

# TRANSFORMATION AND INNOVATION IN THE WAKE OF DEVASTATION

AN ECONOMIC AND DISASTER RECOVERY PLAN  
FOR PUERTO RICO



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# FOREWORD FROM THE GOVERNOR



## TRANSFORMATION AND INNOVATION IN THE WAKE OF DEVASTATION: AN ECONOMIC AND DISASTER RECOVERY PLAN FOR PUERTO RICO

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**P**uerto Rico experienced a disaster that was unprecedented not only in the Island's history but in the history of the United States. In September 2017, Puerto Rico was hit by two ravaging hurricanes, Irma and Maria, with Category 4 or greater winds within weeks of each other—something that had never happened anywhere in the nation. It is unparalleled that an entire state population lost power, water, communication systems, and basic services, with devastation so extreme that it has taken months to fully restore these services on an emergency basis. Being an island, none of the solutions to our challenges was easy, and the logistics chain to bring in needed resources has been long, expensive, and time-consuming. As we approach the one-year anniversary, we have only just begun permanent reconstruction efforts. Based on this, in many ways, this is the first truly catastrophic natural disaster in modern U.S. history.

As bad as the situation has been, there is reason for real hope. The complete and widespread devastation gives us an opportunity to view our island as a blank canvas, upon which we can implement innovative solutions that can make Puerto Rico a showcase for the world with a modern and more resilient infrastructure, a newer and stronger housing stock, and a more vibrant and competitive economy.

Toward that end, I have spent substantial amounts of time engaging with stakeholders across Puerto Rico, as well as with the best minds across the United States and around the world, to develop a shared vision for the future that can capitalize on the opportunities before us.

My concept for Puerto Rico's recovery is built around the four core principles of (1) promoting effective governance and transparency, (2) investing in building the capacity we need both for reconstruction and for the future of Puerto Rico, (3) incorporating resiliency into everything that we build and do, and (4) pursuing innovation in our recovery wherever possible.

Building on these principles, the vision for Puerto Rico seeks to define how we will fit into the economy, environment, and the society of the future at not only the national but also the global levels. Puerto Rico has much to contribute to America's success as a global leader, and this recovery plan will set the foundation for a strong, resilient, and thriving Puerto Rico. In this plan, I address how we can accomplish this through developing Puerto Rico as (1) a source of the "Human Cloud," (2) a platform for innovation, (3) "open for business," (4) a connector of the Americas, and (5) a place that enhances the quality of life of the U.S. citizens of Puerto Rico. Each of these components of the vision strengthens the Island's ability to be a leader in a global economy.

The path presented in this plan not only is essential to Puerto Rico's recovery and reconstruction but also marks a key opportunity for America to correct course on the patchwork of oftentimes unequal and incoherent federal laws and policies that have limited Puerto Rico from reaching its full potential to date. The plan presents an opportunity to build on the policies of

fiscal stabilization and debt restructuring laid out in the Puerto Rico Oversight, Management, and Economic Stability Act and to invest in a way that revitalizes our island and people as an asset for America’s national and global economic success.

The recovery funding that Congress has appropriated to date should provide the resources needed to jumpstart this vision. I realize the magnitude of the responsibility before us, and I am fully committed to working together with you to invest those federal resources responsibly and wisely and to taking the actions necessary to modernize our government structures so that we can truly transform Puerto Rico. Toward that end, I established the Central Office of Recovery, Reconstruction, and Resiliency (COR3) to serve as a focal point for strategic thought and management of the recovery. This group will lead the implementation of my vision and coordinate with other stakeholders across the Island and across the country to make it a reality.

The publication of *Transformation and Innovation in the Wake of Devastation: An Economic and Disaster Recovery Plan for Puerto Rico* marks the definitive transition from the emergency phase of our island’s recovery into longer-term recovery and the strengthening of our infrastructure, our economy, and our people. It establishes an initial “road map” that describes and clearly justifies the need for resources and identifies some of the impactful ways in which we can invest them into our recovery to capture the opportunities before us and achieve the results the U.S. citizens of Puerto Rico so desperately need and deserve. In its development, COR3 worked closely with a long list of federal government agencies, the Homeland Security Operational Analysis Center (HSOAC, a federally funded research and development center operated by the RAND Corporation under contract with the U.S. Department of Homeland Security), municipalities, the private sector, the nonprofit sector, and others to begin the process of developing and operationalizing this shared vision for Puerto Rico. COR3 will now guide recovery investment and policy in the days, months, and years ahead.

To make the vision for the future of Puerto Rico laid out here a reality, we must come together as Americans. We will certainly encounter significant challenges and obstacles along the way that will require partnerships and creative approaches to resolve. We will need to pull together both resources and expertise from countless public and private-sector partners. We will need to secure whatever additional funding is necessary from Congress, federal departments and agencies, and the private sector to fully implement the vision. More importantly, to be confident both now and in the future that the inequities experienced in our past will fade forever, we will need to put Puerto Rico on a path to full equality through statehood. From that point forward, we will be fully empowered as citizens of the United States, with equal rights and responsibilities, to contribute to the success not only of Puerto Rico but of the United States as a whole.

I am confident that the Government and people of Puerto Rico are committed to building a stronger and brighter future and making this vision a reality. With your participation and engagement, we will achieve our goal.



The Honorable Ricardo Rosselló Nevaes,  
Governor of Puerto Rico

AUGUST 8, 2018

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# EXECUTIVE SUMMARY



**It has been almost a year since Hurricanes Irma and Maria devastated Puerto Rico, but the Island's recovery is far from over. The Government of Puerto Rico proposes a transformational plan that will help the Island recover from the hurricanes, become more resilient to future disasters, and turn around the economic decline that Puerto Rico has been struggling with for more than a decade. To achieve this ambitious vision, the Government of Puerto Rico will seek out \$139 billion in funding—from the federal government, foundations and other nonprofits, and Puerto Rico's own budget—to invest in a robust and resilient future.**

**This economic and disaster recovery plan lays out the Government of Puerto Rico's strategic vision and goals and provides a detailed framework for achieving them.**

## **Catastrophic disaster**

In September 2017, Puerto Rico suffered catastrophic damage as Hurricane Irma passed just north of San Juan. Hurricane Maria made a direct hit on the Island two weeks later. The hurricanes' effects on people's health and safety were devastating. Damage to critical infrastructure resulted in cascading failures of the lifeline systems of energy, telecommunications, water, and transportation. Because the disaster occurred at the end of a very active hurricane season, federal resources for disaster response were stretched. In addition, aid from other states was not readily available due to a lack of mutual assistance compacts and the geographical separation of more than 1,000 miles between Puerto Rico and the continental United States. Given the scale of the disaster, the limited response resources, and the failure of lifeline systems, emergency services were severely compromised and residents lacked electricity, food, and water for a prolonged period. And with roads impassable, residents had limited access to medical care. After the hurricanes, people lost their jobs, schools were closed, government services and private enterprise could no longer operate effectively, landslides caused flooding hazards, and wastewater polluted marine environments. While the hurricanes touched

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**The Government of Puerto Rico views the recovery effort as an opportunity to transform the Island by implementing solutions that are cost-effective and forward-looking, harness innovative thinking and best practices, and revitalize economic growth.**

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virtually every segment of the population, older adults, children, individuals with disabilities or chronic illnesses, and women were disproportionately affected by this disaster.

Catastrophic hurricanes and the resulting disasters are not unique to Puerto Rico. Coastal communities affected by Hurricane Katrina in 2005 also suffered widespread damage, severe interruption of essential services, and deep economic losses. Lessons learned from these past disasters suggest that the Island now faces a lengthy recovery. Although Puerto Rico has been working to restore services, reopen schools and other public buildings, and help residents return to normal life since the 2017 hurricane season, much work remains to be done.

Critically, Puerto Rico has been grappling with preexisting conditions that exacerbated the impact of the hurricanes, including an economic crisis spanning more than a decade and structural, demographic, health, social, and infrastructure stresses; in addition, it has been responding to demands for improved government transparency. Efforts to address these challenges—including Governor Ricardo Rosselló’s *Plan for Puerto Rico*; the *New Fiscal Plan for Puerto Rico: Restoring Growth and Prosperity*, which was certified by the Financial Oversight and Management Board; and the *CDBG-DR Action Plan* approved on July 30, 2018—are foundational documents that outline the Governor’s vision for Puerto Rico. His vision for transforming Puerto Rico for the future is grounded in the present, taking into account a variety of preexisting factors that will continue to challenge the Island and its citizens in the years ahead. These include Puerto Rico’s location and geography, changing demographics, the economic trends and fiscal conditions prior to the hurricanes, and the limited maintenance of critical infrastructure. This recovery effort represents more than simply the effort to physically repair and reconstruct the damage caused to the Island by the hurricanes; it is also an opportunity to implement the social, governmental, fiscal, and economic reforms that will lead to a 21st-century Puerto Rico.

### **The plan for recovery**

The Government of Puerto Rico—in particular, the Central Office of Recovery, Reconstruction, and Resiliency (COR3)—was supported by the Federal Emergency Management Agency (FEMA) and the Homeland Security Operational Analysis Center (HSOAC) to develop a recovery plan in response to the Bipartisan Budget Act of 2018 (Public Law 115-123). The effort involved extensive outreach to and collaboration with a broad group

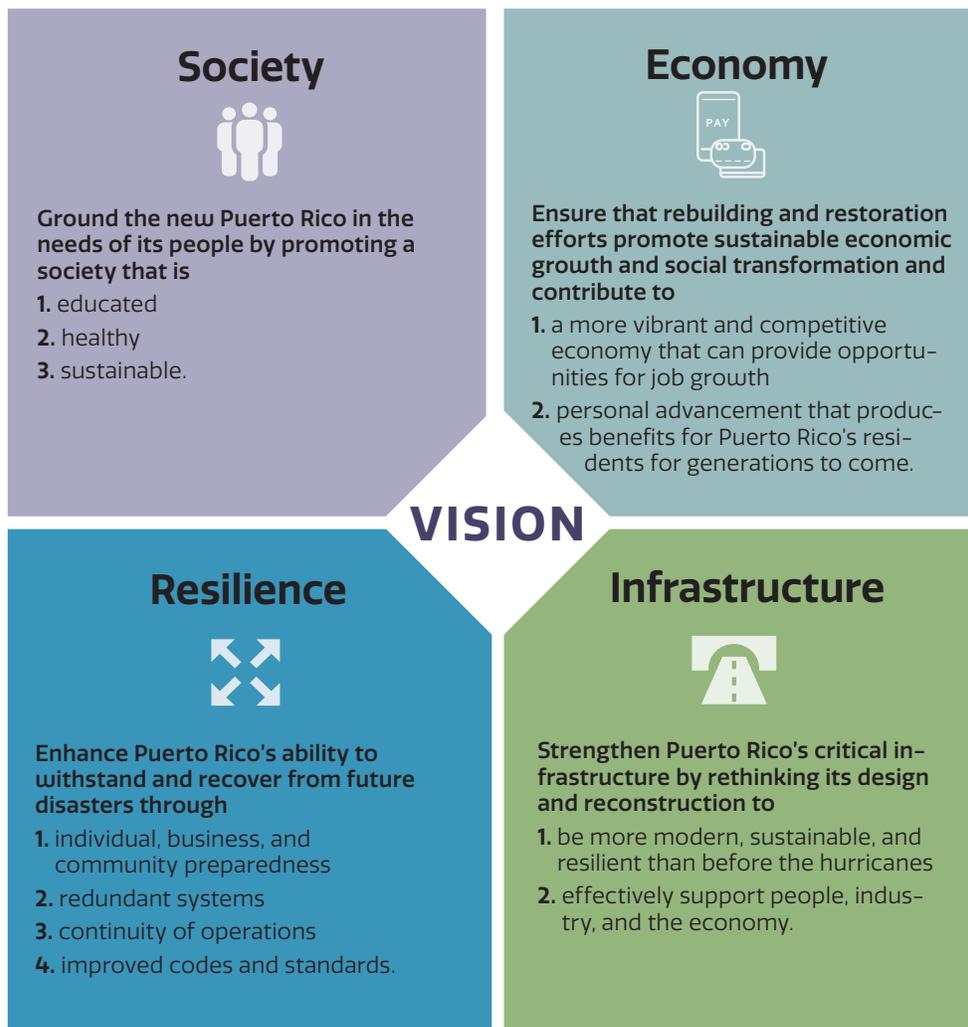
of federal agencies, state and municipal government agencies within Puerto Rico, private-sector and nonprofit entities, and the group most affected by the hurricanes—the people of Puerto Rico.

### A transformational vision for Puerto Rico

The Government of Puerto Rico views the recovery effort as an opportunity to transform the Island by implementing solutions that are cost-effective and forward-looking, harness innovative thinking and best practices, and revitalize economic growth. The Governor is sharing this economic and disaster recovery plan consistent with his vision:

**To build the new Puerto Rico to meet the current and future needs of the people through sustainable economic development and social transformation; transparent and innovative approaches to governance; resilient, modern, and state-of-the-art infrastructure; and a safe, educated, healthy, and sustainable society.**

To achieve the Governor's ambitious vision, the recovery plan is focused on the following four primary goals



## Priority short-term and long-term needs

As it decides how to best invest recovery dollars, the Government of Puerto Rico must take a strategic approach to ensure that its plans account for the challenges it has faced in the past, the interdependence of systems that caused failures to cascade, and its vision for how to grow and thrive in an uncertain future. Recovery planning for Puerto Rico requires balancing solutions that quickly tackle the immense scope of short-term needs with decisions that adequately address long-term resilience needs.

The most-immediate key priorities for Puerto Rico in the short term (1-2 years) are as follows:

- **Reestablish lifeline systems** to provide affordable and reliable energy, telecommunications, water, and transportation. These are important to the economy and necessary to ensure the functioning of government. Furthermore, these systems and the services they provide are crucial to giving Puerto Ricans a sense of normalcy, protecting their health and well-being, and confirming that all regions will take part in the recovery. It is vital to create an energy grid that is reliable enough to get water treatment plants, hospitals, and other critical infrastructure off of emergency generators and make them less vulnerable to crashes, outages, or future hurricanes.
- **Repair or rebuild the approximately 166,000 residential structures** damaged or destroyed during the hurricanes. This effort is particularly important for homes built before more-protective building codes were adopted or for which building codes were not enforced. Increasing the number of qualified inspectors and requiring building permits before construction can proceed are critical to enforcing building permit requirements. Noncompliant houses that were not damaged by the hurricanes also remain at risk unless they too are brought up to code.
- **Improve emergency preparedness infrastructure** and develop the government workforce so that all residents and businesses are better protected in advance of a future disaster. Just 37 percent of municipalities reported that their response plans worked adequately given the scope and scale of Hurricanes Irma and Maria. With the arrival of a new hurricane season, it is imperative for Puerto Rico to address gaps in the emergency preparedness infrastructure. The Puerto Rico Emergency Management Agency is working

to update or develop plans for all 78 municipalities with the support of FEMA, which is also educating residents on preparedness and developing the government workforce. Coordinating the parties responsible for the emergency response and for stockpiling materials, resources, and personnel are short-term priorities.

- **Clarify ownership and responsibility** for various infrastructure, assets, and services so that repairs can be completed efficiently and rebuilding reduces risk. Creating a comprehensive inventory and management system is a next step for the energy, transportation, housing, and public buildings sectors, in particular. Consensus is emerging about the need to rethink how services are delivered—for example, creating regional structures—to improve efficiency, reduce costs, and improve the lives of citizens. This reorganization is needed to respond to future disasters and streamline service delivery, but it will have broad implications that likely require involving key stakeholders in Puerto Rico and incorporating municipal input.

In the longer term (3–11 years), the key priorities for Puerto Rico’s recovery are as follows:

- **Stem the flow of residents away** from the Island and encourage economic growth by lowering the costs of doing business, incentivizing formal labor force participation, broadening the tax base, and increasing fiscal discipline.
- **Revitalize urban centers** to focus economic recovery efforts.
- **Scale social services, health, education, and infrastructure systems** to meet the health, social, and economic needs of the current and future population.
- **Rebuild infrastructure to meet modern codes and standards**, and enforce the laws and regulations governing construction, water supply connections, and electricity metering.
- **Establish modern methods for providing both the public and private sectors with timely, accurate, and comprehensive information** to make effective decisions about recovery and day-to-day operations.

Although these are longer-term priorities that will remain enduring efforts on longer timelines, work on addressing them will need to begin immediately to take advantage of the short-term rebuilding and recovery efforts.



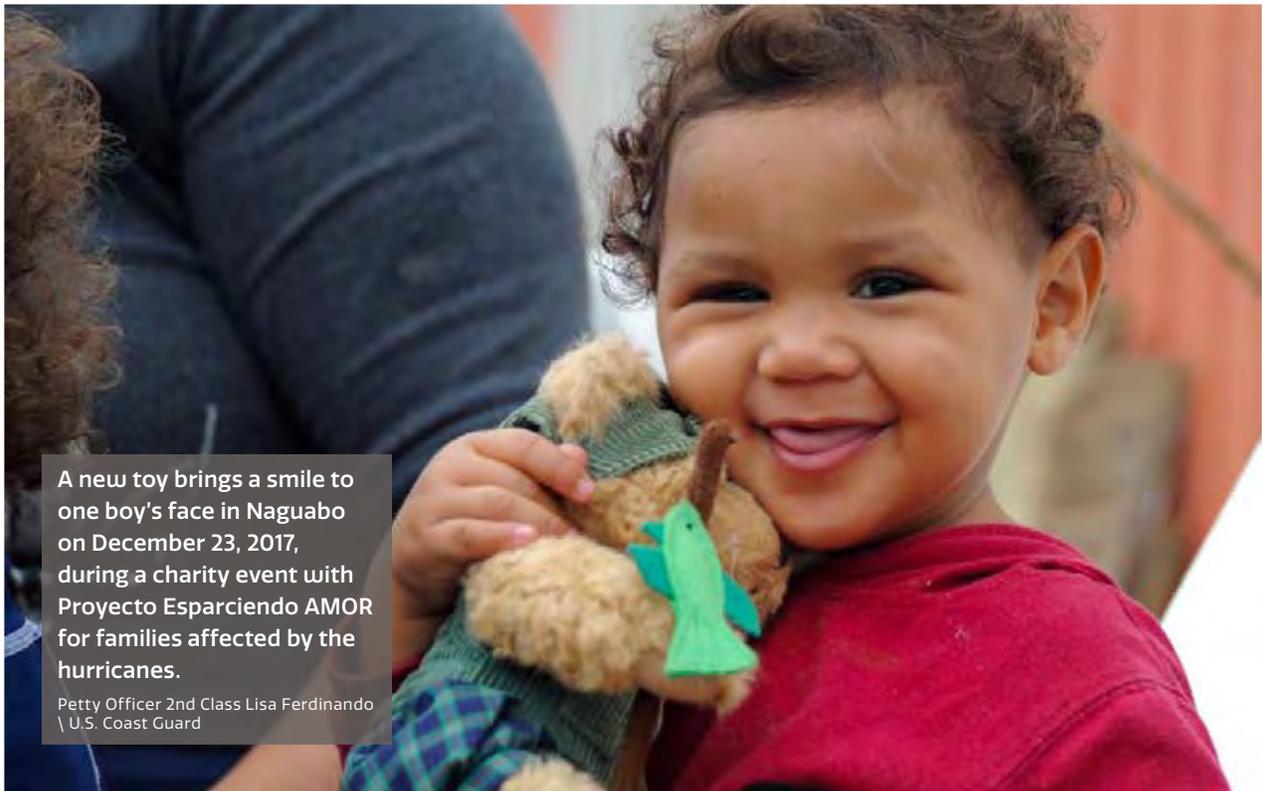
Delivery drivers for FEMA contractor Estes Express Lines volunteer at the Hogar Escuela Sor María Rafaela school for girls in Bayamon on February 1, 2018. The volunteers repaired damaged roofs, tables, benches, and playground equipment during their free time.

Kenneth Wilsey / FEMA

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## Meeting these needs

To address these priorities, the Government of Puerto Rico is focusing on nine areas of physical, natural, and human **capital investments of approximately \$132 billion** (roughly 75 percent for upfront costs and 25 percent for recurring costs, which reflect 11 years of annual costs from 2018–2028 for ongoing activities, such as operations and maintenance). Some of this total amount has already been provided by federal disaster relief, private insurance, the private sector, and philanthropic sources. In addition, the Government of Puerto Rico has identified eight strategic initiatives that build on the nine fundamental capital investments and capitalize on Puerto Rico’s unique assets and strengths to promote economic growth that is grounded in innovation, sustainability, and resilience. These **strategic initiatives add approximately \$6.6 billion** in estimated marginal costs. The Government of Puerto Rico has identified more than 270 specific courses of action—including their estimated costs, possible funding sources, and potential implementers—that will be pursued to ensure that capital investments and strategic initiatives achieve the ambitious objectives indicated in the graphic on the next page.



A new toy brings a smile to one boy's face in Naguabo on December 23, 2017, during a charity event with Proyecto Esparciendo AMOR for families affected by the hurricanes.

Petty Officer 2nd Class Lisa Ferdinando  
U.S. Coast Guard

## CAPITAL INVESTMENTS

### Physical Capital

#### ENERGY

**Transform** the energy system to ensure customer-centric, affordable, reliable, and scalable electricity that incorporates more renewables, microgrids, and distributed energy resources; can drive new businesses and employment opportunities; and can support residents' well-being.

#### COMMUNICATIONS/INFORMATION TECHNOLOGY

**Modernize** the telecommunications system to ensure fast, reliable, and resilient residential, commercial, and emergency communications that drive Puerto Rico's economy, prosperity, and well-being.

#### WATER

**Rethink** water systems to be safer, more reliable, and protected from future disasters to ensure the well-being of Puerto Ricans and the environment as well as the operations of government and businesses.

#### TRANSPORTATION

**Rebuild** and strengthen maritime, surface, and air transportation to ensure a flexible and reliable transportation system that moves people and goods, ensures economic continuity, and facilitates disaster response.

#### HOUSING

**Repair** and rebuild resilient residential housing that is safe and affordable to create a better built environment.

#### PUBLIC BUILDINGS

**Repair, rebuild, and right-size** the public buildings inventory to ensure stronger and more resilient public buildings that meet today's standards, mitigate against future disasters, represent innovative designs, and meet communities' needs.

### Human Capital

#### EDUCATION

**Transform** the education system to produce competitive graduates with the knowledge and skills needed to adapt to changes in the economy, the environment, and technology.

#### HEALTH AND WELL-BEING

**Rebuild** and enhance health and social service infrastructure and regional health care networks to ensure reliable and equitable access to health and social services and health-promoting communities, including an efficient and effective response to public health crises and other future disasters.

### Natural Capital

#### NATURAL ENVIRONMENT

**Restore, plan for, and develop** the natural environment so that marine and terrestrial ecosystems coexist sustainably with tourism, promote the economic development of Puerto Rico, serve as natural infrastructure to protect against storm damage, manage waste, and preserve the natural and cultural heritage of Puerto Ricans.

## STRATEGIC INITIATIVES

### OCEAN ECONOMY (BLUEtide)

**Integrate** and promote all of Puerto Rico's ocean-dependent industries and ecosystems as a cohesive effort to promote economic growth, improve quality of life for residents, and enhance the visitor's experience.

### VISITOR ECONOMY

**Develop** a strong visitor economy to help position Puerto Rico as a global destination of investment, production, and wealth.

### EMERGENCY SERVICES MODERNIZATION

**Enhance** public safety and first responders' ability to deliver reliable, modern, and integrated emergency services.

### AGRICULTURAL TRANSFORMATION

**Modernize** agriculture to promote greater productivity and output and improve exports.

### DIGITAL TRANSFORMATION

**Build** the capabilities and workforce needed to fundamentally transform key industry and government processes to become more user-focused, relevant, and efficient at addressing local needs and delivering basic services.

### 21ST-CENTURY WORKFORCE

**Develop** and protect human capital to establish a world-class workforce, increase labor force flexibility, and create high-quality employment opportunities aligned with economic growth strategies.

### ENTREPRENEURSHIP

**Expand** opportunities for entrepreneurship and development of small to medium local businesses that can compete globally to promote economic development.

### ADVANCED MANUFACTURING

**Address** policy and structural barriers to increase opportunities for investment and the growth of private-public partnerships.

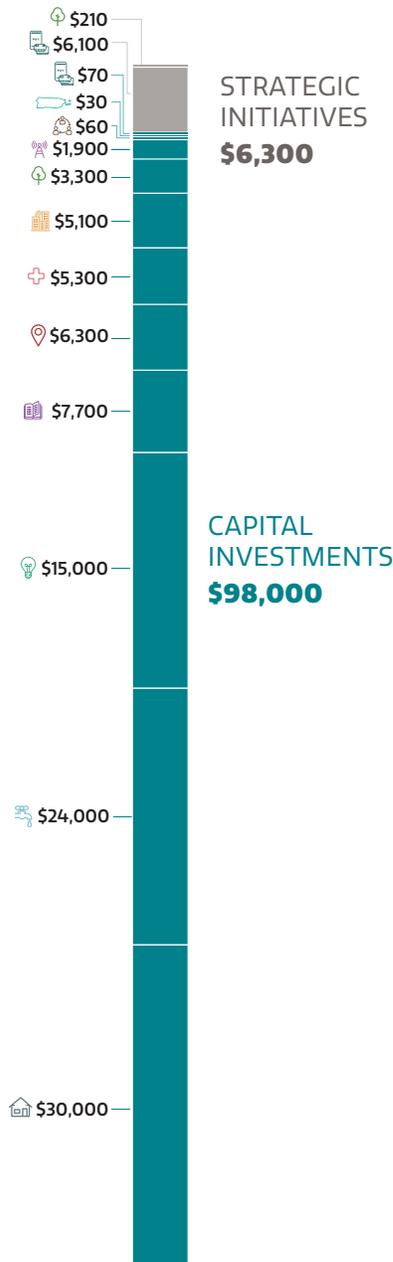
Roughly 270 specific courses of action have been linked with these capital investments and strategic initiatives.

Descriptions of these recovery actions—including estimated costs, possible funding sources, and potential implementers—are available in Chapter 12.

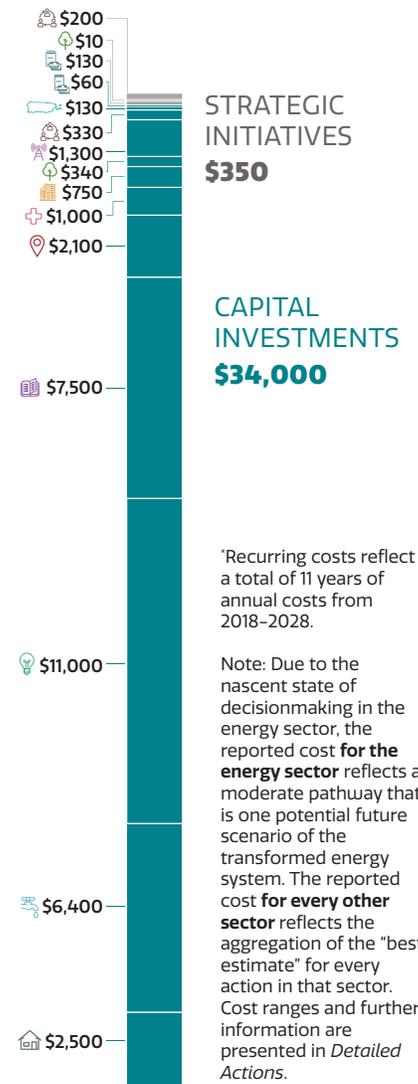
**Total costs  
(in millions)  
\$139,000**



**Upfront costs  
(in millions)  
\$105,000**



**Recurring costs\*  
(in millions)  
\$34,000**



\*Recurring costs reflect a total of 11 years of annual costs from 2018-2028.

Note: Due to the nascent state of decisionmaking in the energy sector, the reported cost **for the energy sector** reflects a moderate pathway that is one potential future scenario of the transformed energy system. The reported cost **for every other sector** reflects the aggregation of the "best estimate" for every action in that sector. Cost ranges and further information are presented in *Detailed Actions*.

The three bars are not in proportion to each other for legibility. Sector costs have been rounded and may not add up to the totals shown.

## Funding Puerto Rico's recovery

Carrying out this economic and disaster recovery plan will require substantial resources. The funds will need to be invested wisely—in a coordinated way over many years—to ensure that they align efficiently and effectively with Puerto Rico's vision. By identifying actions that will help Puerto Rico recover, this strategic plan provides a path to help decisionmakers start identifying and asking questions about potential funding sources. It is clear that multiple federal agencies, as well as private insurance proceeds and the private sector—including public-private partnerships, charitable foundations, corporate foundations, and institutional investors—will play a part in funding the recovery. As recovery actions are implemented in specific programs, the details of those programs will dictate the appropriate sources of funding. The graphic on the next page describes potential funding sources identified to date, with estimates of the money available from each.

Puerto Rico will also take actions, including providing funding, to ensure there is an environment that is attractive to the private sector and investors through public-private partnerships.

## Ensuring transparency

To ensure fiscal transparency in investments and promote global best practices in accountability and coordination of recovery efforts, COR3 plans to use third-party assistance to manage recovery funds and optimize the long-term reconstruction process. The Government of Puerto Rico will employ a set of recovery indicators—tracking both Puerto Rico's recovery from Hurricanes Irma and Maria and progress toward the goals outlined in this plan.

