential risks of malnutrition, dehydration, and disease. Since the effects of a drought period can have effects on the whole population (even drought periods that do not directly affect the municipality's territory, it is recommendable for the municipal administration to consider the whole population of San Germán as exposed to this hazard.

4.11.2.4 NATURAL AND CULTURAL RESOURCES

When a region experiences prolonged and cumulative periods of little or no rainfall, a drought begins. This natural hazard has adverse effects on biodiversity and water supplies. For instance, a precipitation deficit lowers water levels in bodies of water, including mangroves, impacting the region's flora and fauna. Damage to vegetation directly affects animal habitats, creating an imbalance in food availability for wildlife.

Agriculture in the area is also severely affected due to the lack of water. When rainfall is significantly below normal levels, it causes severe hydrological imbalances that negatively affect land productivity systems. Similarly, crop growth and harvests decline, along with the availability and quality of drinking water. Drought can also lead to ecosystem degradation, loss of biodiversity and species, wind erosion, and increased wildfire risk.

4.11.2.5 FUTURE CONDITIONS

Over the long term, drought-related challenges are expected to intensify as rainfall patterns continue to vary. These variations may result in droughts that are more severe, longer in duration, and wider in geographic extent than those experienced historically, thereby increasing vulnerability among affected populations.

Overall population trends in the Municipality of San Germán indicate a general decline at the neighborhood level. However, the population aged 65 and older has increased (see Section 3.4.2), representing a particularly vulnerable segment of the community. The growing proportion of older adults requires special consideration in drought planning due to heightened sensitivity to water shortages, health impacts, and service disruptions.

Future land development also plays a critical role in drought vulnerability. Approving projects near sinkholes or developments that rely on septic systems increases the risk of groundwater contamination, which becomes especially problematic during drought conditions when alternative water sources are limited. Additionally, soil surface impermeabilization and the obstruction or filling of sinkholes reduce natural aquifer recharge by increasing surface runoff. These factors further diminish groundwater availability, limiting its viability as a supplemental water source during drought events.

4.12 WILDFIRE (E1-A)

4.12.1 DESCRIPTION (B1-A)

Wildfires are uncontrolled fires that spread through vegetation, posing serious threats to structures, human health, and natural ecosystems. These events often begin unnoticed and can spread rapidly, producing dense smoke that affects nearby communities. While wildfires may occur at any time of year, they are most common during periods of low rainfall, when grasses, leaves, and other fine fuels become dry and highly combustible.

Wildfire management is a local and global concern due to the complex interactions among human populations, fire activity, and open landscapes. Research cited in the Puerto Rico Forest Action Plan indicates that fire plays a significant role in shaping ecosystem structure and function (DNER, 2021). However, uncertainty remains regarding the full extent of wildfire impacts on ecosystem services because of feedback related to land use, invasive species, and variable climate conditions (DNER, 2016). Understanding both the ecological and social effects of wildfires in Puerto Rico's natural environments is essential for effective conservation and resource management. Fire prevention efforts must actively engage private landowners in areas prone to fires or dense vegetation, particularly given that most wildfires in Puerto Rico are human-caused. Historically, limited emphasis has been placed on wildfire research and monitoring on the island.

The majority of wildfires, as well as the highest risk of occurrence, are concentrated in dry forest regions. Climate change, extended drought periods, and increasing landscape fragmentation caused by human activities have the potential to expand fire-prone conditions into areas that previously experienced minimal wildfire risk. This includes humid tropical forests and non-forested landscapes that were historically less susceptible to fire.

4.12.1.1 RISK MAGNITUDE

The United States Forest Service main classification for fire types (USFS, n.d.) are;

- **Ground Fire** - Fire that burns within the organic material below the litter layer, mostly by smoldering combustion. It typically occurs in duff, peat, dead moss and lichens, and punky wood are typically ground fire. Ground fires mainly growing vegetation such as grasslands, shrubs, and tree bases. Depending on

environmental factors (vegetation composition and density, slope orientation and steepness, wind speed, among others), these fires can vary in intensity but generally release less thermal energy than fires that spread through tree canopies.

- **Crown Fires** – A fire that burns in the crowns of trees and shrubs usually ignited by a surface fire. Crown fires are common in coniferous forests and chaparral-type shrublands. In these types of fires, flames climb through lower branches until reaching the tree canopy. However, in some cases, its spread remains primarily surface-based, often because trees are sparse and their canopies are too far apart.
- **Surface Fire** – A fire that burns through leaf litter and other live or dead fuels located at or just above the ground, mostly by flaming combustion.

While FEMA follows a four-classification typology (FEMA, 1997):

- **Wildfires** – Fueled almost exclusively by natural vegetation. They typically occur in forests and national parks, where federal agencies are responsible for fire management and suppression.
- **Interface or Intermixed Fires** – Fires that occur in urban and/or wildland areas where vegetation and integrated surroundings provide the fuel.
- **Firestorms** – Events of such extreme intensity that effective suppression is virtually impossible. Firestorms occur under severe weather conditions and generally burn until conditions change, or available fuel is exhausted.
- **Intentional and Prescribed Burns** – Fires caused by human intervention and natural fires intentionally allowed to burn vegetation for management purposes.

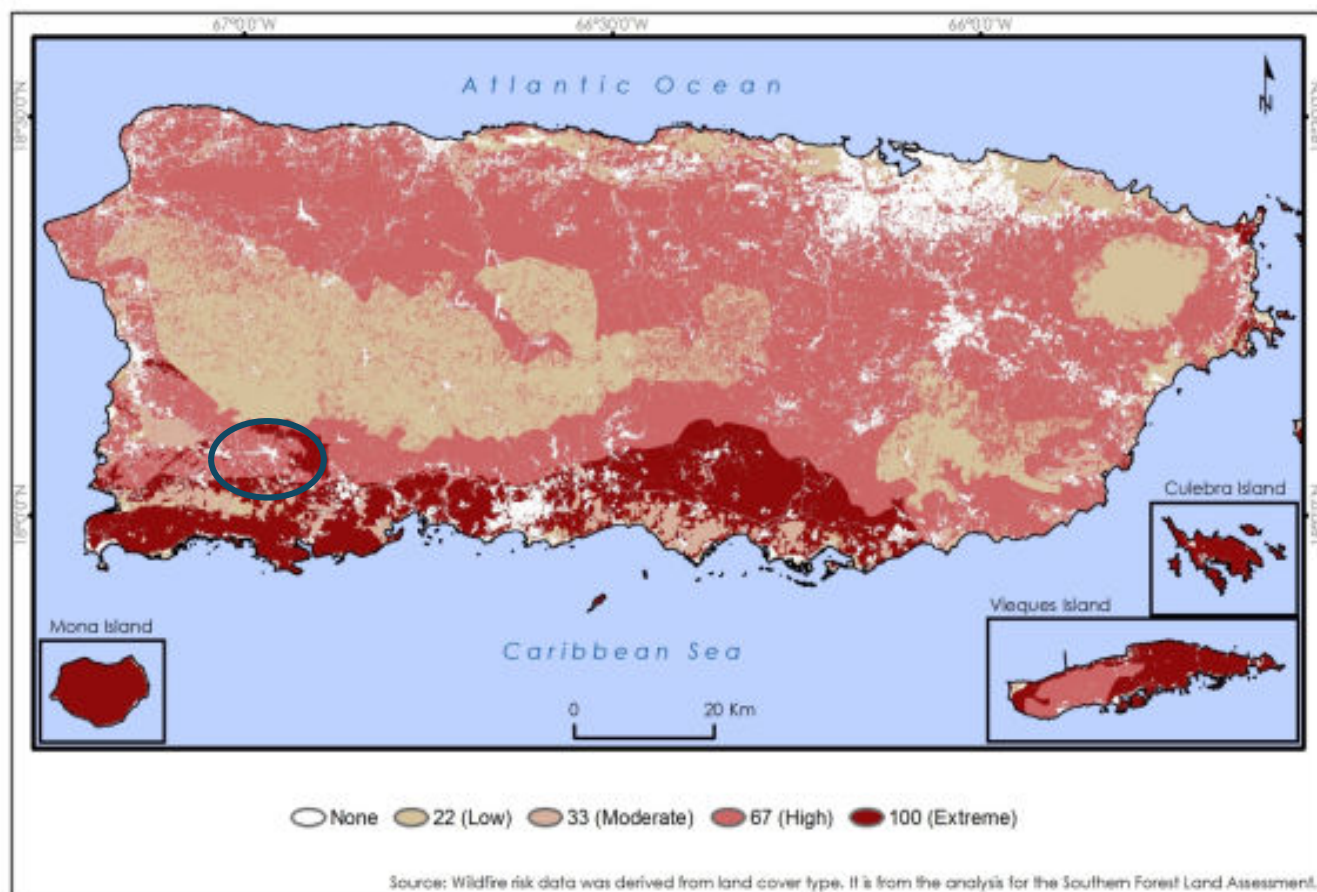
Another typology is the distinction between wildfires and wildland-urban interface (WUI) fires. Wildfires occur in areas with minimal development, except for infrastructure such as roads or power lines. WUI fires, on the other hand, involve situations when fire spreads into areas with structures or other human developments. In WUI fires, flames feed on both vegetation and structural elements of urban areas. The US Fire Administration defines WUI as the zone or area where human structures and developments meet or intermingle with wildland vegetation and fuels (US Fire Administration, 2025).

4.12.1.2 AFFECTED AREA (B1-B)

Figure 23 (DNER, 2021) illustrates the distribution of wildfire incidence across Puerto Rico, Vieques, and Culebra, as defined by the Southern Federal Land Assessment (SFLA). The figure reflects the current understanding of areas identified as fire-prone landscapes. Elevated wildfire occurrence in the southern coastal plains is largely attributed to the combined influence of human activity, the presence of dry and combustible fuels, and prevailing climatic conditions.

Within the municipality of San Germán —generally corresponding to the location highlighted by the blue oval—the landscape is predominantly characterized by low wildfire incidence. However, the northeastern area of the municipality, near the town limit with Maricao and southwest area near the border with Lajas exhibits conditions associated with a higher propensity for wildfires, indicating a transition to a more fire-prone landscape within the municipality.

Figure 23. Overview of areas of Puerto Rico, Vieques and Culebra under different levels of wildlife incidence accounting to SFLA



4.12.1.3 RISK MAGNITUDE (B1-C)

Wildfires are commonly associated with temperate climate regions such as California or parts of Canada; however, recent events in the State of Hawaii demonstrate that fast-moving and deadly wildfires can also occur in tropical, humid environments. The August 2023 Lahaina Fire was a catastrophic example, as rapidly advancing flames swept through densely developed neighborhoods and revealed significant shortcomings in early warning systems, evacuation planning, and overall community preparedness. Driven by dry vegetation, strong winds, and record drought conditions, the fire quickly spread to structures and overwhelmed emergency response capabilities. An independent investigation by the Fire Safety Research Institute found that limited infrastructure resilience, compromised communication systems, and insufficient interagency coordination greatly intensified the impacts of the disaster.

As Puerto Rico faces comparable wildfire risks, particularly in the southern coastal plains, the Lahaina tragedy highlights the urgent need to strengthen fire detection capabilities, improve evacuation routes, and enhance public education on wildfire preparedness. Incorporating building codes that promote fire-resistant materials and defensible space around homes and critical facilities can significantly reduce structural damage during extreme wildfire events. The importance of integrated land-use and vegetation management is also evident, underscoring the need to limit development in wildland-urban interface areas and maintain appropriate vegetation buffers. Lessons learned from Lahaina emphasize that rapid, well-coordinated suppression efforts and resilient communication networks are critical to preventing wildfire escalation. Ultimately, increased cross-agency collaboration, emergency training, and proactive planning are essential to strengthening community resilience and reducing the likelihood of a similar wildfire catastrophe in Puerto Rico.

4.12.1.4 PAST EVENTS (B1-D)

Citing data from the Puerto Rico Firefighters Bureau (PRFB), The Puerto Rico Forest Action Plan states that a total of 7,099 wildland fires were reported across Puerto Rico between 2018 and 2020. The highest number of incidents occurred in 2020, with 5,077 recorded fires. The regions most affected were Ponce, Guayama, and Mayagüez (DNER, 2021).

Within the Department of Natural and Environmental Resources (DNER) Protected Natural Areas, fire incidence increased in 2019 compared to 2018. Notable affected sites included Guánica State Forest, Boquerón Wildlife Refuge, Punta Cuchara Natural Reserve, Caño Tiburones Natural Reserve, and Tortuguero Lagoon Natural Reserve.

Most of these fires were linked to human activities, such as unattended campfires, discarded cigarettes, intentional burning, improper waste burning, and poorly managed prescribed burns in pasturelands (DNER, 2021).

The high frequency of wildfires in Puerto Rico highlights the urgent need for targeted education and public outreach efforts to raise awareness. When combined with active land management and a landscape-scale conservation approach, these initiatives can help reduce the occurrence of fires and mitigate additional pressures on forest ecosystems.

During 2024 a total of 44 wildfires were reported by the Puerto Rico Fire Bureau. The following table shows the details of the wildfires reported in that year.

Table 39. Registered Wildfires in San Germán (2024)

Case Number	Discovery Date	Containment Date	Local Incident ID
PR012324-415	2024-01-23 10:21:06.088000	2024-01-23 15:15:02.146000	Carr. 119 Km. 0.5 Int. Carr. 393, Bo. Hoconuco Bajo, Sector Las Cojobas, San Germán PR, 00683
BPR012424-495	2024-01-24 11:17:39.851000	2024-01-24 14:20:03.013000	Carr. 114, San Germán, PR, 00683
BPR021124-653	2024-02-11 15:10:04.731000	2024-02-11 15:56:04.574000	Carr. 2 Int. Carr. 330, San Germán PR, 00683
BPR021924-1082	2024-02-19 21:52:41.669000	2024-02-19 22:00:28.552000	Carr. 361 Km. 5.0 Int., Bo. Caín Alto, Sector El Hoyo, San Germán, PR, 00683
BPR030124-1121	2024-03-01 21:13:35.075000	2024-03-01 23:05:13.933000	Carr. 361 Km 5 San Germán, PR, 00683
PR080224-778	2024-08-02 15:50:03.025000	2024-08-02 18:32:33.172000	Near Villa Interamericana San Germán, PR
PR010324-534	2024-01-03 12:36:28.331000	2024-01-03 13:29:15.870000	Carr. 3363 Km. 39.0, Bo. La Máquina, San Germán, PR, 00683
BPR011024-823	2024-01-10 16:31:58.804000	2024-01-10 17:58:56.564000	Carr. 2, San Germán, PR, 00683
PR011024-981	2024-01-10 18:54:38.870000	2024-01-10 19:55:16.480000	Carr. 361 Km. 0.4, Bo. Caín Bajo, San Germán, PR, 00683
BPR011124-979	2024-01-11 18:24:10.603000	2024-01-11 19:27:48.255000	Carr. 2, Hospital La Concepción, San Germán, PR, 00683
BPR011324-188	2024-01-13 07:23:04.546000	2024-01-13 07:55:41.201000	Carr. 2 San Germán, PR, 00683
BPR011524-799	2024-01-15 17:09:47.306000	2024-01-15 18:11:09.432000	Carr. 119 Km. 79.1, Sector El Cuatro, San Germán, PR, 00683
BPR011524-937	2024-01-15	2024-01-15	Carr. 119 Km. 79.1, Sector El Cuatro,

	19:58:02.607000	20:37:24.953000	San Germán, PR, 00683
PR011624-994	2024-01-16 17:26:51.592000	2024-01-16 20:04:18.467000	Carr 361 Km. 0.5, Bo. Caín Alto, San Germán, PR, 00683
BPR011624-1053	2024-01-16 18:00:04.483000	2024-01-16 20:10:07.698000	Carr. 361 Km. 0.5, Bo. Caín Alto, San Germán, PR, 00683
BPR011724-431	2024-01-17 10:53:11.672000	2024-01-17 12:08:37.759000	Carr. 361, Bo. Caín Alto, San Germán, PR, 00683
BPR011724-578	2024-01-17 12:47:04.511000	2024-01-17 13:51:11.182000	Carr. 330, Bo. Duey Alto, Parcelas Carolina, San Germán PR, 00683
BPR011724-717	2024-01-17 14:39:07.134000	2024-01-17 14:56:26.476000	Carr. 361, Bo. Caín Alto, San Germán PR, 00683
PR011824-654	2024-01-18 14:03:22.513000	2024-01-18 15:53:51.747000	Carr. 348 Int. Carr. 119, San Germán, PR 00683
BPR011824-810	2024-01-18 15:59:01.076000	2024-01-18 16:30:17.389000	Rosario, San Germán, PR, 00683
BPR012024-421	2024-01-20 10:28:48.140000	2024-01-20 11:51:49.479000	Carr. 348 Km. 15.7, San Germán, PR, 00683
BPR012324-944	2024-01-23 16:11:56.663000	2024-01-23 17:31:34.203000	Carr. 393 Km.1.1 Bo. Hoconuco Bajo, San Germán, PR, 00683
PR012324-952	2024-01-23 16:21:47.141000	2024-01-23 21:33:21.242000	Carr. 114 Km.10.4, San Germán, PR, 00683
PR012524-147	2024-01-25 06:48:18.223000	2024-01-25 08:07:47.118000	Carr. 362 Km. 3.6 Int., Bo. Guamá, Sector Palo Solo, San Germán, PR 00683
BPR020124-1101	2024-02-01 19:37:42.747000	2024-02-01 20:37:51.928000	Carr. 361 Km. 2.8, Bo. Capriles, San Germán, PR, 00683
BPR020424-1120	2024-02-04 23:49:07.749000	2024-02-05 00:23:43.957000	Carr #2 near Pedegral, San Germán, PR, 00683
PR021324-975	2024-02-13 18:12:59.056000	2024-02-13 18:59:20.563000	Carr. 3363 Km. 2.6, Bo. Minillas Alto, San Germán, PR, 00683
BPR021924-57	2024-02-19 02:14:37.276000	2024-02-19 03:19:16.960000	Bo. El Retiro, San Germán, PR, 00683
PR021924-63	2024-02-19 02:24:26.458000	2024-02-19 03:20:20.635000	Urb. Santa Marta, San Germán, PR, 00683
BPR022424-646	2024-02-24 14:12:21.550000	2024-02-24 15:59:17.669000	Carr. 361, Bo. La Calabaza, San Germán PR, 00683
PR032924-631	2024-03-29 15:07:49.903000	2024-03-29 17:18:47.209000	Calle Sirconia, Parcela Minillas, San Germán PR
PR040524-1177	2024-04-05 21:55:32.992000	2024-04-06 08:52:59.896000	Carr. 119 Km. 77.1 Bo. Hoconuco Bajo Camino Tello Irizarry, San Germán, PR 00683
PR053124-1182	2024-05-31 20:40:12.758000	2024-05-31 21:31:54.513000	Carr. 114, Bo Sabana Enea, San Germán PR
BPR092224-333	2024-09-22 10:34:54.490000	2024-09-22 11:44:29.762000	Carr. 362, San Germán 00683 Puerto Rico PR
PR121424-878	2024-12-14 18:50:09.162000	2024-12-14 20:19:54.783000	2.1 R3314, Bo Tuna, San Germán, PR

BPR122924-690	2024-12-29 15:44:35.122000	2024-12-29 16:02:47.866000	Barrio Alcones Camino Monte Bello, San Germán, PR, 00683
PR010724-825	2024-01-07 17:57:15.352000	2024-01-07 20:08:57.344000	Near Cancha Reparto Universidad, San Germán PR
PR010724-826	2024-01-07 17:58:26.345000	2024-01-07 18:14:34.352000	Urb. Reparto Universidad, Calle 2, residencia I-22, San Germán PR 00683
BPR011624-992	2024-01-16 17:24:36.040000	2024-01-16 17:34:12.296000	Carr. 2, Hospital la Concepción, San Germán, PR, 00683
PR011824-655	2024-01-18 14:03:25.654000	2024-01-18 14:19:44.588000	Carr. 348, San Germán, PR
PR012324-421	2024-01-23 10:25:51	2024-01-23 10:34:38.758000	Carr. 119 Km. 0.5 Int. Carr. 393, Bo. Hoconuco Bajo, Sector Las Cojobas, San Germán PR 00683
PR020124-1141	2024-02-01 20:20:35.639000	2024-02-01 20:27:15.801000	Bo. Calabazas, Calle Caín Bajo, San Germán, PR, 00683
PR040524-1179	2024-04-05 21:58:07.424000	2024-04-05 22:06:21.135000	Carr. 119 Km 77.3, Bo. Cain Bajo, San Germán, PR
BPR053124-1178	2024-05-31 20:36:01.059000	2024-05-31 20:42:34.998000	Carr. 114 Int. 317, San Germán, PR, 00683

Source: Puerto Rico Fire Bureau

Additional fire incident data provided by the Puerto Rico Fire Bureau for 2025 and 2026 indicate that fire-related emergencies remain an ongoing concern within San Germán. A review of the records identified approximately eight reported fire incidents during 2025, and more than 30 incidents reported through August 2026. However, the available data set does not distinguish between wildfires, vegetation fires, structural fires, or other fire-related incidents; therefore, the records could not be definitively classified as wildfire events. Despite this limitation, several reported incidents were located along transportation corridors and vegetated areas, including PR-361 (Caín Alto), PR-362 (Guamá), PR-318 (Maresúa), PR-347 (El Coto/Haciendita), PR-101 (Ancones), and PR-396 (Casanga), which are areas that may be susceptible to wildfire occurrence. Due to the uncertainty regarding incident classification, the information is provided for reference purposes and is included in Appendix ____.

4.12.1.5 FUTURE EVENT PROBABILITY (B1-E)

Long-term trends in rain patterns, such as those caused by fluctuations in the El Niño–Southern Oscillation (ENSO), may lead to extended dry periods (CCOF, 2026), reduced soil moisture, and increased vegetation stress. When combined with rising temperatures, these conditions accelerate evapotranspiration and further dry out fuels, significantly increasing the likelihood of ignition and fire spread. As a result, areas that have not historically been prone to wildfires may become increasingly

susceptible under these changing climate conditions.

4.12.2 RISK ANALYSIS (B2-A, B2-B)

4.12.2.1 *ESTIMATED LOSES*

Wildfires can result from both natural conditions, such as the presence of flammable vegetation, and human activities, including the intentional use of fire. These factors strongly influence the potential scale and intensity of wildfire events. The level of potential loss increases with higher population concentrations, greater numbers of structures, and sensitive ecosystems located within the affected area. Climatic conditions, combined with patterns of human activity, largely determine the extent and severity of wildfire impacts.

At present, there is insufficient information to quantify monetary losses related to building damage from this hazard. Additionally, at the time of this Plan update, no official damage estimates were available for the municipality. To address this gap, the municipality will take a proactive approach by incorporating updated damage information in Plan revisions as data become available.

4.12.2.2 *LIFELINES AND CRITICAL INFRASTRUCTURE*

Wildfires pose a significant threat to critical infrastructure, creating cascading impacts across power systems, communications, water supply, transportation, and the built environment. The electric grid is particularly vulnerable. Research from Sandia National Laboratories (Sandia National Laboratories, n.d.) and other institutions shows that wildfire can both damage grid components and be ignited by them, as seen in the 2018 Camp Fire, which caused \$9.3 billion in damages. To address this, the U.S. Department of Energy has invested \$3.46 billion through its Grid Resilience and Innovation Partnerships program (DOE, 2023), funding projects that include undergrounding power lines, installing fire-resistant poles, and deploying advanced sensors.

Communications infrastructure faces similar risks. A study by the University of Wisconsin – Madison faculty found that while cell towers often survive fires physically, power outages lead to widespread service disruptions (Anderson, Barford, & Barford, 2020). Water systems and watersheds are also heavily impacted. Post-fire conditions—such as vegetation loss and soil hydrophobicity—can trigger flooding and

debris flows, introducing sediment, nutrients, and metals into water supplies.

Transportation networks suffer both direct and indirect damage. Roads, bridges, and drainage systems are often compromised by post-fire floods and debris flows. Buildings and other structures in the wildland–urban interface are increasingly at risk due to climate change and urban expansion.

In summary, wildfire creates complex, interconnected risks for critical infrastructure, requiring a combination of engineering solutions, advanced modeling, policy reforms, and community engagement. Official and academic sources consistently call for proactive measures—such as infrastructure hardening, improved land management, and resilience planning—to reduce exposure and enhance recovery.

Wildfire occurs regularly during periods of drought, primarily in the southern region of Puerto Rico. These events have significant social and economic impacts, mainly due to structural and property damage or loss caused by the fires. If the affected area served as an employment or industrial hub, many individuals could face unemployment. Additionally, insurance premiums tend to rise because of increased demand for coverage to mitigate economic losses associated with wildfire hazards. Collectively, these factors negatively affect the region's economy, wildlife, vegetation, and contribute to broader social decline.