## A better future

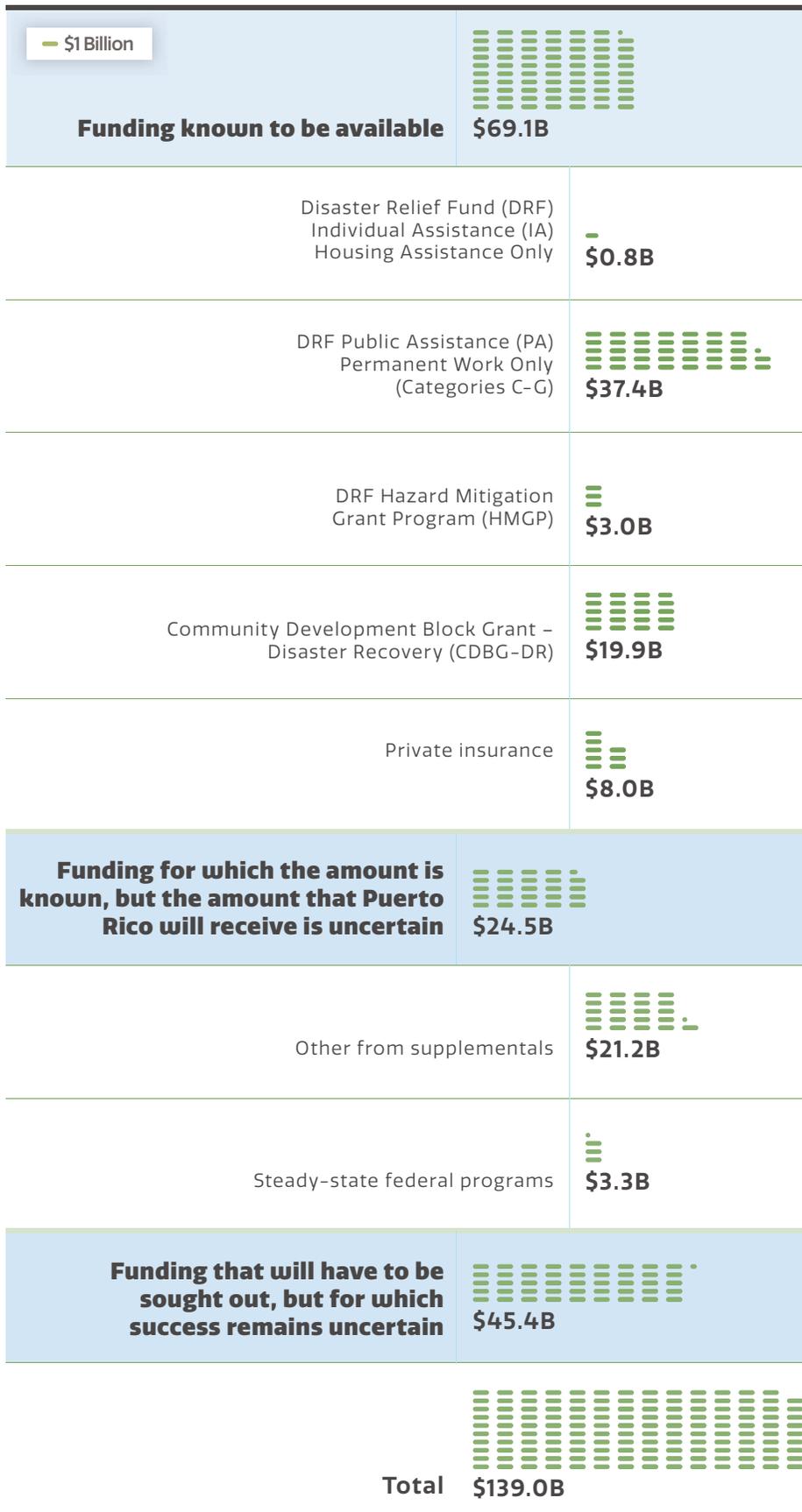
The voices of citizens, community leaders, mayors, agency heads, representatives from supporting federal agencies, subject-matter experts, and other stakeholders have been brought together to support the development of this plan. Using many other sources of data and analysis, the Government of Puerto Rico has developed a comprehensive strategy that goes far beyond simply building back what was destroyed by the hurricanes. This economic and disaster recovery plan builds on the considerable efforts that Puerto Rico has undertaken in recent years in fundamental ways to propose a path to a more equitable, resilient, self-sufficient, and prosperous society for all Puerto Ricans.

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**The voices of citizens, community leaders, mayors, agency heads, representatives from supporting federal agencies, subject-matter experts, and other stakeholders have been brought together to support the development of this plan.**

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## Estimated resources available to Puerto Rico for disaster recovery



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# I INTRODUCTION



Late in the night on September 6, 2017, the southern eyewall of Hurricane Irma passed just north of San Juan. Less than two weeks later, Hurricane Maria made a direct hit as a Category 4 storm. The combined effects of the two hurricanes were widespread and catastrophic, resulting in the loss of life, a complete failure of the power system, and extensive housing and infrastructure damage, and leading to a months-long interruption of essential services for the people of Puerto Rico.

Compounding the situation caused by the hurricanes, Puerto Rico has been facing an economic and fiscal crisis spanning more than a decade; structural, demographic, health, social, and infrastructure stresses (including significant migration of people away from the Island); and a history of limited government transparency.

Together, these factors combined to exacerbate the impact of the hurricanes and led to a broader, long-term disaster that requires a recovery plan that goes beyond merely repairing disaster-damaged infrastructure. The scope of these many preexisting challenges also constrains short-term recovery options and will necessitate transformative changes and investments for years to come.

As Puerto Rico looks to the future, the recovery effort is an opportunity to create a better, smarter, stronger, and more-resilient Island. Recovery investments can help transform Puerto Rico through the implementation of solutions that

- are cost-effective and forward-looking
- harness innovative thinking and best practices from around the world
- are science-based and data-driven
- enhance human capital and contribute to greater economic development, revitalization, and growth (in alignment with the preexisting Plan for Puerto Rico, the Build Back Better plan submitted to Congress in November 2017, and the New Fiscal Plan of June 2018), and the CDBG-DR Action Plan approved on July 30, 2018.

# 2017



**SEPTEMBER 6-7**  
Center of Hurricane Irma passes 50 nautical miles north of San Juan, Puerto Rico (PR).

**SEPTEMBER 10**  
President issues a Major Disaster Declaration for PR (FEMA-4336-DR).



**SEPTEMBER 20**  
Hurricane Maria makes landfall on PR. President signs Major Disaster Declaration (DR-4339) under Stafford Act.



**SEPTEMBER 23**  
FEMA's critical response teams arrive in PR.

**OCTOBER 23**  
Executive Order 2017-065 authorized the creation of the Central Recovery and Reconstruction Office as a division of the P3 Authority, to centralize control and oversight of the recovery and reconstruction of Puerto Rico.

**OCTOBER 26**  
Additional Supplemental Appropriations for Disaster Relief Requirements Act (Public Law 115-72) signed.

**DECEMBER 6**  
The P3 Authority Board formalizes the creation of the Central Recovery and Reconstruction Office (now COR3).

**SEPTEMBER 8**  
Continuing Appropriations Act, 2018 and Supplemental Appropriations for Disaster Relief Requirements Act, 2017 (Public Law 115-56) signed into law. The law includes \$7.4B in CDBG-DR funding, of which \$1.5B was subsequently allocated to PR.

**SEPTEMBER 18**  
President approves PR emergency declaration.

**SEPTEMBER 21**  
FOMB approves reallocation of up to \$1B of Territory Budget funding for emergency response.

**SEPTEMBER 28**  
President waives Jones Act for 10 days.



**NOVEMBER 13**  
Government of Puerto Rico submits Build Back Better Puerto Rico: Request for Federal Assistance for Disaster Recovery.



**FEBRUARY 9**  
Further Additional Supplemental Appropriations for Disaster Relief Requirements Act (Public Law 115-123) signed into law requiring economic and disaster recovery plan be submitted within 180 days. Additional funding appropriated, including \$28B in CDBG-DR funding of which \$18.4B was subsequently allocated to PR.

**MARCH 7**  
FEMA reports that \$1.1B in grants for individuals and families have been approved.



**MARCH 19**  
180-day damage status report presented by Government of Puerto Rico in the *New Fiscal Plan for Puerto Rico*:

- 99% of customers energized
- 99% of telecommunications restored
- 99% of PRASA customers have water
- 100% of hospitals operating.

**MARCH 20**  
Government of Puerto Rico establishes priorities for the selection of mitigation projects to receive \$3B in HMGP funding.

**APRIL 19**  
FOMB releases and certifies the *New Fiscal Plan for Puerto Rico: Restoring Growth and Prosperity*.

**JUNE 6**  
U.S. Small Business Administration has approved 45,086 loans, totaling nearly \$1.60B.

**JULY 3**  
FEMA extends Transitional Sheltering Assistance program to July 23.

**APRIL 10**  
HUD announces allocation of \$18.4B in CDBG-DR funds for Puerto Rico, including \$10.2B for recovery and \$8.3B for mitigation.



**MAY 3**  
FEMA extends Transitional Sheltering Assistance program to June 30.

**JUNE 14**  
Action Plan for \$1.5B CDBG-DR funds due to HUD.

**JULY 30**  
HUD certifies CDBG-DR Action Plan for \$1.5B for PR.

# 2018

**CDBG-DR** | Community Development Block Grant Disaster Recovery  
**Stafford Act** | Robert T. Stafford Disaster Relief and Emergency Assistance Act  
**FOMB** | The Financial Oversight and Management Board for PR  
**P3** | Puerto Rico Public-Private Partnerships  
**HUD** | U.S. Department of Housing and Urban Development  
**HMGP** | Hazard Mitigation Grant Program

Beyond creating a smarter, resilient, and sustainable Puerto Rico, this plan will contribute important lessons learned about how to effect such a sweeping transformation and how to reduce costs of disaster relief in future events.

## A transformational vision for Puerto Rico's recovery

Puerto Rico is facing a turning point—a moonshot opportunity to translate the difficulty of recovery into a better future with a plan that

- targets both economic and social progress
- tackles current needs yet looks to the future
- demonstrates transparency and innovation in governance
- leads to resilient, state-of-the-art infrastructure
- promotes a safe, educated, healthy, and sustainable society.

The recovery from Hurricanes Irma and Maria is an opportunity to address the needs of the people of Puerto Rico, not only immediately but also in the medium and long terms, making Puerto Rico a stronger, better, 21st-century society.

To this end, this economic and disaster recovery plan sets out a path to help guide recovery investments toward this broader transformational vision by

- defining what recovery means for Puerto Rico
- establishing principles for how the Government of Puerto Rico and nongovernmental, private, and nonprofit organizations will work together toward recovery
- describing the phases the recovery will progress through
- identifying the most-pressing recovery issues and the priority actions, as well as potential partners and resources to address each issue
- committing to measuring and reporting on the progress of the recovery.

### VISION

To build the new Puerto Rico to meet the current and future needs of the people through enduring economic development and social transformation; transparent and innovative approaches to governance; resilient, modern, and state-of-the-art infrastructure; and a safe, educated, healthy, and sustainable society.

“

**[The hurricanes have] changed my community because it brought unity within the people ... Everything in life has a purpose. And this purpose was to unite us as a community as one.”**

— FOCUS GROUP PARTICIPANT  
FROM CAYEY MUNICIPALITY  
(TRANSLATION)

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**Success is a Puerto Rico better positioned to address the needs of all of its people, as well as future challenges that will most certainly arise.**

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## Goals of the plan

To achieve this ambitious vision, this plan builds on the Governor’s vision for Puerto Rico by rebuilding, strengthening, and improving four core areas: society, the economy, infrastructure, and resilience, as detailed in the figure on the next page. The first of these—a healthy and vibrant society—will be built on the foundation set by the others. Together, these goals address the most pressing recovery needs while also ensuring that Puerto Rico uses this unique opportunity as a springboard to future prosperity and well-being. To create enduring economic growth and an educated, healthy, and sustainable society, Puerto Rico must and will strengthen infrastructure, implement changes to policy and regulations, and build up the resilience of all systems (e.g., health, education, energy, water, transportation). Success is a Puerto Rico better positioned to address the needs of all of its people, as well as future challenges that will most certainly arise. It will also mean opportunities for job growth and personal advancement that will benefit generations of Puerto Ricans to come, encouraging people to stay in—or return to—a stronger, safer, and more prosperous and resilient Puerto Rico.

## Guiding principles

Innovation, transparency, accessibility, transformation, and sustainability are the principles that will shape the Government of Puerto Rico’s investment decisions and inform the planning and implementation of the goals outlined in this plan. Good governance will ensure that these principles are actively integrated into decisionmaking structures.

**Innovation:** Innovation will play a crucial role in the recovery effort—including how investments are identified, crafted, and implemented. In Puerto Rico, innovation means turning recovery ideas into solutions that improve Puerto Rico’s capabilities by leveraging emerging technologies and methods and integrating those with expert advice. Puerto Rico’s innovative solutions are problem-oriented, usable, forward-looking, and adaptive. They emphasize doing things more equitably, more efficiently, less expensively, or in a way that is more environmentally sustainable. Being innovative means Puerto Rico will not shy away from novel or unprecedented approaches to solving problems. At a minimum, innovative solutions will not simply repeat what has been done in the past. Instead, Puerto Rico will take a new path, one that takes advantage of new thinking and new technologies and advances the Island’s resiliency and economic-growth initiatives.

## Society



Ground the new Puerto Rico in the needs of its people by promoting a society that is

1. educated
2. healthy
3. sustainable.

## Economy



Ensure that rebuilding and restoration efforts promote sustainable economic growth and social transformation and contribute to

1. a more vibrant and competitive economy that can provide opportunities for job growth
2. personal advancement that produces benefits for Puerto Rico's residents for generations to come.

# VISION

## Resilience



Enhance Puerto Rico's ability to withstand and recover from future disasters through

1. individual, business, and community preparedness
2. redundant systems
3. continuity of operations
4. improved codes and standards.

## Infrastructure



Strengthen Puerto Rico's critical infrastructure by rethinking its design and reconstruction to

1. be more modern, sustainable, and resilient than before the hurricanes
2. effectively support people, industry, and the economy.

## FEDERAL LEGISLATION SUPPORTING THE DEVELOPMENT OF THIS PLAN

In the aftermath of Hurricanes Irma and Maria and at the request of the Governor, President Donald Trump signed Major Disaster Declarations on September 10, 2017 (FEMA-4336-DR-PR), and on September 20, 2017 (FEMA 4339-DR-PR), respectively, under the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act). These declarations authorized the Federal Emergency Management Agency (FEMA) to provide a wide range of assistance programs for the individuals and public institutions in Puerto Rico, in close coordination with the Government of Puerto Rico and the Island's municipal governments. In alignment with the National Disaster Recovery Framework (NDRF), FEMA coordinated recovery efforts across federal and state-level agencies; private-sector entities; and voluntary, faith-based, and community organizations across Puerto Rico.

In response to overwhelming recovery needs in the wake of the 2017 hurricane season and the California wildfires, Congress passed the Bipartisan Budget Act of 2018 on February 9, 2018 (Public Law 115-123). This legislation requires the Governor of Puerto Rico, with support and contributions from the Secretary of the Treasury, the Secretary of Energy, and other federal agencies having responsibilities defined under the NDRF, to produce within 180 days an economic and disaster recovery plan that defines the priorities, goals, and outcomes of the recovery effort. Congress specified that the plan include the following sectors: housing, economic issues, health and social services, natural and cultural resources, governance and civic institutions, electric power systems and grid restoration, environmental issues, and other infrastructure systems. In addition, the legislation calls for the plan to be based on an assessment of the damage from Hurricanes Irma and Maria.

Congress also required that Puerto Rico's economic and disaster recovery plan be developed in coordination with and certified by the Financial Oversight and Management Board established under the Puerto Rico Oversight, Management, and Economic Stability Act; by federal

agencies; and by key partners from private and nongovernmental entities.

Congress called for a description of Puerto Rico's plan for recovery over 12-month and 24-month time horizons. This plan goes further, including actions to be implemented over the next several years that capitalize on disaster recovery assistance to accelerate economic development on the Island. In the short term, the plan prioritizes restoring critical infrastructure and enacting a series of governance and policy adjustments that will build a strong foundation for the remainder of the plan's transformative objectives. These actions include improving emergency preparedness, increasing the ease of doing business in Puerto Rico, strengthening government capacity in day-to-day service provision and during disasters, making available high-quality data to guide decisionmaking and support transparent governance, and promoting formal work and workforce training.

### Engaging stakeholders through the National Disaster Recovery Framework

Under the NDRF, Recovery Support Functions bring together the knowledge, skills, and resources of federal departments, agencies, and other organizations to focus on the recovery. The functions are organized into the following six components, each coordinated by a federal agency (shown in parentheses):

- Community Planning and Capacity Building (U.S. Department of Homeland Security/FEMA)
- Economic Recovery (U.S. Department of Commerce)
- Health and Social Services (U.S. Department of Health and Human Services)
- Housing (U.S. Department of Housing and Urban Development)
- Infrastructure Systems (U.S. Army Corps of Engineers)
- Natural and Cultural Resources (U.S. Department of the Interior).

**Transparency:** The Government of Puerto Rico is committed to transparency in managing recovery investments and tracking their impacts on economic and social outcomes. In keeping with the International Monetary Fund’s Fiscal Transparency Code, the Government of Puerto Rico will prioritize recovery activities that support fiscal transparency and accountability through fiscal reporting, forecasting and budgeting, risk analysis and management, and resource revenue management. Transparency also includes clear and open decisionmaking processes; the Government of Puerto Rico will take steps to ensure that timely and accessible information on recovery efforts is available to the public throughout the recovery.

**Accessibility:** Recovery investments need to be considered within the context of how people in the most vulnerable circumstances gain access to services and goods to ensure that they are available to all residents when needed. Strategies to address these considerations include targeting investments to provide equal access to services and goods; diminishing barriers to access created by financial, social, health, cultural, and functional limitations; and making investments that increase the affordability, availability, or appropriateness of existing services and goods.

**Transformation:** The Government of Puerto Rico’s vision for economic and disaster recovery is transformative—in that the goal is to build back hurricane-damaged systems in a way that is driven by and for the greater, longer-term needs of the people of Puerto Rico. The recovery effort will be flexible and responsive enough to endure over time. But the Government of Puerto Rico has also developed this plan with an eye toward ensuring that, to the greatest extent possible, investments in recovery from Hurricanes Irma and Maria align to tackle the longer-term challenges facing the Island. This means applying a mindset, processes, and human resources that allow for an integrated approach and a thorough and ongoing calibration of recovery investments. This strategy is necessary to effectively weigh the short- and long-term benefits of specific choices and their interdependencies, as well as how each addresses the long-standing economic, infrastructure, and societal challenges that Puerto Rico faced even before the disaster brought about by the hurricanes.

**Economic sustainability:** Recovery investments must be evaluated to ensure that returns—both capital and strategic—can be sustained over the long term. Puerto Rico may experience a



Hurricane survivors in the Luis Llorens Torres neighborhood of San Juan obtain water and other supplies distributed by FEMA on December 6, 2017. FEMA also offered medical care and flu vaccines.

Photo by Eduardo Martinez / FEMA

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**With the 2018 hurricane season under way as this plan is being finalized, there is also a critical and immediate need to prepare infrastructure and people to weather another emergency.**

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growth in economic activity spurred by recovery investments to repair or rebuild damaged infrastructure. The Government of Puerto Rico will develop and deploy recovery investments in a way that ensures that capital improvements can be sustained over the long term and that related economic and societal improvements are not fleeting. For example, it is important not to build infrastructure unless there is a plan for funding to maintain it, including sustaining the human and economic benefits brought about by immediate capital investments.

### **A roadmap to long-term recovery**

Successful recovery in Puerto Rico requires an unprecedented mobilization of diverse resources, all operating within a complex mix of individual constraints and mutual interdependencies. Coordinating multiple concurrent efforts across diverse sectors, multiple levels of government, and a complex topography will rely on efficient and clear communications and the sharing of information. Moreover, sequencing actions in such a complicated effort requires consideration of the Island's immediate needs; available financing; progress on related activities; and the reality of constrained capacity, in both the public and private sectors, to undertake recovery actions.

Ensuring that people are safe and have access to the services and resources they need to start rebuilding a relatively normal life are the most immediate needs. With the 2018 hurricane season under way as this plan is being finalized, there is also a critical and immediate need to prepare infrastructure and people to weather another emergency. In addition, coordinating multiple efforts across diverse sectors and a complex topography requires efficient and clear communication and sharing of information. In addition, government agencies, businesses, and individuals need to know who owns or is responsible for rebuilding infrastructure, assets, and services. Therefore, in the short term (1-2 years), this plan is focused on

1. reestablishing lifeline systems to provide reliable energy, telecommunications, water, and transportation
2. repairing or rebuilding the approximately 166,000 residential structures damaged or destroyed during the hurricanes
3. improving emergency preparedness infrastructure and developing a resilience-oriented workforce
4. clarifying ownership and responsibility for various infrastructure, assets, and services.

As part of the longer-term recovery (3–11 years), Puerto Rico looks to build sustainable social and economic growth. This will require diverse efforts at multiple levels to support individuals and strengthen communities, businesses, and governance. The migration of people from the Island can be stemmed by making Puerto Rico an attractive place to live—that is, a society with resilient lifeline systems, a modern standard of living, communities that are connected and healthy, and good educational and job opportunities. And beyond the population, business and enterprise will be attracted to a Puerto Rico that has lower costs of doing business, a trained workforce, and accountable governance. With more timely, accurate, and comprehensive information to inform their decisionmaking, both the public and private sectors will be better positioned to support growth. In the longer term, the priorities for Puerto Rico’s recovery are to

1. stem the migration away from the Island and encourage economic growth by improving the ease of doing business, incentivizing formal labor force participation, broadening the tax base, and increasing fiscal discipline
2. revitalize urban centers to focus economic recovery efforts
3. scale social services, health, education, and infrastructure systems to meet the health, social, and economic needs of the current and future population
4. rebuild infrastructure to meet modern codes and standards, and enforce the laws and regulations governing construction, water supply connections, and electricity metering
5. establish modern methods for providing both the public and private sectors with timely, accurate, and comprehensive information to make effective decisions about recovery and day-to-day operations.

A wide selection of potential courses of action designed to address these short- and long-term priorities are described throughout this plan. These actions span multiple sectors and are interconnected. They are presented in the plan in an order that reflects (1) actions that must come first because they provide critical support to ensure the success of all other actions (these are the precursor actions; see “Start with a Strong Foundation,” Chapter 5), (2) capital investments in lifeline and other systems that support social and economic growth (see “Build Resilient Communities, Modernize Infrastructure, and Restore the Natural

Environment,” Chapter 6), and (3) strategic initiatives that build on the precursor actions and capital investments and take advantage of unique assets or fill critical gaps for Puerto Rico (see “Focus on the Future,” Chapter 7).

The figure on the next page illustrates the key elements of the plan and reflects how the plan is organized. Guiding the plan is Governor Ricardo Rosselló’s vision, principles, and goals, as described in this chapter. A series of high-level objectives—the precursors, followed by the lifeline and other capital investments, then the strategic initiatives—provide anchor points for critical recovery priorities. The plan concludes with “Detailed Actions” (Chapter 12) describing various actions that align with each of the objectives. Many of these actions contribute to more than one objective and thus have multiple benefits for achieving the objectives, goals, and vision of this plan.

## Developing the plan

The Government of Puerto Rico—in particular, the Central Office of Recovery, Reconstruction, and Resiliency (COR3)—was supported by FEMA and the Homeland Security Operational Analysis Center (HSOAC, a federally funded research and development center operated by the RAND Corporation under contract with the U.S. Department of Homeland Security) in the development of this economic and disaster recovery plan. The effort involved extensive outreach to and collaboration with a broad group of federal agencies, state-level and municipal government agencies within Puerto Rico, private-sector and nonprofit entities, and the group most affected by the hurricanes—the people of Puerto Rico.



The view of PR-53 heading south, taken during a helicopter tour for members of Congress to view hurricane damage, on January 25, 2018.

K.C. Wilsey / FEMA

**VISION**

To build a new Puerto Rico to meet the current and future needs of the people

**GOALS**

- Foster a society grounded in the needs of the people
- Promote sustainable economic growth
- Strengthen critical infrastructure
- Enhance resilience

**OBJECTIVES**

**PRECURSORS**

Actions that act as a foundation for other investments

- Build government capacity** to handle day-to-day business and recovery efforts
- Make high-quality data** available to support better decisionmaking
- Enhance local capacity** to secure and manage recovery funds
- Maximize the impact** of available federal funding
- Support planning** at the local level
- Increase the ease** of doing business
- Reduce barriers** to formal work and incentivize workforce training

**CAPITAL INVESTMENTS**

9 foundational sets of actions to take today that invest in infrastructure, people, and the environment

**Lifeline capital investments**

- 💡 Transform the energy system
- 📶 Modernize the telecommunications system
- 🚰 Rethink water systems
- 📍 Rebuild and strengthen maritime, surface, and air transportation

**Other investments**

- 🏠 Repair and rebuild resilient residential housing
- 📖 Transform the education system
- 🏥 Rebuild and enhance health and social service infrastructure
- 🏢 Repair, rebuild, and right-size the public buildings inventory
- 🌿 Restore, plan for, and develop the natural environment

**STRATEGIC INITIATIVES**

8 future-facing sets of actions that reflect the economy of tomorrow in Puerto Rico

- 🌊 Ocean economy
- 🏠 Visitor economy
- 🚑 Emergency services modernization and integration
- 🌾 Agricultural modernization and processing
- 💻 Digital transformation
- 👤 21st-century workforce
- 🏠 Entrepreneurship
- 🏭 Advanced manufacturing

**ACTIONS**

Roughly 270 specific ways to act on all of the above

The plan was developed over the course of three dynamic and—given the urgency—overlapping phases:

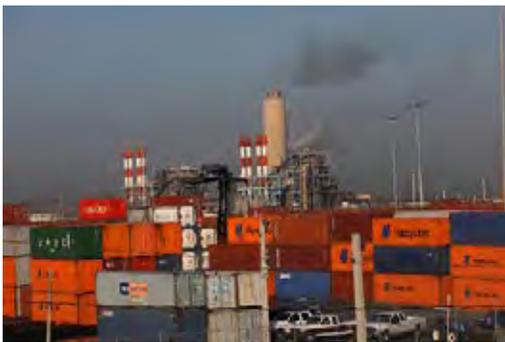
1. identifying damage, needs, and priorities for recovery
2. identifying potential courses of action (and their related costs)
3. aligning the plan objectives and courses of action and identifying potential funding sources.

As noted, the first phase involved **identifying damage, needs, and priorities for recovery**. This intensive assessment of the damage from the hurricanes and of remaining needs across the Island provides the baseline needed to define, compare, and prioritize courses of action. The damage and needs assessment describes conditions before the hurricanes, the damage caused by Irma and Maria (both direct physical damage and the effects on Puerto Rico’s population and economy), conditions six to nine months after the hurricanes, and remaining needs. The damage and needs assessment draws on myriad data sources, as well as stakeholder interviews and roundtables, literature reviews, and media reporting. At the same time, the Government of Puerto Rico developed the vision and goals for the plan, which were then laid out for the team that FEMA convened to aid in the plan’s development. The Government of Puerto Rico and the FEMA and HSOAC teams then worked together in an iterative process involving a series of coordination meetings and interactive workshops, along with a review of completed and forthcoming plans for Puerto Rico. Work during this phase also drew from and built on the many plans, critical guidance, and other documents—relevant to the Island as a whole or to specific sectors—that were produced before and in parallel with the recovery plan.

The second phase involved **identifying potential courses of action**—a collection of potential activities, policies, and other actions that could contribute to recovery—and estimating the associated costs. Dedicated teams of experts, each focused on a specific sector (such as energy or economic activity), conducted background research, and engaged with sector stakeholders and subject-matter experts in Puerto Rico and beyond. These teams also reviewed existing plans, proposals, and the literature to identify strategies, best practices, and possible innovations to meet Puerto Rico’s needs. Although it was not possible to conduct formal cost-benefit and feasibility analyses for each course of action, the teams evaluated each action’s responsiveness to needs, level of innovation, and alignment with the evidence base (e.g.,

### TRACKING COURSES OF ACTION

Each course of action presented in this plan has an identifier based on the sector in which it was developed and an arbitrary number used for tracking (e.g., EDU 1). All courses of action in “Detailed Actions” (Chapter 12) include their respective tracking identifiers for easy reference.



The Port of San Juan, shown on October 12, 2017, struggled after the hurricanes with a lack of power and bottlenecks due to the competing needs of daily operations and the emergency response.

Shannon Stapleton / Reuters



Wind turbines in Naguabo remained idle on February 13, 2018, due to damage from the hurricane's high winds.  
K.C. Wilsey / FEMA



A specialist with FEMA's Disaster Survivor Assistance program helps a resident in San Juan's Villa Nevarez neighborhood register with FEMA on January 5, 2018.

Yuisa Rios / FEMA

based on best or promising practices). As part of this process, some courses of action were eliminated from consideration or adjusted in an effort to roughly align the costs and benefits. For example, a course of action proposing to turn some roads from paved to gravel was eliminated because the estimated costs of maintaining the gravel road over time exceeded the potential savings from the modification.

For each proposed course of action, the relevant sector team also established rough-order-of-magnitude cost estimates to support high-level planning and inform decisionmaking. These estimates include both initial costs (e.g., construction investment) and recurring costs (e.g., operations and maintenance) over an 11-year period (i.e., 2018–2028, to align with the fiscal plans). Even though ranges and point estimates are given for courses of action depending on the methods and information used, the cost information presented in this plan should be regarded as preliminary because more-specific cost estimates will require more specificity regarding implementation choice, as well as the completion of ongoing damage assessments. As more-detailed policy choices are made in support of these courses of action, more-detailed cost-benefit analyses will help inform policymakers about various investments' impacts on long-term fiscal sustainability. This will, in turn, support consideration of different levels of implementation for some courses of action to constrain costs and maximize benefits. Costs are associated with correcting pre-hurricane deficiencies, as well as addressing hurricane damage. Therefore, costs do not necessarily align with or match estimates of hurricane damage in Puerto Rico reported here and elsewhere.

The third phase of the plan development effort involved **aligning the plan objectives and courses of action and identifying potential funding sources**. The plan team sorted these actions into broadly defined objectives that aligned with the overall plan vision: seven objectives focused on precursors needed to start the recovery with a strong foundation, nine objectives focused on capital investments (such as water and telecommunications), and eight objectives focused on strategic initiatives (such as enhancing the visitor economy). Then, the plan team developed two to five portfolios (sets of actions) for each objective based on themes that aligned with the objective (e.g., more resilience, lower cost). The Government of Puerto Rico selected one or more portfolios for each objective. Courses of action that were fundamental to the success of all capital investments (the



precursors) were moved into their own portfolio. The total set of approximately 270 actions from the selected portfolios provided the basis for total cost estimates for the plan.

Most of these actions are focused on the capital investments needed for Puerto Rico to recover. To meet the plan objectives, Puerto Rico will require approximately \$139 billion over the 2018–2028 time period, and some of these funds have already been provided by federal disaster relief, private insurance, the private sector, and philanthropic sources. The figure above provides the breakdown of costs (the initial upfront and recurring operations and maintenance costs). A more detailed description of costs by sector is included in “Estimated Costs and Funding for Puerto Rico’s Recovery” (Chapter 8), and a list of the selected portfolios are presented later in this plan (“Detailed Actions,” Chapter 12).

In identifying funding sources for the courses of action, the sector teams considered both U.S. government aid and nongovernmental funding sources. Funds from the Disaster Relief Fund, special appropriations for disaster relief and recovery, and steady-state federal programs funded via normal annual program budgets were estimated and refined with FEMA and other outside experts. Nongovernmental funders (charitable and corporate foundations, institutional investors, and venture capitalists) were also examined as potential funders for recovery actions. But eligibility requirements for many of the supplemental funding elements are still unspecified, so the possible funding sources are notional at this time. More detail is provided in Chapter 8.



# | A VISION FOR PUERTO RICO



## Governor's introduction

**H**urricanes Irma and Maria had devastating impacts on the Island of Puerto Rico, creating an enormous toll on human life and on Puerto Rico's infrastructure, which had effects that reverberated for months and that we are still grappling with to this day. In November 2017, I published a report summarizing these damages and creating a call for action. In *Build Back Better*, I requested federal funds to support recovery. Our approach was and is that recovery dollars should be used to invest in an efficient and effective future rather than merely building back to the preexisting state. Given the level of destruction, we have an opportunity to take an approach that makes a fresh start for many of these infrastructure systems.

In looking at the road ahead, this is not only an opportunity to physically repair and reconstruct the damage caused to the Island by the hurricanes but also a moonshot moment to implement the social, governmental, fiscal, and economic reforms that have been addressed in the foundational plans that underpin Puerto Rico's vision for transforming its future. Those plans include the *Plan for Puerto Rico*, *Build Back Better*, the *New Fiscal Plan for Puerto Rico*, and the *Community Development Block Grant - Disaster Recovery Action Plan*.

Transforming Puerto Rico requires a vision for the future that is grounded in the present. Puerto Rico's road to recovery and transformation must take into account a variety of preexisting conditions that have challenged us—including our Island's changing demographics, the economic trends and fiscal conditions, and the condition of our critical infrastructure. Puerto Ricans put their faith in me to lead us to solutions to these challenges even before Irma and Maria, and now the need is even greater.

In this chapter, I lay out the realities that Puerto Rico has faced over the past decade and that I have made the mission of my administration to overcome, followed by my vision for the future. These are the foundations for the hurricane recovery investments described in later chapters in this plan, which we developed in consultation with federal agencies and a wide range of subject-matter experts. This plan will transform Puerto Rico into a more resilient future.

A shop in San Juan displays a sign that reads "clearance due to closing" on August 3, 2015. Puerto Rico has been in economic decline since the mid-2000s.

Alvin Baez / Reuters



## Conditions before the hurricanes

**Economic trends.** Since 1996, Puerto Rico's economy has been in near-continuous recession, with low labor-force participation (approximately 40 percent prior to the hurricanes) and double-digit unemployment. Economic contraction in the years prior to the hurricanes contributed to a severe fiscal crisis, in which lower revenues and high rates of spending were financed through heavy borrowing. This resulted in high and unsustainable levels of debt, including more than \$70 billion in bond debt and a substantial unfunded pension liability. Despite stabilization efforts by the Government of Puerto Rico, Puerto Rico's credit rating dropped below investment grade in early 2014, followed by a series of defaults on debt payments.

The fiscal crisis ultimately resulted in the passage of the Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA) in 2016, which established the Financial Oversight and Management Board (FOMB) and provided the framework for restructuring Puerto Rico's debt. FOMB's purpose is "to provide a method for [Puerto Rico] to achieve fiscal responsibility and access to the capital markets" by certifying financial plans, approving and monitoring budgets and activities related to the budgets and fiscal plans, providing advice on issues of financial stability and management, and certifying restructuring and approving actions related to debt issuance. Recovery activities will be undertaken in a way that is consistent with FOMB's authorities.

**The cost of imports.** Since 1920, Puerto Rico has been subject to the Jones Act, which requires that all goods transported by water between U.S. ports be carried on U.S.-flag ships that are constructed in the United States, owned by U.S. citizens, and crewed by U.S. citizens and U.S. permanent residents. The Jones Act may constrain Puerto Rico's ability to import a variety of goods and services at more-competitive prices (including, but not limited to, liquefied natural gas, food, and other commodities). Although data limitations obscure the exact magnitude of the effect, it is likely that the prices of imports in Puerto Rico, and of the goods and services produced from these imports, may be artificially inflated, which disadvantages both producers and consumers.

**Limited maintenance of infrastructure.** The financial hardships created by the economic decline and lack of transparency over ownership and responsibility, as well as the socioeconomic and governance challenges in Puerto Rico, contributed to deferred repairs and maintenance of infrastructure, such as the telecommunications and energy systems, transportation networks, and public buildings.

It is common in Puerto Rico for buildings to be owned by one set of entities (e.g., the Public Buildings Authority or the Puerto Rico Industrial Development Company) and for day-to-day operations to be managed by another organization, such as a government agency or private-sector tenant (e.g. the Department of Education). This lack of accountability over asset management—combined with limited finances—has meant that repairs are often deferred or not completed.

**Population demographics.** In the span of approximately three decades, Puerto Rico’s population has transformed—from a primarily young, rapidly growing, and urbanizing demographic to an older population in which deaths have outnumbered births (see figure on the next page). An increasing number of young people and working-age adults have been migrating away from the Island.

In part, the economic contraction that began affecting Puerto Rico in 2006 has led to some of these demographic changes, with the lack of economic opportunities decreasing childbearing and encouraging migration. And in 2006, the birthrate in Puerto Rico was already well below the level that is required for a population to replace itself within a generation. A decade later, childbearing had declined far enough to place Puerto Rico’s birthrate among the lowest in the world. The continuing loss of people from Puerto Rico, particularly school-aged children and working adults, has added to the stress on its economy and created a shortage of professional workers in many sectors.

In 2016, the median per capita income in Puerto Rico was \$11,688. Forty-five percent of residents had an annual income below the federal poverty level, with high rates of poverty among those younger than 18 (57 percent) and those older than 65 (approximately 40 percent).

The Human Cloud is a technologically enabled alternative approach to organizing work, in which employers divide jobs into small components and engage a geographically independent workforce through global digital platforms to execute them. Combining elements of globalization and the gig economy, the Human Cloud provides employers with an accessible skilled workforce on-demand and provides employees with significant freedom to choose where, when, and how they work.

## The vision for Puerto Rico

The preexisting conditions described earlier demanded both a vision for innovation and transformation. Efforts have been under way since before the hurricanes to address key challenges, and they will continue through the recovery. The Governor’s vision builds on both the strengths of Puerto Rico’s citizens and the solutions modern technology can offer to leapfrog beyond past challenges and the destruction wrought by the hurricanes. The goal of this vision is to create a prosperous, resilient and innovative Puerto Rico that is:

- **A magnet for workers in the Human Cloud.** As jobs rely increasingly on information technology and become less tied to physical location, workers can join the “Human Cloud” and export their services wherever these are required. With the ideal natural and environmental setting of Puerto Rico, warm and welcoming

# A snapshot of Puerto Rico's demographics and income



## Demographics (2016)

In a 10-year period (2006–2016), people have moved to Puerto Rico but many more have left, for a net loss of **525,000 residents**

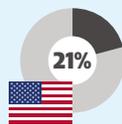


There is a shortage of **professional workers** in many sectors and fewer **school-aged children**

**1.2 births** per woman vs. 1.84 in the U.S. overall



Roughly **25 percent** of Puerto Rico's 3.4 million residents are **60 or older**



By comparison, roughly **21 percent** of the United States as a whole is **60 or older**

## Race and Ethnicity (2017)

**98%** self-identify as **Hispanic/Latino**

Roughly **69%** self-identify as **white**

**9%** self-identify as **black or African-American**

**7%** self-identify as **2 or more races**



## Language (2016)

**Less than 25%** report speaking English "very well"

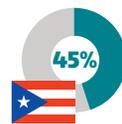
**More than 90%** speak Spanish at home



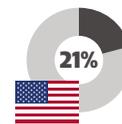
## Income (2016)

Median per capita income is **\$11,688**

**40%** participate in the **labor force**



**45%** of Puerto Ricans **live below the federal poverty level**

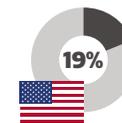


**21%** of Mississippi residents **live below the federal poverty level** (the poorest U.S. state)

**Poverty is worse** among minors (57%) and those older than 65 (about 40%)



Nearly **25%** of Puerto Ricans **receive Social Security**



Less than **19%** of residents in the U.S. overall **receive Social Security**

**Nearly 50%** of Puerto Ricans use **Medicaid or the Children's Health Insurance Program** vs. 20% in the U.S. overall



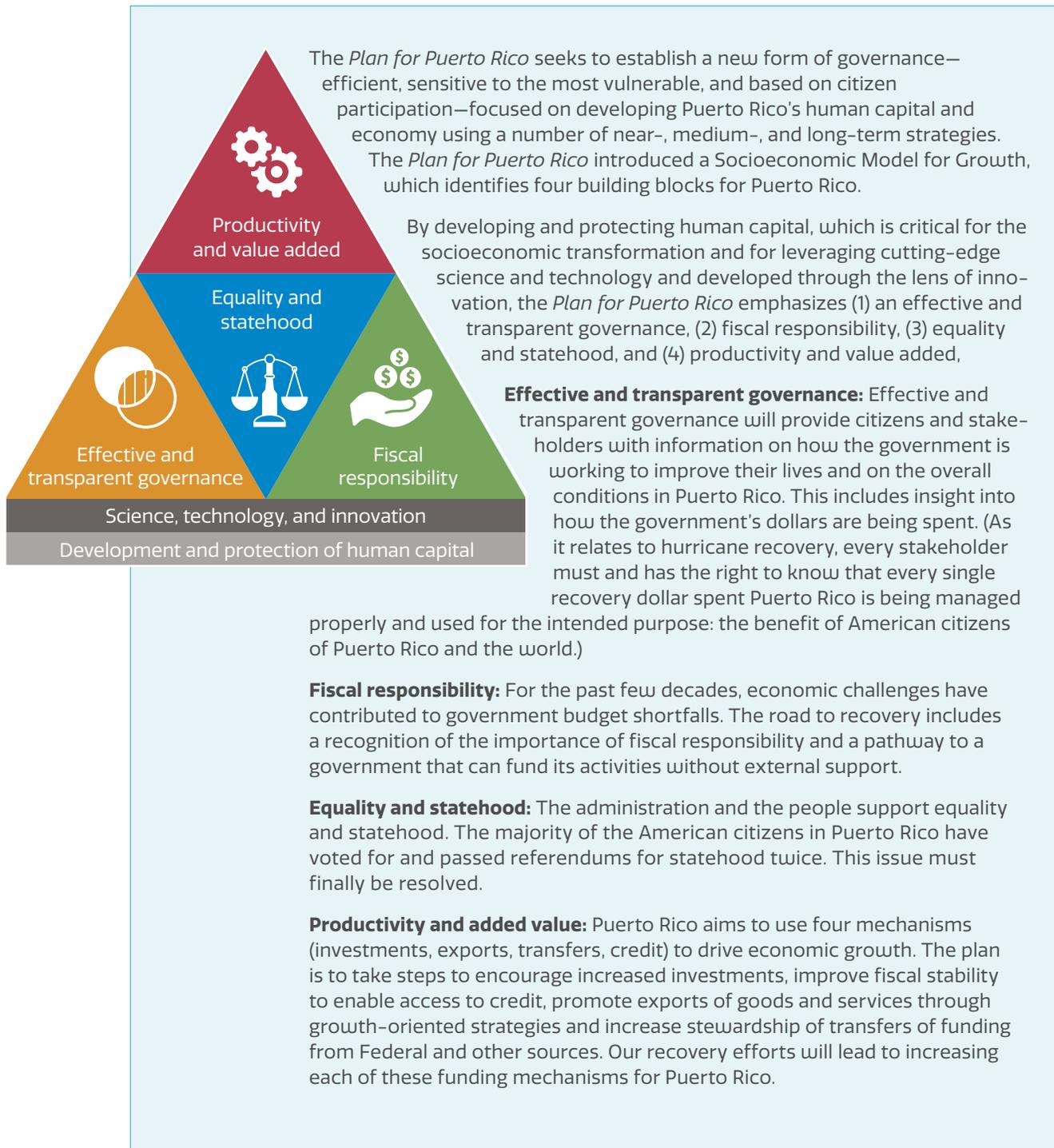
communities, and rich cultural heritage, a revived Puerto Rico will be the ideal place for this Human Cloud of virtual workers.

- **A platform for innovation.** Educated, energized, and engaged Puerto Rican talent will be empowered to generate great ideas and develop them into products and approaches and scale them up to make Puerto Rico—and the world—a better place. Puerto Rico will be the intellectual laboratory of the world. Innovation will permeate all aspects of society—government, business, and human capital.
- **Open for business.** Entrepreneurship, local industry, production, and innovation will be the focus as Puerto Rico becomes an exporter of knowledge, goods, and services. Streamlined government, reduced complexity, increased ease of doing business, and the eradication of bureaucratic obstacles will lead to a competitive and sustainable business environment.
- **A connector of the Americas.** By virtue of Puerto Rico’s unique geographical advantage and its cultural ties to North, Central, and South America, Puerto Rico will be the nexus of business, finance, and diplomacy for the Americas.
- **A place that enhances the quality of life of the U.S. citizens of Puerto Rico.** Puerto Rico must advance all possible initiatives that bring us closer to statehood and that allow us to gain full political and economic equality with the rest of the states of the Union. To achieve parity in federal transfers, especially in programs linked to payroll taxes, such as Social Security and Medicare, we need to maximize the opportunities and engagement to obtain long-term and equitable solutions. Part of these efforts include achieving equality in the quality of health care services and education, achieving equality in per capita income, and establishing a clear and safe path to the maximum expression of equality: statehood.



Governor Ricardo Rosselló, shown at the Aspen Ideas Festival, displays a hand-drawn map that illustrates his vision of a new, stronger, better, and more resilient Puerto Rico.

To achieve this vision, the efforts that were put in motion before the hurricanes, including the Plan for Puerto Rico (see graphic below), are even more important now. First and foremost, reforming government is vitally important to setting Puerto Rico on this aspirational course.



## Reforming government

Achieving the vision for a stronger Puerto Rico requires government reform to fix chronic problems, improve policies, build a stronger and more resilient base, and take a longer-term view. Puerto Rico is developing laws and policy that will reduce the cost of doing business through tax reform and energy reform, reducing excess legislation and regulation, and revamping the education system to produce a competitive labor force.

Many steps are currently being planned or are under way to create a new approach to government that will work to more effectively support the well-being of all Puerto Ricans:

- **New government act:** Puerto Rico has 131 agencies, which is both costly and creates challenges relating to a siloed and complex bureaucracy. The central government will consolidate these to approximately 35 agencies. A newly enacted law will facilitate this change, and create a more effective and “right-sized” government structure.
- **Government as Single Employer Act:** The Single Employer Program positions the central government as the sole public service employer and establishes the concept of mobility for employees among different agencies and departments. This program will act as a vehicle to enable transformation by allowing the government to more efficiently allocate resources across the new government structure, and will create opportunities for government employees. The program mobilization plans will be aligned with the right-sizing efforts as opportunities are identified to create pathways to move employees to areas of greatest need within the government.
- **Eliminate red tape:** The Government of Puerto Rico has made a commitment to review all 8,994 registered regulations, including the 4,727 regulations that have not been reviewed since approval.



## LEGAL FOUNDATION TO ENSURE THE EASE OF DOING BUSINESS AND TO ATTRACT HUMAN CAPITAL

This competitive framework provides incentives for relocation to Puerto Rico, offers tax advantages for the export of goods and services, and allows companies to take advantage of tax incentives in exporting services anywhere in the United States.

Act No. 20 of 2012, known as the Act to Promote the Exportation of Services, provides attractive tax incentives for companies that establish and expand their export services businesses on the Island. The law promotes investments in research and development and initiatives from the academic and private sectors by granting credits and exemptions for these activities. It also helps to decrease operational and energy spending for companies moving to the Island to help their operations remain profitable and efficient.

Act No. 22 of 2012, seeks to attract new residents to Puerto Rico by providing a total exemption from Puerto Rico income taxes for all passive income realized or accrued after such individuals become bona fide residents of Puerto Rico. This relocation is intended to result in new local investments in real estate, services and other consumption products, and in capital injections to the Puerto Rico banking sector, all of which will accelerate the economic growth of the Island.

Act No. 73 of 2008, known as the Economic Incentives Act for the Development of Puerto Rico, was established to provide the adequate environment and opportunities to continue developing a local industry, offer an attractive tax proposal, attract direct foreign investment, and promote economic development and social betterment in Puerto Rico.

While regulations can be effective at promoting and protecting public interests, outdated and obsolete regulations may unnecessarily curtail economic growth and impede private sector investment. The DALE TIJERA program seeks to identify ineffective and outdated regulations throughout the government as a first step toward eliminating unnecessary red tape.

- **Digital reform to improve service provision:** The Government of Puerto Rico will review its provision of services to ensure that they are provided as efficiently and effectively as possible, including by taking advantage of online services to improve access to functions like requests for permits. Currently, the Government of Puerto Rico provides 340 services. These will be reviewed to identify those that would benefit from an innovative approach that takes advantage of digital technologies.

Achieving the vision requires turning the corner on downward trends by jumpstarting economic growth. Efforts to improve the ease of starting and expanding business are under way, including development of tools, laws, and policies to make Puerto Rico highly competitive. Reducing the cost of doing business, create incentives to attract capital investment and developing a robust business class that is sustainable are all key drivers of economic growth. Some of the efforts under way to develop the legal framework to spur growth are described in the sidebar to the left.

## SPECIFIC INITIATIVES TO IMPROVE THE BUSINESS ENVIRONMENT

These initiatives include new investments across the spectrum of the economy.

**Destination Marketing Organization (DMO).** Through the approval of Act No. 17 of 2017, Puerto Rico's tourism marketing is now in the hands of a specialized private sector entity, the Destination Marketing Organization (DMO). The DMO will maximize the use of available marketing funds by investing strategically and providing continuity to marketing and promotional efforts. The DMO will be self-funded with income from the industry through casino revenues, room taxes, and others. The entity was incorporated in June 2017, and its thirteen Board members were named. The DMO is now able to receive donations, establish and collect reasonable fees for its services, develop a sponsorship program for private funding, and formalize cooperation agreements with governmental and nongovernmental organizations.

**Invest Puerto Rico (IPR).** To promote private sector investment and growth on the island, Invest Puerto Rico (IPR) was created through the approval of Act No. 13 of 2017. IPR has several components. It markets Puerto Rico as a business-friendly jurisdiction to attract new investors. It develops and reviews new export strategies. It provides a portfolio of services to potential investors that facilitate their establishment on the island, and develops strategies that result in the development of supply chain linkages on the island. The entity was incorporated and its eight Board members were named in August 2017 and are meeting regularly to establish the entity's bylaws (approved November 2017), administrative processes, and initial programs.

**Permit reform.** Puerto Rico passed the Permitting Reform Act (Law 19-2017) in March 2017, which streamlines the permitting process for businesses to promote new investments, job creation, and economic development in the Island. The law promotes economic development and reduces burdensome processes, with the goal of turning Puerto Rico into an attractive destination for investment. It expedites and consolidates multiple processes to obtain permits, certifications of fire prevention, environmental health licenses, and authorizations into one Single Permit.

It also increases Puerto Rico's competitiveness and places the Island in a better position to attract foreign investment. Small- and mid-sized businesses are now able to obtain the Single Permit automatically. Law 19-2017 also created the Unified Information System, which integrates all requirements to do business in Puerto Rico into a single website (One Stop-PR Doing Business). This reform allows users to apply for both state and municipal permits and licenses online.

These changes are a significant step in improving the ease of doing business and are critical levers to improve Puerto Rico's ranking in the ability approve and issue permits in a transparent manner. The image below is an example of how permit reform works.

### KEY TOPICS

Dealing with construction permits

Target

138 out of 190

87

### PROBLEM INDICATORS

22

**Procedures:** Too many separate steps required to commence operation.

165

**Time (days):** 120 days (or 73% of the time) is due to evaluation in Municipal permits offices.

6.3

**Cost (% of value):** 80% of total cost is due to Municipal construction.

### GOVERNMENT ACTION

New Single Use Permit in place.

15 out of 19 autonomous municipalities have been integrated in the Unified Information System.

Municipal construction tax will be evaluated as part of Regionalization of Services initiative.

In addition, Executive Order 004-2017 creates an interagency group to oversee the permit process of critical infrastructure projects. Executive Order 003-2017, among other action items declares a state of emergency in the critical infrastructure of Puerto Rico and addresses the use of an expedited permitting process under Act. No. 76-2000 seeking to promote the development of new infrastructure, including but not limited to, the use of renewable energy.

## Opportunity Zones

The Tax Cuts and Jobs Act of 2017 created Opportunity Zones to spur investment in distressed communities throughout the country. The U.S. Department of the Treasury and the Internal Revenue Service have designated Opportunity Zones for every state, as well as Puerto Rico.

The Opportunity Zones legislation aims to attract investment capital through a unique tax-advantaged opportunity to invest "recognized capital gains" in Qualified Opportunity Zones. Under the Opportunity Zone Program, states nominate low-income communities to be designated as Qualified Opportunity Zones, which are then eligible for the tax benefit. In the case of Puerto Rico, the entire island has been designated a Qualified Opportunity Zone.

The extensive damage from the hurricanes created short-term challenges, but also created a longer-term redevelopment opportunity for the island. Puerto Rico has a comprehensive redevelopment agenda, combining near-term relief with longer-term transformative redevelopment. Puerto Rico's island-wide Opportunity Zone designation creates a universe of Opportunity Zone investment opportunities far broader than those in other, much smaller zones.

Puerto Rico is currently designing an innovative Opportunity Zone program that will attract private investment in development projects that will complement and leverage the use of federal funds to diversify Puerto Rico's economy and promote comprehensive economic recovery. A powerful tool for transformative reconstruction and redevelopment, the Opportunity Zone program will stimulate private investment in distressed communities, stem the migration of people away from the Island, and position Puerto Rico as a 21st Century economy.

## Digital government

By integrating information technology and digitizing processes that will enable organizational changes, the government will enhance delivery of services and achieve operational savings government-wide. The foundation for the government's socioeconomic development model is based on science, technology and innovation. The mission is to enable the transformation of Puerto Rico through innovation, technology, and a collaborative approach to challenges that will result in new knowledge and real impact; among the initiatives for a digital government are the following

- **Innovation plan.** This presents a comprehensive strategic and tactical innovation plan for Puerto Rico that addresses short-term initiatives and outlines a long-term vision.
- **Technology infrastructure.** We will design and build a resilient, cutting-edge technical infrastructure as a basic building block to support Puerto Rico's innovation agenda and technology development.
- **Dashboard.** The dashboard provides real-time and historic data to measure performance and accountability, recognizing data as a strategic resource.
- **Proactive institute.** This improves strategy definition and decisionmaking with the aid of data analytics, predictive models, and artificial intelligence.

## Tying the recovery effort to Puerto Rico's transformation

These disasters have presented Puerto Rico with an opportunity to accelerate many of the reforms and initiatives across the Island. Recovery cannot focus only on repairing damages from the disaster; it must also look to economic recovery. It is true that federal, philanthropic, nonprofit, and private investments in recovery are greatly needed to repair the damages caused by Hurricanes Irma and Maria. But reforms must be implemented that will protect those investments over the long term and encourage economic growth. Puerto Rico is ripe for transformative innovation; the Island will not only address recovery needs but also address the chronic issues and ongoing concerns that have been a drag on Puerto Rico's ability to prosper. Recovery dollars will be invested with the intent to propel Puerto Rico toward the visions and goals set forth in the foundational plans. It is essential that capital investments be used in a strategic manner to affect the recovery by improving the physical infrastructure beyond its pre-hurricane condition, by improving the human capital environment, and by improving the natural capacity of the Island.

This recovery effort will become a case study on how to make smart investments that allow not just rebuilding, but building a new Puerto Rico that will be an intellectual and economic hub in the Americas. Puerto Rico will take great ideas, scale them up, show they will work, and use them as models for the rest of the world. The economic and disaster recovery plan describes eight strategic initiatives that will drive the investments for recovery of Puerto Rico. This investment strategy specifically eliminates silos and takes advantage of the cross-sector interdependence that is foundational to a successful recovery. The damage from the hurricanes has helped clearly brought into focus the importance of the lifeline systems of energy, transportation, water and wastewater, and communications, as well how the recovery can create a stronger, more resilient Puerto Rico.

The core values for the recovery are centered on

- **Capacity-building.** Through the recovery process, the goal is to build the government's capacity to handle day-to-day business and the recovery efforts. The government will enhance the local capacity to create and implement recovery plans that are strategic and integrated with the recovery of the whole Island. This will increase capacity across all components of the Island. This applies to building the capacity to execute with greater speed, accountability, and transparency, especially in terms of efforts

to improve capacity in critical infrastructure. Whether it is the electrical grid, the water systems, communication, or transportation, focus must increase our managerial abilities, output rate, knowledge, and other skills through incentives, technology, and training to effectively implement this economic and disaster recovery plan.

- **Resiliency.** This concept needs to be in every conversation. Resiliency will be the center of economic and recovery goals in order to build back better. The goal is to build a Puerto Rico that is stronger, more sustainable, and more resilient across every system, program, and component of our recovery.
- **Transparency.** This recovery will involve a significant amount of funding. It is essential that recovery efforts are transparent in reporting the funds that are coming into Puerto Rico, how these funds are spent, and how this funding fits into the overall execution of our recovery plan. Our dashboards and report mechanisms will show that funds are expended for the benefit both of Puerto Rico and the world. The goal is a transparent and accountable recovery, and through this core value Puerto Rico will increase credibility among all our stakeholders.
- **Innovation.** Innovation must be a key integrating factor of everything. This is across all reform efforts from government service, from infrastructure to the business community, and to human capital efforts. Effective innovation techniques will help transition to a new model of sustainable, knowledge-based, economic growth where the development of human capital plays a key role. Certainly, near-term innovation will be critical across the electrical grid, water systems, communication and technology, and transportation. But innovation must be broader and included in all reforms, services, methods, concepts, and planning of repair and reconstruction. Innovation is key to reimagine a better, stronger Puerto Rico.

Currently, this economic and disaster recovery plan contains \$139 billion in funding needed to accomplish the repair and reconstruction to infrastructure and to implement the reforms needed to make necessary improvements across the Island. Some of these needs will be covered by the transition disaster assistance resources, which is expected to be approximately

\$94 billion. But other funding opportunities will be identified to effectively implement this vision.

The establishment of the Central Office of Recovery, Reconstruction, and Resiliency (COR3) was an essential part of implementing this vision. The idea is to have a holistic, data-driven approach to invest and rebuild. The following are key among COR3's responsibilities:

- Develop, present, and administer short-, medium-, and long-term recovery plans
- Monitor contracting for compliance and effectiveness purposes
- Implement and enforce checks and balances for procurement and approval of contracts and payments
- Deploy a proven grant-management software and provide external visibility via frequent status updates to a public website
- Coordinate and channel all efforts and activities of the government related to recovery efforts
- Process, finance, and execute infrastructure projects related to recovery efforts

The catastrophic nature of Hurricanes Irma and Maria has produced an extremely challenging recovery, and the current fiscal situation complicates these challenges. Puerto Rico has limited financial capital and a dated infrastructure. This amplifies what is at stake and emphasizes that this opportunity will be used to make significant changes in the economy and damaged infrastructure. Throughout the rebuilding process, COR3 will take a holistic approach in all phases of the operation.