Wildfires in San Germán can significantly impact agricultural activities in the Guanajibo Valley by damaging land, infrastructure, and critical resources. In the agricultural sector, fires can destroy crops, pastureland, and irrigation systems, leading to immediate production losses and long-term soil degradation due to the loss of organic matter and increased erosion. Overall, wildfires represent a multi-dimensional threat that can interrupt production, damage critical assets, and create environmental and economic consequences for the municipality.

4.12.2.3 SOCIAL VULNERABILITY

Social vulnerability plays a critical role in shaping how communities experience and recover from wildfire events. Research consistently shows that populations with higher levels of poverty, older adults, individuals with disabilities, limited English proficiency, and households without reliable transportation face greater challenges preparing for, evacuating from, and recovering after wildfires. The CDC/ATSDR Social Vulnerability Index (SVI) identifies these demographic and socioeconomic conditions as key factors that increase susceptibility to disaster impacts, including wildfires, by constraining a

community's adaptive and coping capacity before, during, and after an event. National-scale studies further demonstrate that U.S. communities experiencing wildfire occurrence or exposure tend to have systematically higher levels of social vulnerability, including higher unemployment, lower educational attainment, and greater concentrations of medically or socially dependent populations (Schumann, III, et al., 2024).

Wildfires also exacerbate existing inequalities through indirect impacts such as prolonged displacement, loss of livelihoods, and health effects from smoke exposure. Peer-reviewed studies show that socially vulnerable populations experience disproportionate health burdens from wildfire smoke, including higher rates of respiratory and cardiovascular illness and increased mortality risk, due to pre-existing health conditions and limited access to medical care. FEMA and the U.S. Fire Administration emphasize that older adults, low-income households, people living in mobile homes, and individuals without access to private vehicles face heightened risk of injury or death during wildfire evacuations, underscoring the importance of incorporating social vulnerability into wildfire mitigation, evacuation planning, and recovery strategies. (Dennin, Nock, Muller, Akindele, & Adams, 2025) (Dennin, Nock, Muller, Akindele, & Adams, 2025)

4.12.2.4 NATURAL AND CULTURAL RESOURCES

The severity, scale, and consequences of wildfire can be grouped into the following categories:

- **Impact on Landscape** - The most visible effect after a wildfire is the loss of scenic quality caused by the destruction of vegetation cover and its regression to earlier ecological stages.
- **Impact on Wildlife** - Wildfires have both immediate and long-term effects on fauna. In the short term, fires can cause direct mortality, particularly among invertebrates, small vertebrates, and young animals with limited mobility, as well as larger herbivores and carnivores that may be trapped by flames or barriers such as fencing. In the longer term, habitat loss, reduction of forage, and ecosystem disruption can force wildlife migration and threaten vulnerable or endangered species.
- **Impact on Soil** - Wildfires significantly alter soil structure and increase its susceptibility to erosion. The combustion of organic matter destabilizes soil aggregates, causing progressive disintegration. As a result, solid particles are then removed by rain or wind erosion. Fire often creates hydrophobic (water-

repellent) layers to the deposition of organic compounds and changes in mineral composition, which reduce water infiltration and further accelerate surface runoff and erosion. Significant losses of soil and organic matter reduce nutrient levels, lowering fertility. In addition, heat also kills many organisms, reducing biological activity and disrupting biogeochemical cycles. However, not all effects are negative. Naturally occurring fires (now increasingly rare) can benefit forest health by mobilizing nutrients and controlling pests. Low-intensity fires help retain carbon in the soil, preventing its release as carbon dioxide.

- **Alteration of the Water Cycle** - Wildfire-induced soil degradation can significantly disrupt the hydrological cycle. Reduced infiltration lowers groundwater reserves that feed aquifers essential for agriculture and urban use. At the same time, increased surface runoff accelerates soil erosion, transports sediment into water bodies, and heightens the risk of flash flooding following intense rainfall events.
- **Increase in Carbon Emissions** - The combustion of biomass during wildfires releases substantial quantities of carbon dioxide (CO₂), methane (CH₄), and suspended particles. These emissions cause significant environmental damage and negatively affect people with respiratory illness (Asthma, COPD, etc.).

Wildfires can lead to numerous environmental consequences, including the destruction of vegetation cover, the death or displacement of wildlife, the loss of fertile soil, and an increase in erosion events. They can also cause significant loss of life and property, resulting in substantial economic costs associated with firefighting and recovery efforts.

As for cultural resources, wildfires pose a serious threat to cultural resources, including historic buildings, and archaeological sites. Intense heat and flames can destroy irreplaceable structures, artifacts, and archives, erasing centuries of heritage in a matter of hours. In addition, smoke, soot, and water used during firefighting operations can further damage delicate materials. Post-fire effects such as erosion and flooding after fires may expose or wash away archaeological remains.

Beyond physical damage, the loss of cultural landmarks disrupts community identity and traditions, while also affecting tourism and local economies. Protecting these resources requires proactive planning, fire-resistant measures, and collaboration between emergency agencies and cultural preservation experts.

4.12.2.5 FUTURE CONDITIONS (E1-A)

Puerto Rico already experiences a high annual probability of wildfire-supporting conditions. According to the World Bank-supported ThinkHazard! platform, Puerto Rico's wildfire hazard is classified as High, meaning there is a greater than 50% probability in any given year of weather conditions capable of supporting a significant wildfire that could cause impacts to life or property. This assessment incorporates historical fire occurrence, climate variables, vegetation type, and drought conditions and is widely used in infrastructure and hazard mitigation planning worldwide (World Bank, n.d.).

Taken together, the best available scientific evidence indicates that Puerto Rico currently faces a probability exceeding 50% annually of wildfire-supportive weather conditions, with future probability and severity expected to increase due to rising temperatures, expanded drylands, and longer seasonal droughts. While precise ignition probability percentages cannot be reliably projected at the municipal scale, confidence is high that wildfire occurrence, fire weather days, and burned area will increase by mid-century, particularly in southern, western, and interior regions of the island (World Bank, n.d.).

4.13 PANDEMIC/EPIDEMIC

4.13.1 DESCRIPTION (B1-A)

An epidemic occurs when the incidence of a disease or health-related event rises suddenly and significantly above what is expected in a specific community or region. According to the CDC, an epidemic represents a sudden increase in cases over the normal baseline in a population, and outbreaks—often used interchangeably—refer to such events in more limited geographic areas (CDC, 2012).

A pandemic is essentially an epidemic that has expanded to span multiple countries or continents, affecting a large portion of the global population. The CDC describes it as an epidemic with broad geographic spread, while the World Health Organization defines it as the worldwide transmission of a new disease to which people generally have little or no immunity (CDC, 2012).

These terms emphasize both the magnitude of cases and their geographical distribution: an epidemic is localized, but a pandemic reaches across international borders and impacts global public health systems. Consequently, emergency

response strategies must escalate accordingly—from targeted regional interventions during epidemics to coordinated global action in pandemics.

4.13.1.1 AFFECTED AREA (B1-B)

This LHMP considers that all areas of the municipality are equally vulnerable to the Pandemic/Epidemic Hazard.

4.13.1.2 RISK MAGNITUDE (B1-C)

Although all these events can result in loss of life and economic disruption, to distinguish between the following terms:

- Epidemic: refers to a sudden increase in the number of disease cases beyond what is normally expected within a specific population and geographic area.
- Outbreak: shares the same definition as epidemic but is typically used for a more localized area.
- Cluster: describes a grouping of cases in a particular place and time that appears to exceed the expected number, even if that expected number is unknown.
- Pandemic: refers to an epidemic that has spread across multiple countries or continents, usually affecting a large population (CDC, 2012).

4.13.1.3 PAST EVENTS (B1-D)

The following table listing epidemics and pandemics in Puerto Rico has been collected from various sources. This list does not intend to be exhaustive:

Table 40. Pandemics and Epidemic in Puerto Rico 1855 – 2020

Disease	Date	Classification	Description
Cholera Epidemic	1855 – 1856	Epidemic	Between 1855 and 1856, Puerto Rico suffered a major cholera outbreak that claimed over 25,820 lives, representing approximately 4–10% of the island's population at the time. (Vega Lugo, 2021)
Measles and Malnutrition	1917 – 1918	Epidemic	A severe measles outbreak occurred between 1917 and 1918, resulting in

			nearly 9,000 cases and approximately 2,000 deaths. High infant mortality—59% of deaths within six months were in children under two—was driven by malnutrition and poor living conditions (Rigau-Pérez & Vallejo - Calzada, 2020).
Spanish Flu (A/H1N1 influenza pandemic)	1918 - 1919	Pandemic	Puerto Rico was affected by the global A/H1N1 influenza pandemic, also known as the Spanish flu. Beginning around June 1918, community spread produced as many as 1,000 cases in four days in areas like Puerta de Tierra. Misdiagnosis as dengue initially obscured the true impact (Rosario Urrutia, 2021).
Poliomyelitis	1960	Epidemic	The 1960 polio epidemic in Puerto Rico was the most severe paralytic polio outbreak in the Western Hemisphere at the time. It impacted 68 of 76 municipalities, causing 495 cases of paralysis, predominantly among school-age children (Timothee, Morris, Filiberti, & Mainardi, 1963).
Dengue	2013, 2024	Outbreak	Dengue is endemic in Puerto Rico, with significant outbreaks occurring in 2013 and again in 2024. The 2024 outbreak triggered a public health emergency, with 6,291 confirmed cases, a 4.2% rate of severe dengue, and 11 deaths reported (Rodríguez, et al., 2024) (Ware-Gilmore, et al., 2025)
Chikungunya	2014	Epidemic	The first locally acquired chikungunya case in Puerto Rico was confirmed on May 5, 2014, triggering expanded surveillance efforts using Puerto Rico's dengue infrastructure. Between May 5 and August 12 of that year, 10,201 suspected cases (approximately 282 per 100,000 residents) were reported, of which 1,975 (68%) were laboratory-confirmed. During this period, four deaths were also recorded. (Sharp, et al., 2014)

Zika	2015 – 2016	Epidemic	The first locally transmitted Zika case in Puerto Rico was reported in December 2015. By April 2016, over 6,000 suspected cases had been evaluated, with 683 confirmed cases. Pregnant women and related neurological issues (e.g., Guillain-Barré syndrome) were of particular concern. (Thomas, et al., 2016) (Dirlikov, et al., 2016)
COVID – 19	2020 – 2022	Pandemic	See narrative below

COVID – 19 Pandemic

Puerto Rico confirmed its first COVID-19 case—a European tourist—on March 8, 2020, leading the governor to declare an emergency on March 12 and implement early measures including airport screening and mandatory isolation, as outlined in the Puerto Rico Department of Health’s epidemic situation reports (PRDH, 2022), (COR3, n.d.). By April 6, 2022, official data reported 270,485 confirmed cases and 4,171 deaths due to COVID-19 in Puerto Rico, according to detailed government spreadsheets and dashboards maintained by the Puerto Rico Health Department (PRDH, 2022), (COR3, n.d.).

The municipality experienced significant economic and social disruptions. A Bayesian analysis revealed a clear causal relationship between rising COVID-19 infections and increased unemployment, and engineering studies from the University of Puerto Rico–Mayagüez estimated that unemployment soared above 17%, also noting elevated operating costs for businesses due to personal protective equipment (PPE) and safety measures (Hernández – Padilla & Méndez-Piñero, 2020).

Subsequent public health research revealed widespread mental health consequences. One study found that 31% of healthcare workers scored in the range of depressive symptomatology following combined stress from prior disasters (e.g., hurricanes) and the pandemic; another identified high levels of anxiety (26.9%) and stress (69.9%) among physicians during the second COVID-19 wave (Hernández – Torres, et al., 2023), (Sánchez – Plazas, García – De Jesús, Martínez – González, Amaya – Ardila, & Almodóvar – Rivera, 2024).

4.13.1.4 FUTURE EVENTS PROBABILITY (B1-E)

Puerto Rico's susceptibility to future pandemics or epidemics is underscored by its subtropical climate, population distribution, and healthcare infrastructure. A university-developed emergency preparedness model—commissioned by Puerto Rico's Department of Health—simulated influenza pandemics and demonstrated how variations in disease transmissibility, healthcare capacity, and mitigation efforts can significantly influence outbreak trajectories and the likelihood of healthcare system overload. Furthermore, the U.S. Department of Health and Human Services' Hospital Preparedness Program (HPP) in Puerto Rico operates under the Assistant Secretary for Preparedness and Response, with coordinated health care coalitions and special pathogen systems explicitly designed to reduce pandemic risk by strengthening surge capacity and infection-control readiness. These combined efforts reflect a data-driven recognition that, without sustained investment in public health infrastructure and preparedness modeling, Puerto Rico remains at an elevated probability for experiencing another epidemic or pandemic (Hirsh & Centeno - Marín, 2015),(ASPR, n.d.)

4.13.2 RISK ASSESSMENT (B2-A, B2-B)

4.13.2.1 ESTIMATED LOSSES

The COVID-19 pandemic resulted in significant mortality across Puerto Rico, underscoring the importance of public health hazards in local mitigation planning. Official data from the Puerto Rico Department of Health indicate that COVID-19 mortality is tracked through an epidemiological surveillance system that compiles death certificate data and case investigations and is made publicly available through government data portals. At the territorial level, thousands of deaths have been attributed to COVID-19 since 2020, as reported in official datasets and federal summaries. However, cumulative mortality totals for individual municipalities, including San Germán, revision are not consistently published as single static figures in official reports. Instead, municipality-level death counts must be obtained by querying downloadable datasets provided by the Puerto Rico Department of Health, which allow users to filter results by municipality.

These datasets are considered provisional and subject to due to reporting delays and ongoing validation of death records, as acknowledged by public health authorities. Consequently, while San Germán-specific COVID-19 mortality was not recorded as

fixed published figure. Based on the currently available data, the total number of COVID-19-related deaths in San Germán cannot be reliably determined.

4.13.2.2 LIFELINES AND CRITICAL INFRASTRUCTURE AND LIFELINES

In the event of a pandemic or epidemic, the most significantly affected lifeline is typically the healthcare and medicine lifeline. During widespread disease outbreaks, hospitals, clinics, and other healthcare facilities often face overwhelming demand for services. Surges in patient volume can exceed system capacity, leading to shortages of personal protective equipment (PPE), critical medical devices (such as ventilators during COVID-19), hospital beds, and qualified medical personnel. As resources are redirected to address the immediate public health emergency, non-urgent and even some essential non-related medical services may be postponed or delayed. Additionally, mortality management systems—including morgues, funeral services, and vital records processing—may experience severe strain during periods of elevated death rates.

However other lifelines can be affected such as the Food, Hydration and Shelter Lifeline, due to increase food insecurity from unemployment and economic shutdowns or closed or reduced shelters due to infection control requirements. The Safety and Security Lifelines can be affected by high absenteeism due to illness, quarantine or caregiving responsibilities and increase levels of stress and burnout among first responders and law enforcement officers.

Other lifelines and critical infrastructures can be affected by increased demand, like increased residential water demand) or the lack of trained personnel to maintain existing operations.

4.13.2.3 SOCIAL VULNERABILITY

For this hazard, the whole population of San Germán is considered equally vulnerable. Nonetheless besides factors of age and poverty, the 2019 - 2024 ACS shows that a total of 1,541 people in San Germán did not have health insurance coverage (US Census Bureau, 2025). This means that 5.0% of the total population of San Germán is uninsured.

Table 41 shows the breakdown of uninsured people in San Germán according to the 2020 - 2024 ACS.

Table 41. Number of People in San Germán without Healthcare Coverage

Age Cohort	4.13.2.4 NUMBER OF PEOPLE UNINSURED
Under 6 years	0
6 to 18 years	44
19 to 25 years	218
26 to 34 years	156
35 to 44 years	314
45 to 54 years	376
55 to 64 years	201
65 to 75 years	221
75 years or older	11

Source: US Census 2020–2024 American Community Survey

As it can be seen, the greatest amount of uninsured persons are in the 35 –44 (314 individuals) and 45–54 (314 individuals) year old groups.

4.13.2.5 NATURAL AND CULTURAL RESOURCES

The scientific literature shows that the COVID-19 Pandemic produced mixed environmental outcomes. While temporary lockdowns initially led to short-term improvements in air quality and reductions in greenhouse gas emissions in many regions, broader evidence suggests that the pandemic also generated significant negative environmental impacts.

These impacts included increased pollution from the widespread use of personal protective equipment, deforestation, illegal poaching and logging, overfishing, and disruptions to conservation programs and projects. The findings also note that the spread of pandemics may be intensified by environmental pollution and rapid global population growth (Muche, Yemata, Molla, Muasya, & Tsegay, 2022) (Guo & Lee, 2021).

At the same time, despite these adverse impacts, the period of reduced human activity—often referred to as the *anthropause*—also produced several positive effects on natural resources. These included short-term reductions in indoor and outdoor air

pollutants including PM_{2.5}, PM₁₀, NO₂, SO₂, CO, and CO₂, as well as a decrease in noise pollution from ships, boats, vehicles, and aircraft. Collectively, these changes benefited aquatic ecosystems and water quality, influenced bird behavior, supported wildlife biodiversity, and contributed to temporary ecosystem recovery (Muche, Yemata, Molla, Muasya, & Tsegay, 2022).

When it comes to cultural and heritage sites, a report from UNESCO notes that the crisis has produced both negative and positive effects across different types of World Heritage properties (UNESCO, 2021). The sudden cessation of travel and tourism disrupted visitor flows and eliminated a critical source of revenue for many sites, where tourism income is essential to supporting conservation activities, routine maintenance, and staff salaries. Local communities surrounding these properties were similarly affected, with widespread loss of employment and income.

Conversely, in some cases, the reduced level of human activity enabled rehabilitation and restoration efforts to proceed more efficiently, while anthropogenic pressures were temporarily reduced across many natural areas. This contrast highlights the diverse and uneven impacts of the crisis on World Heritage properties. At the same time, it highlights opportunities to build upon the environmental benefits observed during reduced activity periods, while advancing targeted research, sustainable tourism strategies, and long-term recovery planning (Guo & Lee, 2021) (Guibert & Hyde, 2021), (UNESCO, 2021).

4.13.2.6 FUTURE CONDITIONS (E1-A)

Puerto Rico faces structural and environmental conditions that elevate its exposure and vulnerability to future pandemics relative to many mainland U.S. locations. As a tropical island with high population density in urban corridors, frequent international travel, and climatic conditions favorable to vectors and pathogens, Puerto Rico is particularly susceptible to emerging and re-emerging infectious diseases, especially those with zoonotic or vector-borne origins. The CDC and peer-reviewed research document ongoing transmission of diseases such as dengue and previous outbreaks of Zika and Chikungunya, demonstrating the island's continued exposure to pathogens with outbreak and epidemic potential. This exposure holds regardless of the development pattern of the municipality.

4.14 HAZARD PRIORITIZATION

After receiving feedback from the public and stakeholders (see Section 2.6–2.7) along with their own expertise the planning committee has determined that the following is the prioritization for the hazard discussed in this LHMP.

Table 42. Hazard Priorization

Hazard	Priority
Earthquake	High Priority
Landslide	High Priority
Flooding	High Priority
Tropical Cyclones/Extreme Winds	High Priority
Extreme Heat	High Priority
Drought	High Priority
Wildfire	High Priority
Pandemic/Epidemic	Mid Priority

During the public participation activities, the participants were asked also to prioritize the natural hazards.

Thee result from that exercise was.... *(it shall be completed once the public participation activities are completed)*.

4.15 PLANNING MECHANISM

Understanding and recognizing regulatory and planning capacities enables more effective management of land use and economic growth. These capacities consist of the legal frameworks and public policy provisions that influence land use to guide sustainable development, while also supporting actions that mitigate the vulnerability of communities and their resources to natural hazards.

Besides the Public Policies already discussed in Section 1.1, what follows is a list in chronological order of enactment of the regulatory and planning mechanisms available to the municipality for the implementation of this LHMP.

4.15.1 KARST SPECIAL PLANNING AREA PLAN AND REGULATION (PRAPEC, BY ITS SPANISH ACRONYM) – 2014)

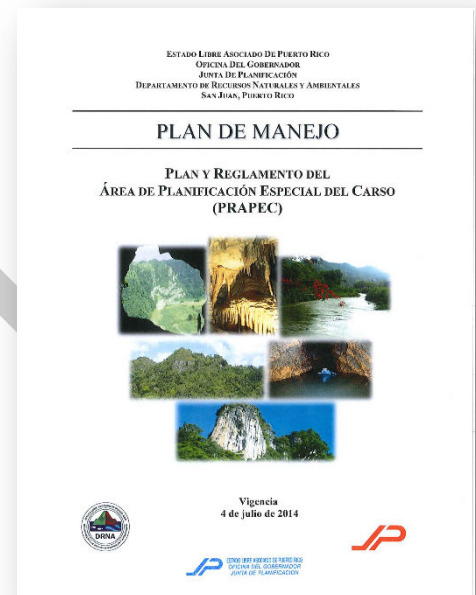
In compliance with Act 292-1999, this plan and regulation establish two overlayed districts in the karst zones of Puerto Rico. The Restricted Karst Special Planning Area (APE-RC) overlayed district aims to protect the land within the Restricted Karst Area. According to Act 292-1999, lands under this district cannot be used for the extraction of materials from the earth's crust, except in cases where such activities had already been recognized by the competent authorities at the time of the adoption of PRAPEC. Additionally, the APE-RC imposes other restrictions, such as prohibitions on subdivision in certain underlying districts.

On the other hand, the Special Planning Area for the Karst Zone (APE-ZC) overlayed district includes lands within the karst physiography that are not part of the APE-RC. Its purpose is to allow the extraction of materials from the earth's crust for commercial purposes under appropriate conditions, in areas of the karst zone that are not within the APE-RC, and to address lands that, although part of the karst physiography, are not included in the restricted area.

4.15.2 JOINT REGULATION FOR THE EVALUATION AND ISSUANCE OF PERMITS RELATED TO DEVELOPMENT, LAND USE, AND BUSINESS OPERATIONS (2023)

The Joint Regulation for the Evaluation and Issuance of Permits Related to Development, Land Use, and Business Operations (*Reglamento Conjunto* in Spanish) is a regulatory instrument created by the Planning Board in compliance with Law No.

Figure 24. PRAPEC Coversheet



161, as amended. Its main purpose is to regulate land use, territorial planning, and the granting of permits related to development, construction, and business operations within a uniform and centralized framework. The Joint Regulation aims to harmonize public policy on land use planning with the principles of sustainable development, seeking a balance between economic growth, environmental protection, and social well-being. This regulation establishes the rules to classify land, define zoning districts, regulate zoning, and determine the permitted uses in each category. Additionally, it sets the procedures to evaluate projects, issue permits, and monitor compliance with the applicable provisions. Its purpose is to provide a uniform regulatory framework for the evaluation and issuance of permits, ensure the proper use of land, protect natural resources, and facilitate economic development under criteria of competitiveness and sustainability, integrating planning with permit management.

Figure 25. Joint Regulation Cover



Of particular importance in the Joint Regulation is the zoning district *Distrito de Riesgo para Espacios Abiertos* – Open Space (RE-A).¹⁸ The RE-A zoning district is established to identify lands designated as open space in accordance with federal regulations (44 CFR Part 80) or another federal program, due to the presence of a risk condition resulting from a natural event. These spaces may include, but are not limited to, severe flooding and landslides. There are conditions in these areas that are unfavorable or harmful to health, safety, or general welfare, and there may be a risk of loss of life and property. Land within this district may be susceptible to one or more of the identified hazards.

The purpose of the district is to preserve the open space condition established in perpetuity by federal regulation, which the government or the community must uphold, with the objective of protecting health, life, and property; preventing severe losses and repetitive use of affected properties; reducing the investment of public and federal funds in mitigation; and limiting rescue efforts, among other goals.

¹⁸ Joint Regulation Rule 6.1.30

4.15.3 SPECIAL FLOOD HAZARDS AREAS REGULATION (2021)

The 2021 regulation was adopted by the Puerto Rico Planning Board under its authority from Public Law No. 75 of 1975 and Public Law No. 3 of 1961 to control development in flood-prone zones. It aligns Puerto Rico's floodplain management requirements with the minimum standards of the National Flood Insurance Program (NFIP), administered by FEMA. The regulation establishes updated criteria for construction, land use, and development within Special Flood Hazard Areas (SFHAs), including requirements such as elevating structures above Base Flood Elevation and submitting technical certifications. It applies to new construction, substantial improvements, and land-use changes across designated flood zones such as AE and VE, using FEMA Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FIS) for zone identification. The revision clarifies and expands regulatory provisions to enhance public safety and prevent harmful development in high-risk areas.

4.15.4 PUERTO RICO BUILDING CODE

The Puerto Rico Building Code sets minimum requirements for the design, construction, modification, and upkeep of buildings to ensure the safety, health, and well-being of the public. It is derived from nationally and internationally recognized model codes and is updated periodically to incorporate improvements in construction practices and lessons learned from past hazard events. The code includes provisions addressing structural safety, fire protection, accessibility, energy conservation, and resistance to natural hazards such as earthquakes, hurricanes, floods, and strong winds. Adherence to the Building Code is mandatory for all new construction and substantial renovations throughout Puerto Rico. Enforcement is carried out through local permitting, planning review, and inspection processes to verify compliance with established standards. Overall, the Puerto Rico Building Code is a key instrument for advancing resilient, safe, and sustainable development across the island.

4.15.5 REGULATION FOR THE DESIGN, OPERATION CRITERIA AND MAINTENANCE OF STORMWATER SYSTEMS IN PUERTO RICO

Figure 26. Regulation 40 Cover



Adopted in 2023 as Planning Regulation No. 40, this regulation updates and replaces the island's outdated 1975 standards to address current engineering practices, environmental considerations, and increased flood risk. The regulation is designed to provide developers, engineers, contractors, and municipalities with modern technical criteria for designing, operating, and maintaining public and private stormwater systems, incorporating updated scientific knowledge and methodologies necessary for managing stormwater infrastructure under present-day conditions. Its objectives include minimizing flood-related damage, improving the capture and management of runoff, reducing impacts to water resources and ecosystems, and

supporting safer, more resilient community development. The regulation integrates risk management principles and aligns with Puerto Rico's climate adaptation policies, requiring consideration of urban flooding, karst hydrology, low-impact development practices, and stormwater control structures such as retention and detention systems. It also establishes minimum design considerations for all land development projects and provides a comprehensive framework for planning, monitoring, and maintaining stormwater systems across the island.

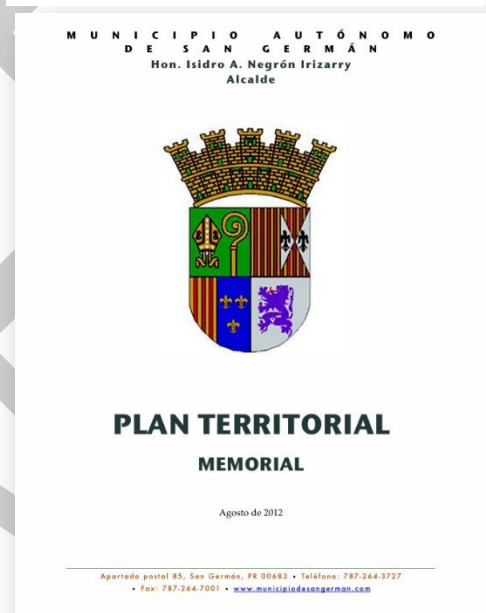
4.15.6 SAN GERMÁN LAND USE PLAN (2012)

As per the Municipal Code, the Municipality of San Germán is in the process of updating their Territorial Plan. The Territorial Plan (PT, by its Spanish acronym) is a strategic and comprehensive tool for organizing land use within a municipality. This plan covers, at a minimum, the entire municipal area and aims to define the essential elements of such organization, as well as establish a program for its development and implementation, including its validity period.

The 2012 version of San Germán's PT is currently being updated to:

- Incorporate policies, strategies, and recommendations from land-use planning instruments approved by the Planning Board (JP) after the last review of the PT.
- Include provisions from recently approved or amended statutes.
- Review the municipal socioeconomic context based on recent population trends.
- Integrate information on policy and plan changes resulting from Hurricanes Irma and María in Puerto Rico.
- Include topics of mitigation, adaptation, and climate change resilience in public policy and state, sectoral, and municipal planning.
- Reflect the vision of the municipal administration and its citizens regarding the physical and socioeconomic development of San Germán.
- Adjust local land uses according to current and future context and needs.

Figure 27. San Germán Land Use Plan Cover Page



4.15.7 SAN GERMÁN EMERGENCY OPERATION PLAN

This Emergency Operation Plan (EOP) describes how emergency operations are structured through the Incident Command System, enabling unified command and efficient allocation of resources. It details the activation levels of the Municipal Emergency Operations Center, which escalates from routine monitoring to full 24/7 multi-agency disaster response. The municipality highlights the importance of

interagency collaboration, including coordination with state and federal agencies when local capabilities are exceeded. Community involvement, public information, and support for vulnerable populations—such as individuals with disabilities, children, and the elderly—are essential components woven into all phases of emergency management. Additionally, the plan incorporates long-term recovery strategies, emphasizing damage assessments, restoration of critical services, and alignment with federal assistance processes. Ultimately, it presents a structured, community-centered approach to ensure San Germán can respond to, withstand, and recover from a wide range of emergencies.

4.15.8 NATIONAL FLOOD INSURANCE PROGRAM

The National Flood Insurance Program falls within the category of planning mechanisms, as it imposes certain floodplain management requirements. FEMA provides flood insurance to communities that are following the NFIP criteria. This includes adopting and enforcing floodplain management practices that promote appropriate development in these flood-prone areas.

The National Flood Insurance Program of the Federal Emergency Management Agency allows homeowners, business owners, and renters in participating NFIP communities to purchase federally backed flood insurance. This insurance provides assistance to help cover the costs of repairing damage caused by flooding to buildings and their contents. This is an insurance program established to help property owners, renters, and businesses recover more easily and at a lower cost. Likewise, the program aims to reduce the impact of flooding on both public and private structures. These efforts help mitigate the effects of flooding on new and improved structures within each community.

The NFIP has several components, including:

- Floodplain management — for which the community must adopt and enforce measures for managing flood-prone lands in accordance with NFIP regulations;
- The preparation of Flood Insurance Rate Maps (FIRMs); and
- Flood insurance.

The Municipality of San Germán has a collection of FIRM maps that can be consulted to determine whether your property is in a high-risk area or in a low- to moderate-risk zone. FIRMs refer to the official map developed and approved by FEMA and adopted by the Puerto Rico Planning Board to designate areas at risk of a 100-year flood (or a

1% annual chance of occurrence). In addition, these maps serve as a tool for managing special areas due to their susceptibility to flooding events.

While the Write Your Own Program (WYO) began in 1983 as a partnership between insurance companies and FEMA. This arrangement allows property and casualty insurance companies to underwrite and service federal flood insurance policies in their own company name. A key feature of this type of policy is that all companies participating in the WYO program provide the same coverage, and their rates must comply with NFIP rules and regulations.

Communities, for their part, adopt and require compliance with the NFIP's minimum standards for construction and development in designated Special Flood Hazard Areas. However, many communities seek to achieve a higher level of safety and protection for their residents beyond the NFIP minimum standards. For this purpose, communities have the option of participating in the NFIP's Community Rating System (CRS), which allows them to obtain reductions in flood insurance premiums.

This is because the CRS recognizes additional community efforts to: 1) Reduce flood damage to insurable property; 2) strengthen and support NFIP insurance provisions; and 3) encourage a comprehensive approach to floodplain management. These additional efforts provide residents with greater safety, reduce property damage, enhance community resilience, and promote a better quality of life. The municipality's participation in the NFIP will be discussed in Section 6.6

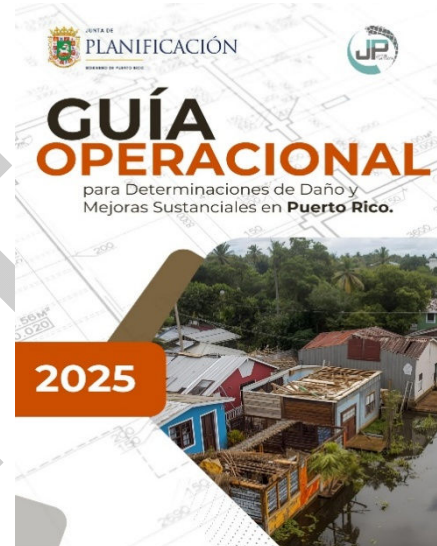
4.15.9 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)

The NPDES is a program authorized under the United States Clean Water Act and administered by the Environmental Protection Agency (EPA). This program requires Municipal Separate Storm Sewer Systems (MS4s) to obtain a permit for the discharge of stormwater into water bodies. In the case of Puerto Rico, the EPA issued a general permit in 2016, under which municipalities can obtain coverage by submitting a Notice of Intent (NOI) and adopting a Stormwater Management Program (SWMP). If any of the mitigation measures listed in Section 6.5 modify the NOI or the SWMP, they will be properly amended.

4.15.10 OPERATIONAL GUIDELINES FOR DETERMINING DAMAGES AND SUBSTANTIAL IMPROVEMENTS IN PUERTO RICO (2025)

The Floodplain Administrator or the Participating Community may review, require, and audit permits in accordance with the provisions of Act No. 3 of September 27, 1961, known as the “Floodplain Building Control Act”; Act No. 75, the “Puerto Rico Planning Board Organic Act”; Act No. 161 of December 1, 2009, as amended, the “Puerto Rico Permit Process Reform Act”; and Act No. 38 of June 30, 2017, the “Uniform Administrative Procedure Act of the Government,” as amended, and in compliance with the regulations of the National Flood Insurance Program (NFIP) of the Federal Emergency Management Agency (FEMA), Title 44 of the Code of Federal Regulations (CFR), Part 60.3 [d, e, and Subpart B], and its related sections.

Figure 28. Operational Guidelines



As of the effective date of this guidance, an evaluation of substantial damage or substantial improvement will be required as part of the permitting requirements in Special Flood Hazard Areas. The Floodplain Administrator will require that both new structures and substantial improvements be constructed in a manner that minimizes or prevents damage during a regulatory flood.

4.15.11 GREEN INFRASTRUCTURE AND NATURE BASED SOLUTIONS

Section 502 of the United States Clean Water Act defines green infrastructure as the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvesting and reuse, or landscaping to store, infiltrate, or evapotranspiration stormwater and reduce flows to sewer systems or surface waters.

Green infrastructure is a cost-effective and resilient approach to managing wet weather impacts that provide many benefits to the community. While conventional single-purpose gray stormwater infrastructure (such as pipe drainage and water treatment systems) is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while providing environmental, social, and economic benefits.

Stormwater runoff is a major cause of water pollution in urban areas. When it rains on rooftops, streets, and parking lots in cities and suburbs, the water cannot soak into the ground as naturally would. Instead, stormwater drains through gutters, storm sewers, and other collection systems and is discharged into nearby water bodies. This runoff carries trash, bacteria, heavy metals, and other pollutants from the urban landscape. Higher flows resulting from heavy rainfall can also cause erosion and flooding in urban streams, damaging the environment, property, and infrastructure.

When rain falls in undeveloped natural areas, the water is absorbed and filtered by soil and vegetation. Stormwater runoff is cleaner and less problematic. Green infrastructure uses vegetation, soils, and other elements and practices to restore some of the natural processes needed to manage water and create healthier urban environments. At the municipal scale, green infrastructure is a network of natural areas that provide habitat, flood protection, cleaner air, and cleaner water. At the neighborhood, development, or sector scale, managing stormwater systems in a way that mimics natural processes help absorb and store runoff that can otherwise cause localized flooding (EPA, 2019).

Some green infrastructure measures that may be considered to mitigate flooding problems include:

- Rainwater harvesting
- Rain gardens (bio-retention/bio-infiltration)
- Urban rain gardens (“planter boxes”)
- Bioswales
- Porous pavements
- Green streets
- Green parking lots
- Green roofs
- Land conservation
- Creation or maintenance of urban tree canopy
- Wetland restoration
- Riparian area rehabilitation
- Sand dune restoration, among others.

The Municipality will consider green infrastructures measures when developing or championing flood control measures with the state or the federal government. In addition to flood control, green infrastructure provides benefits such as improved water quality, enhanced water supply, reduced stormwater management costs

(public and private), improved habitat quality, increased spaces for recreation and physical activity, job creation in the maintenance of natural areas, and increased property values (EPA, 2019).

4.15.12 FOUR – YEAR INVESTMENT PROGRAM

The Four-Year Investment Program 2022–2023 to 2025–2026 (hereinafter, the PICA) is a short- and medium-term planning instrument designed to guide, coordinate, and direct public investments during the period it covers. Through this instrument, the Planning Board integrates the efforts of various government entities aimed at improving the quality of life of the people of Puerto Rico, in line with established public policies.

The Framework of Reference for the Four-Year Investment Program for the period 2022–2023 to 2025–2026 guides agencies and public corporations in preparing their investment and capital improvement programs. The framework includes a demographic and socioeconomic profile of Puerto Rico as a whole and by regional organization, a diagnosis of the recent performance of the economy, and information on development patterns and priority projects for the competitive Puerto Rico to which all aspire.

The full PICA document for the 2022–2023 to 2025–2026 period incorporates all information on capital improvement projects to be carried out by government entities. It includes a detailed analysis of the distribution of recommended resources by program areas and the origin of those resources. This analysis is the result of an integration process designed to guide budget recommendations formulated by the Office of Management and Budget regarding the Annual Capital Improvements Program included in Puerto Rico's budget.

This program serves as a short- and medium-term planning tool to guide, coordinate, and direct public investments during its period of effectiveness. It uses Puerto Rico's demographic and socioeconomic profile, along with a regional analysis as established by the Planning Board (JP, 2022).

With respect to the municipality's Hazard Mitigation Plan, the PICA is used to integrate information on the current performance of Puerto Rico's economy, including data on public debt and development trends, as well as projects designated as priorities for implementation on the Island. Within this framework, the PICA provides municipalities

with information from government entities regarding funding allocations and investments in improvements they are responsible for implementing, which contribute to municipal efforts to mitigate natural hazards.

As part of the projects influencing all Functional Areas of Puerto Rico, the review of municipal Mitigation Plans is included. The Planning Board was designated by the Government Authorized Representative (GAR) as the agency responsible for reviewing and developing Hazard Mitigation Plans in coordination with the 78 municipalities¹⁹.

¹⁹ GAR function is currently held by COR3

5. MUNICIPAL CAPACITIES

5.1 REGULATORY AND PLANNING CAPACITIES (C1-A)

Understanding and recognizing regulatory and planning capacities enables more effective management of land use and economic growth. These capacities consist of the legal frameworks and public policy provisions that influence land use to guide sustainable development, while also supporting actions that mitigate the vulnerability of communities and their resources to natural hazards.

Discussion of the Regulatory and Planning Capabilities of the municipality have been already discussed as part of Section 4.11

5.2 TECHNICAL AND ADMINISTRATIVE CAPACITIES (C1-A)

The Municipality of San Germán is well staffed to implement this LHMP. The Municipality has fully staffed office of Planning and Land Use. Copy of this municipal organigram can be found as part of Appendix E.

Table 43 shows the Municipality's Technical and Administrative Capacity

Table 43. Municipal Technical and Administrative Resources

Personnel Team / Resources	Yes	No	Future Positions	Department or Agency	Opportunities to Integrate into LHMP	Comments
Planners with experience in land use and mitigation	YYes		N/A	Office for Planning and Land Use	This office can support the municipality in minimizing development in lands expose to natural hazards.	N/A

Personnel Team / Resources	Yes	No	Future Positions	Department or Agency	Opportunities to Integrate into LHMP	Comments
Engineers or professionals trained in construction practices related to buildings and infrastructure		No	Through contract services if needed	N/A	N/A	Currently the municipality does not have this staff. If the need arises this position will be procured by external professional services.
Planners or engineers with a broad understanding of natural hazards		No	Through contract services if needed	N/A	N/A	Currently the municipality does not have this staff. If the need arises this position will be procured by external professional services.
Emergency Manager	Yes		Director of the Municipal Emergency Management Office	Municipal Emergency Management Office, Department of Public Safety	The LHMP may be used to update the EOP	N/A
Scientists familiar with natural hazards		No	Through contract services if needed	University of Puerto Rico, Puerto Rico Seismic Network, other universities in Puerto Rico		Currently the municipality does not have this staff. If the need arises this position will be procured by external professional services.

Personnel Team / Resources	Yes	No	Future Positions	Department or Agency	Opportunities to Integrate into LHMP	Comments
Personnel with expertise or education regarding the vulnerabilities and natural hazards affecting the community	Yes		Community Representative	N/A	N/A	Municipal personnel provide direct experience and local expertise in hazard mitigation, emergency response, and disaster recovery.
Resource development staff or grant writers	Yes		Director of Municipal Federal Programs	Municipal Federal Programs Office	This staff may write and administer grants to cover the mitigation strategies mentioned below.	N/A

5.3 FINANCIAL CAPACITY (C1-A)

Access to federal funds and grants is necessary to implement the mitigation strategies to be included in this LHMP. The 2024 Basic Financial Statement highlights the following:

- “Government -wide: Total assets and deferred outflows of the Municipality (total primary government) exceeded its total liabilities and decreased inflows of resources at the close of fiscal year 2024 Government activities revenues decreased 4% while expenses increased by 8% compared with the prior fiscal year.
- “A positive net change in fund balances of the Municipality’s governmental funds of \$3,386,566 in fiscal year 2024 resulted in ending funds balances of \$11,723,267, increasing 47% with respect to 2023 year.” For the fiscal year 2024, the General Fund reported an excess of revenues and other financing resources over expenditures and other financing uses of \$1,502,233.”
- “On a budgetary basis, actual revenues and other financing sources exceed actual expenditures and other financing uses by \$1,482,766.”

The Municipality has successful track record administrating federal funds from various funding streams and has a dedicated office to administer and supervise the use of federal funds, and when any finding has been identified by grant – providers it has been addressed and corrected.

5.3.1 FEMA FUNDING STREAMS

For hazard mitigation projects the municipality has identified the following FEMA – administered possible funding streams which it could draw from.

Stafford Act – Section 404

Section 404 refers to Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, which authorizes the Hazard Mitigation Grant Program (HMGP), administered by FEMA. Its primary purpose is to reduce future disaster losses by funding long-term mitigation projects after a major disaster is declared.

Under Section 404, funding is made available to states, territories, tribes, and local governments to implement mitigation measures that lessen the impacts of future hazards such as floods, earthquakes, hurricanes, wildfires, and droughts. Unlike Section 406, Section 404 projects do not have to be tied to facilities that were damaged by the declared disaster. This allows communities to take a proactive approach by investing in mitigation actions that address known risks before damage occurs.

Eligible projects under Section 404 may include activities such as elevation or acquisition of flood-prone structures, drainage improvements, seismic retrofits, safe rooms, wildfire mitigation measures, and hazard mitigation planning. Projects must be cost-effective, technically feasible, and consistent with an approved Hazard Mitigation Plan. The program typically provides up to 75 percent federal funding, with the remaining share provided by non-federal sources.

Under Section 404 is also the Hazard Mitigation Grant Program (HMGP) that can support plan development, data collection, risk assessments, and engagement activities required to maintain FEMA approval following a presidential disaster declaration.

Stafford Act – Section 406

Section 406 of the Stafford Act supports mitigation projects by allowing hazard-mitigation measures to be incorporated directly into the repair or replacement of public facilities damaged during a declared disaster. This provision enables communities to strengthen damaged infrastructure against future hazards, such as elevating flood-damaged buildings, reinforcing structures to withstand high winds, or improving drainage systems during repairs. Mitigation measures funded under Section 406 must be cost-effective and directly related to the damaged facility. By integrating mitigation into recovery activities, Section 406 helps reduce the likelihood of repetitive damage and future repair costs. Overall, it ensures that rebuilding efforts contribute to long-term resilience rather than simply restoring pre-disaster conditions.

Stafford Act – Section 428

Section 428 of the Stafford Act can support mitigation projects by allowing communities to integrate hazard-resilient and risk-reduction measures directly into disaster recovery projects funded through FEMA's Public Assistance Program. Through its alternative procedures, Section 428 enables flexible project design, fixed-cost funding, and consolidation of damaged facilities, making it easier to incorporate mitigation improvements such as relocation, elevation, floodproofing, or structural hardening. Applicants may also reinvest cost savings from efficiently managed projects into additional mitigation features, if project objectives are met. By emphasizing outcomes rather than strict cost reimbursement, Section 428 encourages rebuilding that reduces future risk rather than simply restoring pre-disaster conditions. This approach allows mitigation to become an integral part of recovery, strengthening resilience and reducing the likelihood of repetitive losses.

Flood Mitigation Assistance Program

The Flood Mitigation Assistance (FMA) Program reduces flood hazards by providing funding to help communities identify and implement measures that lessen long-term flood risk to National Flood Insurance Program (NFIP) insured properties. The program focuses on projects such as elevating, acquiring, relocating, or floodproofing flood-prone structures, with priority given to repetitive loss and severe repetitive loss properties. By mitigating flood damage before disasters occur, FMA helps protect lives and property, reduces future flood insurance claims, and lowers the overall cost of disaster assistance. The program encourages proactive risk reduction by aligning

mitigation investments with floodplain management and local hazard mitigation planning.

Stafford Act – Section 203 (BRIC)

The Building Resilient Infrastructure and Communities (BRIC) program supports mitigation projects by providing pre-disaster funding to help communities reduce risks from natural hazards before disasters occur. Administered by FEMA, BRIC focuses on long-term, cost-effective investments that enhance the resilience of critical infrastructure, lifelines, and communities. The program funds activities such as infrastructure retrofits, flood control projects, seismic upgrades, and nature-based solutions, as well as hazard mitigation planning and capacity building. BRIC emphasizes innovative, large-scale projects that address multiple hazards and provide measurable community benefits. By investing in mitigation prior to disasters, the BRIC program helps protect lives and property, reduce future disaster costs, and support more resilient and sustainable development.

5.3.2 NON-FEMA FEDERAL FUNDING STREAMS

Non-FEMA federal Funding Streams can include:²⁰

CDBG-DR

The Department of Housing and Urban Development's Community Development Block Grant-Disaster Recovery (CDBG-DR) program can fund hazard mitigation planning and projects by supporting activities that reduce long-term disaster risk and address unmet recovery needs following a major disaster. CDBG-DR funds may be used to develop or update hazard mitigation plans, conduct risk assessments, and support resilience and mitigation planning efforts that guide future investments. In addition, the program can finance mitigation projects such as drainage improvements, flood control infrastructure, elevation or acquisition of flood-prone properties, utility hardening, and other measures that reduce vulnerability to natural hazards. Unlike some recovery programs, CDBG-DR allows communities to target mitigation actions even if facilities were not damaged in the most recent disaster, as long as the activities address identified risks.

²⁰ Please note that the following list is not intended to be exhaustive.

CDBG-MIT

The Department of Housing and Urban Development's Community Development Block Grant–Mitigation (CDBG-MIT) program supports hazard mitigation planning and projects by providing federal funding specifically dedicated to reducing future disaster risks in communities that have experienced major disasters. CDBG-MIT funds can be used for mitigation planning activities such as risk assessments, data analysis, and development of strategies that guide long-term resilience investments. The program also finances a wide range of mitigation projects, including flood risk reduction, stormwater management, wildfire mitigation, resilient infrastructure upgrades, and nature-based solutions. CDBG-MIT emphasizes addressing identified vulnerabilities and repetitive loss areas, even if they were not directly damaged in a recent disaster. By focusing on forward-looking risk reduction, the program helps communities proactively adapt to climate impacts and future hazards. Overall, CDBG-MIT integrates mitigation into long-term recovery and development efforts, strengthening community resilience and reducing future disaster losses.

It should be noted that CDBG-DR and CDBG-MIT differ primarily in their purpose and how they support hazard mitigation planning and projects. CDBG-DR focuses on post-disaster recovery, with mitigation activities integrated into rebuilding efforts to address unmet needs and reduce future risk as communities recover. Under CDBG-DR, mitigation planning and projects must be closely tied to disaster recovery goals and justified by disaster impacts or recovery assessments. In contrast, CDBG-MIT is specifically dedicated to hazard mitigation and long-term risk reduction, allowing communities to fund mitigation planning and projects even if areas or facilities were not damaged in the most recent disaster.

Resilience and Emergency Relief Programs

The Federal Highway Administration (FHWA) Resilience and Emergency Relief Programs support Hazard Mitigation Plans by promoting the identification and reduction of risks to transportation infrastructure from natural hazards. Through the Emergency Relief Program, FHWA allows mitigation and resilience measures—such as improved drainage, roadway elevation, and bridge reinforcement—to be incorporated into post-disaster repairs. FHWA resilience initiatives also encourage vulnerability assessments and risk-based planning that align with the risk assessment and mitigation strategy components of FEMA-approved HMPs. By integrating hazard mitigation and climate resilience into transportation planning, these programs help ensure that roads and bridges are addressed as critical lifelines. Overall, FHWA

programs complement Hazard Mitigation Plans by supporting transportation-focused mitigation actions that reduce future disruption and repair costs.

National Resource Conservation Service

The Environmental Quality Incentives Program (EQIP) and the Watershed and Flood Prevention Operations (WFPO) program support hazard mitigation projects by addressing risks at the landscape and watershed scale through conservation and infrastructure improvements. EQIP, administered by the USDA Natural Resources Conservation Service (NRCS), provides financial and technical assistance to landowners to implement conservation practices that reduce erosion, manage runoff, improve soil health, and mitigate risks from flooding, drought, and wildfires. These practices—such as vegetation management, streambank stabilization, and water retention—help lessen downstream flood impacts and enhance resilience to climate variability. The Watershed and Flood Prevention Operations program support larger-scale mitigation through structural and non-structural measures, including small dams, floodwater retarding structures, channel improvements, and watershed planning. Together, these programs reduce hazard exposure upstream, protect communities and infrastructure downstream, and integrating natural resource management into long-term flood and drought mitigation strategies.