Data will be a critical component of recovery. Using geospatial intelligence, the Government of Puerto Rico will assess critical areas of need or asset maps of critical infrastructure. These products can depict the critical areas of need and areas where we need to invest, such as

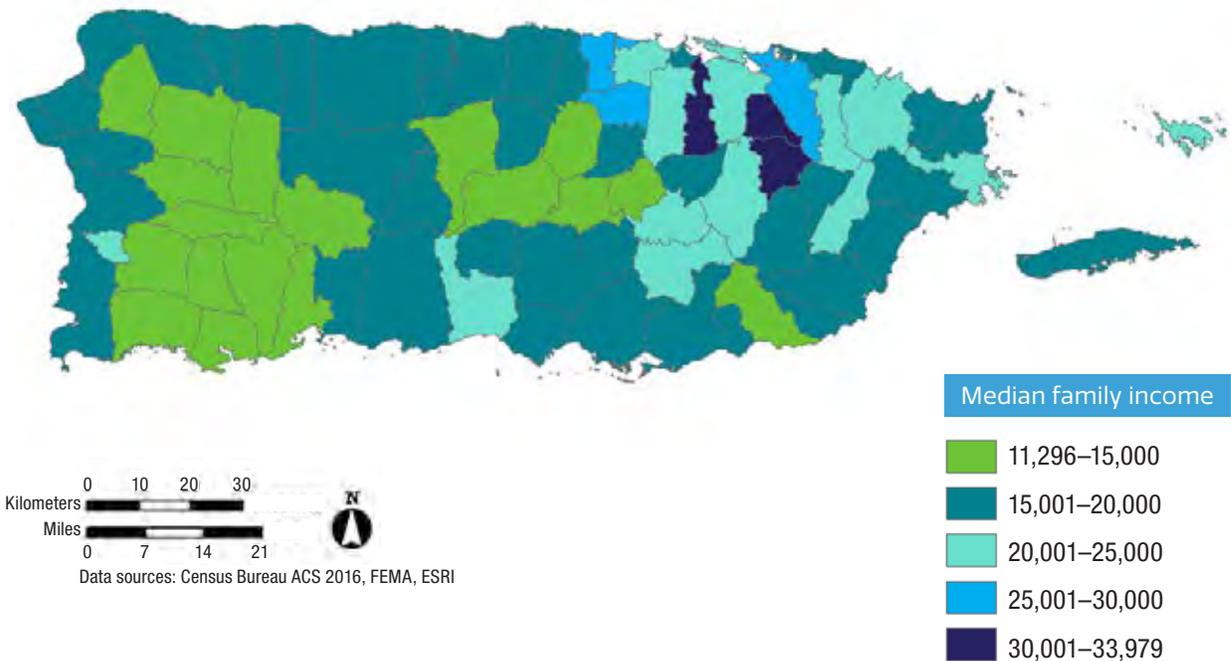
- **Poverty.** Data can show where the critical areas of poverty are. To reduce the poverty gap, the Government of Puerto Rico will use the data as a guiding principle of where we invest.
- **Asset map.** The Government of Puerto Rico will have asset maps for tourism, agriculture, industry, and development.

This helps to determine where investments will be made and show stakeholders where the best place is for them.

- **Infrastructure map.** Such maps can show where critical infrastructure is located. They will identify needs and where resources can be directed.
- **Population map.** Different population centers have unique needs, and population maps will help plan effectively for those needs. See, for example, income inequities in the map below.
- **Flood areas and housing.** Structures must be moved out of the flood plain. This is key to resilience.

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### Median family income in Puerto Rico (2016 American Community Survey)



## Specific Recovery Goals



### Energy 2.0

On average, the Puerto Rico energy infrastructure is about 28 years older than anywhere else in United States. Power is derived from 98 percent fossil fuels (petroleum fuel, natural gas, and coal), and the system does not meet the needs of the 21st century. Puerto Rico needs an effective, dependable, and cost-effective electric power system. This is vital to the socioeconomic transformation agenda that the Island needs.

The new power system will be based on a Privatization and Concession Model. The Government of Puerto Rico will leverage and facilitate expedited private sector investments in a modern, cost-efficient, and environmentally compliant energy infrastructure; reform PREPA operations and services to clients; and allow for greater competition in energy generation.

The government will leverage recovery funding in partnership with the private sector to develop a power sector that maximizes long-term power needs through privatization of some services or through a public-private partnership.

The goal is to implement a modern power sector that increases renewables from 1 percent to 40–45 percent and decreases Puerto Rico’s reliance on petroleum fuel. The modernized system will lower costs to the consumer from the current 30 cents per kilowatt hour to 4–5 cents per kilowatt hour, which is more in line with other states.

The end state is a robust regulatory framework for lower prices. The framework will enable customers to choose how to best address their energy needs through the use and development of microgrids or nanogrids across the Island, among other technologies. A framework will increase reliability and resiliency in a customer-centric model where the consumer is in control.

The goal is for Energy 2.0 to be the model for the rest of the world.

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**The goal is for  
Energy 2.0 to be  
the model for the  
rest of the world.**

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## Water

There are great deficiencies in water production, management, and distribution. A concise and sustainable plan for dredging and maintaining water reservoirs is needed; currently, close to 50 percent of the water produced is lost through leaks in the water distribution lines.

Other key initiatives include construction of a dam in Río Grande de Manatí in Ciales; water recovery and management and silt disposal; and reservoir restoration using laminar flow aeration technology.



## Communications

Even with the advances made over the past several years, Puerto Rico has yet to be in an optimal position regarding the capacity of its communications infrastructure, including broadband, fiber-optics, and other technology to be competitive in the 21st century.



## Transportation

The government will modernize road and transportation systems and establish a culture of preventative maintenance. A multi-port capability is envisioned that includes promoting the development of regional airports and seaports availing ourselves of three Part 139 Federal Aviation Administration airports and four main seaports including San Juan, Ponce, Ceiba, and Mayagüez. The full development of the Port of Ponce is critical to increase resiliency and redundancy in the transportation and logistics sector.



## Resilient communities and housing

Fragility in the housing market has been fully exposed because of Hurricanes Irma and Maria. The degree of damage caused by the storms was worsened due to widespread destruction of inadequate housing structures and damage to unoccupied and unmaintained homes. It has been estimated that anywhere from 45 percent to 55 percent of Puerto Rican households have either erected or maintained houses through informal construction, a self-managed method of construction completed without the use of an architect or engineer, proper permits, and often not in conformance with land-use codes. In many cases, informal construction is occurring without proper title to the land. This type of construction reduces the structural integrity of homes to withstand natural environmental conditions and renders them ineffective to withstand hurricane conditions.

A top priority to create resilient communities and housing is a transition from informal housing to formal housing and create a path to home ownership for thousands of working families who live in rented residences.

Puerto Rico will build housing resilient to hurricanes, earthquakes, flooding, and other natural disasters. This involves getting homes out of the 100-year floodplain, more households with homeowners and flood insurance, and strict adherence to building codes to result in stronger, more resilient housing across Puerto Rico.



#### Education: World-class education for all

Education in Puerto Rico must respond to the needs of a society in constant evolution and influenced by emerging global elements, while maintaining and reinforcing ethics and values. It will allow its participants to be the center of innovative ideas, promoting alternatives and solutions to situations related to their community and to society in general. Thus, schools will excel, serving as conduits of concrete ideas and viable solutions that respond to economic and social development, both globally and in our contemporary Puerto Rico.

A global objective of education is to develop human resources to the maximum of their capabilities. Puerto Rico will strive for the continuous progress of human capacity in a changing world. To do this, several fundamental changes will be established in the educational direction of Puerto Rico.

A new sustainable financial model in education will evaluate approximately 300 school closures to better realign educational facilities and services to student enrollment. The result will be a revised organizational structure at the central level, right-sized education structure, and a world-class education system where families have the right to choose the preferred education for their children.



#### Health care: Healthy population with high-quality access for all

Puerto Rico will propose to the federal government an amendment to the existing state plan to reduce Puerto Rico from eight regions to a single region for health services. This will allow flexibility for patients to choose where and how their services are provided. The responsibility to insure, aside from falling on insurers, should also fall on medical groups and cooperatives that can compete on equal terms and assume risks, increasing competition. All of this will result in reductions in administrative expenditures. This rule will not prevent the establishment of agreements with municipalities or suppliers capable of providing optimal services to specific areas or

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**The goal is not to rebuild only to a pre-hurricane Puerto Rico and call the work done. Instead, these difficulties will be used as an opening to build a better Puerto Rico for everyone. The Island is positioned to become a model not only for generations of Puerto Ricans but also for the Americas and the world.**

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populations. Instead, there will be competition for patients' preference among various choices of coverage.



### Public-private partnerships and infrastructure

Puerto Rico has a great opportunity to modernize its infrastructure with the use of public-private partnerships by leveraging past successes and the President's infrastructure plan. Puerto Rico's public-private partnership pipeline is the most aggressive in the United States, which, coupled with its gold standard legal framework, makes it the best jurisdiction to serve as the case study on how public-private partnerships can become one of the cornerstones for recovery and reconstruction.

Puerto Rico's current public policy in favor of public-private partnerships spans across all infrastructure sectors, including the following projects: university residential housing, maritime and ground transportation, cruise ship ports, power generation, transmission, and distribution, renewable energy, energy storage systems, water, and government services, among others.

## Conclusion

The vision for Puerto Rico is bold, aggressive, and fearless—but necessary. Puerto Rico suffered greatly from Hurricanes Irma and Maria, and the fiscal crisis exacerbated these struggles. But the recovery is an opportunity to do better. The goal is not to rebuild only to a pre-hurricane Puerto Rico and call the work done. Instead, these difficulties will be used as an opening to build a better Puerto Rico for everyone. The Island is positioned to become a model not only for generations of Puerto Ricans but also for the Americas and the world. Together, Puerto Rico's government, its citizens, and partners will make a more resilient Puerto Rico that all will be proud to call home.

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# PUERTO RICO: AN ISLAND UNDERGOING TRANSFORMATION



In the early afternoon of September 6, the main island of Puerto Rico began experiencing Hurricane Irma's sustained tropical storm-force winds. Although Irma's southern eyewall passed just north of Puerto Rico, the Island experienced 10 to 15 inches of rainfall, concentrated in the mountains, between September 5 and 7. Rain, combined with tropical storm-force winds, caused minor damage to structures and trees and widespread power outages. Puerto Rico experienced a near total loss of electricity and water for several days. The island of Culebra suffered the most devastating impacts of Irma: Many homes were destroyed or suffered major damage, trees were uprooted, and nearly all power and water services were lost. After the hurricane, President Donald Trump issued a Major Disaster Declaration for Puerto Rico (FEMA-4336-DR), dated September 10, 2017. The Federal Emergency Management Agency (FEMA) designated nine of Puerto Rico's 78 municipalities as eligible for Individual Assistance, which provides relief for immediate needs and housing restoration.

Less than a week after Irma, Hurricane Maria began forming in the Atlantic Ocean. On September 20 at 6:15 a.m. AST, the Category 4 hurricane made landfall on the main island of Puerto Rico with peak wind speeds of up to 155 mph. The center of the hurricane moved west-northwest from southeastern Puerto Rico, over the center of the main island. Extreme winds battered all of the main island of Puerto Rico and the island of Vieques, as well as Saint Croix in the U.S. Virgin Islands (see the figure on the next page). Most of the main island of Puerto Rico and Culebra experienced extreme flooding. In the early afternoon, the hurricane moved offshore, although tropical storm-force winds continued into the late-night hours. Hurricane Maria was the most intense hurricane at landfall in Puerto Rico since the 1928 San Felipe II hurricane and was the fifth most intense in history at landfall in the United States (including the continental United States, Puerto Rico, and Guam).

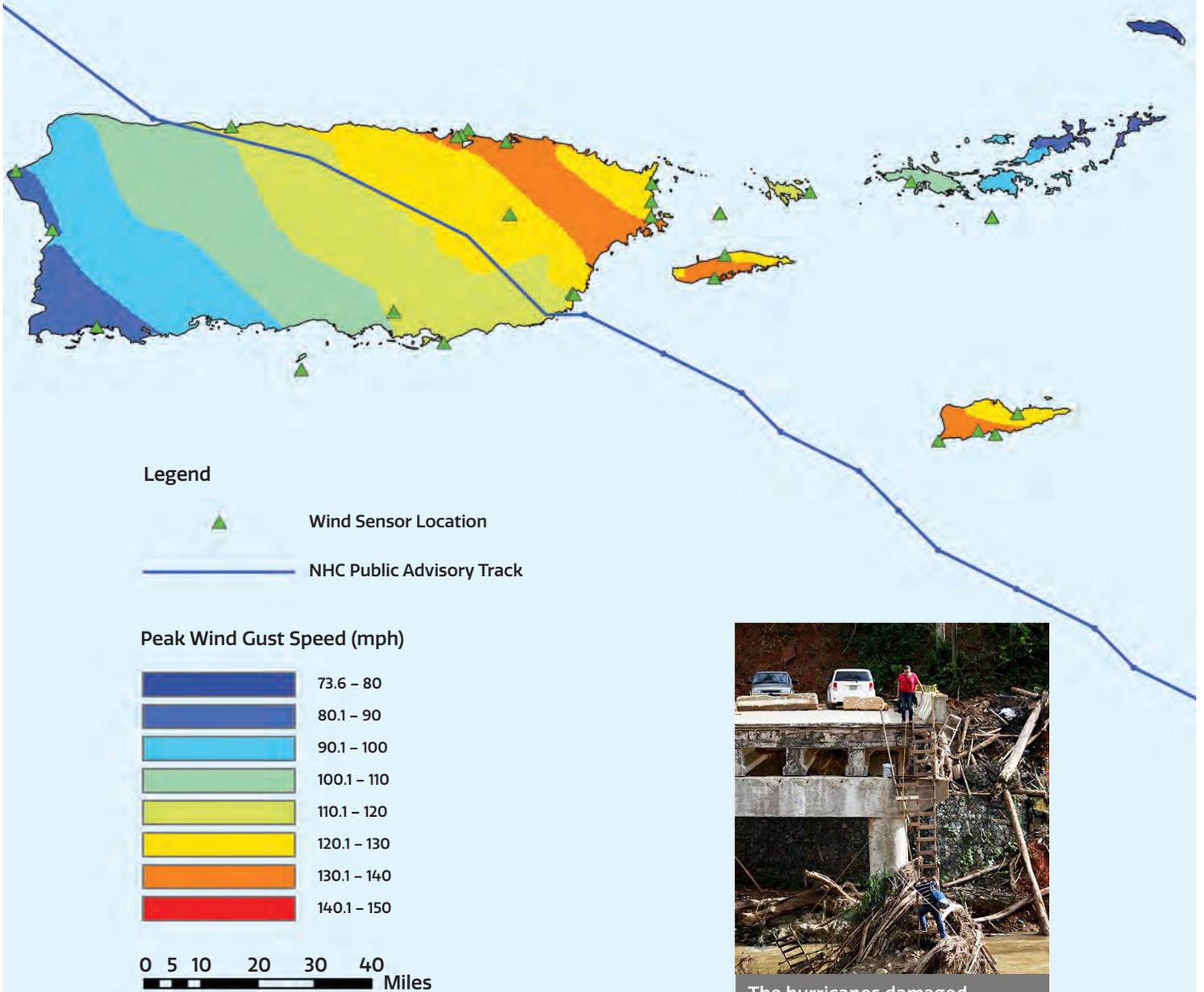
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**“Puerto Rico has a hurricane season! Emergency plans exist and have been tested many times in the past, including Irma just the week before. For the most part, they successfully passed those tests. The difference is that existing plans underestimated the level of devastation that Maria created.”**

—A senior-level FEMA official

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## Estimated peak wind gusts from Hurricane Maria



NOTE: Wind gusts shown are model estimates based on limited sensor data. Estimated 3-second wind gust speeds (mph) at 10 meters above ground over flat open terrain from a model (from Applied Research Associates, Inc.) fit to surface-level observations using National Hurricane Center storm track (smoothed at 1400 UTC on 9/20/2017) and central pressure data through Forecast/Advisory 37 at 0900 UTC on 9/25/2017.



The hurricanes damaged bridges across Puerto Rico, including this one in Utuado. About half of Puerto Rico's bridges were structurally deficient or functionally obsolete before the hurricanes.

Alvin Baez / Reuters

Many parts of Puerto Rico received 15 inches of rain or more from September 19 through September 21, 2017. The concentrated rain from the two hurricanes led to more than 41,000 landslides across a significant portion of Puerto Rico—and at least one landslide per square kilometer in most of the mountainous areas. Hurricane Maria’s extreme wind damaged most of the Island’s weather stations, but those that were working logged wind speeds of 137 mph on the islands of Culebra and Vieques to the east of the main island of Puerto Rico. Mountainous terrain likely contributed to the higher wind speeds and the widespread flooding of streams and rivers. In response, President Trump issued a second Major Disaster Declaration (DR-4339-PR) on September 20, and FEMA extended eligibility for both Public Assistance and Individual Assistance to all 78 municipalities.

## **Preparation for and response to Hurricanes Irma and Maria**

Among the municipalities that responded to a survey conducted by the Homeland Security Operational Analysis Center (HSOAC) team, about 85 percent reported having disaster preparedness plans in place before the 2017 hurricane season, and 72 percent reported conducting emergency preparedness exercises at least once a year. Only 37 percent reported that the plans worked adequately after the hurricanes. Of those with disaster preparedness plans in place, 57 percent of the plans specifically addressed how to protect children, seniors, and individuals with disabilities. Lastly, 19 of the 78 municipalities had hazard mitigation plans—which aim to reduce the ultimate damage caused by a disaster—that were out of date, according to a FEMA Community Conditions Assessment from May 2018. Some municipalities also lacked a detailed inventory of municipal assets, hindering their ability to both protect those assets ahead of a disaster and facilitate their repair and recovery afterward. Prior to the hurricanes, Puerto Rico’s governmental agencies took a wide range of precautionary measures to protect the Island. The Puerto Rico Aqueduct and Sewer Authority (PRASA) and the Puerto Rico Electric Power Authority (PREPA) preemptively lowered water in reservoirs and stockpiled some fuel and materials—preliminary steps that proved insufficient given the extensive damage and prolonged response period following Maria.

The approved emergency preparedness plans did not envision a disaster as extreme as Hurricane Maria in which critical systems

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**“The best agent of change is all of us. We have created a directory of resources because within the community we have carpenters, builders, plumbers, etc. We have people with equipment who can help clear the roads. There’s a bank of resources and that’s the most valuable currency we can have, the people. Really, we’re the ones who will see Puerto Rico through. Whatever comes from the outside is just mere aid, but we’re the ones who will make Puerto Rico rise above.”**

—Focus group participant from  
Loiza  
(translation)

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failed and caused a cascading chain of effects. The total collapse of the telecommunications grid and widespread infrastructure damage rendered existing contingency plans insufficient and hindered coordination with state government agencies. Power outages created failures in water treatment plants. Failures in the telecommunications system made it difficult to coordinate both response operations and repair damages to critical systems. Washed-out, debris-strewn roads cut off municipalities across Puerto Rico for days and even weeks in the mountains, and local leaders indicated that they did not have the equipment they needed to address these problems. In some instances, mayors resorted to extraordinary measures to provide food and water for citizens. Many set up community food kitchens and distribution centers, where citizens and nongovernmental organizations brought supplies to share with the broader community. These community leaders were fiercely proud of the resilience that their citizens and communities displayed in the face of such devastation.

### **Hurricane impacts, by the numbers**

The hurricanes’ impact on the people of Puerto Rico cannot be overstated. The hurricanes left in their wake deep economic losses and damage to infrastructure. Hundreds of thousands of residents needed assistance to meet basic needs for an extended period of time. The businesses that survived struggled to open their doors, given that Hurricane Maria essentially destroyed Puerto Rico’s electric grid and severely disrupted cellular service, landlines, and internet access. The hurricanes shut down water and sewer services, hindered first responders’ ability to dispatch 911 calls, and brought transportation to a halt. Schools and some health care facilities were forced to close, and hospitals had to rely on emergency generators.

The graphics on the following pages provide a high-level overview of damage after the hurricanes and, where available, repairs to date and remaining needs based on data collected from various entities. Damage estimates are based on available data (generally through March or April 2018) and include economic activity from the recovery effort. In many—and possibly most—cases, hurricane impacts (e.g., power outages, business interruption, road closures) persisted beyond March or April. As a result, total damage figures are not yet available.



# Infrastructure

## DAMAGE OVERVIEW

### ENERGY



**Over 25% of transmission line towers** and poles were damaged, which rendered **100% of the power grid inoperable**.

**21% of the 1,110 gas stations** were closed.

## REPAIRS

**99.99%** of customers have been energized (as of 08/03/2018)

**87% of gas stations** are re-opened (as of 3/21/18).

## NEEDS

**Power outages** remain intermittent.

**Significant work** remains on transmission and distribution systems.

### WATER



**100%** of PRASA customers **lacked drinking water**.

#### Out of service:

**40 water treatment plants** of 114

**800 water pumping stations** of 1,311

**22 wastewater treatment plants** of 51

**222 sanitary pumping stations** of 714

**Untreated wastewater spills** occurred in San Juan (13.7B gallons) and Manatí, Mayaguez, and Ponce (0.78M-1.19M gallons).

**Storage tanks were damaged** at 65 non-PRASA sites.

As of 2/28/18:

**100% of water and wastewater treatment plants** in PRASA's principal service regions are operational.

**Drinking water had been restored** in 46 non-PRASA communities using solar-powered water pumps.

Multi-agency efforts are under way to **stabilize Guajataca Dam**.

**\$2.51B** in initial estimates of hurricane damage and \$16.45B in legacy pipe replacement

**\$215.8M** of stormwater system damages in 51 of Puerto Rico's municipalities



### COMMUNICATIONS AND INFORMATION TECHNOLOGY



**95% of cellular sites** were out of service

**91% of private telecom infrastructure** was damaged.

**80% of above ground fiber** and **85-90% of "last-mile fiber"** was destroyed.

**1 submarine cable** supported off-Island communications for about 40 days after the primary cable landing station for many major telecom carriers flooded.

**60% of communications infrastructure** was fully reliant on generators (as of January 2018).



**4.3% of cell sites** are out of service overall, but up to 25% of sites in some municipalities are (as of 03/21/18).

Information is limited about the extent of repairs and continued reliance on generators.

**Off-Island communications** are restored for Puerto Rico but remain vulnerable in a future storm. Culebra and Vieques are relying on microwave systems until their submarine networks are operational.

**\$1.5B** in total damage to **private telecom infrastructure**

### TRANSPORTATION



**Just 400 miles** of road were passable (out of 16,700 miles).

**100% of Tren Urbano** service was suspended.

**Bus service** in San Juan was nonexistent for two weeks.

**Air travel** was suspended for 2 days, then there were only 10 flights per day for a week.

**Major ports** and all ferry terminals and vessels were damaged.

As of 3/9/18: **15 roads and 9 bridges** were closed.

**Tren Urbano** is operational.

**Ferry service** is operational.

**All airports** are operational.

**Seaports** are operational, and cruise ship traffic has rebounded (since early 2018).



#### Estimates for repairs

- **Public roads and bridges:** (emergency and permanent) \$647M
- **Tren Urbano:** \$106M
- **Other municipal transit systems:** \$36M
- **Ports** in San Juan, Penuelas, Guánica and Fajardo: \$906M
- **Ferries:** \$38.3M
- **San Juan bus system:** \$14.6M
- **PR-22 and PR-5:** \$14.5M
- **Airport:** \$237M



# Infrastructure

## DAMAGE OVERVIEW

### PUBLIC BUILDINGS



**586 public buildings** of 778 owned by Puerto Rico Industrial Development Company reported damage.

**More than 90%** of 735 buildings owned by Puerto Rico Public Buildings Authority applied for assistance with debris removal and emergency protective measures, and **65% were damaged.**

### CULTURAL RESOURCES

**60,000 artists** were put out of work.

**2,000–3,000 historic buildings** and their collections were damaged.

Official government **archives and cultural collections** were amaged.

**30% of parks** were severely damaged.

### NATURAL RESOURCES



**23–31M trees** may have been severely damaged or destroyed, according to preliminary estimates.

More than **40,000 landslides** damaged ecological areas and infrastructure.

Potentially **13.7B gallons of sewage** was discharged into watersheds and the ocean (in addition to 30M cubic yards of sediment in one watershed alone).

Overwash damaged **dunes.**

Strong waves eroded **beaches.**

**75% of sampled wetlands** experienced stress from high winds, flooding, and hydrology changes.

### SOLID WASTE MANAGEMENT

**Storm debris** equaled **4–5 years of landfill capacity.**

**New unpermitted, unregulated dumps** added to 1,600–2,000 existing unregistered, unpermitted dumps.

An estimated **6M cubic yards of debris** was generated.

## REPAIRS

**The lack of a comprehensive inventory of public buildings** and little clarity as to which entities are responsible for them have hindered repairs.



**10,000 corals** have been reattached.



**Waste diversion program** kept debris equaling **1–2 years** of capacity out of landfills.

**2–4 years of landfill capacity** is left in lined, environmentally protective landfills.

The Corps of Engineers collected of **4M cubic yards of debris.**

## NEEDS



**8,500 applications** from 43 applicants **seek about \$300M** in public assistance for repairs (as of 5/3/18).

**\$15,000 per artist** in replacement materials and workspaces

**\$450–\$700M for historic buildings**

**\$5M** to repair **official government archives**

**\$130–\$195M** to build **storm-hardened center** to store historical and cultural artifacts

**\$320M** for **park repairs**, (plus additional costs for improvements, including stormwater infrastructure)

**2.4M trees** need to be restored in urban areas, agroforestry plots, critical watersheds, and protected areas.

**4 high-priority watersheds** need to be managed.

**1M new corals** need to be planted in high-value areas.

**10 high-priority wetlands** need to be restored.

**24 dune sites** need to be restored and protected.

**8–10** high-value eroded **beach sites** need to be restored.

**18 new lined landfill cells**, plus transfer facilities

**Close all unpermitted, unregulated dumps.**

**A solid waste management plan**, including more recycling and composting capacity

**Wood salvage capacity** for 45,000–100,000 logs



# Economy

## Hurricane damage

Coupled with the destruction of various capital stocks, the short-term impact to economic activity was severe. Although data are limited at the time of this writing, the following are estimated impacts from post-storm data (September-December 2017) for the economy, business, and employment.

### Economic Activity Index



Short-run decline in the Economic Activity Index (correlated with GNP) of approximately 12% over the three months following the hurricanes relative to an estimated no-hurricane scenario.

## After the hurricanes



Business and employment losses are based on projections (using pre-storm data) of what conditions would have been like without the storm. Agricultural losses were estimated and reported by the Puerto Rico Department of Agriculture.

### BUSINESS

#### LOSSES FROM THE HURRICANE

Agricultural production: **\$227 million**

Agricultural infrastructure: **\$1.8 billion**

Tourism: **\$547 million** in direct revenue

Trade: Large impacts on exports; imports reflect the response and recovery effort



Many sectors (e.g., tourism and trade) lag pre-hurricane levels despite an uptick in traveler counts and value of exports.

### EMPLOYMENT

Average private payroll employment in the 3 months after the hurricanes: **-4.35%**

Average manufacturing payroll employment in the 3 months after the hurricanes: **-1.27%**

The **overall workforce decreased** in both the number of people employed and the number of people in the labor force.

The hurricanes **accelerated the trend of residents moving away from the Island** to the U.S. mainland.

Employment (and wages) lag pre-hurricane levels.

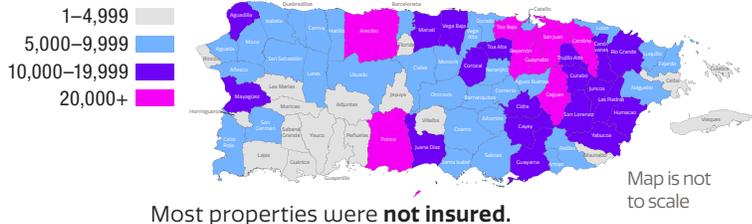


## Hurricane damage

**FATALITIES** According to initial reports, **64 lives** were lost. The official number is being reviewed as part of a study under way by George Washington University.

**HOUSING** **527,000 households** that registered with FEMA indicated they had property damage. **197,000 renter households** indicated damage to personal property (e.g., cars, TVs, clothing).

Number of Individual Assistance registrants with damage to structures or personal property:



Most properties were **not insured**.

## After the hurricanes

The data reveal that there were **1,427** more deaths in the four months after the hurricanes than normal (based on the previous four years) that may or may not be attributable to the hurricanes.

Estimates from other studies range from about 800 to 8,500 deaths from delayed or interrupted health care.

Total damage to all dwellings: **\$33.9B**

Disbursements (as of 5/14/18)

FEMA: **\$517M** in structure repair for owner-occupied homes

FEMA: **\$402M** for personal property

SBA home loans: **\$1.2B**

Homeowners insurance: **\$358M**

A lack of accurate ownership records meant that many homeowners were not eligible for federal assistance.



**EDUCATION** **38-44 schools** were closed permanently by structural damage.



An estimated **1,075 of 1,112 K-12 schools** had reopened by December 2017.

**SOCIAL SERVICES** Households that applied for assistance: **90% of 1.23M**

**HEALTH** **5 of 16 outpatient clinics** administered by the Puerto Rico Department of Health were damaged. **20 of 92 federally qualified health centers** were damaged.

**11% of federally qualified health centers** have limited or no grid power.

- **3** health centers have intermittent power and use generators for backup.
- **5** lack power and rely solely on generators.
- **1** is now using solar power.



## Hurricane damage

**FIRST RESPONDERS** Stations with ability to relay 911 calls:  
**12 of 78** police stations  
**0 of 93** fire stations  
**14 of 56** EMS stations



Damage to state-level communications systems (e.g., two-way radios) used in emergencies left **many agencies and municipalities without critical communications**.

Municipalities reported that **damage hurt key industries** (e.g., agriculture, tourism, retail), and that **cost for first responders was substantial**.

## After the hurricanes

**Almost 90% of municipalities** in a survey had **disaster preparedness plans**, but just 37% said the plans worked adequately after the storms.

**One-quarter of police stations** were classified as "restricted use" or "unsafe" after the storms.

**All 99 fire stations** submitted public assistance applications for building repairs.

Significant numbers of **municipal personnel moved away**.

## The hurricanes had a human cost

In interviews and focus groups conducted after the hurricanes,<sup>1</sup> residents described lacking water, electricity, and even food; being trapped in their communities because roads were impassable; having no access to medical care or pharmacies; and getting injured as they rode out the hurricanes alone. In the hurricanes' wake, people reported losing their jobs because they had no gasoline to get to work, struggling to pay for necessities as prices spiked, and worrying about the disruption to their children's education.

Most poignant were the stories residents told about the psychological toll—the deaths of loved ones, the separation from family members, and the financial stress. At one focus group in Las Marias, residents related how they saw community members die after being trapped in their cars for days. One mayor said that three dialysis patients died in his town because they could not access treatment.

Many mayors spoke of the difficulty of helping their residents while being cut off from outside help. They noted that satellite phones that were provided as a contingency measure did not work and that many agencies and services were unresponsive or inaccessible. Communities in close proximity dealt with the isolation by sharing the resources they had available and working together to identify people in need and clear roadways of debris.

Although the initial death count released by the Puerto Rico Department of Public Safety was 64, the toll appears to be higher. On June 13, 2018, the Government of Puerto Rico revealed that there were 1,427 more deaths in the four months after the hurricanes than normal (based on the previous four years) that may or may not be attributable to the hurricanes, and it

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**“Maunabo has a lot of older, sick, and bedridden people. Here we had deaths because of the lack of electric power. I had people call me at 1 a.m. to tell me that a person died because the respiratory aid was turned off.”**

—Focus group participant from Maunabo (translation)

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**“The next day, when we were able to come out, the entire community (helped). Whoever couldn't help clear debris and take it out of the road was the one making breakfast or a pot of soup. The community gave 100 percent.”**

—Focus group participant from Narajito (translation)

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<sup>1</sup> Some focus groups were conducted as part of the Reimagina Puerto Rico initiative sponsored by the Resilient Puerto Rico Advisory Commission.



## MANY MAY BE VULNERABLE TO HURRICANE IMPACTS

Any person can experience vulnerability, especially following a disaster, and it is not a static characteristic of any individual or group. Given the fluid nature of vulnerability, considering characteristics that can increase risk for people in communities can guide actions taken during each of the four phases of emergency management. People who face Communication challenges, have health Maintenance needs, rely on medical devices or supplies to remain Independent, lean on Services to manage behavioral health needs, or infants and children who rely on others for sustenance, and persons who may face Transportation obstacles all may be particularly vulnerable in a disaster (derived from the C-MIST framework for identifying the functional needs of people with disabilities or who have access and functional needs before, during, and after a disaster).

Many community members will face these issues at some point in life. Some of these challenges can be more acutely felt with age, which is of particular importance given the increasingly aged Puerto Rican population. Meanwhile, fragile transportation networks and power grids and inconsistent or easily interrupted access to services can be significant obstacles for people who live in geographically remote areas or are technologically dependent for medical services. Additionally, a communication network that is easily disrupted or does not reach all Puerto Ricans may fail to provide life-saving information in an emergency.

All phases of emergency response and recovery should consider vulnerabilities that communities and individuals face, and the impact that actions will have. For example, when rebuilding the road network, one must consider whether the efforts will promote or restrict equitable access to schools, health and social services, and economic opportunities. Similarly, with a significant portion of the population participating in safety net programs, ensuring that there are jobs and relevant training opportunities available near impacted people must be a part of any consideration of shrinking or placing restrictions on safety net programs.

will update the official count after a George Washington University study is completed. Similarly, independent researchers analyzing vital statistics data found that about 1,000 more people died in September and October 2017 than normal, largely in the hurricane's path or in mountainous rural areas. A Harvard study estimated that hurricane deaths likely ranged from about 800 to 8,500 from indirect causes, such as delayed or interrupted health care. According to a Pennsylvania State University study published August 2, 2018 in the Journal of the American Medical Association, some 1,139 people perished as a result of Hurricane María.

## Loss of power degraded other systems

The loss of power may have been the most damaging consequence for infrastructure, causing entire systems to fail. The fossil fuel-based power plants that generate most of Puerto Rico's electricity did not suffer major damage from the hurricane. However, damage to the electrical grid—including downed power lines, transmission lines, and poles—was severe. Significant work remains to restore electrical transmission and distribution systems to acceptable condition. Some water treatment plants, hospitals, and other critical infrastructure continue to use emergency generators. Although there was major damage to some wind and solar generation facilities, these make up a very small percentage of Puerto Rico's overall generation capacity.

The lack of power disrupted other systems. With much of Puerto Rico's power grid offline, wastewater treatment plants were out of service. Some sewage plants were upstream from the drinking water supply, so their failure could have increased the risk of contamination of drinking water. Water-damaged structures were exposed to other potential environmental hazards, such as mold, an increase in rodents and pests, and chemicals and waste.

Since the hurricanes, there have been concerted efforts to get water treatment plants, hospitals, and other critical infrastructure off of emergency generators, often by incorporating cutting-edge approaches that do not rely on imported fossil fuels into repairs and rebuilding. One approach is the use of "microgrids," in which solar panels or wind turbines allow customers to operate off the grid or are connected to the broader electrical grid but go into "island mode" in an emergency. In addition, dual-backup generation systems are being installed at hospitals to avoid an extended loss of power. Puerto Rico is integrating these assets into the power system and ensuring that they comply with regulations and standards.

PRASA has worked to restore water and sewer services but continues to face challenges. As of February 28, 2018, all water and wastewater treatment plants in each of PRASA's principal service regions were operational, but due to energy availability constraints, 88 percent of water treatment plants and 98 percent of wastewater treatment plants were operating below their normal operating capacity. By the same date, ten non-PRASA facilities were classified as a state priority and eight were classified as a U.S. Environmental Protection Agency (EPA) priority. Together with nongovernmental organizations, EPA has been working to repair damaged non-PRASA water systems, providing generators, and equipping systems to operate on solar power. To date, more than 1,100 solar-powered water pumping systems have been installed. In addition, EPA has been conducting support activities, such as supplying bulk water

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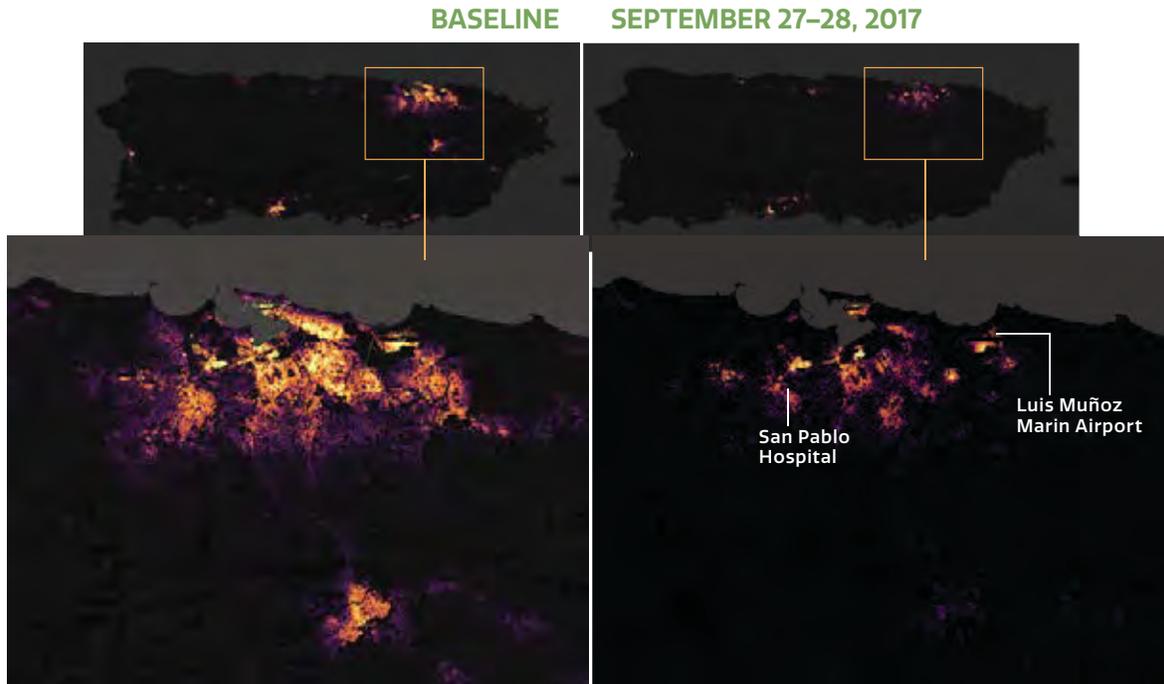
**"As the days went by it descended into chaos. You needed money ... because it was all cash. The ATMs weren't working, the phones were cut off."**

— Focus group participant from Loiza  
(author translation)

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## Nighttime lights in San Juan before and after Hurricane Maria

Source: NASA



and water purification tablets, for these non-PRASA systems. EPA has also been providing support to the Puerto Rico Department of Health in conducting sampling at more than 200 non-PRASA community systems, as well as many PRASA systems.

### Damage to flood protection put people in harm's way

Puerto Rico's dams, levees, natural infrastructure (e.g., coral reefs, wetlands, dunes), and other stormwater infrastructure were also damaged, which resulted in extensive flooding, erosion, and the scouring of waterways. Of 18 dams that were visually assessed, 11 had areas of erosion, and six were inaccessible due to debris, landslides, or road damage. At the Dos Bocas Dam, sedimentation and high flow damaged all three hydroelectric turbines.

Guajataca Dam—the water source for 350,000 people—suffered the most significant damage. During Hurricane Maria, Guajataca's large volumes of water flowed over the emergency spillway, which compromised its structural integrity. Evacuation was ordered for some 70,000 residents downstream and in immediate danger. Since the



Damage to the Guajataca Dam spillway resulted in evacuations being ordered for 70,000 citizens at risk.

Photo: Arthur Brooks/FEMA via Wikimedia

hurricanes, Guajataca Dam’s integrity has been somewhat stabilized, and temporary fixes to the spillways are under way.

### **Mobile devices were nearly useless, and social service providers struggled**

The hurricane’s devastating effects on people’s health and safety cannot be overstated. More than 80 percent of Puerto Ricans rely solely on mobile devices for telecommunications, but mobile communications broke down as the hurricanes took out antennas, fiber-optic cables, and the electric grid. Without service, people were unable to call for help, search for emergency information, and apply online for FEMA relief. Furthermore, the lack of power meant that many communications devices could not be recharged. As a result, basic resources became scarce, communities were isolated, and people with special health needs were not able to access proper care.

Damage to buildings and to electrical, water, and communications infrastructure forced the closure of hospitals, clinics, public health laboratories, food assistance offices, elder-care facilities, and other social service agencies. Even at facilities that remained open, services



Fire crews clear fallen trees in the El Yunque National Forest after Hurricane Irma.

Jose M. Martinez, U.S. Fish and Wildlife Service via Wikimedia

were compromised by intermittent access to power and water, lack of access to electronic records, and the inability of some staff to come to work. Water damage to paper records affected services and operations at the central offices of the Department of Family and in many elder-care facilities. In some schools, instruction was interrupted by the need to use the buildings as shelters.

Six months after the hurricanes, approximately one in ten of the permanent health center sites on the Island had limited or no grid power. Three health centers had intermittent grid power and were relying on generators as a backup source of power, five were without use of grid power and were relying solely on generators, and another health center was using solar power. Many Head Start centers and schools were undergoing repairs and remained closed. Infectious diseases, such as influenza, had been controlled to within comparable rates in the continental United States, although concerns about water quality have persisted (e.g., reported cases of leptospirosis spiked following the hurricane).

### **Coasts, forests, and parks experienced landslides and erosion**

Coastal and terrestrial natural resources act as natural infrastructure to protect communities and physical infrastructure from flooding, pollution, and other hurricane-related effects. As of June 2018, approximately 25 assessments

(of categories of assets, not individual sites) of damage to natural and cultural resources were completed for the recovery plan development process, and a few were still ongoing. The full effects of Hurricane Maria on natural resources will not be known for years to come. Comprehensive, Island-wide information on the condition of natural resources before the hurricanes was not always available, making it difficult to quantify hurricane damage at this time. However, it is clear that coastal impacts included damage to wetlands and mangroves from winds, pollution discharge, excessive sedimentation, changed hydrology, and stranded boats; severely eroded beaches and dunes; and damage to coral reefs, seagrasses, and other species. One rapid assessment found significant impact to wetland buffers at 20 sites, and 75 percent of them had increased stress, mostly due to debris, tree defoliation, disease, damage, and changes in hydrology. About 11 percent—or approximately 13,600 acres—of reefs were also damaged. Coral harvesting, pollution, overfishing, and illegal development practices may inhibit the natural recovery of Puerto Rico’s coastal resources.

Damage to forests was also widespread, with an early order-of-magnitude estimate of between 23 million and 31 million trees killed or severely damaged. Detailed field studies are required to understand the extent of long-term damage to forests. Tens of thousands of landslides increased sedimentation in reservoirs and behind dams, caused flooding hazards, trapped fish in streams, polluted marine environments, and blocked roads and trails. Although these reservoirs were filling with sediment before the hurricanes, landslides substantially exacerbated reservoir capacity challenges and other environmental issues. Preliminary estimates suggest that landslides added an estimated 30 million cubic yards of sediment potential in one watershed alone.

Virtually all this natural damage affected the mortality and habitat of animals. For example, 53 percent of the hawksbill sea turtle nests at Humacao Nature Preserve were lost as a result of the hurricanes, while other species lost their food sources (e.g., seeds), and concerns remain regarding pollinators. Facilities critical for the captive breeding program of the Puerto Rican parrot, a culturally significant, endemic species, were also damaged. These impacts put many threatened and endangered species at a higher risk of extinction, thereby reducing biodiversity and resilience in the long term.



Staff from the U.S. National Archives and Records Administration demonstrate how to clean books and historical artifacts to Puerto Rico General Archive and National Library staff members.

Andrea Booher/FEMA

Before the hurricanes, the majority of landfills were over capacity and/or out of compliance with environmental regulations. After the hurricanes, 1,600–2,000 unpermitted, unregistered dumps have proliferated around Puerto Rico. Hurricane stormwater carried an unknown quantity of pollutants off these sites, potentially affecting the environment and human health. Then, the hurricanes generated a massive amount of debris and solid waste. Unless new cells come online and more-comprehensive waste management measures are adopted, Puerto Rico will run out of landfill capacity in two to four years, not accounting for likely additional waste as hurricane-damaged buildings are demolished.

Finally, wind and water weakened physical structures at hundreds of historic and cultural sites, including Fortín de San Gerónimo de Boquerón (an 18th-century fortress) and the National Library and General Archives, which has a statutory requirement to maintain records significant to Puerto Rican governance and history. Many of the collections of artifacts housed inside these sites were also damaged from hurricane effects and loss of power. Water damage has also increased the risk of mold. Artisans and performers who constitute the cultural community in Puerto Rico lost materials and income.

As of May 2018, coral reef and critical species stabilization was under way. Puerto Rico’s Solid Waste Authority estimated that the hurricanes created 6.2 million cubic yards of waste and debris. By May 15, 2018, the U.S. Army Corps of Engineers had collected 4 million of the 4.15 million cubic yards of debris it was tasked with collecting. Vegetative debris is turned into mulch, and other materials are sent to recycling centers or landfills, preferably for use as cover material. Mulch can also be blown into forests to decompose or used for enriching agricultural soil. Precious woods are harvested and made available for future needs, such as commercial sale and for repairs to historic properties through a pilot program. In many cases, cultural institutions have reopened to the public, but sometimes with temporary fixes for structural damage or with diesel generators to provide power. Cultural institutions are also being provided emergency preparedness education, response kits, and protocols in preparation for future disasters.

### **Municipal governments were severely impacted**

Because of chronic financial pressure, the migration of residents away from the Island, stagnant economic growth or economic

contraction, and overlapping and sometimes duplicative service delivery, municipalities in Puerto Rico faced substantial challenges prior to Hurricanes Irma and Maria. These issues have contributed to more than 60 percent of municipalities running operating deficits in 2016, with many carrying deficits over multiple years, and the amount of municipal debt has increased by more than 50 percent since 2007. Hurricanes Irma and Maria exacerbated these underlying problems by placing additional stress on local economies and municipal finances while creating new issues. A survey of municipalities showed that the hurricanes led to declines in economic activity, particularly in such key industries as agriculture, tourism, and retail. This has led to substantial declines in revenue collection from key sources of municipal revenue, such as sales taxes and business license fees. Because the municipalities were the first responders after the hurricanes, they also incurred substantial unplanned expenses that they could not afford, and many have yet to be reimbursed—negatively affecting their ability to provide services and fund reconstruction projects.

Mayors and municipal staff also reported significant damage and continuing needs across key sectors that impact their constituents' lives and the capacity to govern effectively. Extensive power and telecommunications outages; lack of access to safe drinking water or adequate sewers; and, at times, limited access to health services created immediate health and safety hazards—some of which persisted as of July 2018. For example, about half of the 78 municipalities surveyed in June 2018 reported that their stormwater systems were still unable to handle excess water and prevent flooding when it rains. Almost one-quarter of municipalities—24 percent—reported that half or less of their community had landline or cellular service, while 41 percent of municipalities reported that half or less of their constituents had access to internet services (as of May and June 2018, respectively). Some municipalities noted that they still had communities without electricity.

Municipalities also lost significant human resource capacity: almost all municipalities surveyed lost personnel as a result of residents leaving Puerto Rico following the hurricanes, and nearly half reported significant reductions in policing due to loss of personnel and resources.

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**A survey of municipalities showed that the hurricanes led to declines in economic activity, particularly in such key industries as agriculture, tourism, and retail.**

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## Crosscutting disaster and economic recovery needs

Since the hurricanes, Puerto Rico has been working to restore services, reopen schools and other public buildings, and help residents return to something approaching normal, but much work remains to be done. The previous sections in this chapter identified needs in individual sectors, and the following sections identify unmet needs that cross multiple sectors. The needs are separated into short-term (1–2 years) and longer-term (3–11 years) needs, roughly corresponding to the time needed to address them.

RECOVERY NEEDS ARE  
SEPARATED INTO

**Short-term  
(1–2 years)**

and

**Longer-term  
(3–10 years)**

### Short-term needs

#### Continued efforts to improve governance

As previously mentioned, the Government of Puerto Rico had begun implementation of initiatives outlined in the *March 2017 Certified Fiscal Plan* when the hurricanes hit in September 2017. These ongoing efforts to achieve fiscal responsibility will be critical to ensure that the appropriate capacity exists to support a transparent recovery and promote a strong economy. Local municipality governments will also need the capacity to secure and manage recovery funds.

#### Some critical infrastructure remains nonfunctioning or in disrepair

Reestablishing power, communications, and water utilities across Puerto Rico remains a priority. While reliable power, communications, and water are important to the economy, they are crucial to giving Puerto Ricans a sense of normalcy, protecting their health and well-being, and confirming that all regions will take part in the recovery. It is critical to repair the energy grid and, in the process, use strategies that support the future resilience of water treatment plants, hospitals, and other critical infrastructure currently relying on emergency generators. These efforts would reduce vulnerability to crashes, outages, or future hurricanes.

#### Homes remain damaged or destroyed

Rebuilding or repairing the approximately 166,000 residential structures that were either damaged or destroyed during the hurricanes remains a key priority in the short term. These efforts are critical for all damaged residential structures—particularly

for the homes built before more-protective building codes and zoning regulations were adopted or for which building codes and land use policies were not enforced. Historically, enforcing building codes has been complicated by a lack of resources for qualified inspectors and an uneven history of requiring building permits before construction could proceed. A major challenge during the recovery will be to require building permits, which has implications for both personnel and processes to enforce building codes and collect penalties. The houses that were not damaged by the hurricanes also remain at risk unless they too are brought up to code or demolished if they are in hazardous areas.

### **Emergency preparedness plans need updating**

With the arrival of a new hurricane season, it is critical for Puerto Rico to address gaps in the emergency preparedness infrastructure so that all residents and businesses are protected in a future disaster. Given that just 37 percent of municipalities reported that their response plans worked adequately after the hurricanes, the Puerto Rico Emergency Management Agency is working to update or develop plans for all 78 municipalities with local input and in partnership with FEMA, which is also educating residents on preparedness and developing the government workforce. Coordinating parties responsible for the emergency response and for stockpiling materials, resources, and personnel are short-term priorities.

### **Responsibility for various infrastructure, assets, and services is not clearly established**

After the hurricanes, determining which agency was responsible for maintenance and repairs of various infrastructure and public buildings was difficult because many sectors had no comprehensive asset inventory or management system. The threat posed by a new hurricane season makes clarifying ownership and responsibility an immediate need. Creating a comprehensive inventory and management system is a next step for the housing, energy, transportation, and public buildings sectors in particular.

Similarly, Puerto Rico's mayors believe that the overlapping responsibilities between the municipalities and the Government of Puerto Rico for maintaining and clearing debris from roads led to coordination issues and delays in getting critically needed supplies to some areas after the hurricanes. There appears to

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**Creating a comprehensive inventory and management system is a next step for the housing, energy, transportation, and public buildings sectors in particular.**

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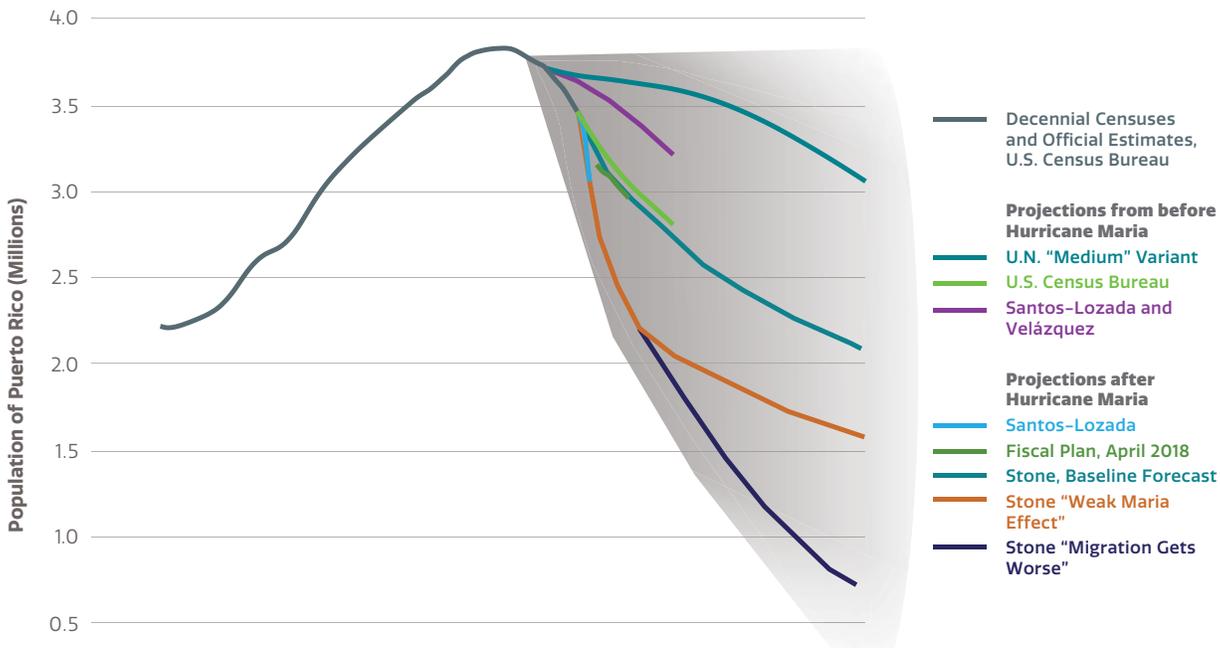
be emerging consensus about the need to rethink how services are delivered more broadly—including creating regional structures—to improve efficiency, reduce costs, and improve the lives of citizens. This reorganization is needed to respond to future disasters and streamline service delivery, and will require involving key stakeholders across Puerto Rico.

## Longer-term needs

### Economic contraction that precipitated population loss and inhibits recovery must be addressed

From 2006 to 2016, Puerto Rico lost a net 525,769 migrants—equivalent to 14 percent of its total population. Population estimates for 2017 are not expected from the Census Bureau before the end of

**Puerto Rico's population was already declining; the hurricanes made future losses harder to project**



the year, and access to the restricted records will be required to isolate the flow of residents away from the Island after the hurricane. In the interim, school enrollments provide a well-established indirect source of migration data. Over the six months following the hurricane, nearly twice the number of Puerto Rican children had enrolled in schools in the continental United States on an annual basis than had enrolled in each of the previous three years.

Based on this analysis, policies related to the following broad strategies will be considered in order to stabilize the population and encourage economic growth:

- Increase the attractiveness of doing business in Puerto Rico by lowering the financial and nonfinancial costs of doing business and stemming the flow of residents away from the Island.
- Increase the formal labor force participation rate by reducing or removing disincentives for formal work and by strengthening the education and workforce development system so the labor pool has sufficient skills to meet the demands of an evolving economy.
- Broaden the tax base, improve tax collection rates, and increase the fiscal and economic resilience of Puerto Rico through a flattening of the tax structure, and lower dependence on particular tax exemptions that have not produced the expected benefit returns.
- Increase fiscal discipline to ensure a sustainable and right-sized public sector.

### **Municipal priorities for economic development and recovery**

The municipalities that HSOAC met with generally noted that revitalizing Puerto Rico's urban centers should be a key focus of economic recovery efforts. Participants argued that this would allow the central and municipal governments to reduce expenditures and take advantage of economies of scale by concentrating delivery of key services; provide employment opportunities to residents; keep tax revenues within the municipality; reduce social isolation for the poor, older adults, and those with special needs; and improve resilience and facilitate

more-effective emergency response and recovery in the event of another natural disaster.

Municipalities were asked to share their visions for recovery and economic development. Although responses varied substantially across 12 regional roundtables, the following broadly shared objectives emerged:

- Invest in rebuilding and upgrading key infrastructure, including energy, telecommunications, water, and transportation.
- Incentivize large manufacturers to stay in Puerto Rico.
- Reduce labor shortages by both incentivizing workers to stay in Puerto Rico and allowing businesses (particularly agribusinesses) to bring in foreign workers on temporary visas.
- Involve municipal authorities in identifying priorities for their region to support planning at the local level.
- Ensure authority and funding at the local level for planning and implementation of development projects.
- Expand investment in projects related to the visitor economy and tourism to all municipalities in Puerto Rico—not just the traditional hotspots.

### **Housing, social service, health, education, and infrastructure systems must be scaled for the current and future population**

Across sectors, housing, social service systems, financial planning, administrative functions, and physical infrastructure have not been appropriately scaled and adjusted to sustainably meet the health, social, and economic needs of Puerto Rico's citizens. The simultaneous challenges posed by people moving away, the low birth rate, and the aging of those who remain require right-sizing education, workforce development, health, and social services to better match the population's size and needs. For example, older adults may require more emergency and support services or a wider variety of transportation options, and public utilities must be reconfigured to become financially solvent despite a shrinking customer base. As efforts proceed to build a new Puerto Rico, investments are needed to transform the education system; rebuild and enhance health and social service infrastructure; and repair, rebuild, and right-size the public buildings inventory.

The effectiveness of these investments will be affected by where people choose to live. The difficulty restoring services to remote and vulnerable communities after the hurricanes convinced many mayors that Puerto Rico needs to invest in revitalizing urban centers and bolstered support for implementing regional approaches to providing services and reducing duplication of effort (voiced during a series of roundtables with mayors). “No tiene sentido”—it makes no sense—one mayor said about plans to spend \$5 million to rebuild roads and bridges connecting one community to the rest of the municipality because its location ensures that disaster will strike again. Many mayors said that it was much easier to provide and restore a wide range of services to citizens living in urban centers, which is especially important as Puerto Rico’s population ages. All of this underscores the importance of monitoring the population’s size and updating assumptions about trends in fertility and residents relocating outside of Puerto Rico.

### **Infrastructure in Puerto Rico is vulnerable to natural hazards and needs to be built to 21st-century standards**

Many years of deferred maintenance has degraded Puerto Rico’s infrastructure and raised repair costs. Degraded power and water facilities in particular result in lost revenue that puts public utilities and agencies further in debt. In addition, many of Puerto Rico’s systems are not built according to the latest standards. Developing infrastructure that meets 21st-century standards will make Puerto Rico more attractive to businesses, potential immigrants, and returning residents and will also help increase the tax base. To do so, Puerto Rico will have to transform the energy system; modernize the telecommunications system; rethink the water system; rebuild and strengthen maritime, surface, and air transportation; and repair and rebuild residential housing, among other investments.

In addition, Puerto Rico has entered another hurricane season, and other natural hazards—such as drought, sea-level rise, and significant seismic events—have the potential to affect infrastructure and residents. Risks to Puerto Rico communities from the impacts of the changing climate are projected to increase because of changes in atmospheric and sea-surface temperatures, the frequency and intensity of inundation events, storm surges, and ocean acidification. Understanding these vulnerabilities and creating robust and flexible systems will take significant investment moving forward, and these investments

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**Developing infrastructure that meets 21st-century standards will make Puerto Rico more attractive to businesses, potential immigrants, and returning residents and will also help increase the tax base.**

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will restore, plan for, and develop the natural environment alongside built infrastructure in the face of future uncertainty.