5.3.3 LOCAL FUNDS

San Germán like other municipalities in Puerto Rico, receives revenue from the Municipal Revenue Collection Center (MRCC). Other funding sources include revenue from the Sales and Use Tax (IVU, by its Spanish acronym), legislative funds that might be assigned from time to time and other sources. Depending on the state of municipal finances, the municipality might determine that there are some funds that can be used to pay for or cover local funds match for mitigation projects.

However, most major capital improvement projects depend on federal funds transfers. The use of federal funds varies widely from year to year. In some cases, these funds are used to cover costs associated with the creation and monitoring of specific programs (for example, Section 8 or housing programs). In other cases, the funds are used to finance major capital improvement projects.

5.4 OUTREACH AND COMMUNICATIONS CAPACITY (C1-A)

Building robust outreach and communication capacity is essential to the successful implementation of a Hazard Mitigation Plan, as effective risk communication enables residents to recognize their risks, actively participate in planning processes, and make informed decisions to reduce potential impacts. FEMA guidance underscores the importance of early and thoughtfully designed engagement strategies to ensure that key stakeholders exchange information at the right time, promoting shared awareness of hazards and broad support for mitigation actions. Communication is a fundamental preparedness capability because it provides timely, practical information that helps individuals and communities act to limit harm. Research further demonstrates that outreach efforts are most successful when messages are clearly defined, customized for specific audiences, and conveyed through trusted sources. Communities that prioritize outreach—by collaborating with local leaders, leveraging a variety of communication channels, and tailoring messages to different population groups—tend to achieve higher public involvement and more effectively incorporate community feedback into hazard mitigation planning. These practices ultimately contribute to more effective plans and more resilient communities (FEMA, 2025).

The Municipality demonstrates adequate capacity to conduct effective outreach and communication activities. The Office of _____ is responsible for coordinating these efforts, and an organizational chart for this office is provided in Appendix E. The Municipality utilizes both social media platforms for real-time communication and traditional methods to disseminate information to the public. In addition, the Planning Office administers the Community Board responsible for land-use decisions, which is largely composed of municipal residents. This board serves as an important forum for public engagement and provides an opportunity to further expand and strengthen the Municipality's outreach and communication capacity.

Table 44 details the communication tools available to the municipality.

Table 44. Outreach and Communications Tools

Tool or resource	Present or not present	Description	Agency in Charge
Social Media	✓	Facebook Page	Facebook Page
Planning Board Print Material	✓	Print Material regarding hazard mitigation, focused on flood hazard	Print Material regarding hazard mitigation, focused on flood hazard

Tool or resource	Present or not present	Description	Agency in Charge
Radio or Podcast	✗	Radio broadcast in local radio or voiceover podcast through the internet	N/A
Community Meetings	✓	Community Outreach Meeting to reach people that do not have access to social media	Various
Web Page	✗	Interactive Business Internet page	N/A
Publisher or capacity to publish material	✗	Print needs can be outsource	N/A

5.5 CAPACITY DEVELOPMENT (C1-B)

Strengthening institutional and technical capacity is vital to the successful implementation of a Hazard Mitigation Plan, as communities must have the expertise, resources, and organizational frameworks needed to move from planning to sustained risk-reduction actions. FEMA guidance stresses that effective mitigation planning relies on well-coordinated teams, access to reliable technical data, and the ability to collaborate across agencies and stakeholders—all of which directly affect the execution of mitigation strategies. National evaluations have shown that local and state governments often face challenges in implementing mitigation projects not due to a lack of commitment, but because of limited technical assistance, constrained administrative capacity, and insufficient engagement with federal support programs. Studies focused on low-capacity communities further demonstrate that gaps in technical knowledge, training, and leadership involvement can significantly hinder mitigation outcomes. These findings highlight the importance of strengthening workforce skills, enhancing guidance and tools, and reinforcing institutional support to achieve long-term resilience.

The Municipality continues to enhance its mitigation capacity by retaining qualified professionals as staff or contractors as needs arise. It also actively participates in training and continuing education opportunities offered through Commonwealth agencies and academic institutions to build and maintain the technical and institutional expertise necessary to support hazard mitigation efforts.

6. MITIGATION ACTION PLAN

The goals, objectives, and mitigation actions outlined in this Plan are based on discussions held by the designated Mitigation Plan Committee, as well as the public-participation activities conducted to date.

6.1 MITIGATION GOALS (C3-A)

6.1.1 MUNICIPAL GOALS AND OBJECTIVES

Mitigation strategies are intended to provide a set of policies and projects based on a hierarchical framework for action. This framework consists of the following:

1. Prevent and reduce the loss of life and property.
2. Protect the critical infrastructure located in the municipality.
3. Reduce the economic and social impact of hurricanes, floods, droughts, landslides, earthquakes, and other natural hazards.
4. Define the levels of vulnerability presented by each of these hazards in different sectors of the municipality and prevent illegal or inappropriate development in areas vulnerable to them.
5. Identify and propose strategies aimed at mitigating the effects of these risks.
6. Stop the destruction–reconstruction–destruction cycle characteristic of many communities exposed to natural hazards.
7. Educate the community about natural hazard risks, mitigation and loss–reduction measures, and the role and benefits of the natural and environmental resources within the Municipality; and
8. Apply the policies and goals of the Disaster Mitigation Act (Law 106-390 of 2000), known as the *Disaster Mitigation Act of 2000*, approved on October 30, 2000, which amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988.

This Plan retains the objectives of the Municipality's previous Mitigation Plan, namely:

Goal #1: Reduce the impact of natural hazards on both residents and municipal assets.

- **Objective 1.1:** Protect existing developments from future disaster events
- **Objective 1.2:** Reduce vulnerability in future projects
- **Objective 1.3:** Promote the conservation and sustainable management of

forests, wetlands, rivers, coastal areas, and other environmentally sensitive zones that provide natural protection against hazards such as flooding, landslides, and hurricanes.

Goal #2: Strengthen the capacity of municipal agencies to implement and oversee mitigation programs.

- **Objective 2.1:** Identify and develop the policies, regulations, and training necessary for an effective hazard mitigation program in the Municipality.

Goal #3: Increase the knowledge and understanding of those who live and work in the Municipality of San Germán regarding natural hazards and the principles of risk reduction.

- **Objective 3.1:** Develop outreach programs focused on raising public awareness about hazards and associated risks.
- **Objective 3.2:** Support local businesses and industries in becoming increasingly disaster resilient.

Goal #4: Improve the capacity to restore critical facilities, essential infrastructure, and ensure continuity of municipal operations following natural disasters.

- **Objective 4.1:** Improve municipal capabilities to support emergency response and recovery operations.
- **Objective 4.2:** Carry out planning efforts to maximize governmental coordination and communication between the municipality, the central government, and federal agencies.
- **Objective 4.3:** Reduce the vulnerability of essential services, infrastructure, and key municipal services.

6.1.2 NATIONAL MITIGATION INVESTMENT STRATEGY

The Municipality also adopts the National Mitigation Investment Strategy and the following goals.

- **Goal 1:** Show how Mitigation Investments Reduce Risk – The whole community will build a shared understanding of mitigation investment and its value. Specifically, the whole community will understand how effective mitigation investments can protect people, homes, neighborhoods, cultural and historic resources, ecosystems and lifelines (for example, communications, energy, transportation and water). The federal government and its non-federal

partners will create a shared vocabulary and common measures to communicate information about risk and find opportunities to educate, hire, train and develop a base of qualified mitigation professionals.

- **Goal 2:** Coordinate Mitigation Investments to Reduce Risk - The whole community will coordinate mitigation investments through shared risk information, reinforced strategies for risk reduction, and easier access to existing funding. Such coordination will help the whole community justify mitigation investments and choose the most cost-effective and reasonable actions.
- **Goal 3:** Make Mitigation Investment Standard Practice The whole community will factor mitigation into investment decisions, especially for buildings and infrastructure. The federal government and its non-federal partners will use and expand financial products and approaches for mitigation investment, including funding, incentives and financial risk transfer opportunities. The federal government and its non-federal partners also will make mitigation standard professional practice critical to safeguarding lifelines, services, and national safety and security.

6.2 MITIGATION STRATEGY SELECTION CRITERIA

The following methodologies were used to select the mitigation actions:

- The Planning Committee reviewed mitigation actions from the previous Mitigation Plan.
- The Committee evaluated those actions and determined which ones were appropriate to include in the current Plan. Actions were excluded if:
 - The measure had already been implemented during the previous plan's period and was not a recurring or ongoing action.
 - The measure was no longer necessary or useful based on new information. This applies to mitigation actions linked to identified hazards, risks, and vulnerabilities.
- The Committee considered the Letters of Intent (LOIs) submitted by the municipality to COR3 in 2019 to participate in the Hazard Mitigation Grant Program. These projects were incorporated into the current Plan, ensuring no duplication of projects included in the previous Plan.
- Committee members evaluated and added new measures. These new actions were proposed based on the Committee members' professional experience and suggestions received from community members.

The mitigation strategies of the Municipality of San Germán were evaluated by the Committee using the STAPLEE methodology. This methodology was considered in the selection of the strategies included in Section 6.5. This methodology has seven evaluation criteria:

- S – Social: The proposed action must be socially acceptable.
- T – Technical: The proposed action must be technically feasible.
- A – Administrative: The community must have the capacity to implement the action (for example, determining whether the responsible agency can supervise the mitigation project).
- P – Political: Mitigation actions must be politically acceptable.
- L – Legal: The community must have the authority to implement the proposed action.
- E – Economic: Economic considerations must include the current economic base, projected growth, and opportunity costs.
- E – Environmental: The environmental impact must be considered, given statutory requirements and the public's interest in maintaining sustainable and environmentally healthy communities.

6.3 MITIGATION STRATEGY CATEGORIZATION

To further understand the chosen mitigation strategies, this LHMP classifies said strategies in five broad categories as shown below.

- Prevention – Prevention activities aim to keep hazards from creating or worsening problems. These actions are typically carried out through government programs or regulatory measures that guide land-use development and building practices. Prevention is especially effective for reducing future vulnerability in areas that have not yet been developed. Examples include:
 - Planning and zoning
 - Building codes
 - Open-space preservation
 - Floodplain regulations
 - Stormwater management regulations
 - Maintenance of drainage systems
 - Capital improvement programming

- Riverbank realignment
 - Projects addressing fault zones
- Property protection – measures involve modifying existing buildings and structures so they can withstand natural hazards, or removing structures located in high-risk areas. Examples include:
 - Acquisition of properties
 - Relocation
 - Elevating structures
 - Protection of critical facilities
 - Structural retrofits (wind protection, floodproofing, seismic techniques)
 - Safe rooms, shutters, impact-resistant windows
 - Insurance policies
- Natural resource protection – activities reduce the impact of natural disasters by preserving or restoring natural areas that offer protective benefits. These areas include flood plains, wetlands, steep slopes, and sand dunes. Parks, recreational agencies, and conservation organizations commonly implement measures such as:
 - Flood protection
 - Watershed management
 - Riparian buffers
 - Forest and vegetation management (including wildfire and fuel-load control)
 - Erosion and sediment control
 - Wetland preservation and restoration
 - Habitat preservation
 - Slope stabilization
- Structural mitigation – Projects aim to reduce the impact of disasters by controlling or altering the natural flow of hazard events through engineered construction. These projects are usually designed by engineers and maintained by public works teams. Examples include:
 - Reservoirs
 - Dams, levees, and retaining walls
 - Diversion, detention, and retention systems
 - Channel modifications
 - Stormwater drainage systems
 - Installation of storm drains and related infrastructure
- Emergency Services – Although not typically classified as mitigation, emergency management measures reduce the human and property impacts

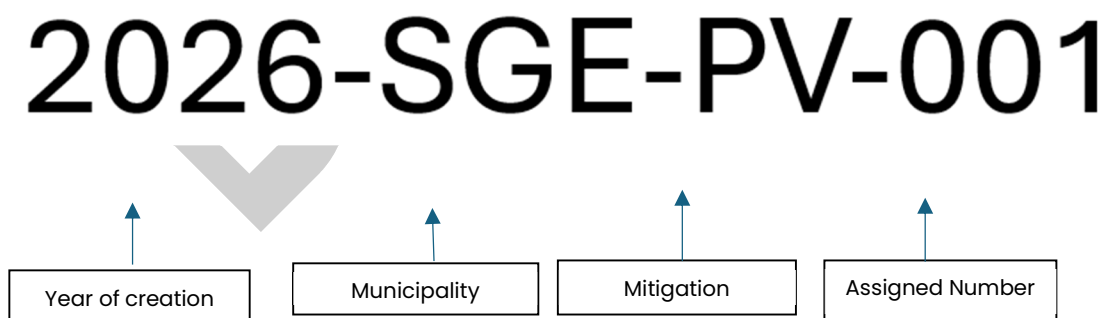
of natural hazards. These actions occur immediately before, during, or after a disaster. Examples include:

- Warning systems
- Evacuation management and planning
- Emergency response drills and training
- Flood-fighting measures
- Installation of shutters
- Public awareness and outreach - Efforts to help inform residents, elected officials, business owners, homebuyers, and visitors about hazard-prone areas and mitigation techniques they can use to protect themselves and their property. Examples include:
 - Outreach projects
 - Demonstration events and guest presentations
 - Hazard information materials
 - Property-specific risk information
 - Library materials
 - Educational programs for children
 - Exposure to risk-related information

6.4 MITIGATION STRATEGIES (C4-A, C4-B, C5-A, C5-B, E2.B)

To improve tracking and updating, each mitigation strategy has been given a unique identification number. The following figure shows the meaning of the nomenclature.

Figure 29: Example of Unique Id Nomenclature



Tables 45-50 have the details of the mitigation strategies adopted by this LHMP.

Each identified mitigation strategy shall include:

- Assigned category,
- Hazard(s) Mitigated
- Priority
- Responsible entity
- Founding source
- Estimated cost (when available)
- Qualitative Benefit
- Time Horizon
- Status
- Location in 2018 (if applicable)

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Table 45. Mitigation Strategies – (Prevention) Local Planning and Regulation

2026 ID	2020 ID	Description	Danger	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-LP-001	P-1	Identify the "special needs" of citizens and develop evacuation and rescue procedures for this population.	All	Medium	Food, Hydration and Shelter	Leader: Office of Emergency Management Support: Mayor's Office, Citizen Service Office	Municipal	Short Term	Current Status: Ongoing Execution – Needs have been identified, and evacuation and rescue procedures are being developed through the OMME. This strategy will improve assistance to vulnerable communities and strengthen the safety and effectiveness of the processes.
2026-SGE-LP-002	P-2	Purchase of GIS equipment and programs to improve the generation and interpretation of geographic information.	All	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The Municipality has opted not to continue with the purchase of specialized equipment and programs, since it currently uses tools such as Google Earth. Suppressed in this LHMP. The Planning Committee has determined that this strategy is not feasible.
2026-SGE-LP-003	New	Update the Land Use Plan to promote appropriate land use and reduce construction in high-risk areas.	All	High	All	Leader: Office of Planning and Project Management Support: Office of Finance and Office of the Mayor	Municipal, Planning Board	Medium Term	Current Status: In Execution – The Municipality will be carrying out the review and update of the Land Use Plan in coordination with the Planning Board. This strategy seeks to promote orderly and sustainable development, as well as reduce exposure to risks from natural disasters.
2026-SGE-LP-004	New	Develop the Stormwater Management Plan in compliance with the MS4 Permit, which will include proper stormwater runoff management and periodic maintenance of existing infrastructure.	Flooding	High	Water Systems	Leader: Office of Planning and Project Management Support: Office of Finance and Office of the Mayor	Municipal	Medium Term	Current Status: In Execution – A draft of the Plan is currently available. This strategy will improve stormwater management, reduce the risk of flooding, and contribute to the protection of infrastructure.

2026 ID	2020 ID	Description	Danger	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-LP-005	New	Update the Emergency Management Plan, including updated risk scenarios and clear response protocols for hazard events.	All	High	All	Leader: Office of Emergency Management Support: Mayor's Office	Municipal	Medium Term	Current Status: In Execution – The data of municipal employees and vehicles and the existing response plans are being updated. This strategy will strengthen preparedness and improve response to emergencies.
2026-SGE-LP-006	New	Conduct fire, earthquake, and other hazard drills.	All	High	Safety and security	Leader: Office of Emergency Management Support: Mayor's Office	Municipal	Medium Term	Current Status: Ongoing Execution – Drills have been conducted to strengthen community and municipal preparedness. This strategy will help familiarize the population and municipal employees with response procedures, evacuation, safe routes, and meeting points.
2026-SGE-LP-007	New	Develop response plans for extreme heat events.	Extreme Heat	High	Food, Hydration and Shelter	Leader: Office of Emergency Management Support: Office of Planning and Project Management	Municipal	Medium Term	Current Status: New – This strategy improves preparedness and coordination during extreme heat events, enabling timely actions that reduce health risks, protect vulnerable populations, and ensure an effective emergency response.
2026-SGE-LP-008	New	Develop a strategic reforestation plan in order to provide shade and strategic cooling areas in the urban areas of the municipality.	Extreme Heat	High	Health & Medicine	Leader: Public Works Support: Office of Planning and Project Management	Municipal	Medium Term	Current Status: New – This strategy reduces urban temperatures by increasing shade and natural cooling, improving public health, enhancing comfort, and strengthening resilience to extreme heat in urban areas.

2026 ID	2020 ID	Description	Danger	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-LP-009	New	Consider mitigation measures for extreme heat in the next revision of the Land Use Plan.	Extreme Heat	High	Safety and security	Leader: Office of Planning and Project Management Support: Mayor's Office	Municipal	Medium Term	Current Status: New – This strategy will ensure long-term risk reduction by promoting climate-sensitive development, improving urban design, and protecting public health.
2026-SGE-LP-010	New	Develop the logistics necessary to provide controlled access to drinking water during high-attendance municipal events, particularly in outdoor activities exposed to heat.	Extreme Heat	High	Water Systems	Leader: Office of Economic Development and Tourism Support: Office of Emergency Management and Public Works	Municipal	Medium Term	Current Status: New – This strategy reduces dehydration and heat-related illnesses during high-temperature events by ensuring access to safe drinking water, improving public safety and overall event resilience.

Table 46. Mitigation Strategies – Property Protection

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-PP-001	PP-1	Provide critical facilities of the Municipality with protection measures against strong winds and flooding, so that they are more resilient in the event of a danger event. Install storm shutters in critical installations.	Tropical Cyclone/Extreme Winds, Flooding	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – This strategy is repetitive; consolidated with strategy #PP-4 through PP-8. It will be removed in the next this LHMP revision,

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-PP-002	PP-2	Provide community centers with an electric generator and recondition structures to be resistant to earthquakes and hurricanes.	Tropical Cyclone/Extreme Winds, Earthquake	High	Energy	Leader: Office of Emergency Management Support: Office of Federal Programs, Finance, Public Works and Mayor's Office	Municipal	Long Term	Current Status: Completed – The community centers of Poblado Rosario and Guamá were certified as shelters. This strategy will improve community safety and will allow the operation of the centers during disasters. To be removed in the next LHMP revision.
2026-SGE-PP-003	PP-3	Purchase and installation of a ICHP reciprocating motor generator, with all the necessary components to create an electrical distribution micro-grid in the area of the Pueblo de San Germán through the underground power lines. This microgrid must be able to operate continuously for 365 days, to ensure continuity of operations in critical facilities and provide essential services to communities.	All	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – Suppressed in this LHMP. The Planning Committee has determined that this strategy is not feasible due to the amount of funding required by the project. It was substituted by other strategies such as (1) providing generators to persons with health conditions, (2) installation of a generator and solar panels at the Emergency Management Office (OMME) building and the Police Commissioner's office.
2026-SGE-PP-004	PP-4	Installation of storm protection systems in the Sol Theater, to increase the resilience of the building in the event of a danger event.	Tropical Cyclone/Extreme Winds	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The project was not feasible because the building is historic and the Puerto Rico Institute of Culture (ICP) would not approve the proposed work. As a result, HMGP required the removal of this strategy and its replacement with a feasible alternative.
2026-SGE-PP-005	PP-5	Installation of storm protection systems in the building of the Department of Public Works of the Municipality of San Germán, to increase the resilience of the building in the event of a hazard event.	Tropical Cyclone/Extreme Winds	High	Safety and security	Leader: Office of Planning and Project Management Support: Office of Federal Programs, Finance, Public Works and Mayor's Office	Municipal, Federal (HMGP-FEMA)	Medium Term	Current Status: In Design – The project has already been awarded and is in the stage of performing wind vulnerability studies and design. This strategy will protect the building and will allow the continuity of municipal operations during rainfall and wind events.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-PP-006	PP-6	Installation of storm protection systems in the old Mayor's Office, to increase the resilience of the building in the event of a danger event.	N/A	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The project was not feasible because the building is historic and the Puerto Rico Institute of Culture (ICP) would not approve the proposed work. As a result, HMGP required the removal of this strategy and its replacement with a feasible alternative.
2026-SGE-PP-007	PP-7	Installation of storm protection systems at the Santiago R. Palmer Convention Center, to increase the resilience of the building in the event of a hazard event.	Tropical Cyclone/Extreme Winds	High	Safety and security	Leader: Office of Planning and Project Management Support: Office of Federal Programs, Finance, Public Works and Mayor's Office	Municipal, Federal (HMGP-FEMA)	Medium Term	Current Status: In Design – The project has already been awarded and is in the stage of performing wind vulnerability studies and design. This strategy will protect the building and will allow the continuity of municipal operations during rainfall and wind events.
2026-SGE-PP-008	PP-8	Installation of storm protection systems in the Market Square building, to increase the resilience of the building in the event of a hazard event.	Tropical Cyclone/Extreme Winds	High	Safety and security	Leader: Office of Planning and Project Management Support: Office of Federal Programs, Finance, Public Works and Mayor's Office	Municipal, Federal (HMGP-FEMA)	Medium Term	Current Status: In Design – The project has already been awarded and is in the stage of performing wind vulnerability studies and design. This strategy will protect the building and will allow the continuity of municipal operations during rainfall and wind events.
2026-SGE-PP-009	New	Installation of storm protection systems at the Luis A. Ufret Senior Center, Casa del Estudiante building, Ventanilla Unica (municipal taxes office), and National Guard building to increase the building's resilience in the event of a hazard.	Tropical Cyclone/Extreme Winds	High	Safety and security	Leader: Office of Planning and Project Management Support: Office of Federal Programs, Finance, Public Works and Mayor's Office	Municipal, Federal (HMGP-FEMA)	Medium Term	Current Status: In Design – The project has already been awarded and is in the stage of performing wind vulnerability studies and design. This strategy will protect the building and will allow the continuity of municipal operations during rainfall and wind events.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-PP-013	PP-9	Installation of an electricity generator to provide electric service in the event of a loss of connectivity due to disaster (Coordinates 18.052862, -67.023999).	All	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The provided coordinates are incorrect. The indicated location corresponds to a forested area that is not suitable for the installation of an electric generator. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-PP-014	PP-10	Installation of an electricity generator to provide electric service in the event of a loss of connectivity due to disaster (Coordinates 18.045196, -67.021787).	All	High	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The provided coordinates are incorrect. The indicated location corresponds to a forested area that is not suitable for the installation of an electric generator. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-PP-015	PP-11	Installation of an electricity generator to provide electric service in the event of a loss of connectivity due to disaster (Coordinates 18.051876, -67.022185).	All	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The provided coordinates are incorrect. The indicated location corresponds to a forested area that is not suitable for the installation of an electric generator. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-PP-016	PP-12	Installation of an electricity generator to provide electric service in the event of a loss of connectivity due to a disaster (Coordinates 18.052752, -67.01008).	All	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The provided coordinates are incorrect. The indicated location corresponds to a forested area that is not suitable for the installation of an electric generator. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-PP-017	PP-13	Installation of an electricity generator to provide electric service in the event of a loss of connectivity due to a disaster (Coordinates 18.044169, -67.014925).	All	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The provided coordinates are incorrect. The indicated location corresponds to a forest that is not suitable for the installation of an electric generator. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-PP-018	New	Installation of electric generators in critical municipal facilities, including the Department of Public Works, the Arquelio Torres Coliseum, and the Mayor's Office, to provide backup electrical service and ensure the continuity of operations and essential services during disaster events that cause interruptions of the electrical system or loss of connectivity.	All	High	Energy	Leader: Office of Planning and Project Management Support: Office of Federal Programs, Office of Finance and Public Works	Federal (HMGP-FEMA)	Medium Term	Current Status: In Design – The project has already been awarded and is in the design stage. This strategy will allow the continuity of municipal operations during rainfall and wind events.
2026-SGE-PP-019	PP-14	Provide critical facilities of the Municipality with protection measures against strong winds and flooding, so that they are more resilient in the event of a danger event. Install storm shutters in critical facilities (Coordinates 18.104192, -67.005721-Guama Community Center).	Tropical Cyclone/Extreme Winds, Earthquake	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – It was determined that other buildings had higher priority for the installation of storm shutters, since they directly affect municipal operations during an emergency. To be removed in the next LHMP revision.
2026-SGE-PP-020	PP-15	Provide critical facilities of the Municipality with protection measures against strong winds and flooding, so that they are more resilient in the event of a danger event. Install storm shutters in critical installations (Coordinates 18.085768, -67.086621).	Tropical Cyclone/Extreme Winds, Earthquake	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – It was determined that other buildings had higher priority for the installation of storm shutters, since they directly affect municipal operations during an emergency. To be removed in the next LHMP revision.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-PP-021	PP-16	Provide critical facilities of the Municipality with protection measures against strong winds and flooding, so that they are more resilient in the event of a danger event. Install storm shutters in critical installations (Coordinates 18.07342, -67.096779).	Tropical Cyclone/Extreme Winds, Earthquake	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The provided coordinates are incorrect. The indicated location corresponds to a forested area that is not suitable for the installation of storm shutters. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-PP-022	PP-17	Provide critical facilities of the Municipality with protection measures against strong winds and flooding, so that they are more resilient in the event of a danger event. Install storm shutters in critical installations (Coordinates 18.107037, -67.048618).	Tropical Cyclone/Extreme Winds, Earthquake	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – It was determined that other buildings had higher priority for the installation of storm shutters, since they directly affect municipal operations during an emergency. To be removed in the next LHMP revision.
2026-SGE-PP-023	PP-18	Provide critical facilities of the Municipality with protection measures against strong winds and flooding, so that they are more resilient in the event of a danger event. Install storm shutters in critical installations (Coordinates 18.078685, -66.994487).	Tropical Cyclone/Extreme Winds, Earthquake	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – It was determined that other buildings had higher priority for the installation of storm shutters, since they directly affect municipal operations during an emergency. To be removed in the next LHMP revision.
2026-SGE-PP-024	PP-19	Construction of a safe room with an electric generator that is resistant to earthquakes and hurricanes (Coordinates 18.137849, -67.071917).	Tropical Cyclone/Extreme Winds, Earthquake	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – Following the evaluation of multiple alternatives, this strategy was determined to be infeasible due to its limited community benefit and the potential reduction of available space and parking capacity. It will be removed in the next LHMP revision.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-PP-025	PP-20	Construction of a safe room with an electrical generator that is resistant to earthquakes and hurricanes at the Arquelio Torres Coliseum	Tropical Cyclone/Extreme Winds, Earthquake	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – Following the evaluation of multiple alternatives, this strategy was determined to be infeasible due to its limited community benefit and the potential reduction of available space and parking capacity. It will be removed in the next LHMP revision.