### **Building-permit and code-enforcement gaps reduce the effectiveness of utilities and perpetuate activity in the informal sector**

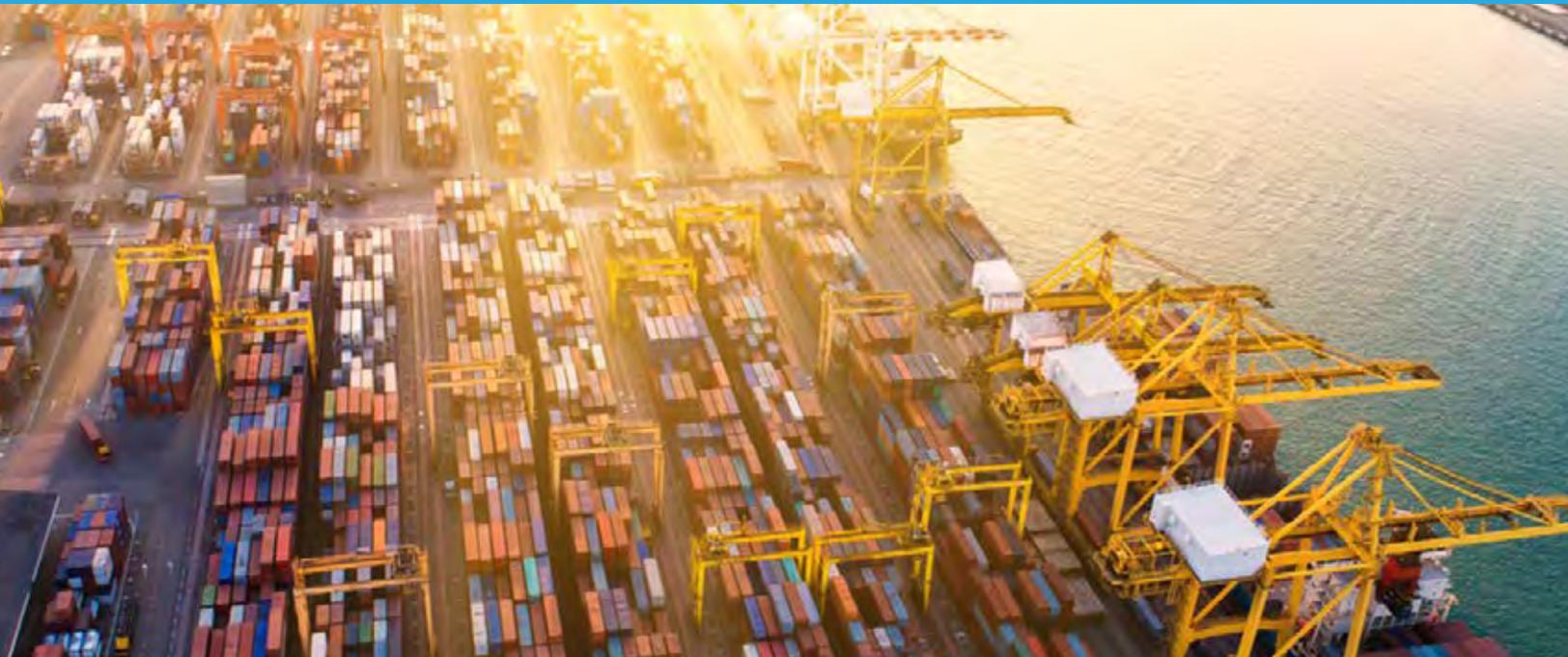
Before the hurricanes, informal buildings and infrastructure, including residential septic tanks, were commonly constructed without permits and thus were not in compliance with building codes. Construction was allowed to occur in areas that are known to be hazardous, such as areas prone to flooding and landslides. Similarly, unmetered water connections and inconsistent electricity metering were common, and laws and regulations governing these activities were not rigorously enforced. As the Island rebuilds, the Government of Puerto Rico will clarify which entities are in charge of regulation and enforcement, and partner with those entities to improve building codes, standards, and enforcement to protect residents from substandard buildings and vulnerable locations and to improve the collection of fees and taxes across the Island.

### **Timely and accurate data on Puerto Rico's economic and fiscal status are required**

Both the public and private sectors require timely, accurate, and comprehensive information to make effective strategic decisions regarding both recovery and day-to-day operations. Puerto Rico's outdated methods of national income accounting and lack of participation in some data programs (including those of the U.S. Census Bureau, U.S. Bureau of Labor Statistics, U.S. Bureau of Justice Statistics, U.S. Department of Health and Human Services, Energy Information Administration, National Center for Education Statistics, National Center for Health Statistics, and U.S. Department of Agriculture) limit the quantity of information available relative to U.S. states. Although the Puerto Rico Institute of Statistics has been recognized as an exemplar of good statistical practice, it cannot be expected to fill this gap at historical funding levels.

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# PUERTO RICO'S OPPORTUNITY



**A**ccording to the Federal Emergency Management Agency (FEMA), as of July 2018, nearly \$35 billion in funding had been allocated to Puerto Rico. These initial obligations only begin to cover the investments needed to move Puerto Rico toward its broader vision of economic and disaster recovery. Additional recovery funds present a unique opportunity to advance the vision for a transformed Puerto Rico. This unprecedented influx of resources will

- allow transportation and energy systems to be rebuilt and made more resilient, schools to be redesigned, and the health care and emergency services systems to be modernized
- increase the supply of resilient housing, especially for older adults and other people in vulnerable circumstances
- attract additional investors from the private and philanthropic sectors
- allow the unique natural and cultural resources of Puerto Rico to be protected in alignment with these goals.

Although fundamental, federal funds will not be enough to achieve this vision or necessarily fully achieve all of the goals set forth in this plan for society, the economy, infrastructure, and resilience; the private sector and philanthropy will also be essential sources of funding. While the vision and goals of the plan are meant to be aspirational, making them a reality will require innovative thinking about how post-disaster assistance can be most productively invested in a way that encourages new investments and continues to build a strong and sustainable economy and a vibrant society through public-private partnerships.

### **Recovery investments can help propel Puerto Rico toward its vision and goals**

Puerto Rico's economic development and growth requires investments not only in making its infrastructure stronger and more resilient but also in promoting the health and well-being

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**“This is a transformative moment in the history of Puerto Rico.”**

—Governor Ricardo Rosselló

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## Hurricane Disaster Appropriations

After Hurricane Irma, the Continuing Appropriations Act, 2018 and Supplemental Appropriations for Disaster Relief Requirements Act, 2017 (Public Law 115-56) was signed into law. It included \$7.4 billion in Community Development Block Grant – Disaster Recovery funding (CDBG-DR), of which \$1.5 billion was subsequently allocated to Puerto Rico. It also added \$7.4 billion to the Disaster Relief Fund (DRF), which supports Public Assistance (PA), Individual Assistance (IA), and the Hazard Mitigation Grant Program (HMGP). These funds support all U.S. ongoing disaster recovery efforts.

After Hurricane Maria, President Donald Trump issued a major disaster declaration, and the Additional Supplemental Appropriations for Disaster Relief Requirements Act, 2017 (Public Law 115-72) was signed into law, including funds for the Disaster Assistance Direct Loan Program (managed by the Federal Emergency Management Agency), the Disaster Nutrition Assistance Program (managed by the U.S. Department of Agriculture), and the General Fund (part of the National Flood Insurance Program). It also added \$18.7 billion to the Disaster Relief Fund.

In February 2018, the Bipartisan Budget Act of 2018 (Public Law 115-123) was signed into law and appropriated an additional \$28 billion in CDBG-DR funding, of which \$18.4 billion was subsequently allocated to Puerto Rico. It also added \$23.5 billion to the Disaster Relief Fund.

These three disaster-relief related acts (Public Laws 115-56, 115-72, and 115-123) also included \$35 billion of non-DRF, non-CDBG-DR appropriations to federal agencies for specific disaster-relief activities.

of both its people and environment. To truly propel Puerto Rico toward the vision and goals laid out in this plan, the Government of Puerto Rico will be strategic in selecting initiatives that leverage and maintain investments in infrastructure, people, and the environment while also setting the stage for diversified economic activity and building capacity in areas that attract and support new public-private partnerships and other investors. Federal recovery investments in infrastructure, people, the environment, and strategic economic and societal capacities will need to be combined with efforts to attract and maintain new partners and investors and efforts to lower the cost of doing business by reducing transaction costs; streamlining permitting and enforcing property rights; and providing timely, accurate information. To maintain both federal and private or philanthropic partnerships, governance and policy need to promote transparency, reflect appropriate regulations and procurement processes, and be enforced adequately.

## Investing can promote disaster recovery and enduring economic recovery

As Puerto Rico moves forward in its economic and disaster recovery activities, investing in infrastructure, people, and the environment will be critical to promoting economic and social development and improving people's everyday lives. By making the investments flexible, resilient, and sustainable, Puerto Rico will position itself to respond to future disasters—and set the stage for an economic landscape that will likely look different in the future than it does today. To start, a key set of foundational actions—increasing the ease of doing business in Puerto Rico, strengthening government capacity in day-to-day service provision and during disasters,

making available high-quality data to guide decisionmaking and support transparent governance, and promoting formal work and workforce training—will be put in place to support and sustain the recovery investments.

To achieve Puerto Rico’s vision, capital investments are also needed in three critical areas. First, physical infrastructure must be rebuilt to provide the services that people, businesses, and communities need to thrive. Without power, telecommunications, water, transportation, houses, and public buildings, recovery is not possible. However, physical capital must be built back better than before: It must be adaptable to Puerto Rico’s possible future pathways, be resilient to future storms, and protect the Island’s wealth of historical structures.

Second, human capital—a healthy, educated, and trained workforce—is critical to improving economic growth, giving residents greater opportunities, and reducing inequities. Investments must be made to develop a skilled workforce that is prepared to meet today’s challenges but flexible enough to adjust to tomorrow’s opportunities.

Finally, investments in natural capital are necessary to protect communities and businesses from disasters and to provide food, fiber, and fuel; habitat for native species; and recreational and tourism opportunities. This natural capital is part of what makes Puerto Rico a unique and desirable location. Investments in solid waste infrastructure are also imperative to improve both the economic environment and the natural environment; experts estimate that, in the absence of action, Puerto Rico will run out of landfill capacity within two to four years.

These capital investments have the potential to benefit all Puerto Ricans and to motivate new investors from the Island, the rest of the United States, and abroad by reducing the cost



Source: @ricardorossello via Twitter

## GETTING DOWN TO BUSINESS

A week before Hurricane Irma made landfall, the Governor and Boston Scientific officials announced that the major medical device manufacturer would be investing an additional \$10.5 million in its facilities in Dorado. Soon after, Boston Scientific was chartering its own planes to bring food, clothing, and emergency supplies to its employees and to fly its products off the Island in the hurricane’s wake.

These additional costs—on top of recent changes to the tax code that diminish incentives that drew Boston Scientific to Puerto Rico in the first place—significantly increased Boston Scientific’s cost of doing business on the Island.

How can Puerto Rico encourage companies like Boston Scientific to stay and attract new businesses? Investing in resilient and modern infrastructure, a skilled workforce, and Puerto Rico’s natural capital will go a long way toward ensuring that companies have the resources and workforce they need to thrive. Lowering the cost of doing business by, for example, streamlining that makes business permitting and regulation compliance processes more affordable, will also improve the business environment.

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**Capital investments provide the essential foundation upon which Puerto Rico will grow and thrive over the coming years—while the strategic initiatives are sets of actions aimed at seeding and catalyzing specific areas for Puerto Rico's growth.**

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of doing business and providing Puerto Rico with a comparative advantage moving forward. These capital investments are foundational to Puerto Rico recovering from the disaster and reversing its economic decline.

Investing in physical, human, and natural capital does not just mean rebuilding these assets—even to high standards; it also means maintaining and protecting these assets in the future. Small investments and forward-thinking approaches now can have huge dividends moving forward and are key to the long-term success of these recovery efforts.

The nine capital investment priorities described in this plan are intended to build a smarter, stronger Puerto Rico and provide the foundation for economic growth. These investments restore and enhance physical, human, and natural capital. The Government of Puerto Rico will balance investments aimed at quickly addressing the immense scope of short-term needs with those needed to adequately address long-term resilience.

### **Strategic initiatives build on capital investments and focus on the future**

Capital investments provide the essential foundation upon which Puerto Rico will grow and thrive over the coming years, while the strategic initiatives are sets of actions aimed at seeding and catalyzing specific areas for Puerto Rico's growth (see the figure on the next page). For this plan, strategic initiatives reflect an opportunity to capitalize on an asset or strength in Puerto Rico (e.g., it is bordered by both the Atlantic Ocean and Caribbean Sea) or to close a gap that could hinder Puerto Rico's economic development or resilience. The eight strategic initiatives described in this plan are intended to encourage a growing focus on these opportunities. The initiatives comprise crosscutting actions that create an ecosystem of investable projects, supportive policy, accessible and sustainable resources, and a clearly defined direction.

### **Recovery investments are interdependent**

Disasters do not happen in silos and neither can disaster recovery. Prior disaster recovery efforts and Puerto Rico's experiences with Hurricanes Irma and Maria have underscored the importance of understanding cross-sector interdependencies and coordinating across sectors during economic and disaster recovery efforts. Understanding cross-sector interdependencies

## CAPITAL INVESTMENTS

### Physical Capital

#### ENERGY

**Transform** the energy system to ensure customer-centric, affordable, reliable, and scalable electricity that incorporates more renewables, microgrids, and distributed energy resources; can drive new businesses and employment opportunities; and support residents' well-being.

#### COMMUNICATIONS/INFORMATION TECHNOLOGY

**Modernize** the telecommunications system to ensure fast, reliable, and resilient residential, commercial, and emergency communications that drive Puerto Rico's economy, prosperity, and well-being.

#### WATER

**Rethink** water systems to be safer, more reliable, and protected from future disasters to ensure the well-being of Puerto Ricans and the environment as well as the operations of government and businesses.

#### TRANSPORTATION

**Rebuild** and strengthen maritime, surface, and air transportation to ensure a flexible and reliable transportation system that moves people and goods, ensures economic continuity, and facilitates disaster response.

#### HOUSING

**Repair** and rebuild resilient residential housing that is safe and affordable to create a better built environment.

#### PUBLIC BUILDINGS

**Repair**, rebuild, and right-size the public buildings inventory to ensure stronger and more resilient public buildings that meet today's standards, mitigate against future disasters, represent innovative designs, and meet communities' needs.

### Human Capital

#### EDUCATION

**Transform** the education system to produce competitive graduates with the knowledge and skills needed to adapt to changes in the economy, the environment, and technology.

#### HEALTH AND WELL-BEING

**Rebuild** and enhance health and social service infrastructure and regional health care networks to ensure reliable and equitable access to health and social services and health-promoting communities, including an efficient and effective response to public health crises and other future disasters.

### Natural Capital

#### NATURAL ENVIRONMENT

**Restore**, plan for, and develop the natural environment so that marine and terrestrial ecosystems coexist sustainably with tourism; promote the economic development of Puerto Rico; serve as natural infrastructure to protect against storm damage, manage waste, and preserve the natural and cultural heritage of Puerto Ricans.

## STRATEGIC INITIATIVES

### OCEAN ECONOMY (BLUEtide)

**Integrate** and promote all of Puerto Rico's ocean-dependent industries and ecosystems as a cohesive effort to promote economic growth, improve quality of life for residents, and enhance the visitor's experience.

### VISITOR ECONOMY

**Develop** a strong visitor economy to help position Puerto Rico as a global destination of investment, production, and wealth.

### EMERGENCY SERVICES MODERNIZATION

**Enhance** public safety and first responders' ability to deliver reliable, modern, and integrated emergency services.

### AGRICULTURAL TRANSFORMATION

**Modernize** agriculture to promote greater productivity and output, and improve exports.

### DIGITAL TRANSFORMATION

**Build** the capabilities and workforce needed to fundamentally transform key industry and government processes to become more user-focused, relevant, and efficient at addressing local needs and delivering basic services.

### 21ST-CENTURY WORKFORCE

**Develop** and protect human capital to establish a world-class workforce, increase labor force flexibility, and create high-quality employment opportunities aligned with economic growth strategies.

### ENTREPRENEURSHIP

**Expand** opportunities for entrepreneurship and development of small to medium local businesses that can compete globally to promote economic development.

### ADVANCED MANUFACTURING

**Address** policy and structural barriers to increase opportunities for investment and the growth of private-public partnerships.

Roughly 270 specific courses of action have been linked with these capital investments and strategic initiatives.

Descriptions of these recovery actions—including estimated costs, possible funding sources, and potential implementers—are available in Chapter 12.

(not limited to just those among physical infrastructures) will help ensure that recovery and rebuilding plans account for ways in which failures in one sector can affect other sectors and investments in one sector can help improve the health and performance of another.

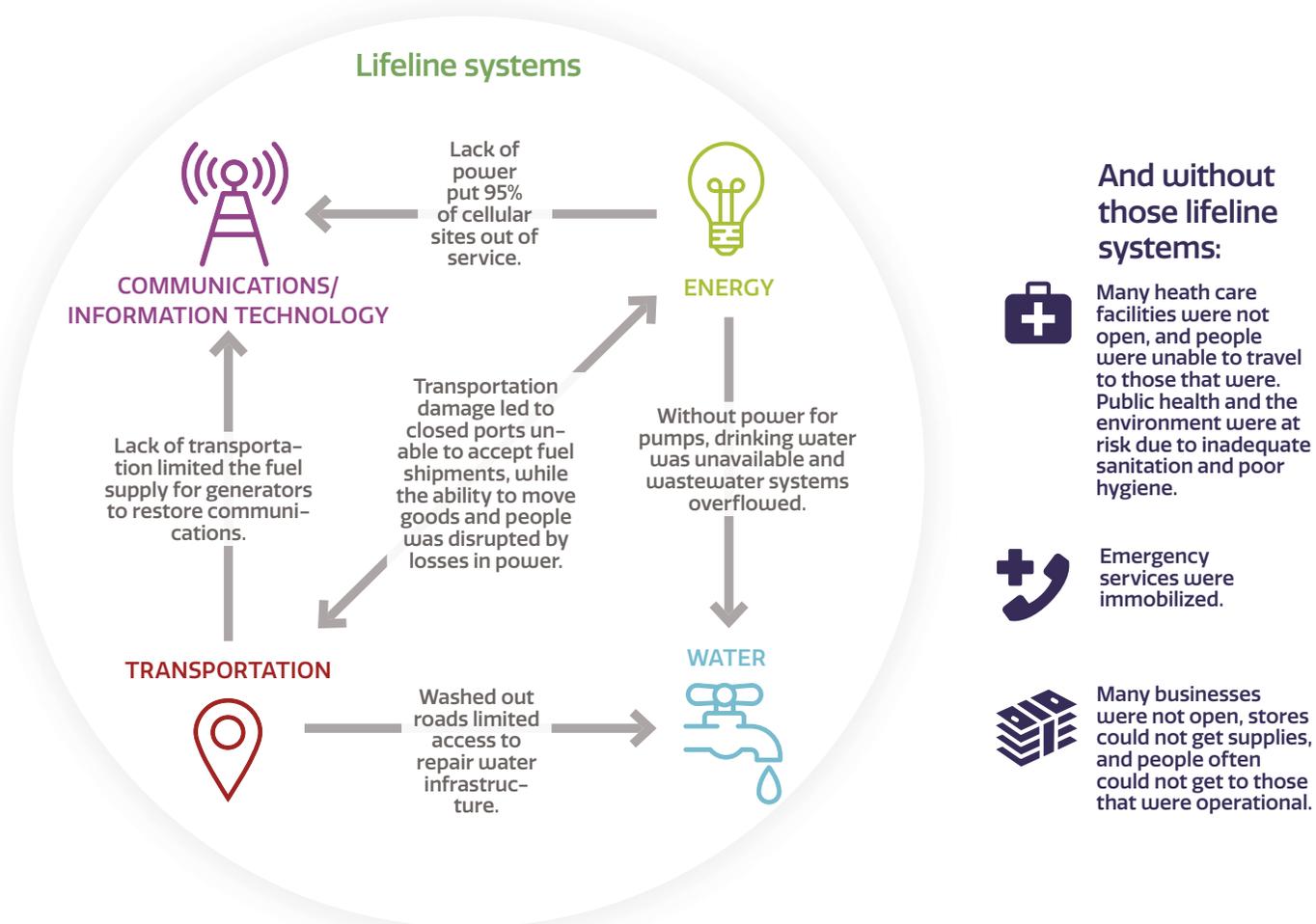
Completing a thorough analysis of cross-sector interdependencies across the entirety of Puerto Rico is no small feat. But the hurricanes highlighted a few key interdependencies that should be carefully considered in ongoing recovery planning. The figure on the following page provides *examples* of these interdependencies and describes how failures in one system led to failures in another during and after the hurricanes. In particular, four systems—energy, telecommunications, water, and transportation—are considered lifeline systems because practically every critical service provided by social service agencies, municipalities, and the Government of Puerto Rico relies on having access to each of them. Additionally, these lifeline systems depend on each other to operate. Ensuring the reliability and resilience of these critical systems is foundational to all recovery efforts.

Having a good understanding of cross-sector interdependencies alone is not enough. Coordination and collaboration among sectors is essential to ensuring that a systems view drives recovery efforts and that actions taken across sectors are scoped, sequenced, and carried out in an efficient manner. For example, a key action for the energy sector to consider is to bury high-risk power lines underground, and one for the transportation sector is to repair surface damage to the transportation network. Because underground power lines are often collocated with roads, burying the power lines in advance of restoring the roads may help ensure that the roads do not need to be repaired twice. A lack of coordination or sufficient situational awareness on the part of one or both sectors could lead to process inefficiencies, ultimately delaying recovery efforts. This is just one example, from among many, that could be improved through cross-sector collaboration. More than three-fourths of the actions listed in “Detailed Actions,” Chapter 12 of this plan, depend directly on one or more other actions being taken. Although this plan does not prescribe a way to sequence actions or specify details of how coordination and collaboration ought to occur among sectors, the courses of action constituting this plan were developed bearing in mind cross-sector interdependencies. A more detailed implementation plan will be required to map out the interdependencies among

recovery efforts and ensure that they are planned and executed appropriately.

This plan highlights actions for Puerto Rico to achieve the following:

- **Start with a strong foundation:** This section of the plan (Chapter 5) describes the actions that affect or feed into all systems and other recovery actions.
- **Build resilient communities, modernize infrastructure, and restore the natural environment:** This section of the plan (Chapter 6) begins with a description of the critical capital investments needed to rebuild and strengthen lifeline systems—that is, the systems that all other systems depend on. The chapter concludes with a description of the remaining critical capital investments needed for economic growth.
- **Focus on the future:** This section of the plan (Chapter 7) describes a suite of future-focused strategic initiatives that capitalize on a unique asset or strength in Puerto Rico (e.g., oceans, tourism) or that close a gap that could hinder Puerto Rico’s economic development or resilience to future disasters.



# START WITH A STRONG FOUNDATION



## Governor's introduction

To become stronger and more resilient, Puerto Rico must take advantage of this opportunity to develop and implement the new Model for the Socioeconomic Transformation of Puerto Rico (described in Chapter 2). This model will not only drive the physical reconstruction and rehabilitation of lifeline infrastructure assets but also encourage and promote a new vision for Puerto Rico. The new vision will be essential for the future economic and fiscal health of the Island by serving as the cornerstone and foundation of solid and sustainable economic development through productivity and added value.

This new vision, as the foundation of this recovery effort, is based on four main drivers that will help Puerto Rico transform into an economic success. The main objective of these drivers is to improve Island residents' access to resources and opportunities that are key elements in a successful recovery. These drivers are

- improved competitiveness to increase investments
- increased exports of goods and services
- improved access to credit
- increased stewardship of transfers of funding from federal and other sources.

The socioeconomic transformation envisioned in this recovery effort and described in this plan is driven by four core values: capacity-building, resiliency, transparency, and innovation. These values empower and support the ability of individuals and local organizations to participate in the recovery process, which is critical to long-term, sustainable social and economic growth. The goal is a collaborative and inclusive approach. Thus, the following are also core facets of community resilience underpinning the plan:

- Social and organizational networks and partnerships need to be supported and strengthened to ensure that communities are well prepared in advance of the next disaster.

The restaurateur, shown June 12, 2018, was a week away from opening Pueblo Sano in Orocovis when Hurricane Maria hit. The restaurant opened three months later, with assistance from the Foundation for Puerto Rico.

GDA via AP Images



## LOCATING COURSES OF ACTION ASSOCIATED WITH SPECIFIC PORTFOLIOS

The following chapters highlight some specific courses of action, followed by an identifier that appears in parentheses. The identifier is based on the related sector and an arbitrary number used for tracking (e.g., TXN 3 denotes a transportation action). Use the identifier to locate more information about a specific course of action in "Detailed Actions," Chapter 12 of this plan.

- Recovery efforts that are informed by cross-sector thinking and diverse stakeholder perspectives help ensure that rebuilding is context-sensitive and robust to a range of concerns.
- Effective governance ensures that scarce public resources are invested wisely and reach those who need them most.
- Recovery efforts must promote consistent and equitable access to high-quality economic, social, and health services.
- Improving the capacity of local governments to provide services day-to-day and during disasters will strengthen the Government of Puerto Rico's ability to respond to disasters and facilitate recovery Island-wide.
- A trained, capable, and resilience-oriented workforce needs to be developed to support recovery in both the public and private sectors.
- Improving the integration and availability of information and data will allow for timely and informed decisionmaking about immediate and longer-term resource allocation.

As part of the public policy of this administration and consistent with the *New Fiscal Plan for Puerto Rico*, efforts to deliver government services more efficiently and more cost-effectively are being considered to further improve implementation of the recovery plan. This commitment, along with a more effective, efficient, and transparent government structure, has led the efforts to develop this plan to transform and restructure the public sector.

Consistent with these elements for recovery, the Government of Puerto Rico has identified several specific actions that are critical to the success of its vision and that it plans to prioritize for investment. These actions are precursors—actions that should come first because they are critical to the success of all of the priorities discussed later in this plan. A more detailed discussion of these precursors follows.



# PRECURSORS TO PUERTO RICO'S RECOVERY

## Build government capacity to handle day-to-day business and recovery efforts

The Government of Puerto Rico is committed to building the necessary capacity to coordinate sector-based plans for infrastructure systems and capital improvement projects (CPCB 11). The coordinated planning of recovery investments (especially those related to infrastructure systems) will allow officials to examine and address hazard risk across sectors and at the neighborhood, municipal, and multijurisdictional levels. Well-coordinated planning will minimize fragmentation in the delivery of federal resources (over time and across programs), increase returns on investments, and ensure that systems are built stronger and smarter. The Government of Puerto Rico intends to work in conjunction with teams of experienced planners to collaborate on investments and coordinate input from all sectors. These efforts will facilitate infrastructure planning and transparency and also help integrate the needs of the various sectors during development and implementation.

Efforts to more efficiently plan for and cost-effectively deliver government services will further the implementation of the recovery plan. As falling tax receipts, declining state-level subsidies, and the continued movement of people away from the Island take a toll on municipal budgets, municipalities will need to find efficiencies in their operating budgets to continue delivering basic services. A small number of municipalities have created consortiums to explore sharing services, with limited success. To further this objective, the Government of Puerto Rico plans to engage the 78 municipal governments, citizens, and other stakeholders in a transparent, finite decisionmaking process for adopting and funding a regional service delivery and planning model (MUN 7). This action is administrative and will require some time to implement.

The Government of Puerto Rico has already taken some concrete actions to streamline the governance process of the Island's public affairs. Specifically, the government has implemented new legislation as a precursor to consolidating government agencies, started a digital reform, promoted a process to enhance basic

and essential public services, and comprehensively reformed the permit process. In addition, it has promoted a new vision for local governance structure, eliminated red tape, established the Single Employer Act, and downsized and externalized some government services. These actions will help minimize the burden of the government structure on public finance, reduce bureaucracy, and promote transparency and fiscal responsibility.



## PREPARING FOR AN UNCERTAIN FUTURE

As Puerto Rico moves forward, some aspects of the recovery will be influenced by conditions that are beyond the control of local decisionmakers. Recognizing the existence of such aspects will help leaders develop an approach to recovery that evolves to meet changing conditions.

**Governance:** Future changes to the institutions, laws, and policies that now govern Puerto Rico could influence recovery efforts.

**Climate and extreme weather:** Puerto Rico is vulnerable to climate-related stressors and extreme weather and its effects.

**Economic conditions:** Puerto Rico's ability to recover depends on both global economic conditions and local conditions.

**Population and demographics:** Puerto Rico's population has been declining, and the *New Fiscal Plan for Puerto Rico* projects that the decline will continue at an annual rate of 0.5 percent to 1.2 percent between 2019 and 2023. However, the size and makeup of the population over the long term are unknowable, even though many recovery initiatives hinge on right-sizing infrastructure and systems to better match the population.

**Technology:** Technological advancements in any field can create the space for new approaches to address a need or can change the effectiveness of existing resources or chosen paths forward.

## Make high-quality data available to support better decisionmaking

Collecting and making available high-quality data and information can reduce uncertainty for investors and the public at large; doing so will also lead to more-informed decisionmaking by government and local leaders (ECN 6). These efforts require

- improving and maintaining transparent property records and tax rolls and enforcing property rights (making real-estate transactions less burdensome)
- presenting timely, audited financial reports
- improving the process of collecting and storing basic economic information, such as gross domestic product and tourism satellite accounts (an economic measure of tourism)
- providing information about public-sector policies and programs to interested parties.

Toward this end, the Government of Puerto Rico intends to work closely with municipal governments to help them increase the transparency and accessibility of services—for example, by instituting e-government portals, 311 systems, and other technology-based systems (MUN 9). In addition, the Government of Puerto Rico intends to develop platforms to track and publicly report key performance indicators for state and local services in a standardized format to help citizens monitor and evaluate change (MUN 11). Such systems will help government at all levels deliver services more efficiently, saving taxpayer dollars and improving outcomes for residents.