Table 47. Mitigation Strategies – Structural Improvement

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-SI-001	PE-1	Flood Control and Replacement of the Vado Bridge Camino Los Brujos Carr 362 KM 5.2 Bo Guama (Coordinates 18.06.10 N -67.00.29 W).	Flooding, Earthquake & Landslide	Medium	Transportation	Leader: Office of Planning and Project Management Support: Mayor's Office, Office of Federal Programs	Municipal, State	Long Term	Current Status: Funding – The Municipality is waiting for fund allocation. This strategy improves reliable and safe access for residents and emergency services
2026-SGE-SI-002	PE-2	Landslide Control Carr 362 km 6.2 Bo Guama (Coordinates 18.06.29 N -67.00.16W).	Tropical Cyclone/Extreme Winds, Earthquake, Landslide	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – It will not be carried out, since the Municipality does not provide this type of service for private properties. Likewise, its execution would not be cost-beneficial for the Municipality. To be removed in the next LHMP revision.
2026-SGE-SI-003	PE-3	Landslide Control Carr 362 km 6.2 Bo Guama (area different from the previous strategy, coordinates 18.07.13 N -67.01.16 W).	Tropical Cyclone/Extreme Winds, Earthquake, Landslide	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The project could not be identified at the provided coordinates, as it is a vacant lot. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-SI-004	PE-4	Flood Control Construction of beads and rainwater control Carr 361 km 5 Sector El Hoyo (Coordinates 18.07.27 N -67.00.54 W).	Tropical Cyclone/Extreme Winds, Earthquake, Landslide	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The location of the provided coordinates does not appear to be an area prone to flooding. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-SI-005	PE-5	Landslide control Calle Aguamarina #96 Pueblo Nuevo (Coordinates 18.04.35 N -67.01.08 W).	Tropical Cyclone/Extreme Winds, Earthquake, Landslide	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The project could not be identified at the provided coordinates, as it is a vacant lot. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-SI-006	PE-6	Landslide control: Calle Aguamarina #95, Pueblo Nuevo (Coordinates: 18.04.35 N - 67.02.08 W).	Tropical Cyclone/Extreme Winds, Earthquake, Landslide	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The project could not be identified at the provided coordinates, as it is a vacant lot. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-SI-007	PE-7	Landslide control Urb Salamanca calle Sevilla #29 (Coordinates 18.04.35 N -67.02.08 W).	Tropical Cyclone/Extreme Winds, Earthquake, Landslide	Low	Seguridad y Sistemas de Agua	Leader: Office of Planning and Project Management Support: Office of Federal Programs, Finance, and Mayor's Office	Federal (HMGP-FEMA)	Long Term	Current Status: In Design – The project is in the stage of award for design. This strategy will protect properties vulnerable to landslides in the urbanization.
2026-SGE-SI-008	PE-8	Flood Control Construction of beads and water control Street B plot #149 Bo Sabana Eneas (Coordinates 18.05.10 N -67.05.07 W).	Flooding	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The project could not be identified at the provided coordinates. To be removed in the next LHMP revision.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-SI-009	PE-9	Flood Control Story construction and water control Café Madrid Bo Hoconuco (Coordinates 18.06.31 N -67.03.53 W).	Flooding	High	Safety and security	Leader: Office of Federal Programs Support: Mayor's Office, Office of Planning and Project Management	Federal (Public Assistance - FEMA)	Short Term	Current Status: Completed – Ditches were constructed in the area. This strategy reduces the risk of flooding in the area.
2026-SGE-SI-010	PE-10	Landslide Control Bo Rosario Alto (Coordinates 18.08.58 N -67.02.27 W).	Landslides	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The project could not be identified at the provided coordinates; the house adjacent to the road has a retaining wall. To be removed in the next LHMP revision.
2026-SGE-SI-011	PE-11	Bo Duey Landslide Control (Coordinates 18.07.58 N -67.04.08 W).	Landslides	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – It will not be carried out, since the Municipality does not provide this type of service for private properties. Likewise, its execution would not be cost-beneficial for the Municipality. To be removed in the next LHMP revision.
2026-SGE-SI-012	PE-12	Flood control, bead construction, culverts in Bo Duey (Coordinates: 18.07.31 N -67.05.00 W).	Flooding	Medium	N/A	Leader: Office of Federal Programs Support: Mayor's Office, Office of Planning and Project Management	Federal (Public Assistance - FEMA)	Short Term	Current Status: Execution – Ditches are being constructed in Camino Barceló and Punta Brava. This strategy will reduce soil erosion and decrease the vulnerability of communities to heavy rainfall events.
2026-SGE-SI-013	PE-13	Flood Control Construction of beads and water control Café Madrid (Coordinates 18.06.31 N - 67.03.47 W).	Flooding	Medium	Water Systems	Leader: Office of Federal Programs Support: Mayor's Office, Office of Planning and Project Management	Federal (Public Assistance - FEMA)	Short Term	Current Status: Completed – This strategy its duplicated. It will be consolidated with strategy #PE-9. It will be removed in the next this LHMP revision,
2026-SGE-SI-014	PE-14	Water channeling in the Santa María Urb. to prevent flooding and damage to property and infrastructure.	Flooding	High	Water Systems	Leader: Office of Planning and Project Management Support: Mayor's Office, Office of Federal Programs	Federal (HMGP-FEMA)	Long Term	Current Status: In Design – The design has been completed. It is awaiting approval of an increase in funding by FEMA for construction. This strategy will protect structures at risk, as it will help prevent landslides and flooding in the urbanization.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-SI-015	PE-15	Construction of a storm sewer system to channel rainwater, prevent erosion, and improve the resilience of flood control systems. (Coordinates 18.131046, -67.051672).	Flooding	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The location of the provided coordinates does not appear to be an area prone to flooding. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-SI-016	PE-16	Construction of a storm sewer system to channel rainwater, prevent erosion, and improve the resilience of flood control systems. (Coordinates 18.131513, -67.071355).	Flooding	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – It will not be carried out, since the Municipality does not provide this type of service for private properties. Likewise, its execution would not be cost effective for the Municipality. Suppressed in this LHMP. The Planning Committee has determined that this strategy is not feasible.
2026-SGE-SI-017	PE-17	Construction of a storm sewer system to channel rainwater, prevent erosion, and improve the resilience of flood control systems. (Coordinates 18.106775, -67.034505).	Flooding	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The location of the provided coordinates does not appear to be an area prone to flooding. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-SI-018	PE-18	Construction of a retaining wall to stabilize the land and prevent landslides (Coordinates 18.131046, -67.051672).	Landslides	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The location of the provided coordinates does not appear to be an area prone to landslides. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-SI-019	PE-19	Construction of a storm sewer system to channel rainwater, prevent erosion, and improve the resilience of flood control systems. (Coordinates 18.07504, -67.078034).	Flooding	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The location of the provided coordinates does not appear to be an area prone to flooding, as it is at a high elevation. Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-SI-020	PE-20	Construction of a retaining wall to stabilize the ground and prevent landslides (Coordinates 18.130716, -67.070628).	Landslides	High	Water Systems	Leader: Office of Planning and Project Management Support: Mayor's Office, Office of Federal Programs	Federal (Public Assistance - FEMA)	Medium Term	Current Status: In Procurement – Project is out for bid under the PA program. This strategy will stabilize the bridge area, reduce landslide risk and protect nearby infrastructure and water systems.
2026-SGE-SI-021	PE-21	Construction of a retaining wall to stabilize the land and prevent landslides (Coordinates 18.133188, -67.014202).	Landslides	High	Transportation	Leader: Office of Federal Programs Support: Mayor's Office, Office of Planning and Project Management	Federal (Public Assistance - FEMA)	Long Term	Current Status: Ongoing – The Municipality has several projects aimed at stabilizing and repairing embankments along roadways in multiple areas. This strategy will improve land resilience by reducing erosion, thereby preventing damage to the roadway.
2026-SGE-SI-022	PE-22	Construction of a storm sewer system to channel rainwater, prevent erosion, and improve the resilience of flood control systems. (Coordinates 18.071966, -67.054909).	Flooding	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The project could not be identified at the provided coordinates. To be removed in the next LHMP revision.
2026-SGE-SI-023	PE-23	Construction of a retaining wall to stabilize the land and prevent landslides in the Trujillo ravine.	Landslides	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The proposed retaining wall at Trujillo Creek is not prioritized for inclusion in the mitigation plan, as there have been no reported landslides or demonstrated need in the area. Additionally, the project lacks sufficient data to support its cost-effectiveness or broader community benefit in accordance with FEMA mitigation planning criteria. To be removed in the next LHMP revision.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-SI-024	PE-24	Construction of a retaining wall to stabilize the land and prevent landslides in the ravine of the La Salamanca urbanization.	Landslides	High	Safety and security	Leader: Office of Planning and Project Management Support: Mayor's Office, Office of Federal Programs	Federal (HMGP-FEMA)	Long Term	Current Status: In Design – The project is in the stage of award for design. This strategy will protect properties vulnerable to landslides in the urbanization.
2026-SGE-SI-025	PE-25	Build water channeling systems in the Paseo del Estudiante extension, on José Luis Rodríguez Street.	Flooding	High	Transportation	Leader: Office of Planning and Project Management Support: Mayor's Office, Office of Federal Programs	Federal (HMGP-FEMA)	Long Term	Current Status: Funding – This project was approved by FEMA. The documents for the procurement process are being drafted. This Strategy reduces flood risk, protects transportation infrastructure and nearby properties, improves public safety and mobility, lowers disaster-related costs, and increases community resilience to severe rainfall events.
2026-SGE-SI-026	PE-26	Construction of a storm sewer system to channel rainwater, prevent erosion, and improve the resilience of flood control systems. (Coordinates 18.143312, -67.023088).	Flooding	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – The project could not be identified at the provided coordinates Suppressed from this LHMP as it lacks specificity. It will be eliminated from the next LHMP revision.
2026-SGE-SI-027	PE-27	Retaining wall in Poblado Rosario, Urb. San Florencio, Rosaura Street – To prevent erosion of the land by a nearby ravine (Carmen Santiago Case).	Landslides	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – It will not be carried out, since the Municipality does not provide this type of service for private properties. Also, its execution would not be economically feasible for the Municipality. To be removed in the next LHMP revision.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-SI-028	PE-28	Retaining Wall in Carr. 3363 Bo. Minillas Alto - to prevent erosion of the municipal road adjacent to two residences. (Richard Rivera Case).	Landslides	N/A	N/A	N/A	N/A	N/A	Current Status: Withdrawn – It will not be carried out, since the Municipality does not provide this type of service for private properties. Also, its execution would not be economically feasible for the Municipality. To be removed in the next LHMP revision.
2026-SGE-SI-029	PE-29	Flood control by building trenches to channel stormwater, prevent erosion, and improve resilience.	Flooding	High	Transportation	Leader: Office of Federal Programs Support: Mayor's Office, Office of Planning and Project Management	Municipal, Federal (FEMA)	Medium Term	Current Status: New – Although this is a new strategy, currently there are various flood control and ditch construction projects in several neighborhoods, which are in different stages: Completed – Camino Roque Ayala; Bidding – Camino Genaro Nazario and Sector Los Pérez in Minillas; Camino Quiñones in Duey; Award Stage – Camino Anselmo in Poblado Rosario; Camino La Bola and Camino La Panchita in Guamá. This strategy will reduce soil erosion and decrease the vulnerability of communities to heavy rainfall events.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-SI-030	PE-30	Construction of walls to stabilize the ground and prevent landslides.	Landslides	High	Transportation	Leader: Office of Planning and Project Management Support: Mayor's Office, Office of Federal Programs	Municipal, Federal (FEMA)	Long Term	Current Status: New – Although this is a new strategy, currently there are various gabion wall construction projects in several neighborhoods, which are in different stages: Completed – Cuchi Ayala in Hoconuco; Execution – Camino El Indio in Cotuí; Design – Camino Los Padilla in Cotuí; Camino Los Ponce in Duey; Camino Mayo Rodríguez in Rosario Peñón; Camino El Sabroso in Maresúa. This strategy will improve land resilience by reducing erosion, thereby preventing damage to property and infrastructure.
2026-SGE-SI-031	New	Designate and condition municipal facilities throughout the municipality to serve as cooling centers during heat waves.	Extreme Heat	High	Safety and security	Leader: Office of Emergency Management Support: Mayor's Office, Office of Federal Programs	Municipal, State	Medium Term	Current Status: New – This strategy reduces health risks during heat waves by providing safe, temperature-controlled spaces for vulnerable populations and improves public safety, prevents heat-related illnesses, and strengthens community resilience during extreme heat events.
2026-SGE-SI-032	New	Rehabilitate or construct public transport stops to provide shade for pedestrians and public transport users.	Extreme Heat	High	Food, Hydration and Shelter	Leader: Office of Planning and Project Management Support: Mayor's Office, Office of Federal Programs	Municipal, State, Federal	Medium Term	Current Status: New – This strategy improves comfort and safety for pedestrians and transit users by reducing heat exposure. It encourages public transportation use, protects vulnerable populations, and enhances urban resilience to rising temperatures.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-SI-033	New	Design and install fixed water supply points in strategic high-risk areas (tanks, rural hydrants, cisterns or artificial ponds) to facilitate the rapid response of brigades against forest fires, reducing operating times and increasing suppression capacity.	Wildfire	High	Safety & Water Systems	Leader: Emergency Management Support: Mayor's Office	Municipal Funds	Short Term	Current Status: New – Strategy identified during the plan update to strengthen wildfire response capacity. Priority locations and potential funding sources will be evaluated for implementation.
2026-SGE-SI-034	New	Construction of runoff management systems such as bioswales or infiltration ditches, rain gardens and natural retention areas, designed to capture surface runoff and allow its infiltration into the soil, favoring the recharge of aquifers while at the same time reducing surface runoff that when accumulated can cause floods and landslides.	Landslides , Flooding, Drought and Extreme Heat	High	Water Systems	Leader: Emergency Management Support: Mayor's Office	Municipal Funds	Short Term	Current Status: New – Strategy incorporated to promote sustainable stormwater runoff management and reduce risks associated with flooding, landslides, drought, and extreme heat. Evaluation of potential implementation areas is required.
2026-SGE-SI-035	New	Improve ventilation system in municipal buildings for safe operation that reduces the risk of transmission in enclosed spaces	Pandemic /Epidemic	High	Health & Medicine	Leader: Emergency Management Support: Mayor's Office	Municipal Funds	Short Term	Current Status: New – Strategy incorporated to strengthen municipal preparedness for pandemics and epidemics through improvements in ventilation and exposure control in municipal buildings. Eligible facilities and intervention needs will be evaluated.

Table 48. Mitigation Strategies: Natural Resources Protection

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-NR-001	New	Plant Chrysopogon zizanioides (Vetiveria Zizanioides), among other vegetation species, to stabilize slopes and prevent landslides, slope erosion, and sedimentation of water bodies.	Earthquake	High	Transportation	Leader: Public Works Support: Office of Planning and Project Management	Municipal	Long Term	Current Status: Not Started This strategy will contribute to slope stability and will reduce risks of landslides and erosion.
2026-SGE-NR-002	New	Protect natural water bodies (streams, lagoons, ponds) and their riparian areas to contribute to the thermal regulation of the environment through evaporation and natural cooling processes.	Extreme Heat, Drought, Flooding	High	Water Systems	Leader: Public Works Support: Office of Planning and Project Management	Municipal	Medium Term	Current Status: New - This strategy enhances environmental resilience by restoring natural water bodies and their riparian zones, which help regulate local temperatures through natural cooling processes. It also improves water quality, supports ecosystems, and reduces the impacts of heat, drought, and flooding on surrounding communities.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-NR-003	New	Implement vegetation management programs in high-risk areas by controlling the reduction of plant fuels (dry material, grasses, and dense shrubs) and establish firebreaks around communities, critical infrastructure, and access corridors, in order to reduce the likelihood of ignition and limit the spread of wildfires. These actions must be carried out in accordance with technical plans that define the frequency, handling methods and proper disposal of the removed material, avoiding inappropriate practices such as the uncontrolled accumulation or burning of vegetative waste.	Wildfire	High	Safety and security	Leader: Public Works Support: Office of Planning and Project Management	Municipal	Medium Term	Current Status: New – This strategy reduces wildfire risk by decreasing fuel loads and limiting fire spread in high-risk areas. It helps protect communities and critical infrastructure, improves access for emergency response, and enhances overall safety by creating defensible spaces and reducing the intensity of potential fires.

Table 49. Mitigation Strategies – Emergency Services

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-ES-001	ES-1	Porta Coeli Cemetery Improvements and Expansion	All	High	Health & Medicine	Leader: Office of Federal Programs Support: Office of Planning and Project Management and Office of the Mayor	Federal (ARPA)	Medium Term	Current Status: In Design – Plans and specifications for the expansion of the cemetery are being developed. This strategy will strengthen capacity and logistics during emergency events and will improve space management.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-SGE-ES-002	New	Improve or develop integrated communication and early warning systems capable of issuing warnings through multiple channels, including alarms, visual signals, and digital platforms, to inform the community about natural hazards, expected risks, protective measures, evacuation routes, shelter locations, road conditions, and other critical information before, during, and after an event, supporting a timely response and a more effective recovery.	All	High	Communication	Leader: Office of Emergency Management Support: Office of Federal Programs	Municipal, State, or Federal	Medium Term	Current Status: New - This strategy improves public safety by ensuring timely and reliable communication before, during, and after emergencies. By delivering clear warnings and guidance through multiple channels, it enables faster decision-making, supports evacuation and protective actions, and reduces risks to life and property from hazards such as extreme heat, hurricanes, earthquakes, floods, droughts, landslides, and wildfires.
2026-SGE-ES-003	New	Design, construct, and/or designate and maintain structures for the implementation of collection centers and/or safe havens and/or Emergency Operations Centers, through the appropriate municipal agencies or departments, to store non-perishable supplies, including, but not limited to: food, essential items, short- and long-term medical supplies (including medications), communication equipment, and other necessary resources.	All	High	Food, Hydration and Shelter	Leader: Office of Planning and Project Management Support: Office of Federal Programs and Office of Emergency Management	Municipal, State, or Federal	Medium Term	Current Status: New - This strategy provides critical benefits by ensuring the availability and safe storage of essential supplies before, during, and after emergencies. It strengthens emergency response capacity by centralizing resources such as food, medical supplies, and communication equipment, allowing for faster and more organized distribution. Additionally, it enhances community resilience by establishing secure and reliable facilities that support coordinated municipal response and protect residents during disasters.

Table 50. Mitigation Strategies – Education and Awareness

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-LMA-EA-001	EPC-1	To guide citizens on how to avoid the occurrence of urban and forest fires, throughout the Municipality of San Germán	Wildfire	High	Safety and security	Leader: Office of Emergency Management Support: Office of Planning and Project Management and Office of the Mayor	Municipal	Medium Term	Current Status: Ongoing Execution – CERT training was provided to municipal personnel to support disaster response. This strategy will increase public awareness and strengthen municipal capacity to respond to fires.
2026-LMA-EA-002	EPC-2	Talks on how to prepare for the season of strong winds (Hurricanes) throughout the Municipality of San Germán	Tropical Cyclone/Extreme Winds	High	Safety and security	Leader: Office of Emergency Management Support: Mayor's Office	Municipal	Medium Term	Current Status: Ongoing Execution – CERT training was provided to municipal personnel to support disaster response. This strategy will improve community preparedness and the effectiveness of municipal response to strong wind events.
2026-LMA-EA-003	New	Develop, in collaboration with central agencies and non-profit organizations, information campaigns (educational materials, talks, and announcements) on the risks of extreme heat and the preventive measures applicable at home and in outdoor spaces.	Extreme Heat	High	Safety and security	Leader: Office of Emergency Management Support: Mayor's Office	Municipal, State or Federal	Medium Term	Current Status: New – Reduces unnecessary exposure to extreme heat events, minimize all costs related to medical emergencies related to extreme heat, promote sustainable and resilient practices during extreme heat events.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-LMA-EA-004	New	Conduct community outreach on the installation and management of rainwater harvesting and storage systems (e.g., cisterns), targeting communities, as a measure to increase resilience to drought events or situations where water service may be affected.	Drought, Tropical Cyclone/Extreme Winds, Earthquakes	High	Water Systems	Leader: Office of Emergency Management Support: Office of Planning and Project Management and Office of the Mayor	Municipal	Medium Term	Current Status: New - Community outreach on rainwater collection and storage systems, such as cisterns, helps increase water availability during droughts and service interruptions. This strategy reduces reliance on municipal systems, promotes sustainable practices, and improves household and community resilience during events like hurricanes and earthquakes.
2026-LMA-EA-005	New	Implement community-based programs of practical workshops focused on urban agriculture, basic food management, and small-scale production, supported by educational gardens, with the aim of strengthening applied knowledge, food self-sufficiency, and community resilience. This strategy contributes to improving food security, reducing dependence on external supply chains, and strengthening the capacity to respond to disruptions, such as those experienced during pandemics, when access to food may be limited.	Pandemic/Epidemic	High	Food, Hydration and Shelter	Leader: Office of Emergency Management Support: Mayor's Office	Municipal	Medium Term	Current Status: New - Community workshops on urban agriculture and food handling strengthen food security by reducing dependence on external supply chains. They build practical skills, promote self-sufficiency, and enhance the community's ability to respond to disruptions, particularly during emergencies such as pandemics.

2026 ID	2020 ID	Description	Hazard	Priority	Lifeline	Municipal Office in Charge	Possible Sources of Funds	Implementation term	Status
2026-LMA-EA-006	New	Develop and implement educational workshops and orientation campaigns on wildfire prevention, including the risks associated with illegal burning, the safe handling of combustible materials, the identification of high-risk conditions, and preventive measures that residents can adopt to reduce the likelihood of fires.	Wildfire	Medium	Safety and security	Leader: Office of Emergency Management Support: Mayor's Office	Municipal	Short Term	Current Status: New – This strategy promotes changes in community behavior by educating and raising awareness about safe practices, reducing the incidence of forest fires caused by human activities, such as illegal burning. In addition, it contributes to the protection of lives, property, critical infrastructure, natural resources and air quality.

6.5 PARTICIPATION IN THE NFIP

Covered under the PRPB, the Municipality maintains continuous participation in the National Flood Insurance Program (NFIP) and remains committed to meeting all program requirements to reduce flood risk and protect life and property. Ongoing participation in the NFIP enables residents and businesses to access federally backed flood insurance while promoting sound floodplain management practices. The PRPB, on the municipality's behalf, enforces floodplain management regulations consistent with FEMA requirements, including the adoption and use of Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FIS) for development decisions. Local permitting, inspection, and enforcement activities help ensure that new construction and substantial improvements in Special Flood Hazard Areas comply with applicable elevation and floodproofing standards. The Municipality also supports public awareness and education activities related to flood risk, insurance requirements, and mitigation measures. Continued compliance with the NFIP strengthens eligibility for federal hazard mitigation funding and supports the long-term reduction of flood-related damages.

7. PLAN MAINTENANCE

This chapter describes the procedures and actions necessary to ensure that the Plan is effectively implemented, regularly reviewed, and maintained in alignment with the established mitigation goals and objectives. In some instances, Plan updates may require adjustments to proposed mitigation actions to reflect changes in on-site conditions that could either increase or reduce the level of risk affecting certain areas.

In accordance with federal requirements, the Local Hazard Mitigation Plan (LHMP) review process must include the following elements:

- A description of the methods and schedule for monitoring, evaluating, and updating the Mitigation Plan within a five-year period.
- A process for integrating the Mitigation Plan's requirements into other applicable local planning mechanisms, such as comprehensive plans or capital improvement plans.
- A description of how the community will continue to participate in the Plan's review and maintenance process.

7.1 POINT OF CONTACT

The designated point of contact responsible for the monitoring, revision, and update of the LHMP is as follows:

Table 51. Point of Contact Information

Name:	Valeria Cruz
Position:	Director
Office:	Planning and Project Management Office
Telephone:	(787) 264-5954
Email:	vcruz@municipiodesanGermán.com

7.2 CONTINUOUS PUBLIC PARTICIPATION (D1-A)

The Municipality of San Germán, is committed to ensuring ongoing public

participation by implementing the following engagement methods:

- Public education and awareness initiatives
- Surveys
- Community workshops and meetings held throughout the municipality

Consistent with this commitment, public participation and community education are integral components of several mitigation strategies included in this Plan. Residents are encouraged to submit comments and participate in LHMP updates at any time, including requesting copies of the Plan during its development, monitoring, and maintenance phases.

Each time a progress report is completed, it will be made available for public review. Plan progress will also be discussed periodically during public meetings and shared through social media and other communication platforms. Public participation notices will be distributed throughout all monitoring and oversight stages of the Plan. Additionally, the Municipality will continue providing presentations to community groups regarding the LHMP and the status of mitigation strategy implementation. These groups may include elected officials, schools, and other community organizations. The Municipality will also promote civic engagement and preparedness education by offering training courses and workshops—such as Community Emergency Response Team (CERT) programs—and by informing residents about the National Flood Insurance Program (NFIP) and other relevant initiatives.

Mitigation efforts will be tailored to address the specific vulnerabilities and needs of individual communities, supporting the development of a more informed, prepared, and resilient population. This approach underlines the Municipality's commitment to sustained community engagement throughout the Plan's effective period, updating cycles, and post-adoption activities.

7.3 LHMP OVERSIGHT (D2-A)

The Municipality's strategy for Plan implementation, monitoring, and evaluation establishes a framework that promotes collaboration, information sharing, and innovation. Through its Planning Committee, composed of representatives from various municipal agencies and departments, the Municipality will work with partners and residents to apply a localized and coordinated approach to hazard mitigation. This collaborative strategy is intended to reduce losses, address community needs, and strengthen the Municipality's capacity to withstand future hazard events.

The Plan will be monitored to assure:

- Maintain current and accurate hazard and risk information
- Ensure mitigation strategies reflect community and stakeholder priorities
- Comply with federal and Commonwealth LHMP requirements
- Maintain eligibility for mitigation funding
- Ensure consistency with other local and regional planning efforts

To support effective implementation, the Municipality will leverage existing resources and infrastructure planning processes. Mitigation actions identified as immediate or short-term will be pursued over the next five (5) years, subject to available funding and resources.

7.4 LHMP EVALUATION AND MONITORING

Evaluation of the LHMP will be an ongoing process. In addition to FEMA's required five-year review, the Municipality will conduct annual evaluations, or more frequently if conditions warrant. Following each annual review, the Planning Committee will meet to approve a yearly progress report documenting updates, accomplishments, and progress toward mitigation goals and objectives. This report will be submitted to the Office of the Mayor and made available to the public.

A preliminary schedule for Planning Committee meetings is outlined below:

Table 52. Preliminary Planning Committee Meeting Schedule

Time Period	Participants	Purpose of the Meeting
Annual Meeting (2027)	Planning Committee (Can be open to the public if deemed necessary)	The Committee will identify funding needs, reassess hazard priorities, develop strategies for grant applications, and conduct site visits to high-risk areas to monitor progress and engage directly with communities.
Annual Meeting (2028)	Planning Committee (Can be open to the public if deemed necessary)	The Committee will review mitigation implementation status, identify emerging risks, and evaluate

		community needs. Site visits will be conducted as necessary.
Annual Meeting (2029)	Planning Committee (Can be open to the public if deemed necessary)	The Committee will confirm progress on mitigation actions and assess the need for additional funding.
Annual Meeting (2030)	Planning Committee (Can be open to the public if deemed necessary)	The Committee will hold its final meeting prior to the next LHMP update to verify mitigation implementation status, which will be documented in the updated Plan.

7.5 LHMP UPDATE AND REVISION (D2-C, D3-A)

7.5.1 REVISION FOLLOWING A MAJOR DISASTER

If a major emergency or disaster declaration affecting the Municipality occurs during the Plan's five-year term, the Planning Committee—along with stakeholders, community representatives, and nonprofit organizations—will convene to identify newly affected areas, revise mitigation priorities, and incorporate lessons learned. This meeting will replace the annual review scheduled for that year.

7.5.2 FIVE-YEAR COMPREHENSIVE UPDATE

In accordance with federal guidance, the LHMP will be comprehensively updated five (5) years after approval and submitted to the State Hazard Mitigation Officer and FEMA for review and approval. Approximately eighteen (18) months prior to the Plan's expiration, the review process will begin, including a full evaluation of the municipal profile, risk assessment, and mitigation strategies, with attention to updated guidance and requirements.

7.6 INTEGRATION WITH OTHER PLANNING MECHANISMS (D3-A)

The following public policies and planning documents were considered in the development of this LHMP:

Commonwealth Level:

- Puerto Rico Land Use Plan (PUT-PR)
- San Germán Territorial Plan (PT)
- Karst Special Planning Area Plan and Regulation
- Joint Regulation for the Evaluation and Issuance of Permits
- Special Flood Hazard Areas Regulation (2021)
- Stormwater System Design, Operation, and Maintenance Regulation
- San Germán Emergency Operations Plan

Following adoption, the LHMP will guide updates to the Territorial Plan, special area plans, and urban expansion plans, and will inform municipal budget priorities. Once FEMA approval is received, a digital copy of the Plan will be submitted to the Puerto Rico Planning Board to support updates to the PUT-PR and other relevant Commonwealth planning documents.

8. ADOPTION AND APPROVAL (F1-A, F1-B)

8.1 LHMP ADOPTION

Federal policy establishes LHMPs must include “Documentation that the LHMP has been formally adopted by the governing body of the jurisdiction requesting approval of the Plan. The municipality has one (1) year to adopt the Plan once it receives an *Approval Pending Adoption (APA)*.”²¹

This LHMP was adopted by the Municipality of San Germán on **XXXXXX**. A copy of **Resolution**, titled “*To Adopt the 2026 Natural Hazard Mitigation Plan of the Municipality of San Germán, and for Other Related Purposes,*” is included as part of **Appendix A**.

8.2 LHMP APPROVAL

This LHMP was approved by FEMA and the SHMO on **XXXXXX**. A copy of the Approval Letter, titled “*Approval of the Local Hazard Mitigation Plan, Municipality of San Germán,*” is included in **Appendix A**. FEMA’s approval of the Plan is valid for a period of **five (5) years**, through **XXXXXX**.

²¹ 44 C.F.R. §201.6(c)(5)

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APPENDIX A: ADOPTION AND APPROVAL

ADOPTION

APPROVAL BY FEMA

FEMA APA LETTER

FEMA REVIEW TOOL

DRAFT

APPENDIX B: PLANNING COMMITTEE

COMMITMENT LETTER



Carta de Compromiso sobre el Plan de Mitigación Municipal

El Municipio de San Germán, representado en este acto por su alcalde, Hon. Virgilio Olivera Olivera, mediante el presente documento denominado carta de compromiso se compromete en conjunto con la Junta de Planificación de Puerto Rico (JPPR) trabajar en la revisión y actualización del plan de mitigación contra peligros naturales municipal (Plan). El mismo tiene el objetivo de identificar actividades y medidas dirigidas a la mitigación de peligros naturales tales como huracanes, inundaciones, sequías, terremotos, deslizamientos, tsunamis entre otros que apliquen. El Plan tiene dentro de sus prioridades la reducción de pérdidas de vida y propiedad asociado a los diferentes peligros naturales e identificar medidas para atender las necesidades del municipio y sus residentes de manera planificada y ordenada, promoviendo así el desarrollo sostenido mediante la preservación de la función natural y los beneficios de la conservación de los recursos naturales y la infraestructura.

Observando los planes que se han vencido, y están próximos a vencer, la *Oficina Central de Recuperación, Reconstrucción y Resiliencia* (COR3 por sus siglas en inglés) procedió asignar presupuesto a la JPPR para atender la revisión y actualización de los Planes de Mitigación Contra Peligros Naturales de los municipios. Es importante destacar que los planes de mitigación deberán estar aprobados por la Agencia Federal para el Manejo de Emergencias (FEMA por sus siglas en inglés) para evitar que los municipios pierdan los fondos asignados para la ejecución de los proyectos. Por lo tanto, recae sobre el municipio la responsabilidad de gestionar adecuadamente su plan, ya que la falta de vigencia conllevaría la pérdida de dichos fondos.

La JPPR está facultada para asistir a los municipios, conforme a la Ley Orgánica de la Junta de Planificación de Puerto Rico, Ley Núm. 75 del 24 de junio de 1975, según enmendada, 23 LPRA., sección 62 (k). Asimismo, la JPPR podrá hacer uso de recursos externos para la elaboración del plan de mitigación.

A su vez el Municipio está facultado a realizar acuerdos con cualquier agencia del Gobierno Central para que este desarrolle o lleve a cabo, en beneficio del Municipio, cualquier estudio, trabajo, obra o mejora pública municipal conforme a lo establecido en la ley Código Municipal de Puerto Rico, Ley Núm. 107 del 13 de agosto de 2020, según enmendada.

Es esencial que este plan cumpla con los requisitos del Acta de Mitigación de Desastre, la cual establece que los gobiernos municipales y estatales que hayan adoptado sus planes de mitigación contra peligros naturales serán elegibles para fondos de mitigación pre-desastre (Pre-disaster Mitigation Act) y post desastre a través del Programa de Subvención para la Mitigación de Riesgos (HMGP), el Predisaster Mitigation (PDM) y el Flood Mitigation Assistance Program (FMAP).

Por lo tanto, el municipio reconoce que la JPPR se comprometerá a coordinar junto al municipio la aprobación del Plan; coordinar la evaluación del Plan por parte del COR3 y FEMA; y efectuar la entrega del Plan aprobado por COR3 y FEMA al municipio.

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El Municipio asignará una persona contacto o empleado municipal designado por el alcalde que será el contacto oficial (POC) del municipio para la coordinación, ejecución y la elaboración de la actualización del plan de mitigación. Esta persona trabajará directamente con el personal designado por la Junta de Planificación en este proyecto.

Asimismo, el Municipio agilizará y tramitará la adopción del plan mediante Orden Ejecutiva o a través de la Legislatura Municipal mediante Ordenanza Municipal. También coordinará en conjunto con la JPPR o el personal autorizado, el proceso de participación ciudadana.

Se coordinará por parte del municipio la recopilación de información necesaria que sea requerida, incluyendo:

- Identificación de todos los Riesgos locales – Descripción de los diferentes eventos ocurridos en el Municipio y los impactos que han tenido en la comunidad.
- Identificación de inventario de activos del Municipio, de considerarse el activo como uno crítico favor de identificar el mismo como activo-crítico.
- Información necesaria para complementar la Tabla de análisis de capacidad.
- Identificación e Implantación de las Medidas / actividades de Mitigación: Lista de proyectos y Plan de Acción describiendo cómo los proyectos serán implantados por prioridades, cómo serán administrados, si son costo-beneficiosos.
- Evaluación del Plan Preliminar.
- Evaluación del Borrador del Plan.
- Evaluación del Borrador Final del Plan.
- Implementación del Plan de Mitigación – Monitoreo, Evaluación y Actualización.
- Realizar los esfuerzos educativos y comunicación necesarios a los diferentes sectores de la ciudadanía de este proceso de actualización del plan.
- La JPPR coordinará con el municipio respecto a cualquier otra información que se requiera.

Este compromiso no implica la erogación de fondos públicos por parte del municipio ni de la JPPR. A su vez, podrá ser terminado por la JPPR o por el Municipio, mediante comunicación escrita dirigida al presidente de la JPPR o al alcalde, según corresponda.

Por lo que, de acuerdo con este compromiso, yo, Virgilio Olivera Olivera lo firmo conforme a los mejores intereses del pueblo de San Germán.

En San Juan, Puerto Rico, hoy 16 de diciembre de 2025.


Alcalde

PLANNING COMMITTEE APPOINTMENTS

NOTIFICACIÓN DE DESIGNACIÓN Comité de Planificación del Municipio de San Germán

Yo, Hon. Virgilio Olivera Olivera, alcalde del Municipio de San Germán, designo a los siguientes funcionarios y representantes como integrantes del *Comité de Planificación para la actualización del Plan de Mitigación contra Peligros Naturales del Municipio de San Germán*, con el deber de apoyar, asesorar, coordinar y evaluar los trabajos de revisión, actualización, implementación y monitoreo del Plan mencionado.

Nombre	Puesto y Oficina	Correo electrónico	Teléfono (Ext.)
Virgilio Olivera Olivera	Alcalde	volivera@municipiodesangerman.com	787-892-3500 ext 2236
Pedro Ramos	Director de Obras Públicas Municipal	pramos@munsangerman.onmicrosoft.com	939-299-9536
Dereck Marrero	Director de la Oficina de Municipal de Manejo de Emergencias	d.marrero@municipiodesangerman.com	787-892-3500 ext 2213
Braulio Torres	Comisionado de la Policía Municipal	btorres@municipiodesangerman.com	787-892-3500 ext
Yaritzamarely Jusino	Secretaría Municipal	y.jusino@municipiodesangerman.com	787-892-3500 ext 2242
Karelys Vega	Directora de Programas Federales	kvega@municipiodesangerman.com	787-892-3500 ext 2225
Ramón J. Cruz	Supervisor General de Obras Públicas Municipal	rjcruzmartinez@gmail.com	787-640-7908
Valeria A. Cruz	Directora de la Oficina de Planificación y Gerencia de Proyectos	vcruz@municipiodesangerman.com	787-892-3500 ext 2602

Johaneliz Acosta	Directora de la Oficina de Servicios al Ciudadano	jacosta@municipiodesangerman.com	787-892-3500 ext 2201
Ismael Madera	Director de Finanzas	imadera@municipiodesangerman.com	787-892-3500 ext 2268

Funciones principales del Comité:

- Coordinar con los trabajos relacionados con la actualización del Plan de Mitigación.
- Participar de talleres, presentaciones y reuniones sobre la actualización del Plan de Mitigación de Riesgos
- Proporcionar información, y datos sobre la evaluación de los riesgos y vulnerabilidades del municipio, así como las capacidades y los proyectos prioritarios de mitigación.
- Asegurar el cumplimiento con los requisitos estatales y federales para la elegibilidad de fondos de mitigación.
- Ayudar a diseñar y proponer acciones y proyectos de mitigación al municipio para fortalecer la resiliencia y reducir los riesgos de desastres.
- Mantener comunicación con la ciudadanía y promover la participación comunitaria en el proceso de mitigación.
- Apoyar la adopción e implantación del Plan de Mitigación.

Esta designación tendrá vigencia inmediata y se mantendrá en efecto hasta que se notifique lo contrario.

Firmada hoy, 5 de febrero de 2026

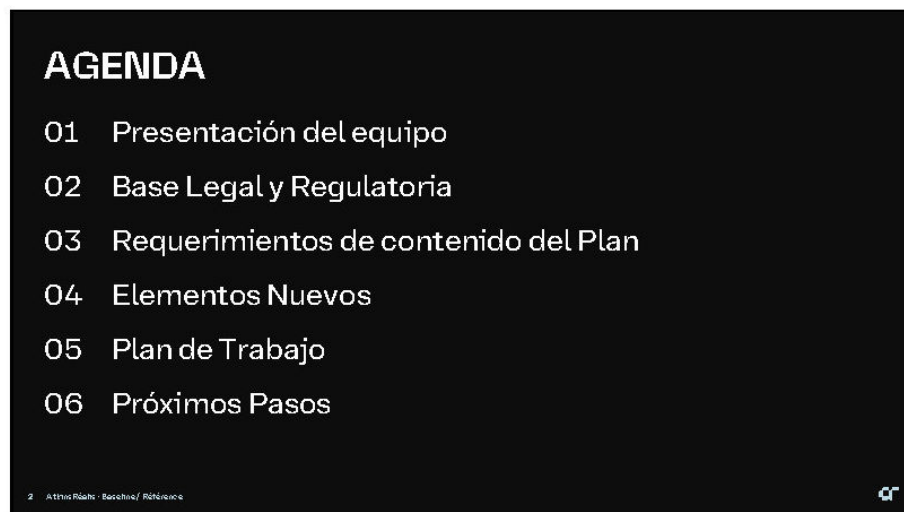
Virgilio Olivera Olivera
Nombre

Firma 
Alcalde Municipio de San Germán

FIRST PLANNING COMMITTEE MEETING PRESENTATION



1



2

1

Equipo de Trabajo



3

Equipo de Trabajo

William Pitre, Senior Planner

Ivelisse Gorbea, Senior Planner

Celso Ruiz, Data Analyst

Marsha Caride, Administrative Assistant

4

2

Equipo de Trabajo

Mario González, Analista de Planificación

Yashira Santos, Analista de Planificación

Leonardo Pérez, Analista de Planificación

Armando Rodríguez, Analista de Planificación

Juan Rotger, Analista de Planificación

6



5

Adjuntas



Armando Rodríguez

Hatillo



Juan Rotger

San Germán



Yashira Santos

Peñuelas



Yashira Santos

Ututo



Juan Rotger

6 AtkinsRéalis - Baseline / Référence



6

3

Base Regulatoria

7 AtkinsRéalis - Baseline / Référence



7

Base Legal y Regulatoria

- **Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended**

- PL100-707, signed into law November 23, 1988, amended the Disaster Relief Act of 1974, PL 93-288.
- National Flood Insurance Act of 1968, as amended.
- National Dam Safety Program Act (Pub. L. 92-367), as amended.
- Regulation: 44 CFR Part 201 Mitigation Planning.



8 AtkinsRéalis - Baseline / Référence

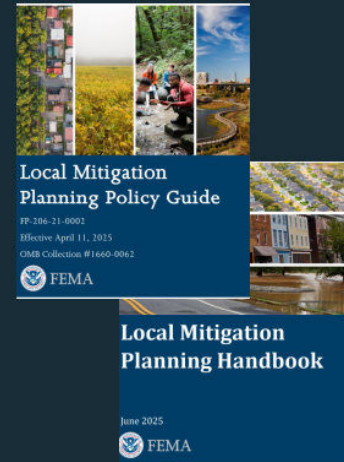


8

4

Requerimientos del Plan de Mitigación

- Elemento A: Proceso de Planificación
- Elemento B: Identificación de Peligros y Evaluación de riesgos
- Elemento C: Estrategias de Mitigación
- Elemento D: Plan de Seguimiento e Implementación
- Elemento E: Actualización del Plan
- Elemento F: Adopción del Plan
- Elemento G: Peligros Potenciales ante fallos en Represas (opcional)
- Elemento H: Requisitos Estatales Adicionales



10 AtkinsRéalis - Baseline / Référence

9

Elementos nuevos del Plan

1. Identificación y evaluación de riesgos

- Se clasifica la infraestructura crítica por servicio vital o línea de vida
- Se analiza su exposición y vulnerabilidad
- Se prioriza por línea de vida

2. Evaluación de capacidades

- Se evalúa la capacidad local para proteger servicios vitales
- Se identifican brechas y se proponen acciones

3. Estrategia de Mitigación

- Se incluyen acciones específicas para proteger, estabilizar y restaurar servicios vitales

4. Participación de Partes Interesadas

- Se invita a agencias responsables o representantes de servicios vitales y se documenta su participación
- Se comunica al público y recopila retroalimentación sobre los servicios vitales



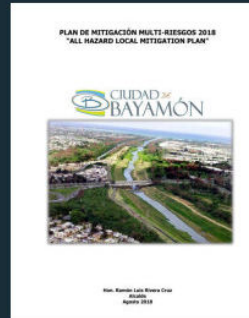
10 AtkinsRéalis - Baseline / Référence

10

5

Elementos nuevos del Plan

- **Actualización del Plan:** "Review Tool" especifica los elementos que se deben documentar para reflejar los cambios
 - El Plan describe los cambios en las áreas propensas a peligros (ha incrementado o disminuido la vulnerabilidad o peligro)
 - Deberá reflejar los cambios en prioridades y progreso de los esfuerzos locales de mitigación.



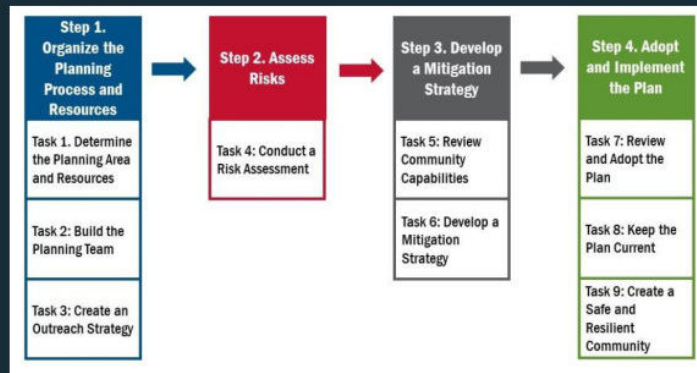
Element E: Plan Update		
Element E Requirements	Location in Plan (section and/or page number)	Met / Not Met
E1: Was the plan revised to reflect changes in development? (Requirement 64.CFR § 201.6(d)(3)).		
E2-a: Does the plan describe the changes in development that have occurred in hazard-prone areas that have increased or decreased each community's vulnerability since the previous plan was approved?	Click or tap here to enter text.	Choose i

11 AtkinsRéalis - Baseline / Référence



11

Proceso del Plan de Mitigación



12 AtkinsRéalis - Baseline / Référence

[Local Mitigation Planning Handbook](#)



12

Riesgos a Evaluar

13 AtkinsRéalis - Baseline / Référence



13

Peligros a considerar



Terremoto



Modificaciones
costeras



Manejo de
Ciclónica



Fuego Forestal



Deslizamientos



Inundaciones



Calor Extremo



Pandemia/
Epidemia



Tsunami



Ciclones Tropicales



Sequías

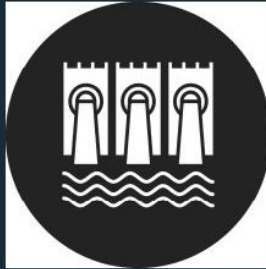
14 AtkinsRéalis - Baseline / Référence



14

7

Represas



Adjuntas



Peñuelas



Utuado

16 AtkinsRéalis - Baseline / Référence



15

¿Qué necesitamos del Municipio?



Designación del Comité de Planificación



Apoyo en la actualización de las estrategias de mitigación del plan anterior.



Incorporación de nuevas estrategias de mitigación.



Actualización de capacidades

16 AtkinsRéalis - Baseline / Référence



16

Evaluación de Capacidades

17 AtkinsRéalis - Baseline / Référence



17

Capacidades



18 AtkinsRéalis - Baseline / Référence



18

9

Participación Ciudadana

19 AtkinsRéalis - Baseline / Référence



19

Participación Ciudadana

- Dos reuniones de participación ciudadana.
- Notificación será publicada por Junta de Planificación.
- Publicar 15 días antes de la reunión
- Se otorga 15 días para comentarios
- Para la Segunda reunión se discute el primer borrador.
- El primer borrador será comentado por el público, el municipio y la Junta de Planificación



20 AtkinsRéalis - Baseline / Référence



20

10

Ventana para la primera actividad de participación ciudadana

2 de marzo al 13 de marzo

Debe informar su fecha de reunión antes del lunes 9 de febrero.

Favor proveer varias fechas para que su analista de Planificación pueda estar.

De no recibir las fechas en o antes del lunes 9, su reunión será calendarizada después de las de otros municipios.