## Enhance local capacity to secure and manage recovery funds

Municipalities will need more capacity to apply for, secure, and manage recovery funds (MUN 4) because the number and size of grants received for rebuilding is likely to be much higher than Puerto Rico's grant-management workforce has ever experienced. In coordination with Central Office of Recovery, Reconstruction, and Resiliency (COR3), the Puerto Rico Federal Funds Management Office plans to strengthen and expand its cadre of financial-management personnel to ensure that funds are managed efficiently and spent in accordance with regulations. The agency will also implement new accounting

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**Collecting and making available high-quality data and information can reduce uncertainty for investors and the public at large; doing so will also lead to more-informed decisionmaking by government and local leaders.**

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practices to reduce uncertainty and improve decisionmaking (CPCB 12). Additional staff will be made available to fulfill legal requirements for reviewing federally funded projects that may affect historic buildings, roads, bridges, tunnels, and houses (NCR 19). Where local personnel lack such expertise or experience, the Puerto Rico Federal Funds Management Office may import specialized labor.

The agency, in coordination with the COR3, also intends to increase capacity by learning from other regions' procurement experiences in prior recoveries (e.g., Hurricanes Katrina and Sandy). The agency plans to convene chief acquisition officers, contract officers, other procurement experts, and third-party recovery experts, particularly from Louisiana, New Jersey, and New York, alongside officers and experts in Puerto Rico. This forum for individuals with post-disaster experience will help train Puerto Rican procurement officers, share best practices, advise on possible shortcomings, and provide recommendations (CPCB 13).

## Maximize the impact of available federal funding

The Government of Puerto Rico plans on dedicating a significant amount of Community Development Block Grant- Disaster Recovery (CDBG-DR) funding for the nonfederal share for Public Assistance (PA), Hazard Mitigation Grant Program (HMGP) projects, and other programs that require matching. Sufficient funds from CDBG-DR and other eligible sources must be devoted to meeting the estimated \$10 billion identified for the federal cost-share. CDBG-DR funding for PA and HMGP projects will initially provide the matching funds required to secure federal grants for various projects, including those to repair roads, public buildings, and other infrastructure (ECN 34). Puerto Rico's executive branch plans to enhance the success of these federally funded projects through fiscal responsibility initiatives, as documented in the fiscal plans, that strengthen the government's revenue base (e.g., ECN 4), which can in turn help Puerto Rico regain meaningful access to credit markets and decrease investor uncertainty. Transparency efforts are discussed further in "Commitment to Transparency," Chapter 9 of this plan.

At the municipal level, many governments are in financial distress and are unable to address expenses from emergencies.

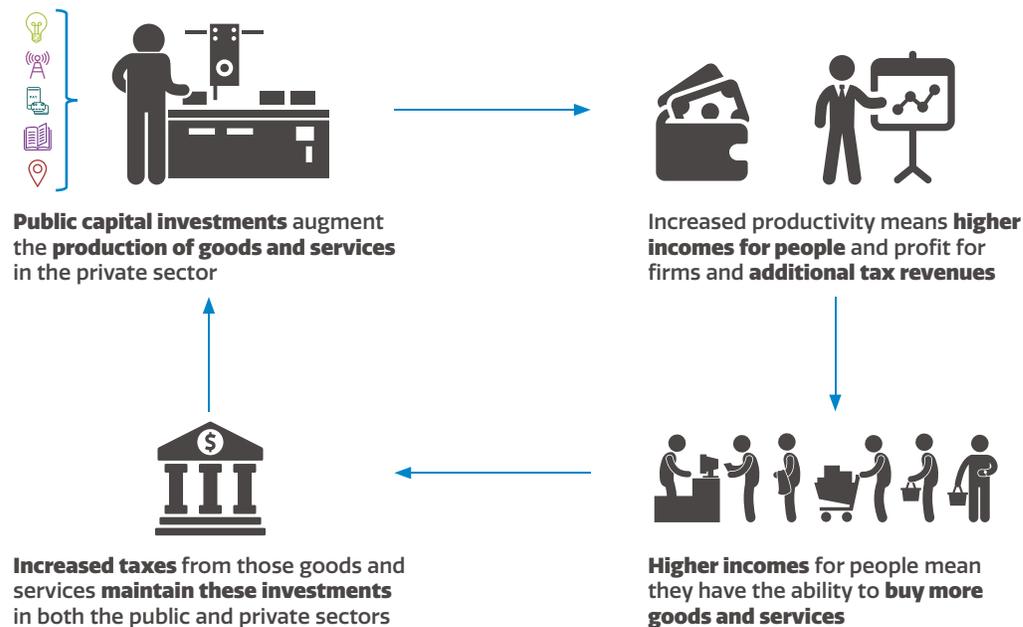
A Small Business Administration official and a translator help a woman apply for SBA disaster assistance on January 4, 2018, at the Las Piedras Disaster Recovery Center.

Yuisa Rios / FEMA



In addition, many individuals and private-sector entities lack disaster insurance. The Government of Puerto Rico will encourage municipalities to set aside money (e.g., from tax revenues) as emergency reserves for extraordinary expenses not immediately covered by day-to-day operating budgets and/or insurance in the event of emergencies and natural disasters (MUN 1). This local management of emergency funds can increase the speed and effectiveness of emergency response and recovery. To further enhance recovery, the Puerto Rico Planning Board intends to take the lead on establishing a coordinated process for developing recovery plans that all municipalities can follow (CPCB 9). This initiative includes funding for local disaster recovery managers (e.g., 40 full-time managers) who can support municipal governments in planning and implementing multiple recovery projects.

**Economic initiatives will spur a reinforcing cycle of prosperity for Puerto Rico**



## Support economic development planning at the local level

Beyond establishing local control of emergency planning and funds, communities are more likely to work toward disaster recovery in an organized and efficient manner when they have an existing shared vision for economic development. The vision provides a post-disaster target to aim toward; it can also serve to keep this target front-of-mind and not overlooked amid the immediate needs and stress of an emergency. With economic development in mind, the Government of Puerto Rico proposes that all municipal and regional economic plans assess available local workforces, provide additional education and training where necessary, and identify infrastructure needed to support industry locally (MUN 2). Federal funding may be available to support more-resilient infrastructure and assist with other local business needs. Similarly, funding from workforce-development programs may be available from several federal agencies, and nongovernmental organizations and philanthropic donors may support educational or workforce programs.

These initiatives are aligned with one of the four socioeconomic transformation core values described earlier—capacity-building (in this case, of Puerto Rico human resources)—as well as the development of a capable, trained, and educated workforce. Also, this effort drives the Governor’s vision of developing a “Human Cloud” workforce in which professionals establish themselves in Puerto Rico and are able to provide services that can be exported globally.

## Increase the ease of doing business

As noted in a recent World Bank report,<sup>1</sup> financial and nonfinancial costs of doing business (i.e., transaction costs) are relatively high in Puerto Rico. In fact, 36 percent of municipalities surveyed during the development of this plan identified permitting issues and excessive red tape as the most significant barriers to economic growth, and more than one-third also cited a lack of state financial support and of coordinated regional and municipal economic development. To make the best use of capital investments, the Government of Puerto Rico aims to lower these costs by reforming policies related to permitting, taxation, occupational licensing, and other regulations that impede commerce, both internally and externally (ECN 1). These

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<sup>1</sup>World Bank, *Doing Business 2018: Reforming to Create Jobs*, Economy Profile: Puerto Rico, Washington, D.C., 2018.

actions, in conjunction with the investments documented in this plan, are critical to ensure future economic growth.

Policies aimed at increasing the ease of doing business are consistent with both the Governor’s draft *New Fiscal Plan* and the *Certified Fiscal Plan* (certified by the Puerto Rico Financial Oversight and Management Board, or FOMB). FOMB has advocated that Puerto Rico increase its position in the World Bank’s Doing Business rankings, which assess the ease of doing business in countries throughout the world. Some of Puerto Rico’s rankings, in such areas as permitting, are extremely low. While the efficacy of any of these policies will likely depend on the external economic environment, actions that lower the cost of doing business in Puerto Rico will enhance the effectiveness of any capital investment or strategic initiative. These efforts will advance steps the Government of Puerto Rico has already taken in this direction.

The U.S. Congress can also help decrease costs. For example, if it could be shown that the Jones Act increases the price of many goods imported from U.S. ports for Puerto Rico residents because of the higher transportation costs associated with using Jones Act-qualified vessels, then altering the law to create an exception for Puerto Rico could reduce those prices, although these benefits would have to be balanced against the loss of any other benefits that the Jones Act brings. Therefore, the following actions could contribute to lowering the costs of doing business: (1) exempting Puerto Rico or certain Special Economic Zones (e.g., Port of Ponce) from the provisions of the Jones Act (ECN 39), although the full costs and benefits would need to be considered, and (2) including Puerto Rico in the Stevens Amendment (Title 49 Section 41703(e) of the U.S. Code) (ECN 40), which could allow foreign cargo and passenger aircraft to proceed to the continental United States following a stop in Puerto Rico to unload and load cargo.

The Stevens Amendment allows foreign cargo aircraft to stop in Alaskan airports before proceeding to other cargo airports within the United States. Since the passage of this amendment, Alaska has become a major international air cargo hub serving flights on Asia-North America routes. Adding Puerto Rico to the amendment should boost air cargo activity on the Island and create additional economic opportunities for aviation in Puerto Rico. Including Puerto Rico in this exception should be paired with authorizations from the U.S. Department of Transportation to allow for cargo transfers—benefits that Alaska, the Mariana

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**Policies aimed at increasing the ease of doing business are consistent with both the Governor's draft *New Fiscal Plan* and the *Certified Fiscal Plan*.**

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Islands, and Guam currently enjoy. This initiative should also work to reestablish the “transit-without-visa” program in Puerto Rico, with all the necessary security requirements and safeguards, making it easier for people to visit the Island. These policies would likely result in lower prices and increased economic growth, but they require action by Congress.

## **Reduce barriers to formal work and incentivize workforce training**

Economic growth results from increasing the quality and quantity of factors (for example, land, labor, capital, and entrepreneurship) that contribute to the production of goods and services. Training programs can help new or returning workers develop in-demand skills, which can lower barriers to workforce (re)entry and reduce dependence on the public sector for income. COR3 and the Puerto Rico Department of Labor and Human Resources plan to stand up a workforce development system in high-demand occupations across multiple sectors to increase the supply of available talent, increase income for the trained individuals, fill jobs, and improve efficiencies in the delivery of education and training (ECN 2).

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# BUILD RESILIENT COMMUNITIES, MODERNIZE INFRASTRUCTURE, AND RESTORE THE NATURAL ENVIRONMENT



**N**ine objectives define the capital investments—in infrastructure, human capital, and natural capital—needed to help achieve the goals that are outlined in this plan. Building the strong infrastructure and systems that Puerto Rico needs to support resilient communities, an enduring economy, and a thriving society will require approximately \$132 billion in capital investments over an 11-year period (2018–2028). Some of this has already been provided through federal disaster relief, private insurance, and private-sector and philanthropic sources. This chapter begins by describing the capital investments needed to restore and strengthen four lifeline systems—energy, telecommunications, water, and transportation—before turning to a description of

  
Physical  
capital

  
Human  
capital

  
Natural  
capital

**CAPITAL  
INVESTMENTS**

capital investments needed in additional sectors—housing, education, health, public buildings, and the natural environment. The objectives outlined here for each of these sectors are future-focused and include a series of high-level steps to achieve that objective. Given the breadth and scope of the recovery, more than 270 specific recovery actions were identified that support the overall objectives. A brief description of these more-detailed courses of action, their estimated costs, and possible funding sources and implementers can be found in “Detailed Actions,” Chapter 12 of this plan.

Solar panels being installed in Caguas.

FEMA/Yuisa Ríos



Physical  
capital

## TRANSFORM THE ENERGY SYSTEM

**Develop an energy system that is customer-centric, affordable, reliable, and scalable; incorporates more renewables, microgrids, and distributed energy resources; and can drive new businesses and employment opportunities and support residents' well-being**

### Issues to Address

The complete failure of Puerto Rico's electrical grid is emblematic of the magnitude and longevity of the disaster. One hundred percent of Puerto Rico was without power as a result of the hurricanes. Without power, many other systems—telecommunications, water, and transportation, to name a few—failed. Puerto Rico's electrical grid was vulnerable before the hurricanes due to a fragile system, dependency on fossil fuels, lack of skilled workers, and outstanding debt. These factors exacerbated the catastrophic situation caused by the hurricanes. The Puerto Rico Electric Power Authority (PREPA) is undergoing a transformation of governance. A likely path forward is the privatization of PREPA's generation assets and the formation of public-private partnerships for leasing and operating transmission and distribution assets. Through support of the Southern States Energy Board, the Puerto Rican legislature will be developing an energy policy for a 30-year time horizon by December 2018 to support managing and maintaining these assets.

## Taking action

Implementing a new vision for the energy sector is an opportunity to literally power the future of Puerto Rico. This effort will focus first on customers but will also emphasize establishing a financially viable, reliable, resilient, and sustainable energy system that powers the economic engine of the Island. A foundation of industry-leading best practices must be established as the basis of an energy-sector transformation. With coordinated planning and analysis, substantive input from all the stakeholders, and thoughtful stewardship of resources, Puerto Rico will be able to ensure that the lights stay on and that the Island can truly be open for business.

The Government of Puerto Rico will leverage the knowledge of world-class technical experts and engage diverse stakeholders to help inform an innovative and sustainable path forward. To enable decisionmakers to define that path, the technical and economic tradeoffs between these courses of action and financial constraints will be clarified. Ongoing modeling efforts to support these decisions are well under way and include the following:

- development of the 2018 PREPA Integrated Resource Plan and other planning within PREPA
- extensive modeling and analysis by U.S. Department of Energy National Laboratories, in coordination with U.S. Department of Energy headquarters and shared with PREPA
- supporting modeling and analysis undertaken for the development of this plan, including sophisticated power grid models created by experts at the Massachusetts Institute of Technology's Lincoln Laboratory
- modeling and analysis of future visions for the electrical grid by faculty at the University of Puerto Rico (UPR) and their collaborators.

In particular, cutting-edge technical modeling and simulation undertaken to support the development of this plan can and should underpin Puerto Rico's development of not only a more *reliable* electrical grid but also a more *resilient* one. Traditional approaches for designing and operating electrical grids—which emphasize cost-effectiveness for achieving grid reliability—may not be well-suited for system resilience in the face of events like Hurricane Maria. The grid should be built back better, but it can also be built back *differently*. For example, the engineering firm Burns & McDonnell has developed a range of long-term grid scenarios that incorporate physical infrastructure that is robust enough for Puerto Rico's unique

### REFORMS AIM TO RESTRUCTURE ENERGY GOVERNANCE AND POLICIES

The Puerto Rico Energy Transformation Act, Law No. 120–2018, establishes the legal framework for restructuring PREPA. In support of this restructuring, the law requires the Governor and the Presidents of both the Puerto Rican Senate and House of Representatives to each suggest four organizations to join a Blue-Ribbon Task Force coordinated by the Southern States Energy Board under a grant from the U.S. Department of Energy. The Blue-Ribbon Task Force is responsible for recommending reforms to Puerto Rico's existing energy regulatory framework and energy public policy and is expected to develop a reform package before December 18, 2018.

## **PREPA INTEGRATED RESOURCE PLAN**

The Puerto Rico Energy Commission requires PREPA to submit an updated Integrated Resource Plan by October 1, 2018. Based on extensive analysis and stakeholder engagement, the Integrated Resource Plan will articulate the utility's blueprint for meeting forecasted demand using a combination of traditional and nontraditional generation resources, transmission and distribution enhancements, and demand management.

challenges, and the company has estimated associated costs of these scenarios. Power flow modeling and simulation by Lincoln Laboratory provides a framework for analyzing and responding to extreme events to avoid and mitigate large-scale outages. This type of planning and analysis will give Puerto Rico the opportunity to put cutting-edge planning and operation into practice.

### **Foundational requirements for the health of the energy sector**

To improve the quality, reliability, and speed of recovery of electricity in Puerto Rico, PREPA aims to rebuild and maintain the grid to adhere to industry best practices—tailored to the unique conditions in Puerto Rico. Regulators will need to ensure timely and continual compliance and enforcement with established standards that span both management best practices and technical standards. Toward this goal, PREPA announced that grid reconstruction would utilize U.S. Department of Agriculture (USDA) Rural Development Rural Utility Service standards (ENR 1). PREPA also expects to perform routine operations and maintenance based on periodic risk assessments, and industry best practices can help inform and implement a predictive maintenance effort. A robust operations and maintenance program to support any new construction and investments in the system is essential (ENR 4).

In light of the ongoing restructuring and regulatory jurisdiction changes in the energy sector, the Government of Puerto Rico will further clarify the roles, responsibilities, and authorities of its agencies in the energy sector. In addition, this effort will draw clear lines of authority among the parties that will be responsible (regulators, operators, legislators, and executive officers) and ensure that these entities are accountable and that their operations are transparent (ENR 26).

To achieve the vision for Puerto Rico's energy sector, PREPA and other stakeholders will develop a workforce with the ability to install, operate, and maintain an energy system for the future (including asset management, system planning, and data management) and quickly respond to and repair damage to the electric system as it occurs. It is critical that the workforce is right-sized, new workers are trained, and existing personnel are retrained. A skilled workforce can drive energy system transformation, speed recovery from power loss events, and fuel economic growth from a steady, reliable energy supply (ENR 18).

## **Improve, harden, and maintain electricity infrastructure**

In collaboration with the federal government, PREPA will harden grid assets to support critical infrastructure and public services. The improvements will ensure that hospitals can care for the injured, first responders can dispatch 911 calls, and water pumps can continue to operate (ENR 5). Backup generation will be provided to priority loads to ensure the sustained delivery of public services in the absence of the bulk power system. This approach includes targeted energy solutions for households with electricity-dependent medical needs and prioritization of backup generation for facilities that provide the greatest public benefit (ENR 16). Another component is providing critical facilities that serve as congregate shelters and community service hubs, such as public school buildings, with the appropriate energy and water infrastructure (ENR 17).

Additionally, the Government of Puerto Rico will encourage certain private facilities, such as hospitals and communication towers, to maintain backup generation and establish enforceable inspection and maintenance measures for compliance with requirements. Policies can also remove barriers to consumer investment in distributed energy resources in order to provide emergency energy services (ENR 15).

Modifications and changes to the infrastructure that supports the electrical grid, such as control centers, communication systems, and collection systems, will also be made more resilient to withstand future disasters. For example, PREPA's communication backbone suffered considerable damage from high winds, flooding, and other threats, thus preventing normal system operations and billing and requiring expensive temporary solutions. An assessment of existing communications infrastructure that supports grid monitoring and control functionality will be undertaken (ENR 3). The improvements to this support infrastructure will allow the new grid to include technologies that provide real-time information and grid control to keep the power system operating or speed its recovery. This effort will improve monitoring and analytic capabilities to identify problems, provide warnings to system operators, and anticipate system instability in real time (ENR 11). Robust data systems are important for informing response decisions and improving ongoing operations and maintenance. Deploying these systems includes creating a robust data inventory of assets, which will be coordinated and integrated across other critical infrastructure systems, and acquiring information technology systems to support inventory and asset management (ENR 19).

Specific asset improvements will be made to reduce vulnerability to both flooding and high wind speeds. In some cases, these

improvements can be complementary; in others, tradeoffs will be made based on the modeling and current analyses of system design and asset improvements. For example, to reduce vulnerability to flooding, electrical assets that are at risk will be strengthened, elevated, moved, and made more resistant to damage—or decommissioned if the risks are too costly to mitigate (ENR 6). To reduce vulnerability to high wind speeds, an aggressive vegetation management program will be implemented. Other important activities include hardening or decommissioning assets that may be vulnerable to high winds. Some of these efforts (such as installing poles more resistant to damage) have already been implemented in the restoration process (ENR 7). Services that support the electric system and make it more resilient to outages will also be pursued (ENR 10).

### **Design, build, and maintain an electrical system with “islandable” portions of the grid**

Rebuilding the electrical grid offers an opportunity to incorporate technology and design to limit the extent of grid failures in future disasters. These solutions can range in scale from community and local (e.g., microgrids) to regional (e.g., electrical islands). Microgrids and electrical islands can balance generation and load to continue delivering locally generated electricity if sections of the transmission grid fail (ENR 2). Several groups are performing modeling and analysis to determine the optimal design of a system architecture that incorporates technically feasible, resilient, and financially viable solutions. In the meantime, the Puerto Rico Energy Commission established final microgrid rules in May 2018 to be supplemented by interconnection standards from PREPA in the coming months. The PREPA Integrated Resource Plan will include recommendations for including islandable portions to the grid. On a smaller scale, in July 2018, the Puerto Rico Industrial Development Company (PRIDCO) released a request for proposals for microgrid pilot projects at industrial sites across the Island. To determine how these microgrids and electrical islands will be optimally integrated into the future system, PREPA and the Central Office of Recovery, Reconstruction, and Resiliency (COR3) will collaborate and engage in further conversation with many decisionmaking bodies in Puerto Rico.

## **Diversify energy sources to reduce reliance on imported fuel**

Beyond the resilience efforts, Puerto Rico has the opportunity to be a global leader in the production of energy through renewable yet physically strong assets that empower diverse industries across the economy. Energy generation on islands is often challenging and costly, due to such factors as high-cost imported fuels and the inability to leverage the resilience and efficiency benefits of being connected to a larger grid. The goals for Puerto Rico's energy sector are to diversify its energy sources to be less dependent on costly imports and to establish energy policies and public-private partnerships that can energize economic growth.

To determine the best path forward, PREPA will assess the potential for all types of renewable energy (e.g., wind, solar, biomass, hydro, tidal); evaluate the possibility of optimizing hydropower facilities across Puerto Rico, especially facilities with black start or islanding capabilities; and prioritize the development of ideal renewable energy sites (ENR 23). Ongoing analyses will inform the tradeoffs between these and other choices for the grid.

The power system will be designed and built to meet current and future projections for demand and growth, including right-sizing and relocating assets as required. To respond to future demand, current efforts by PREPA include updating and strengthening system planning analytical tools, especially for dynamic system monitoring (ENR 14). This right-sizing also includes cost-effective energy efficiency and locating new generation closer to demand and critical loads. Before new generation is built, decisions will be made about how best to integrate distributed generation assets across the whole system (ENR 22). Existing generation, such as the assets newly installed during the power restoration efforts, will be maintained to ensure resilience to future disasters (ENR 8).

## **Enhance the emergency preparedness and response of the energy system**

The Government of Puerto Rico will create an energy response and preparedness plan and is currently updating its Energy Assurance Plan for this purpose. The new plan will be reevaluated and updated on a regular schedule and will include implementing preparedness best practices, such as updating mutual aid agreements; pre-positioning equipment, materials, and personnel; and streamlining the incident command system (ENR 21). To facilitate a rapid restoration of electricity, it is necessary to pre-assess the optimal level of material and workers needed for each portion of the grid (ENR 13). For example, the Energy Assurance Plan for Puerto Rico will include fuel

### **PRIDCO INDUSTRIAL FACILITY MICROGRIDS**

On July 8, 2018, PRIDCO, advised by the U.S. Department of Energy, issued a request for proposals for microgrid development at PRIDCO industrial parks. The microgrid solutions will be capable of indefinitely supplying the facilities in "island mode," disconnected from the grid in case of system outage. The target date for selection is October 19, 2018.

coordination between local fuel distributors and Government of Puerto Rico agencies to monitor fuel storage levels. In addition, the federal and state emergency response would be coordinated with the private sector to improve the response to outages, access to information, and the use of available resources (ENR 12).

In the initial emergency response to Hurricane Maria, many issues prevented the efficient transfer of fuel from port to end use. Approaches to preparing for future disasters include stockpiling fuel (diesel and propane) in strategic locations near critical facilities, establishing stand-by blanket purchase order contracts with a fuel provider in case of storm emergencies (a task for PREPA), and coordinating among agencies ahead of time to determine optimal resource planning (e.g., the number of delivery trucks and trained personnel) (ENR 9).

To reduce the time and cost of energy restoration after an emergency, new investments are proposed in the areas of operations and maintenance, standardization of components, relocation of transmission and distribution assets to improve access, stockpiling of rapidly deployable grid restoration assets, installation of additional assets to reduce failures (e.g., battery storage), and redesign of some existing generation and substation units. These investments will be based on whole system modeling efforts (ENR 20).

### **Enable economic growth in a stable governance structure**

To support economic growth, energy needs to become more affordable and prices more predictable. Toward this end, the Government of Puerto Rico will establish goals for the quantity and type of energy sources to be generated, evaluate the costs and benefits of alternative generation resources, and assess incentives for private investment (ENR 24).

The vision for the energy sector is to provide a modern energy system that is affordable, reliable, renewable, scalable, and redundant with the appropriate regulatory policies in place that respond to the needs of customers. The sector must also have a strong, independent, knowledgeable, transparent regulatory framework and commission. A suite of energy sector regulations will be required to align the needs, resources, oversight, incentives, and feedback to deliver on this vision, contribute to economic growth, and facilitate the efficient achievement of energy-related strategic objectives in this plan (ENR 27). The Puerto Rico Energy Commission's establishment of the microgrid rule, for example, supports this approach, and other technical requirements in support of other actions will be implemented (such as establishing

guidelines or requirements to reduce vulnerability to flooding or high wind speeds).

Other initiatives aim to increase the capacity of municipalities to make decisions concerning energy systems. Helping municipalities manage the decisionmaking and implementation process can help advance efforts to meet Puerto Rico's broader renewable energy goals and create consumer participation. Future activities will include improving public decisionmaking and engagement in energy (ENR 25).

### **Understanding the impact of tradeoffs on the cost of reconstruction and future resilience of the electrical grid**

The type and extent of recovery investments will shape Puerto Rico's future energy system. Investing too little could result in a system that is no more reliable or resilient than it was on September 19, 2017. Conversely, a state-of-the-art grid powered principally by renewable energy and battery storage could be extremely costly. Scenario modeling to date suggests that the cost of a truly transformed energy sector could greatly exceed available capital for the recovery. A realistic and responsible level of investment in an appropriately strong, resilient, economically viable electrical grid lies somewhere between these extremes. Strategic-level tradeoffs will be made, including the level of decentralization of the system (e.g., inclusion of islanded portions and microgrids), the level of renewable energy production, the extent of growth of distributed energy resources, and prioritization of assets for hardening measures.



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of energy system strategies and details about cost and funding in Chapter 12 of this plan

A new radome under construction, after the previous radome was damaged by Hurricane Maria.

FEMA/Eduardo Martinez



## MODERNIZE THE TELECOMMUNICATIONS SYSTEM

Modernize the telecommunications system to develop fast, reliable, and resilient residential, commercial, and emergency communications that drive Puerto Rico's economy, prosperity, and well-being

### Issues to address

The failure of Puerto Rico's communications infrastructure created challenges during the disaster. Following Hurricane Maria, police, fire, and emergency medical services were unable to respond to 911 calls. Cellular, landline, and internet services in Puerto Rico make extensive use of aerial fiber-optic cables. This condition made Puerto Rico's telecommunications infrastructure susceptible to damage from extreme weather and natural disasters, as happened during the hurricanes. Some infrastructure, such as poles that support those cables, were damaged by the winds, resulting in the loss of transmission capacity for voice and data communications. In addition,

the remote location of many cell towers made it difficult to repair them and to refuel backup power generators to power essential equipment. Degraded cellular service is of particular concern in Puerto Rico, where at least 80 percent of the population depends on cellular phones to communicate.

While numerous actions are under way to address short-term recovery needs and prepare for the current hurricane season, Puerto Rico is considering medium- and long-term solutions, as well as best practices for implementing them. Government agencies and the private sector play important roles in implementing and funding these solutions. To ensure an effective and innovative modernization of the telecommunications and information systems, Puerto Rico will implement actions using proven best practices, including those related to cyber and information security.

## Taking action

### **Strengthen emergency communications systems to facilitate quick and effective disaster response**

The Government of Puerto Rico will work with its municipal partners to develop capabilities to achieve robust emergency communications so that emergency services and government functions are effective and responsive in the aftermath of a disaster. The first required capability is a system of communications assets that can be safely stored when not needed and quickly deployed throughout the Island during an emergency. This system configured as a network of nodes will restore voice and data communications for disaster response, emergency services, and government functions (CIT 11). This system will include portable power generation to ensure independent operations and remote deployment. Second, the loss of the electric grid during Hurricane Maria points to the need for power redundancy and standardized power backups wherever practical for public safety and government communications infrastructure (CIT 5). Third, Puerto Rico's two 911 centers need redundancy—that is, additional 911 centers outside San Juan—and dispatch capabilities (CIT 3). Currently, a 911 operator must use telephone lines to call a police, ambulance, or fire operator, who then uses a separate system (typically radios) to dispatch first responders to the location of the initial caller. After the disaster hit, most telephone lines were not operational, so 911 operators often could not call first-responder dispatch centers. As a result, many calls to 911 centers did not reach first responders. Fourth, locations must be established where the public can access the internet and government information portals; municipal “hot spots” can be

used for that purpose (CIT 19). Finally, easy access to information and situational awareness (e.g., via status.pr, an online platform launched after Hurricane Maria that uses personal outreach and crowdsourcing to update the media, public, and first responders about conditions across Puerto Rico) is important to ensure a speedy recovery process. For example, real-time information can help determine where to allocate resources during a disaster response.