21 AtkinsRéalis - Baseline / Référence



21

Comunicación

22 AtkinsRéalis - Baseline / Référence



22

11



JUNTA DE
PLANIFICACION
GOBIERNO DE PUERTO RICO

Información de Contacto

Programa	Junta de Planificación	prpb.lhmp@atkinsrealis.com
Plan. Ivette Colón	Junta de Planificación	colon_i@jp.pr.gov
Plan. William Pitre	AtkinsRéalís Caribe	William.Pitre@atkinsrealis.com /+19392051336

Pedimos que el título de todo correo comience únicamente con el nombre del municipio.
 Ej.: "San Germán - Tablas de Mitigación Actualizadas"

Solicitamos que en todo correo electrónico relacionado con el programa se copie siempre al correo oficial:
prpb.lhmp@atkinsrealis.com

Atkins Réalis


23



Grupos de Trabajo

24 Atkins Réalis - Baseline / Référence


24

SIGN IN SHEETS



HOJA DE ASISTENCIA



Fecha: 9 de febrero de 2026

Hora: 1:30pm

Asunto: 1era Reunión con Comité de Planificación

Nombre y dos apellidos	Teléfono	Municipio	Firma	Correo Electrónico
Valeria A. Cruz Zapata	939-244-9710	San Germán	<i>Valeria Cruz Zapata</i>	veruz@municipiode.sangerman.com
Dorilein Muniz Muniz	789-264-5954	San Germán	<i>DMuniz</i>	dmuniz@municipiode.sangerman.com
Braulio Tom Jimenez	782-6400919	San Germán	<i>BTJ</i>	BTJ@municipiode.sangerman.com
Pedro Ramos Collazo	939-299-8530	San Germán	<i>Pedro Ramos Collazo</i>	pedro.amos.collazo@gmail.com
Román Madera Madero	(787) 901-0600	" "	<i>Román Madera Madero</i>	romanm@municipiode.sangerman.com
Dereck Narciso Ramos	787-673-3737	San Germán	<i>Dereck Ramos</i>	dramos@municipiode.sangerman.com

DE

MINUTA

PROYECTO: PRPB 25 LHMP Update

TITULO: LHMP First Planning Committee Meeting

LUGAR DE LA REUNIÓN: Junta de Planificación, Salón B **# REUNIÓN:** 01

FECHA Y HORA: 02/09/2026 a las 1:30 pm **MINUTA POR:** Yashira Santos

Lista de Asistencia:

NOMBRE	INICIALES	COMPAÑÍA
Valeria A. Cruz - Directora de Planificación y Ordenamiento Territorial	VC	Municipio de San Germán
Dorileine Muñoz - Asistente Administrativa Planificación y Ordenamiento Territorial	DMU	Municipio de San Germán
Dereck Marrero - Director Oficina de Manejo de Emergencia (OMME)	DMA	Municipio de San Germán
Braulio Torres - Comisionado Policía	BT	Municipio de San Germán
Ismael Madera, Director Finanzas	IM	Municipio de San Germán
Pedro Ramos, Director Obras Públicas Municipal (OPM)	PR	Municipio de San Germán
Yashira Santos - Analista de Planificación	YS	AtkinsRéalis

Asuntos Discutidos:

ID	ASUNTOS DISCUTIDOS
AD-1	Aprobación de Minuta Reunión Anterior: N/A
AD-2	Asunto Relacionado con Alcance de Servicio Contratado y Entregables N/A
AD-3	Plan de Trabajo Propuesta (Two Weeks Ahead / Four Week Ahead) N/A

NOTA A LOS DESTINATARIOS:

Estas notas de la reunión reflejan la interpretación de AtkinsRéalis sobre la reunión y las acciones previstas que se derivan de la misma. Se asumirá su conformidad en que estas notas constituyen un registro fiel de lo discutido, a menos que se reciban comentarios adversos por escrito dentro de los cinco (5) días posteriores a su recepción.



1

ID	ASUNTOS DISCUTIDOS
AD-4	Asuntos Nuevos • La reunión dio inicio con una presentación a cargo del planificador W. Pitre, de AtkinsRéalis, en la cual se explicó el alcance del proyecto, las actividades a realizar, los requisitos aplicables y el proceso mediante el cual la Junta de Planificación y AtkinsRéalis estarán desarrollando el Plan de Mitigación para los municipios. • Y.Santos procedió a presentarse y abundar sobre su experiencia con mitigación y los municipios, y pasó la palabra para que los participantes indicaran su nombre y dependencia municipal. YS procedió a explicar la asistencia que estará recibiendo el municipio para el desarrollo del Plan de Mitigación. • Y.Santos solicitó que se aclarara quién sería el POC (Point of Contact) por parte del municipio, a lo cual VC aclaró que el POC será ella. • Se identificó que la persona encargada de desarrollar el plan la vez previa no estaba presente en la reunión. • Se explicó en que consiste el programa de mitigación y se procedió a discutir las tablas de estrategias del municipio de San Germán, incluidas en la versión del Plan de Mitigación a revisar. Se explicó la importancia de que los Municipios proveyeran información sobre si las medidas de mitigación habían sido trabajadas o, de no haberlo sido, que explicaran el estado de progreso. En caso de que no se hayan trabajado, deberán proveer una justificación válida dentro del conocimiento de la responsabilidad que conlleva cada medida adoptada previamente por el municipio. • Se discutieron los tipos de actividad en los que están clasificados los proyectos: Prevención, Protección a la Propiedad, Protección a los Recursos Naturales, Proyectos Estructurales, Servicios de Emergencia y Educación y Concientización Pública. • Referente a la acción P-1, se ha identificado las necesidades y actualmente se están trabajando los procedimientos de evacuación y rescate a través de la OMME • Referente a la acción P-2, GIS (Geographic Information System) se solicitó a través de los fondos HGMP 404 (Hazard Mitigation Grant Program) pero luego hubo que priorizar por los límites de fondos por lo cual se tuvo que eliminar para poder realizar otros proyectos de mitigación identificados también en el Plan de Mitigación, por lo cual actualmente no se ha identificado fondos para dicha acción. • Referente a la acción PP-1, se identificó posible duplicidad de acciones en el Plan de Mitigación ya que el PP-14 al PP-18 se desglosa los edificios críticos a los cuales se le instalaran tormenteras. Estas tormenteras están siendo trabajadas a través de los fondos de HMGP 404. Algunas facilidades fueron sustituidas por otras ya que por ser históricas HMGP sugirió el cambio de estas por restricciones del Instituto de Cultura Puertorriqueña (ICP). Algunas de las facilidades afectadas por esto fueron las siguientes: ○ Tormentera en el Teatro Sol fueron sustituidas por tormenteras en la facilidad crítica del Centro de Envejeciente Ufret.

NOTA A LOS DESTINATARIOS:

Estas notas de la reunión reflejan la interpretación de AtkinsRéalis sobre la reunión y las acciones previstas que se derivan de la misma. Se asumirá su conformidad en que estas notas constituyen un registro fiel de lo discutido, a menos que se reciban comentarios adversos por escrito dentro de los cinco (5) días posteriores a su recepción.

ID	ASUNTOS DISCUTIDOS
	○ Tormenteras en la Antigua Alcaldía fueron sustituidas por tormenteras en la Casa de Estudiante. • Referente a la acción PP-2, BT indicó que el Centro Comunal Hiram C Rivera en Rosario Poblado y Centro Comunal de Guama se convirtieron en refugio. • Referente a la acción PP-3, se identificó que por la cantidad exorbitante de fondos que amerita esta acción y la urgencia del municipio de resolver esta necesidad se procedió con otras medidas de obtención de generadores. Entre ellas: ○ Se proveyeron 100 generadores para personas con discapacidad y condiciones de salud especiales. ○ Se instaló un generador y placas solares para el edificio de Manejo de Emergencia (OMME) y para comisionado de la policía. ○ Se instalaron placas solares en el Centro de Envejeciente Hoconuco Bajo. ○ Se instaló generadores en el Centro de Envejecientes Ufret y actualmente se está coordinando para instalar placas solares. • Referente a la acción PP-11 y PP-12, actualmente se encuentra en subasta los generadores para Obras Públicas y Alcaldía. • Referente a la acción PP-19, VC indicó que los fondos se transfirieron a otro proyecto y que de ser el caso que el municipio no desea proceder con esta acción, estará proveyendo una justificación para la tabla de estrategias como parte de la revisión del Plan de Mitigación. • Referente a la acción ES-1, VC indicó que este proyecto se encuentra en proceso de diseño con fondos ARPA. • Referente a la acción EPC-1 y EPC-2, DMA indicó sobre las siguientes medidas tomadas relacionadas: ○ Simulacro de terremoto y fuego, emanaciones de gases y tiradores activos utilizando las plataformas de Facebook. ○ Adiestramiento a personal municipal (CERT) ante fuegos y huracanes. ○ Conferencia a líderes comunitarios para mitigación por derrumbes.
AD-5	Discusión de Acciones por Tomar • Tabla Inferior
AD-6	Coordinación Próxima Reunión • TBD

Acciones Por Tomar:

ID	ACCIONES POR TOMAR	FECHA LÍMITE	ENTIDAD RESPONSABLE
AT-1	Enviar logo del Municipio.	Lo antes posible	Mun. San Germán

NOTA A LOS DESTINATARIOS:

Estas notas de la reunión reflejan la interpretación de AtkinsRéalis sobre la reunión y las acciones previstas que se derivan de la misma. Se asumirá su conformidad en que estas notas constituyen un registro fiel de lo discutido, a menos que se reciban comentarios adversos por escrito dentro de los cinco (5) días posteriores a su recepción.

ID	ACCIONES POR TOMAR	FECHA LÍMITE	ENTIDAD RESPONSABLE
AT-2	Enviar fecha, hora y lugar de reunión comunitaria.	Lo antes posible	Mun. San Germán
AT-3	Continuar con la identificación de estado de proyectos propuestos en su plan de mitigación a revisar.	Lo antes posible	Mun. San Germán

Acuerdos/Aclaraciones:

ID	DESCRIPCIÓN
AC-1	N/A

Anejos:

ID	DESCRIPCIÓN ANEJO	NÚMERO DE PÁGINAS
AN-1	N/A	

PRÓXIMA REUNIÓN:	TBD		
MEDIO DE DISTRIBUCIÓN:	Email		
FECHA DISTRIBUCIÓN:	02/17/2026	ARCHIVO DE REFERENCIA:	First Planning Committee Meeting

NOTA A LOS DESTINATARIOS:

Estas notas de la reunión reflejan la interpretación de AtkinsRéalis sobre la reunión y las acciones previstas que se derivan de la misma. Se asumirá su conformidad en que estas notas constituyen un registro fiel de lo discutido, a menos que se reciban comentarios adversos por escrito dentro de los cinco (5) días posteriores a su recepción.

APPENDIX C – PUBLIC PARTICIPATION AND OUTREACH

FIRST PUBLIC PARTICIPATION MEETING

PUBLIC NOTIFICATION

PLANIFICACIÓN AVISO PÚBLICO

PRIMERA REUNIÓN DE PLANIFICACIÓN CON LA COMUNIDAD

La Junta de Planificación, junto al Municipio de San Germán, invitan a los organismos gubernamentales, entidades privadas, dueños de negocios, líderes comunitarios y ciudadanía en general a participar de la 1ra reunión de Planificación con la Comunidad para la revisión del Plan de Mitigación contra Peligros Naturales.

Los peligros naturales pueden causar la pérdida de vida y propiedad y tener consecuencias nefastas. La mitigación de riesgos es el esfuerzo de nuestra comunidad por reducir los daños o riesgos ocasionados por peligros naturales mediante el diseño de medidas que reduzcan su impacto.

El Plan de Mitigación contra Peligros Naturales para el Municipio de San Germán tiene el propósito de guiar al gobierno municipal en el desarrollo y adopción de estrategias dirigidas al manejo de peligros, tales como inundaciones, huracanes, sequías, deslizamientos, terremotos y otros.

FECHA: 5 DE MARZO DE 2026
HORA: 10:00 AM
LUGAR: CENTRO COMUNAL DE MINILLAS, CALLE BRILLANTE, SABANA GRANDE ABAJO, SAN GERMÁN, PR

SAN GERMÁN

PARA MÁS INFORMACIÓN, ACCEDA: JP.PR.GOV

PLANIFICACIÓN AVISO PÚBLICO

PRIMERA REUNIÓN DE PLANIFICACIÓN CON LA COMUNIDAD

La Junta de Planificación, junto al Municipio de Vieques, invitan a los organismos gubernamentales, entidades privadas, dueños de negocios, líderes comunitarios y ciudadanía en general a participar de la 1ra reunión de Planificación con la Comunidad para la revisión del Plan de Mitigación contra Peligros Naturales.

Los peligros naturales pueden causar la pérdida de vida y propiedad y tener consecuencias nefastas. La mitigación de riesgos es el esfuerzo de nuestra comunidad por reducir los daños o riesgos ocasionados por peligros naturales mediante el diseño de medidas que reduzcan su impacto.

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FECHA: 5 DE MARZO DE 2026
HORA: 10:00 AM
LUGAR: CENTRO DE USOS MÚLTIPLES, CALLE ISABEL SEGUNDA, VIEQUES, PR

VIEQUES

PARA MÁS INFORMACIÓN, ACCEDA: JP.PR.GOV

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JUNTA DE

PLANIFICACIÓN

GOBIERNO DE PUERTO RICO

AVISO PÚBLICO

PRIMERA REUNIÓN DE PLANIFICACIÓN CON LA COMUNIDAD



La Junta de Planificación, junto al Municipio de San Germán, invitan a los organismos gubernamentales, entidades privadas, dueños de negocios, líderes comunitarios y ciudadanía en general a participar de la 1ra reunión de Planificación con la Comunidad para la revisión del Plan de Mitigación contra Peligros Naturales.

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El Plan de Mitigación contra Peligros Naturales para el Municipio de San Germán tiene el propósito de guiar al gobierno municipal en el desarrollo y adopción de estrategias dirigidas al manejo de peligros, tales como inundaciones, huracanes, sequías, deslizamientos, terremotos y otros.

FECHA: 5 DE MARZO DE 2026

HORA: 10:00 AM

LUGAR: CENTRO COMUNAL DE MINILLAS,



PLANES DE MITIGACIÓN
CONTRA PELIGROS NATURALES
Planificar para proteger

SAN GERMÁN

PARA MÁS INFORMACIÓN, ACCEDA: JP.PR.GOV



22



1



5



MINUTES



1^{RA} REUNIÓN DE PLANIFICACIÓN CON LA COMUNIDAD MUNICIPIO DE SAN GERMÁN

Asunto: Actualización del Plan de Mitigación contra Peligros Naturales
Lugar: Centro Comunal de Minillas, calle Brillante
Fecha y Hora: jueves 5 de marzo de 2026, 10:00 am

NOTAS:

- Representante de la Junta de Planificación:
 - Plan. Onix Concepción Rodríguez.
- Personal enlace del Municipio de San Germán:
 - Sra. Valeria A. Cruz Zapata
- La reunión comenzó aproximadamente a las 10:10 pm.
- La Sra. Valeria A. Cruz Zapata expresó un mensaje de bienvenida e introducción a la 1^{ra} Reunión de Planificación con la Comunidad (1^{ra} RPC).
 - También agradeció a los ciudadanos, miembros del Comité de Planificación y la representante de la JP por su participación en la 1^{ra} RPC para la actualización del Plan de Mitigación.
- El Plan. Onix Concepción Rodríguez ofreció un resumen sobre los trabajos a realizarse en la 1^{ra} RPC, los cuales incluían la presentación sobre el proyecto, la encuesta a la comunidad y el ejercicio de identificación de los peligros naturales en su comunidad mediante los mapas impresos.
- Introducción sobre la expiración del Plan de Mitigación y su importancia para el acceso a fondos federales ante impactos de eventos naturales.
- Se procedió a brindar la presentación sobre el proceso de actualización del Plan de Mitigación contra Peligros Naturales del Municipio de San Germán. Entre los asuntos discutidos, se encuentran, pero no se limitan a los siguientes:
 - Identificación de fondos por la JP para realizar una extensión del Proyecto para la actualización de los planes de mitigación, el cual tuvo su inicio en el 2018-19. A estos efectos, se identificaron aquellos planes con 5 años o más desde su aprobación, los cuales perdieron su vigencia y ahora forman parte de este proyecto de actualización.
 - Se mencionó el trasfondo normativo federal y los conceptos básicos de mitigación.
 - Se explicó el ciclo de manejo de emergencias (mitigación, preparación, respuesta y recuperación).
 - Se orientó sobre el proceso de planificación para la mitigación.
 - Se mencionó como se identificarán las estrategias de mitigación, esto mediante la evaluación de riesgos y evaluación de capacidades del Municipio.
 - Se identificaron los riesgos naturales que se estarán evaluando a la luz de la realidad del Municipio. Además, se indicó que en reunión previa con el Comité de Planificación se solicitó a la JP que se incluyera el peligro por tornados.
 - Se ilustró mapa con los 25 municipios cuyos planes de mitigación se están actualizando con la JP.

1 de 2

AtkinsRéalis - Baseline / Référence

- o Se discutió flujograma de las actividades que comprenden el proyecto de actualización de los planes de mitigación. Se identificaron las actividades realizadas y aquellas en el pipeline para realizar.
- o Se administró una encuesta comunitaria mediante un código QR, lo que permitió a los participantes responder preguntas sobre los peligros identificados en su comunidad.
- o Se exhortó a los asistentes a colaborar en un ejercicio de identificación de riesgos utilizando los mapas impresos provistos durante la actividad.
 - **Incendios forestales**
 - Las comunidades del Bo. Rosario Alto y Bo. Rosario Peñón identificaron sus áreas como propensas a incendios forestales. De igual forma, se señalaron preocupaciones similares en el Bo. Caín Abajo, Bo. Caín Alto y el sector Guamá.
 - **Deslizamientos / Riesgo de derrumbe**
 - Se identificó riesgo de derrumbe a lo largo de la carretera PR-119 en los sectores del Bo. Duey Alto y Bo. Hoconuco Alto.
 - **Refugios de emergencia / Acceso a facilidades**
 - Se propuso la utilización de la Escuela Federico Degetau como refugio de emergencia, debido a su proximidad a comunidades aledañas que actualmente carecen de acceso cercano a este tipo de facilidad.
 - **Inundaciones**
 - Se reportó riesgo de inundación en el sector Las 40, identificado como una de las áreas con mayor exposición a este peligro en el municipio. Asimismo, se señaló vulnerabilidad a inundaciones en el Bo. Duey Alto, particularmente en las cercanías de la escuela del sector.
- o El personal del Municipio y de la JP brindó asistencia a los participantes durante ambos ejercicios, ofreciendo orientación tanto en el uso de la encuesta como en la marcación de peligros en los mapas.
- o El alcalde se presentó en la sección de mapas y dio un saludo a la audiencia.
- Al concluir la presentación, se mostró la información de contacto de los enlaces de la JP relacionados con el Proyecto de actualización de los planes de mitigación, así como el correo electrónico oficial para canalizar comentarios (plandemitigacion@jp.pr.gov).
- La reunión comunitaria finalizó aproximadamente a las 12:00 pm.

COMENTARIOS DE LA COMUNIDAD

Plan de Mitigación contra Peligros Naturales San Germán
Municipio mtivetato@gmail.com

Nombre (Opcional): Michael Riveta Torres 787-241-7032

Barrio: Calle 101 KM 2.6 BATHIO ANCONES, SAN GERMÁN

Sector: CLOTTO COLI

Carretera y Kilómetro: 101 KM 2.6 (Cruce Cuartos Piza)

Referencia relativa del lugar: Frente a Cuartos Piza

Comentario relacionado a temas de mitigación de peligros naturales:
(Describe inquietudes, riesgos identificados, sugerencias o situaciones que afecten su comunidad)

Atopados encima de los cables, Bambúes, Bejuco pegados a los cables,

¿Cómo se afectó?
por las lluvias intensas se derrumbó el frente de mica la provocando el peligro de que el pedestal del luz se caiga hacia la calle.

Fecha: 5/Marzo/2026

COMENTARIOS DE LA COMUNIDAD

Plan de Mitigación contra Peligros Naturales San Germán
Municipio

Nombre (Opcional): Hoconuco Benace, Inc. (Sonia Vega Pérez)

Barrio: Hoconuco Bajo

Sector: _____

Carretera y Kilómetro: carr. 119 Km

Referencia relativa del lugar: antigua escuela Federico Degetau

Comentario relacionado a temas de mitigación de peligros naturales:
(Describe inquietudes, riesgos identificados, sugerencias o situaciones que afecten su comunidad)

Solo hay un solo refugio en el sector Perichí. Necesitamos hacer uno más abajo. Para "Georges" la escuela fue refugio.

¿Cómo se afectó?
Tenemos personas que tenían que ir hasta el pueblo para poder refugiarse.

Fecha: viernes 5 de marzo de 2026

COMENTARIOS DE LA COMUNIDAD

Plan de Mitigación contra Peligros Naturales San Germán
Municipio

Nombre (Opcional): Taller Salud (Johanna Sanabria)

Barrio: Hanesua

Sector: _____

Carretera y Kilómetro: Carr 318

Referencia relativa del lugar: Caminó a lafs.

Comentario relacionado a temas de mitigación de peligros naturales:

(Describe inquietudes, riesgos identificados, sugerencias o situaciones que afecten su comunidad)

Tenemos un Comedor Comunitario con un Comité de Seguridad Alimentaria.
Organizamos comunidades dándole la capacitación para actuar ante la
Emergencia y que ellos sean los responsables ante la Emergencia.
Las Organizaciones somos la mano amiga para los Municipios.

¿Cómo se afectó?

Fecha: 3/mayo/26

COMENTARIOS DE LA COMUNIDAD

Plan de Mitigación contra Peligros Naturales San Germán
Municipio

Nombre (Opcional): _____

Barrio: Tuna

Sector: Sect de la Caucha

Carretera y Kilómetro: Carr 3314 Km 4.5 / 2.9 - 2.7

Referencia relativa del lugar: Al lado de la Caucha / Esc. Padre Rufino (Iglesia la Caucha)

Comentario relacionado a temas de mitigación de peligros naturales:

(Describe inquietudes, riesgos identificados, sugerencias o situaciones que afecten su comunidad)

Calletera empujada expuesta deslizamientos.
Hundimiento calletera

¿Cómo se afectó?

Fecha: _____



TRASFONDO

Ley de Mitigación de Desastres de 2000 (DMA2K)

Requiere un plan de mitigación aprobado y adoptado para recibir financiamiento federal a través de:

- ☐ Programa de subvenciones para mitigación de peligros
- ☐ mitigación previa al desastre, y
- ☐ asistencia para mitigar inundaciones.



(d) **Local governments.** The key responsibilities of local governments are to:

- (1) Prepare and adopt a jurisdiction-wide natural hazard mitigation plan as a condition of receiving project grant funds under the HMGP, in accordance with § 201.6.
- (2) At a minimum, review and update the local mitigation plan every 5 years from date of plan approval of the previous plan in order to continue program eligibility.

Regulation: 44 CFR Part 201 Mitigation Planning.



CONCEPTOS IMPORTANTES

Peligros naturales

Eventos o sucesos naturales que amenazan vidas, bienes materiales, infraestructura, el ambiente y otros activos. Tienen a ocurrir repetidamente en las mismas zonas geográficas.

Ej. Terremotos, deslizamientos de tierra, hundimientos, Inundaciones, tsunamis, huracanes, erosión, incendios, etc.

Mitigación de riesgos

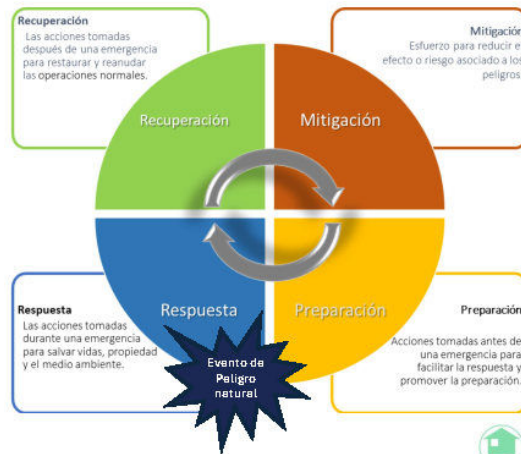
Esfuerzo o acciones para reducir la pérdida de vida y propiedad reduciendo el impacto de los peligros naturales.

Plan de mitigación contra peligros naturales

Documento donde se evalúan la vulnerabilidad del municipio ante los peligros naturales y se identifican acciones para minimizar las pérdidas de vida y propiedad ante un evento futuro.



CICLO PARA EL MANEJO DE EMERGENCIAS



PROCESO DE PLANIFICACIÓN PARA LA MITIGACIÓN

1. Coordinación con Municipio
2. Evaluación de riesgos
3. Evaluación de capacidad
4. Estrategias de mitigación
5. Mantenimiento del plan
6. Documentación del plan



COORDINACIÓN CON MUNICIPIO

- Carta de compromiso
- Designar el Comité de Planificación de Mitigación de Peligros del municipio.
- Reunión inicial ("kick off meeting").
- La participación pública y divulgación a las principales partes interesadas.
- La recopilación y el análisis de datos.
- Preparación y presentación del plan.



EVALUACIÓN DE RIESGOS



Terremoto



Erosión costera/
modificaciones
costeras



Marejada
Ciclónica



Deslizamientos



Inundaciones



Calor Extremo



Tsunami



Ciclones Tropicales



Sequías



Fuego Forestal



Pandemia/
Epidemia



COORDINACIÓN CON MUNICIPIO

- Carta de compromiso
- Designar el Comité de Planificación de Mitigación de Peligros del municipio.
- Reunión inicial ("kick off meeting").
- La participación pública y divulgación a las principales partes interesadas.
- La recopilación y el análisis de datos.
- Preparación y presentación del plan.



EVALUACIÓN DE RIESGOS



Terremoto



Erosión costera/
modificaciones
costeras



Marejada
Ciclónica



Deslizamientos



Inundaciones



Calor Extremo



Tsunami



Ciclones Tropicales



Sequías



Fuego Forestal



Pandemia/
Epidemia



EVALUACIÓN DE CAPACIDAD

- Mide la capacidad para implementar el plan de mitigación de peligros.
- El propósito es establecer la capacidad municipal para la planificación, determinación de la capacidad financiera, la asistencia técnica y la necesidad de adiestramiento.
- Las capacidades evaluadas son las siguientes:



RESULTADO DE EVALUACIÓN



ESTRATEGIAS DE MITIGACIÓN

- Describir las metas y objetivos específicos para minimizar el impacto en el municipio.
- Identificar acciones de mitigación específicas y proyectos.
- Estas pueden incluir:
 - **Prevención**– actividades tales como planificación usos terrenos, regulaciones, mantenimientos, etc.
 - **Protección de propiedades**– mejoras de diseños, relocalización, adquisición, etc.
 - **Proyectos de estructura**– ej. Diques, muros de contención, alcantarillado pluvial, etc.
 - **Servicios de emergencia**– alertas, sistemas de advertencias, manejo y planes de desalojo, ejercicios de respuesta a emergencias, etc.
- Educación y concientización pública.



MANTENIMIENTO Y DOCUMENTACIÓN DEL PLAN

- **Monitoreo:** Identificar frecuencia para verificar el progreso de las acciones en el plan.
- **Evaluación:** Determinar si el plan sigue siendo viable, si las acciones aún tienen sentido, etc.
- **Actualización:** Si se determina que algo debe cambiarse en el proceso de evaluación, identificar persona a cargo (comité de planificación) para la actualización cada 5 años.
- **Adopción del Plan por el municipio:** ordenanza de la legislatura municipal u orden ejecutiva del alcalde.
- **Revisión, certificación y aprobación de FEMA.**

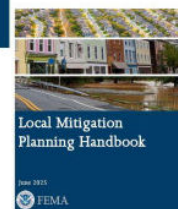
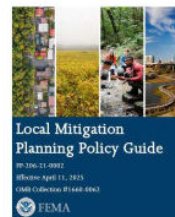


PROYECTO ACTUALIZACIÓN DE LOS PLANES DE MITIGACIÓN



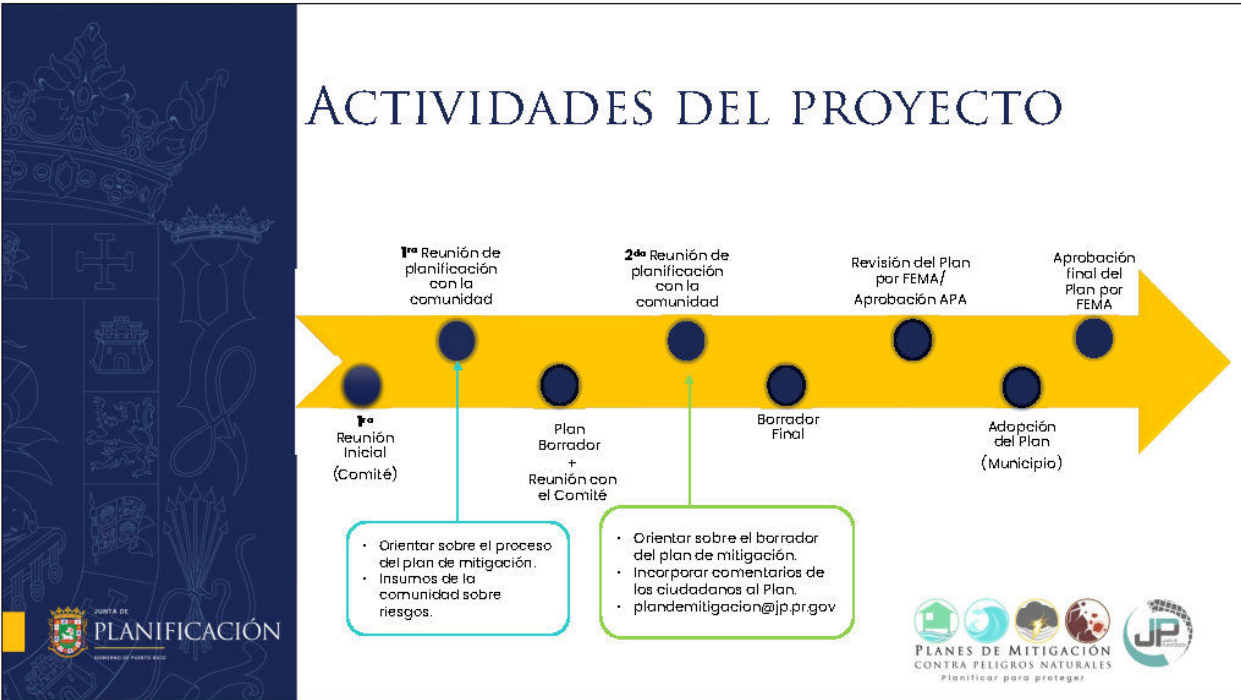
ALCANCE DEL TRABAJO

1. Revisar y actualizar los planes de mitigación contra peligros naturales de acuerdo con las nuevas guías y regulaciones.
2. Coordinar las actividades y trabajos en conjunto con el municipio y la Junta de Planificación.
3. Promover la participación ciudadana.
 - Reuniones de planificación con la comunidad
 - Página cibernética JP (www.jp.pr.gov)



 plandemitigación@jp.pr.gov







JUNTA DE
PLANIFICACIÓN
GOBIERNO DE PUERTO RICO

IDENTIFICAR ÁREAS DE RIESGO





PLANES DE MITIGACIÓN
CONTRA PELIGROS NATURALES
Planificar para proteger



JUNTA DE
PLANIFICACIÓN
GOBIERNO DE PUERTO RICO

INFORMACIÓN DE CONTACTO

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Presidente

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Directora Ejecutiva Auxiliar Interna
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plandemitigacion@jp.pr.gov
*Incluir nombre del municipio en el asunto.

787-723-6200 ext. 16623 y 16681





PLANES DE MITIGACIÓN
CONTRA PELIGROS NATURALES
Planificar para proteger

SIGN IN SHEETS



JUNTA DE

PLANIFICACIÓN

GOBIERNO DE PUERTO RICO



PLANES DE MITIGACIÓN
CONTRA PELIGROS NATURALES
Planificar para proteger

HOJA DE ASISTENCIA

Asunto: 1^{ra} Reunión de Planificación con la Comunidad- Municipio de San Germán
Lugar: Centro Comunal de Minillas, Calle Brillante, Sabana Grande Abajo, San Germán

Fecha: 5 de marzo de 2026
Hora: 10:00 am

Nombre completo (en letra de molde)	Municipio/Barrio/ Comunidad	Teléfono	Correo electrónico	Firma
Pedro Ramos Collazo	Obras públicas Municipio	Covered to Protect PII		
Adalberto Villa Flores	Legislatura San Germán			
Diana Guzmán Colón	Poblado Rosario			
Maria F. Rodríguez				
Dorilein Muñoz	San Germán (Mun)			
Valeria Cruz Zapata	Planificación y Gerencia San Germán			
Sonia Vega Pérez	Cain Bajo			
Casilda Pérez Ramos	"			
Andrea Aponte	SP			
Johanna Sanabria	Taller Salud San Germán			

PHOTOGRAPHIC DOCUMENTATION





SECOND PUBLIC PARTICIPATION MEETING

PUBLIC NOTIFICATION

MINUTES

PRESENTATION

SIGN IN SHEETS

PHOTOGRAPHIC DOCUMENTATION

DRAFT

APPENDIX D: STAKEHOLDER INVOLVEMENT

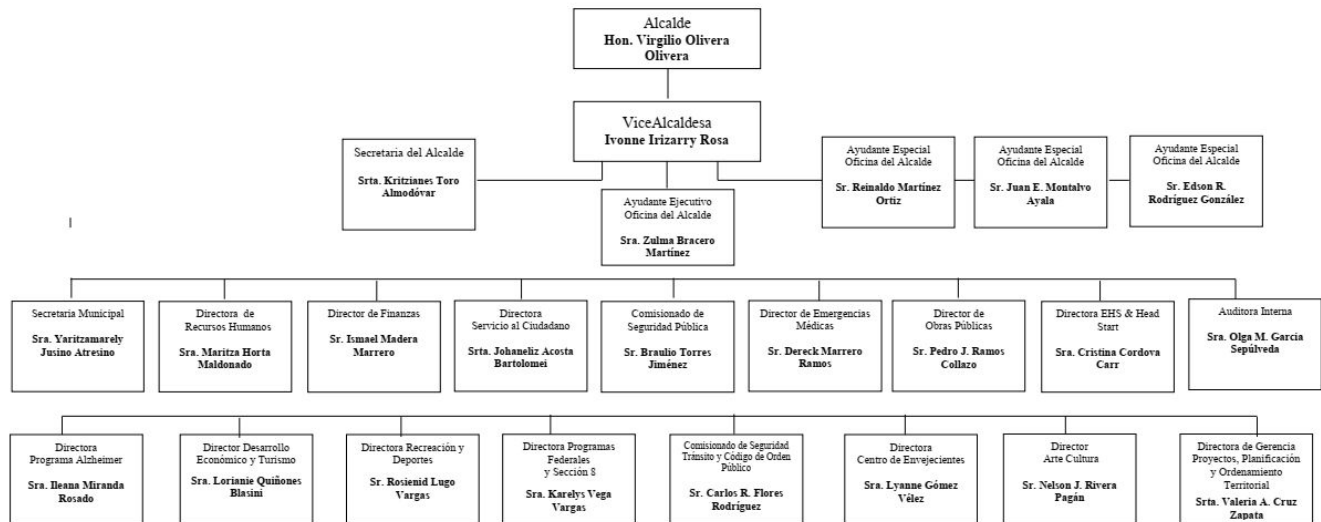
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APPENDIX E: MUNICIPALITY ORGANIZATIONAL CHARTS



CIUDAD DE SAN GERMÁN HON. VIRGILIO OLIVERA OLIVERA ALCALDE

ORGANIGRAMA JEFES DE DEPENDENCIA



Apartado 85 • Ave. Universidad Interamericana # 136 • San Germán, Puerto Rico 00683
Tel./ Fax (787) 892-3500



Oficina de Planificación, Gerencia de Proyectos y Ordenamiento Territorial Municipio de San Germán



FLOODING



WILDFIRE

Listado de Fuegos 2020 – 2026

Fecha de la ocurrencia	Tipo de peligro	Dirección	CFS #
1 de enero de 2020	Fuego	Carr 2 KM 170 HM3	PR010120-297
1 de enero de 2020	Fuego	Carr 2 KM 170 HM3	PR010120-298
7 de enero de 2020	Fuego	Calle H Urb Santa Marta	PR010720-286
7 de enero de 2020	Fuego	Calle H Urb. Santa Marta	PR010720-295
26 de enero de 2020	Fuego	Carr 348 Calle Luis Lupe Vélez Bo. El Rosario Sect El Brujo	PR012620-360
27 de enero de 2020	Fuego	San Germán PR	PR012720-589
4 de mayo de 2020	Fuego	Km 1 Carr 330 Ramal 3330 Bo Duey Bajo	PR050420-468
20 de mayo de 2020	Fuego	Carr 318 Bo Maresua Sect Culebra	PR052020-312
20 de mayo de 2020	Fuego	Km 3.6 Camino Culebra Bo Cotuí	PR052020-318
26 de mayo de 2020	Fuego	Km 0.5 Carr 3363 Bo Soltero	PR052620-565
29 de mayo de 2020	Fuego	Km 0.5 Carr 3363 Minillas Alto	PR052920-409
29 de mayo de 2020	Fuego	Km 0.5 Carr 3363 Minillas Alto	PR052920-412
20 de junio de 2020	Fuego	Km 4.3 Carr 347 Bo. Hoconuco Bajo Sect La Haciendita	PR062020-4
25 de junio de 2020	Fuego	Carr 301 Bo Ancones Sect Cuesta Vieja	PR062520-537
25 de junio de 2020	Fuego	Carr 301 Bo Ancones Sect Cuesta Vieja	PR062520-540
30 de junio de 2020	Fuego	Km 6.7 Carr 396 Sect Los Saaavedra	PR063020-274
11 de julio de 2020	Fuego	A-23 Calle 2 Urb Porta Coeli	PR071120-276
18 de julio de 2020	Fuego	Km 3.6 Carr 362 Bo Guama Sect Palo Solo	PR071820-279
18 de julio de 2020	Fuego	Km 3.6 Carr 362 Bo Guama Sect Palo Solo	PR071820-282
24 de julio de 2020	Fuego	Calle A Bo Sabana Eneas	PR072420-39
24 de julio de 2020	Fuego	Calle A Bo Sabana Eneas	PR072420-40
30 de julio de 2020	Fuego	Km 75.9 Int Carr 119 hacia Maricao Bo Hoconuco Bajo Sect Los Cordero	PR073020-1185
30 de julio de 2020	Fuego	San Germán PR	PR073020-1303
3 de diciembre de 2020	Fuego	Casa 23 Calle Cibeles Urb El Retiro	PR120320-415
30 de diciembre de 2020	Fuego	Calle 2 Urb Porta Coeli	PR123020-120
30 de diciembre de 2020	Fuego	Calle 2 Urb Porta Coeli	PR123020-122
22 de enero de 2021	Fuego	Km 13.6 Carr 348 Rosario Peñon	PR012221-284
7 de febrero de 2021	Fuego	Calle Nestor Torres Carr 330 Bo Rosario Poblado	PR020721-294
7 de febrero de 2021	Fuego	Calle Nestor Torres Carr 330 Bo Rosario Poblado	PR020721-295
20 de abril de 2021	Fuego	169.2 Carr 2 Bo Hoconuco Bajo	PR042021-111
25 de mayo de 2021	Fuego	Km 3.7 Carr 361 Bo Cain Alto	PR052521-355
10 de julio de 2021	Fuego	Km 1.1 Carr 318 Bo Maresua	PR071021-275
7 de septiembre de 2021	Fuego	Km 1.4 Carr 3363 Bo Minillas Alto	PR090721-351
7 de septiembre de 2021	Fuego	Km 1.4 Carr 3363 Bo Minillas Alto	PR090721-352
24 de octubre de 2021	Fuego	M-19 Calle 11 ext Santa Maria	PR102421-419
18 de enero de 2022	Fuego	20 Calle Manila Pueblo	PR011822-19

8 de abril de 2022	Fuego	Km 1.8 int Carr 314 Bo Cotui Sect Quebrada Onda	PR040822-117
8 de abril de 2022	Fuego	Km 1.8 int Carr 314 Bo Cotui Sect Quebrada Onda	PR040822-120
18 de abril de 2022	Fuego	Km 2.4 Carr 347 Bo El Coto	PR041822-416
18 de abril de 2022	Fuego	Km 2.4 Carr 347 Bo El Coto	PR041822-419
20 de abril de 2022	Fuego	Carr 329	PR042022-188
4 de octubre de 2022	Fuego	Calle C Parcelas Sabana Eneas	PR100422-440
4 de octubre de 2022	Fuego	Calle C Parcelas Sabana Eneas	PR100422-442
5 de octubre de 2022	Fuego	306 Calle C Parcelas Sabana Eneas	PR100522-522
6 de octubre de 2022	Fuego	Carr 102 Bo Minillas	PR100622-316
6 de octubre de 2022	Fuego	Km 1.1 Carr 320 Ancones Sect Cuesta Vieja	PR100622-614
7 de octubre de 2022	Fuego	Km 1.2 Carr 320 Bo Ancones	PR100722-226
17 de octubre de 2022	Fuego	Km 1.4 Carr 393 Bo Hoconuco Bajo Sect Las Cojobas	PR101722-88
17 de febrero de 2023	Fuego	E 28 Calle 10 Reparto Universidad	PR021723-306
17 de febrero de 2023	Fuego	E 28 Calle 10 Reparto Universidad	PR021723-307
17 de febrero de 2023	Fuego	Calle 10 Reparto Universidad	PR021723-309
17 de febrero de 2023	Fuego	Calle 10 Reparto Universidad	PR021723-310
22 de abril de 2023	Fuego	Calle Veterano	PR042223-131
30 de abril de 2023	Fuego	Km 2.6 Carr 362 Bo Guama	PR043023-442
3 de mayo de 2023	Fuego	Carr 2	PR050323-446
15 de junio de 2023	Fuego	Km 0.1 Carr 361 Bo Cain Alto	PRR061523-277
13 de julio de 2023	Fuego	Carr 347 Bo El Coto	PR071323-530
13 de julio de 2023	Fuego	Km 2.1 Int Carr 347 Bo El Coto	PR071323-531
14 de julio de 2023	Fuego	Km 36 Carr 102 Bo Minillas	PR071423-478
3 de agosto de 2023	Fuego	Km 4.6 int Camino del Sol Bo La Tea	PR080323-407
5 de noviembre de 2023	Fuego	Carr 2	PR110523-505
30 de diciembre de 2023	Fuego	14.0 PR 348 Rosario Alto	PR123023-236
16 de enero de 2024	Fuego	Km 0.5 Carr 361 Bo Cain Alto	PR011624-1002
16 de enero de 2024	Fuego	Km 0.5 Carr 361 Bo Cain Alto	PR011624-1005
19 de enero de 2024	Fuego	Km 0.6 Carr 361 Bo Cain Alto	PR011924-1127
19 de enero de 2024	Fuego	Km 0.6 Carr 361 Bo Cain Alto	PR011924-1128
23 de enero de 2024	Fuego	Carr 119 int 393 Hoconuco Bajo	PR012324-419
23 de enero de 2024	Fuego	Km 0.5 Carr 119 int 393 Bo Hoconuco Bajo Sect Las Cojobas	PR012324-427
23 de enero de 2024	Fuego	Km 0.5 Carr 119 int 393 Bo Hoconuco Bajo Sect Las Cojobas	PR012324-428
23 de enero de 2024	Fuego	Carr 114	PR012324-965
23 de enero de 2024	Fuego	Carr 114	PR012324-967
5 de febrero de 2024	Fuego	Calle del Angel Urb Monte Bello	PR020524-577
5 de febrero de 2024	Fuego	Calle del Angel Urb Monte Bello	PR020524-578
5 de febrero de 2024	Fuego	Calle del Angel Urb Monte Bello	PR020524-593
25 de marzo de 2024	Fuego	Calle Ernesto Torres Poblado Rosario	PR032524-1072
10 de mayo de 2024	Fuego	30.1 Carr 114 FTE Reparto Universidad	PR051024-551
10 de mayo de 2024	Fuego	30.1 Carr 114 FTE Reparto Universidad	PR051024-550
5 de julio de 2024	Fuego	37 Calle Millonarios Urb Monserrate	PR070524-734
7 de julio de 2024	Fuego	73 Edif 4 Res Lomas	PR070724-375

17 de julio de 2024	Fuego	Km 1.8 Carr 329 Bo Minillas Valle	PR071724-463
10 de agosto de 2024	Fuego	186 Calle Valencia Urb La Nueva Salamanca	PR081024-320
14 de agosto de 2024	Fuego	Km 0.3 Carr 321 Bo Ancones Sect Christian	PR081424-703
5 de noviembre de 2024	Fuego	#273 Reina Isabel las Quintas	PR110524-450
17 de abril de 2025	Fuego	B-40 Calle Principal Urb El Convento	PR041725-1170
17 de abril de 2025	Fuego	B-40 Calle Principal Urb El Convento	PR041725-1173
26 de junio de 2025	Fuego	Carr 166	PR062625-14
31 de julio de 2025	Fuego	Km 1.9 Carr 347 Bo Cotto	PR073125-894
10 de septiembre de 2025	Fuego	Carr 102 Dir a la Tea	PR091025-599
12 de octubre de 2025	Fuego	Casa 103 Calle E Bo La Tea	PR101225-821
12 de octubre de 2025	Fuego	Casa 103 Calle E Bo La Tea	PR101225-822
28 de octubre de 2025	Fuego	Calle L Esq Calle J Urb Riverside	PR102825-491
6 de noviembre de 2025	Fuego	Apt 214 Edif 27 Res El Recreo	PR110625-1228
3 de diciembre de 2025	Fuego	Carr Estatal PR 101 Km 1.2 Bo Ancones	PR120325-950
5 de enero de 2026	Fuego	348 Poblado Rosario	PR010526-1075
25 de febrero de 2026	Fuego	Carr 329	PR022526-187
25 de febrero de 2026	Fuego	Km 1.9 Carr 329 Bo Minillas Valle	PR022526-192
25 de febrero de 2026	Fuego	Km 1.9 Carr 329 Bo Minillas Valle	PR022526-193
28 de febrero de 2026	Fuego	Km 4.3 Carr 362 Bo Guama	PR022826-837
28 de febrero de 2026	Fuego	Km 4.3 Carr 362 Bo Guama	PR022826-838
15 de marzo de 2026	Fuego	Carr 2 Mayagüez a Sabana Grande	PR031526-721
27 de marzo de 2026	Fuego	Calle Gran Bretania Urb Las Quintas	PR032726-991
8 de abril de 2026	Fuego	Carr 114	PR040826-542
7 de mayo de 2026	Fuego	Km 3.5 Int Carr 362 Bo Guama	PR050726-486
7 de mayo de 2026	Fuego	Km 3.5 Int Carr 362 Bo Guama	PR050726-488
25 de mayo de 2026	Fuego	Calle Luis Velez Poblado Rosario	PR052526-666
29 de mayo de 2026	Fuego	Km 73.3 Carr 119 Cain Bajo R330-110-165514508	PR052926-403
11 de junio de 2026	Fuego	Carr 361 Km 1.4	SANG061126-874
16 de junio de 2026	Fuego	Km Carr 361 Bo Cain Alto Sect Periche	PR061626-1377
17 de junio de 2026	Fuego	50/ Km 33.3 Carr 102 Urb Mira Monte	PR061726-1440
25 de junio de 2026	Fuego	Km 173.3 Carr 2 Bo Cain Alto Sec Pin Quinones	PR062526-794
26 de junio de 2026	Fuego	Carr 362 Km 3.4 Sect Palo Solo Bo Guama	SANG062626-488
26 de junio de 2026	Fuego	Carr 2 Km 173	SANG062626-927
1 de julio de 2026	Fuego	Carr 318 Bo Maresua	PR070126-589
1 de julio de 2026	Fuego	Carr 318 Bo Maresua	PR070126-590
4 de julio de 2026	Fuego	Ave Jorge Ramos Comas	SANG070426-888
11 de julio de 2026	Fuego	Carr 362 Guama	SANG071126-454
11 de julio de 2026	Fuego	Carr 314 Camino La Moca Bo Cotui	PR071126-977

12 de julio de 2026	Fuego	Torre Comunicaciones Bo Ancones	SANG071226-706
12 de julio de 2026	Fuego	Carr 101 Km 1.1 Bo Ancones	PR071226-928
12 de julio de 2026	Fuego	Carr 101 Km 1.1 Bo Ancones Dirección a Lajas	PR071226-930
13 de julio de 2026	Fuego	Sect Pin Quinones y Sect Casanga Carr 361 Int 396	SANG071326-1137
14 de julio de 2026	Fuego	Carr 361 Int 396	SANG071426-649
14 de julio de 2026	Fuego	38.5 int Carr 102 Bo Minillas Alto	PR071426-756
14 de julio de 2026	Fuego	38.5 int Carr 102 Bo Minillas Alto	PR071426-766
15 de julio de 2026	Fuego	Carr 347 Km 1 Bo Haciendita	SANG071526-154
15 de julio de 2026	Fuego	Carr 118 Km 2 Bo Retiro Tea	SANG071526-248
15 de julio de 2026	Fuego	Carr 3363 Bo Minillas Alto	SANG071526-547
16 de julio de 2026	Fuego	Carr 396 Bo Cain Alto Sect Casanga	SANG071626-867
30 de julio de 2026	Fuego	Km 1.8 int Carr 318 Bo Maresua	PR073026-879
30 de julio de 2026	Fuego	Km 1.8 int Carr 318 Bo Maresua	PR073026-881
6 de agosto de 2026	Fuego	Carr 345	PR080626-501
6 de agosto de 2026	Fuego	Carr 348 Km 9.1 int Bo Rosario	PR080626-502
10 de agosto de 2026	Fuego	Km 0.6 Bo Guama Sect Gallardo	PR081026-1417
10 de agosto de 2026	Fuego	Km 0.6 Bo Guama Sect Gallardo	PR081026-1418