Beyond supporting effective disaster communications, better communications infrastructure is critical to improving first-responder operations more broadly. Currently, many emergency medical service crews and their hospitals need two dispatchers to communicate with each other; that is because emergency medical service has its own Land Mobile Radio (LMR) system, and hospitals typically use the police LMR system, but the two systems are not interoperable. To solve this problem, the Department of Public Safety and its partners are considering several options, such as upgrading and consolidating the current public LMR systems and supporting networks, using the federal LMR and cellular first-responder networks when they become available, and using one system for voice traffic and another for data traffic (CIT 1).

### **Create and sustain a robust and resilient communications infrastructure, including widely available broadband internet**

Given the nearly catastrophic failure of communications assets during the hurricanes, creating and sustaining robust and resilient communications infrastructure is also a top priority of the recovery effort. A key challenge is the transition from aerial to underground fiber optic cables in buried conduit, which will greatly increase the reliability and resilience of the communications network. To achieve this, the Government of Puerto Rico is considering how to incentivize private telecommunications providers—which own more than 90 percent of the Island’s telecommunications infrastructure—to use buried fiber optic cable for rebuilding damaged networks and for new projects. One option that has been well received by telecommunications providers is a “conduits project” in which the Government of Puerto Rico owns both the trenches and conduits required for fiber optic cables, and private providers install and own the cables that run through the conduits (CIT 21). This incentivizes both the burial of fiber optic cable and the deployment of broadband infrastructure throughout Puerto Rico by greatly reducing the investments required by the private companies. Streamlining the permitting and rights of way processes for installing fiber optic cable and building cell towers will increase the efficiency of recovery efforts and lower costs for the private sector (CIT 13). Methods that encourage

the coordination of trenching by state agencies and the private telecommunications sector—for example, the “conduits project”—are key to these efforts.

Another opportunity is to engage with the Federal Communications Commission (FCC), which has programs that encourage private companies to provide telecommunications and internet services to schools, hospitals, and libraries, especially in rural or disadvantaged areas. In particular, some FCC programs offer funding on a sliding scale to help provide telecommunication services to health clinics, schools, and libraries. The Puerto Rico Telecommunications Regulatory Board and the Puerto Rico Department of Education (PRDE) plan to pursue this and other funding, such as the USDA’s Rural Broadband Program and the U.S. Department of Housing and Urban Development’s Broadband Infrastructure Grants and Community Development Block Grants, to help expand broadband service to all 78 municipalities (CIT 22).

To ensure the swift and effective rollout of the efforts described above, the Puerto Rico Telecommunications Regulatory Board and its partners propose a high-profile panel of nationally recognized subject-matter experts, industry leaders, and senior government officials to develop a comprehensive broadband deployment plan (CIT 25) and oversee the establishment of municipal wi-fi hot spots. This group is expected to play a key role in obtaining political and industry support for the deployment plan, as well as full support from critical agencies, such as the FCC and the U.S. Department of Housing and Urban Development.

While most of these initiatives involve on-Island communications, the Government of Puerto Rico will also improve the resilience of communications that connect Puerto Rico with the world at large. Currently, undersea cables, which form the primary method of communications to and from the Island, converge in the northeastern area of the main island, presenting a single point of failure. The government, with its private partners, aims to address this by introducing new undersea cables that are located away from San Juan (e.g., in the southwest as opposed to the northeast of the main island) and by hardening existing landing sites (CIT 10). This initiative also includes upgrades to existing terrestrial infrastructure for undersea cable communications that address flooding, loss of power, and other physical threats. One strategy is to update the undersea network infrastructure to incorporate a communications ring system linking currently unconnected regions around the Island (CIT 15). The ring system will add to and improve the availability of communication route options both within Puerto Rico and to and from points globally in a natural disaster. Similarly, the increased communications capacity



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of **communication/information technology strategies** and details about cost and funding in Chapter 12 of this plan

available with new cables will improve the performance of the network during such events. When viewed on their own and with a cross-sector lens, these improvements will be critical for Puerto Rico’s vision of economic growth and resilience.

### **Establish governance structures to support and monitor changing infrastructure**

Effective communications governance can play an important role in ensuring that modernization is done efficiently and effectively and leads to transformative outcomes. As an important first step, the Government of Puerto Rico will establish a Puerto Rico Communications Steering Committee that brings together all the relevant stakeholders to implement the vision of a modern telecommunications system (CIT 24). Leadership support, discrete goals and objectives, and appropriate authorities and resources could position this committee for success.

A feasible government-wide digital transformation strategy—with clear priorities, needs, and costs—is also critical to improving communications governance (CIT 16) so that valuable time and resources are not wasted on activities that do not transform and modernize communications. In addition, a new Tier III or Tier IV, cloud-enabled data center for state-level information systems will expand the Government of Puerto Rico’s ability to perform essential functions and deliver essential services efficiently—using government-owned, highly available, scalable, and evolvable infrastructure (CIT 17). The Office of the Chief Innovation Officer (CINO), with help from other government agencies, will expand the scope of the Puerto Rico Innovation and Technology Service to include a focus on citizen-centered services and prioritize a “one-stop-shop” experience for accessing government services and information in an easy-to-use fashion (CIT 32). These initiatives will follow best practices for ensuring digital inclusion and accessibility, such as the ability to access government services from mobile devices.

Efforts to improve governance also include creating a database of critical infrastructure (government and private sector) (CIT 18), using an open, modular, and standards-based approach for information exchange and storage (CIT 14) and a centralized geographic information systems (GIS) resource and data platform (CIT 2). Expanding status.pr (CIT 23) is also on the agenda. Status.pr will provide data updates for ongoing government functions, as well as critical information during disasters. The Puerto Rico Innovation and Technology Service, in coordination with COR3, will oversee this initiative, building on its ongoing efforts to digitize government data,

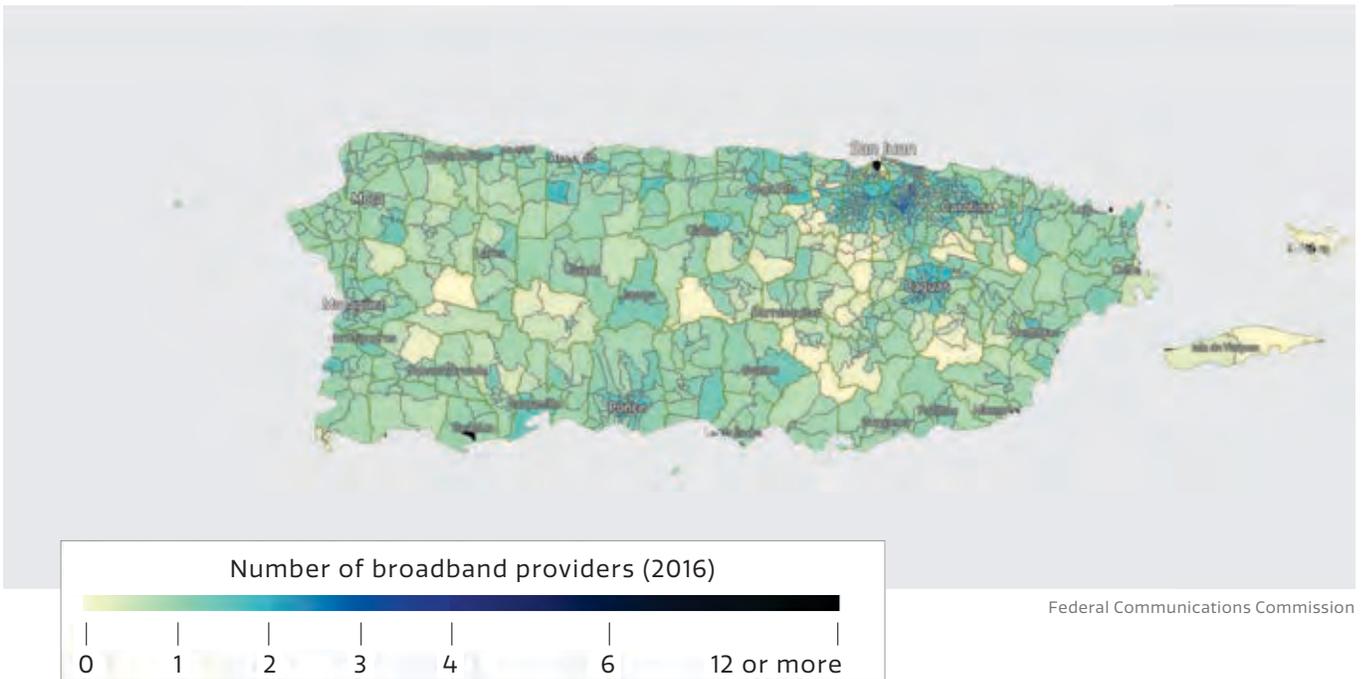
form data-sharing partnerships, and utilize “smart” devices (such as Internet of Things sensors).

Secure, digital identities used to provide online identity verification is an important component of digital transformation to facilitate financial transactions, contracts, and government services. It can also increase accuracy and reduce costs associated with validation and access to government services, especially in disaster recovery, when paper records can be inaccessible. CINO and other government agencies will study existing models of this technology, including its reliance on resilient power and communications, to determine how Puerto Rico might best leverage digital identity in the future (CIT 27).

### **Take advantage of improved access to broadband services and information technology for the betterment of Puerto Rico**

The internet is perhaps the most important aspect of communications infrastructure today. Puerto Rico has the opportunity to transform its future by expanding access to broadband services and using information technology to improve the health, well-being, and education of its people and to spur economic growth. Widely available and affordable broadband can reduce the “digital divide” between more-affluent and disadvantaged segments of Puerto Rico’s population. Furthermore, by leveraging information technology services that wider access to broadband enables, the Government of Puerto Rico can help facilitate a digital transformation that reforms how government serves its citizens and prepares Puerto Rico to successfully compete in an evolving, connected digital world.

## Many parts of Puerto Rico have no broadband provider



To increase access to broadband and teach residents new skills, Government of Puerto Rico agencies will establish a Digital Stewards program, following successful models in Detroit and New York (see sidebar on the next page). This program trains residents to install and service wi-fi hot spots in public housing (CIT 26). Participants learn valuable skills, build employment experience, and act as community liaisons for internet connectivity and maintenance of hot spots in their communities. Also proposed is a public-private initiative focused on providing digital skills training, entrepreneurship programs, and access to new technologies for people throughout Puerto Rico (CIT 28). The initiative will operate through a network of innovation hubs and entrepreneur centers, training partnerships with schools, and outreach via mobile labs to rural and underserved areas.

Given its hurricane-prone location, Puerto Rico is also well positioned to incubate a resilience technology industry to test the ability of systems and construction processes to withstand natural disasters. This effort includes a new Resiliency Innovation Network across Puerto Rico to build on existing university and Puerto Rico Science, Technology, and Research Trust facilities to teach, test, and refine existing resilience products and services, as well as develop new ones to enhance capabilities and stimulate new commercial ventures (CIT 30). For example, the Puerto Rico Science, Technology, and Research

Trust entrepreneurial programs and corporate ties could be leveraged to encourage established companies to collaborate and invest in resilience innovations, existing government ties to PRIDCO could be leveraged for tax incentives and business credits, and the Technology Transfer Office could provide intellectual property protection and negotiate licensing agreements.

Finally, Puerto Rico's CINO, in collaboration with other government agencies, will run a pilot e-Construction Learning Lab project in one municipality to focus on digitizing hurricane damage assessment, permitting, and reporting processes (CIT 31). The findings will feed into a feasibility and cost-benefit analysis for an e-Permitting and e-Construction ecosystem across Puerto Rico. The use of electronic tools and information systems will deliver greater process efficiency, cost savings, flexibility, and independence from paper-based methods while increasing transparency.

Taken together, these actions addressing connectivity, workforce development, public use of the internet for a wide range of tasks, integration of digital technologies into business practices, and digital public services have the potential to transform Puerto Rico into a digital society that stands as a global role model.

### **DIGITAL STEWARDS PROGRAM CASE STUDY: RED HOOK, NEW YORK**

The Digital Stewards program, which began in Detroit, was implemented in Red Hook, New York, by the Red Hook Initiative following Hurricane Sandy in 2012. As the lead for the Digital Stewards program, the Red Hook Initiative became a community hub of disaster response, providing a gathering place for residents to charge phones, fill out FEMA forms, and check in with family members. The initiative helped organize volunteers, posted updates on social media, and increased the reach of its mesh wi-fi to serve more than 1,000 people per day. This wi-fi program's contribution after Sandy was recognized at a White House-hosted FEMA roundtable on emergency response best practices.

In 2017, 92 percent of Digital Stewards agreed or strongly agreed that the program helped them "learn skills that allow them to succeed in the workplace and to make a difference in their neighborhood." Seventy-seven percent remained employed or were actively pursuing further education within six months of completing the program.

Water pipes and bridge foundations are constructed to replace a hurricane-damaged bridge in Mayaguez.

FEMA/Michael Medina-Latorre



Physical  
capital

## RETHINK WATER SYSTEMS

**Develop safe and reliable water systems that are protected from future disasters to ensure the well-being of Puerto Ricans and the environment as well as the operations of government and businesses**

### Issues to address

Flooding, loss of electricity, landslides, and debris that resulted from the hurricanes damaged and disrupted service for nearly every element of Puerto Rico's water system—from drinking water and wastewater services to stormwater management and flood control infrastructure, such as dams, levees, and channels. Although the Puerto Rico Aqueduct and Sewer Authority (PRASA) supplies 96 percent of Puerto Rico's drinking water, community and individual water systems are responsible for drinking water provision in some rural areas. PRASA manages 59 percent of wastewater services on the Island (see figure on the next page), but many communities are serviced by on-site septic systems or small, publicly owned wastewater systems. Stormwater management is also decentralized and falls under the responsibility of municipalities or, in some urban areas,

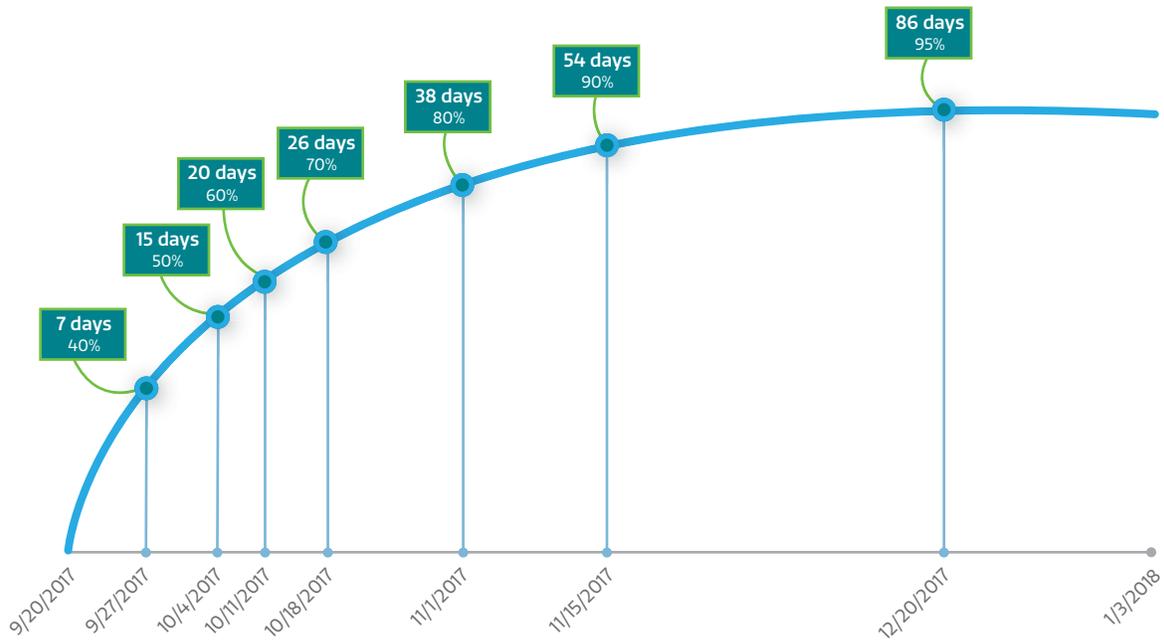
## PRASA's workforce serves the majority of water and wastewater customers



government agencies. Flood control infrastructure is managed by several agencies as well, including PRASA, PREPA, the Department of Natural and Environmental Resources (DNER), and municipalities. For simplicity, drinking water and wastewater infrastructure not owned by PRASA are referred to as non-PRASA in this plan. In addition to infrastructure challenges, Puerto Rico faces degraded drinking water sources due to wastewater, stormwater, and industrial and agricultural contamination. Many of these issues are even more severe in rural or disadvantaged areas. Furthermore, drinking water sources in rural areas are often improperly protected from contamination, which compromises drinking water quality and safety.

Exacerbating these problems is the limited availability of certified operators and maintenance crews, monitoring and enforcement officials, and general emergency preparedness (see figure on the next page). As with many of Puerto Rico's utilities, financial sustainability has been a daunting problem for PRASA, non-PRASA systems, and stormwater system and flood control operators. For PRASA, lost revenue due to leakage, malfunctioning or incomplete metering, illegal connections to the water system, and delinquency rates have contributed to financial challenges. For non-PRASA systems, capacity and knowledge for both long-term fiscal planning and rate setting and collection are limited. This has led to financial instability and constrained operations that have influenced the quality of drinking water and wastewater services. Finally, the capacity of flood control infrastructure has been limited by high rates of sedimentation, and many flood control assets have been undermaintained and were designed to standards that are now outdated. A focus on the resilience of water infrastructure and water management is important, particularly with more-frequent and more-intense precipitation events,

## Restoring PRASA services required months of repairs



droughts, and other stressors continuing to test water systems across Puerto Rico.

### Taking action

Looking ahead, the Government of Puerto Rico will redesign its water systems to be more reliable, safer, and more resilient in the face of future disasters, climate and population-related stressors, and extreme weather. In the short term, PRASA, municipalities, DNER, and the managers of other water systems will need the liquidity and financial management capabilities, as well as the workforce, to handle the potentially large influx of capital as they finance repairs and improvements. In the long term, PRASA will address pre-hurricane contamination, bolster enforcement, and ensure that systems are properly designed, monitored, protected, and maintained so that Puerto Rico's water systems become more efficient and fiscally sustainable. The Government of Puerto Rico will develop a professional workforce to help ensure that operations and maintenance are better managed and that service is safe, reliable, and equitable. Rebuilding and redesigning infrastructure to be more resilient and improving

planning, processes, and mitigation measures will also help address climate-related consequences.

### **Diversify energy sources, enhance emergency protocols, and harden water infrastructure to keep services flowing during disasters**

To keep essential water facilities and assets up and running in emergencies, PRASA and non-PRASA systems will devise ways to diversify energy sources and use more off-grid renewable energy and storage as permanent power sources. For PRASA, this includes installing distributed solar power generation and battery storage, increasing the use of hydropower by optimizing PREPA hydro facilities, maintaining a reserve inventory of solar panels, using biosolids as an energy source, using modular reactors, and developing resilient microgrids (WTR 3). PRASA will reduce its use of electricity through demand management strategies. Non-PRASA systems propose to increase off-grid renewable energy, upgrade electrical systems, and right-size and stockpile backup generators (WTR 12).

PRASA will implement new emergency management protocols to improve its capacity to deliver resilient services to hospitals, schools, and other critical customers during emergencies (WTR 30). In the long term, PRASA will relocate or redesign assets that are in flood zones or in vulnerable remote locations to meet the best management standards and to improve their resiliency to enable continuous operation during extreme storms (WTR 20). This will include priority assets that were damaged during the hurricanes, such as the Dorado Wastewater Treatment Plant and wastewater infrastructure in Utuado.

### **Improve fiscal planning and asset management to enhance sustainability and service provision**

For PRASA to become financially sustainable, it will develop plans to divest assets, reduce operating costs and customer delinquencies, enhance revenue collection through public-private partnerships, and explore alternative pricing mechanisms (WTR 8). In addition, to cut down on the long-term life cycle costs of PRASA's assets, an asset needs assessment and asset management program will be implemented for PRASA's drinking water and wastewater systems, with a particular emphasis on vulnerable assets and large-diameter pipes (WTR 7). These initiatives to improve operations and finances will need to be mirrored in non-PRASA water systems (WTR 15, WTR 16).

### **Make PRASA's drinking water service more efficient and reliable**

PRASA will repair or replace drinking water infrastructure to address both hurricane damage and pre-hurricane deficiencies in ways that enhance resilience (WTR 1). It will make operations and distribution more efficient by increasing the use of smart metering, operational sensors, data, and tools for real-time monitoring and situational awareness; upgrading operational control systems; and enhancing the use of optimization methods to improve quantity and quality of service (WTR 2). To more easily transfer drinking water among service zones, PRASA will improve the interconnections between them (WTR 4). Finally, the agency will upgrade water treatment plants in vulnerable service zones by improving water treatment and storage capacity to better handle high turbidity—cloudiness that is a key measurement of water quality—caused by heavy rains (WTR 5).

### **Build PRASA's wastewater systems for the future, and educate residents to help keep them clean**

PRASA will repair, replace, or improve wastewater treatment plants and sanitary sewer collection systems to maintain regulatory standards in a manner that anticipates future capacity needs and follows industry best practices (WTR 11). To keep wastewater systems flowing, the agency aims to enhance routine cleaning and inspection and educate Puerto Ricans about the proper disposal of fats, oil, grease, and other unauthorized releases into sanitary sewers (WTR 10). PRASA will cut the disposal cost of sludge and other treatment byproducts by reusing them, including selling them for use in the agricultural, industrial, or energy sectors (WTR 13).

### **Improve safety and reliability of non-PRASA drinking water and wastewater systems**

To improve the reliability and safety of non-PRASA drinking water systems, operators will repair or replace existing assets that are damaged or degraded, improve treatment and monitoring, and expand contingency plans to include future demand, climate-related effects, and emergencies (WTR 15). In remote areas with even smaller nonregulated drinking water systems, operators will develop equitable and resilient solutions by better coordinating nongovernmental organization and municipal efforts to support the provision of safe drinking water in these areas (WTR 14). To prevent exposure to raw sewage and contamination of drinking water sources, these operators will work with a range of partners to develop an institution that builds technical capacity and collaboration among practitioners and to implement septic tank design standards and best maintenance

practices (WTR 17). To build self-sufficiency and capacity, non-PRASA systems will improve communication and collaboration, including expanding a “circuit rider” program that provides technical assistance, education, and training, as well as conducting outreach to communities (WTR 16). To contribute to the health and welfare of disadvantaged communities, PRASA will explore opportunities for expanding service into unconnected areas that are vulnerable to environmental and public health hazards associated with drinking water and wastewater systems (WTR 6).

### **Develop drinking water supply sources that are sustainable and safeguarded from contamination**

To ensure that Puerto Rico has a drinking water supply far into the future, PRASA will work with the Puerto Rico Environmental Quality Board and the U.S. Environmental Protection Agency (EPA) to strengthen the redundancy and diversification of drinking water sources, including the use of groundwater and greywater, as well as water reuse (WTR 29). Publicizing measures to protect drinking water, enforce land use restrictions, and remediate contaminated areas can help protect drinking water sources from residential, agricultural, and industrial waste (WTR 28). DNER, working with the Environmental Quality Board and federal partners, will rehabilitate and protect groundwater systems from saltwater intrusion, contamination, and over-extraction (WTR 27).

### **Improve stormwater systems to reduce urban flooding and contaminated runoff**

The Government of Puerto Rico will work with DNER and municipalities to improve stormwater infrastructure design standards; retrofit assets to catch, reserve, and filter stormwater runoff; enhance stormwater permitting processes and land use regulations to implement green infrastructure; right-size system capacity, including conveyances and pumping stations; and implement public outreach and education programs. These efforts will reduce urban nuisance flooding, curb erosion and sedimentation, and mitigate the discharge of contaminated stormwater runoff into surface water bodies (WTR 19).

To manage stormwater systems in a more efficient way, municipal operators will invest in cleaning, monitoring, maintenance, and assessment, including comprehensive and routine asset mapping, assessment of system capacity and condition, removal of debris and blockages, and repair of damaged infrastructure and assets (WTR 18). Other plans include centralizing stormwater system support and management at the state level. The Government of Puerto Rico will



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of **water sector strategies** and details about cost and funding in **Chapter 12** of this plan

support building a workforce of stormwater practitioners, streamlining permitting processes, and enhancing technical capacity, community outreach, and best management practices (WTR 21).

### **Enhance the resilience of flood control infrastructure and management to current and future events**

To upgrade flood control protection, the owners of flood control assets will be requested to evaluate, repair, and improve the performance and resilience of dams, levees, channels, and water control structures. In addition, the plan includes an analysis of the tradeoffs of existing and proposed levees and channels with natural infrastructure alternatives; implement comprehensive monitoring and maintenance programs; and consider the influence of increased flooding from extreme weather (WTR 23). To reduce the need for dredging and ensure the performance of flood control systems, PRASA, PREPA, and other water management and land use entities will implement and enforce sediment control plans and sediment reduction measures (e.g., sluicing and sediment traps) (WTR 24).

In terms of governance, Government of Puerto Rico agencies will lead an effort to transfer, consolidate, and streamline the ownership and management of dams and other flood control infrastructure (WTR 25). PRASA, PREPA, and DNER will also upgrade reservoir management rules to improve the balance among current water management objectives—including drinking water supply, flood control, and hydroelectric generation—and implement risk-informed dam safety programs (WTR 22).

### **Use outreach to improve conservation and emergency preparedness, and engage the public in developing creative approaches and innovative projects**

PRASA will improve communication, education, and outreach to customers on conservation and emergency preparedness strategies, as well as water and wastewater system planning, performance, and investments, to foster strong relationships and garner trust (WTR 26). The agency will engage the public in a “Rebuild by Design” competition led by the Government of Puerto Rico (CPCB 10) to spur innovative resilience projects that are collaboratively developed by government agencies, community members, civic leaders, and internationally recognized design and engineering firms (WTR 9). Just as a similar effort stimulated creative resilience strategies in the aftermath of Hurricane Sandy, this effort will help develop innovative solutions to enhance resilience and address vulnerabilities exposed by Hurricanes Irma and Maria.

Workers onboard a  
freighter in San Juan.

FEMA



Physical  
capital

## REBUILD AND STRENGTHEN MARITIME, SURFACE, AND AIR TRANSPORTATION

**Transform maritime, surface, and air transportation into flexible and reliable systems that move people and goods to ensure economic continuity and facilitate disaster response**

### Issues to address

Although Puerto Rico has numerous small ports and airports, the Port of San Juan and San Juan Luis Muñoz Marín International Airport receive the vast majority of shipments and air traffic. Both suffered significant damage from the hurricanes and, in the immediate aftermath, faced power outages and bottlenecks resulting from the competing needs of daily operations and the emergency response. However, the hurricanes merely worsened existing systemic problems in Puerto Rico's transportation sector. Puerto Rico Ports Authority (PRPA), the primary port operator, struggles to maintain and improve its airports and seaports because of deteriorating finances. In addition, having multiple owners and operators of other port facilities contributes to a lack of coordination among ports.

Similarly, finances are challenging for Puerto Rico Highway and Transportation Authority (PRHTA), which funds and oversees major road and bridge projects. Major roads were in only fair condition before the hurricanes, and 80 percent of Puerto Rico's bridges were in fair or



Damage at the port in Mayaguez

H50AC

poor condition—an issue that hurricane damage compounded. About half of the municipalities surveyed identified road repair, maintenance, and other transportation infrastructure improvements as their number one priority for long-term investment in their jurisdiction.

Puerto Ricans are heavily dependent on their vehicles. Public transportation is generally considered inadequate, and ridership has been declining over the past decade. Adding to these challenges is a lack of clarity, in many cases, over which agency owns particular assets. In the absence of established legal ownership, it may be difficult to determine eligibility for funding needed to make repairs and investments in resilience.

### Taking action

The transportation sector plays an important role in any economy—whether for shipping and receiving goods or getting residents to work, school, appointments, and events. To better serve all these purposes, the Government of Puerto Rico will seize this opportunity to develop a more robust multi-modal (maritime, surface, and air) transportation sector that is well-maintained, safe, efficient, and resilient to future disasters.

### Upgrade ports and consolidate ownership to improve emergency response and attract new maritime business

Ports authorities, in collaboration with private operators, will repair damage to ports and ferry terminals so they are at their full pre-hurricane capacity (TXN 12) and make upgrades that enhance their resilience to storms and sea level rise (TXN 22) (see tourism ports in the figure on the next page). To ensure that backup capacity exists if the Port of San Juan is damaged, PRPA and other port operators will further develop an existing seaport (e.g., Ponce) to provide redundant capacity through the use of public-private partnerships (TXN 10). Reevaluating the Maritime Transportation System Recovery Plan will help the ports take advantage of lessons learned during the hurricane response, such as pre-positioning reserve capacities and assets to better respond to an emergency, establishing an integrated operations center, developing a communications protocol for first responders during a disaster, and implementing pre-hurricane protection measures in an integrated fashion to protect critical resources (TXN 13).

To better manage the maritime transportation system as a whole and to make ports more attractive to maritime businesses and investors, input from industry experts indicates the need for consolidating ownership and oversight of the nine main ports (TXN 15). In addition to being a multi-purpose port, the Port of Ponce will be a future regional

## San Juan Tourism Ports



### PIER 1

In-transit cruise ships and limited passenger capacity turnaround port. Also used by the military.



### PIER 2

Operated by Maritime Transportation Authority for local ferry service.

### PIER 3

In-transit cruise ships. Royal Caribbean has preferential use.



### PIER 4

In-transit cruise ships and turnaround port. Carnival and its subsidiaries have preferential use.



### PANAMERICANOS I (EAST) & II (WEST) PIERS

In-transit cruise ships and turnaround port. Royal Caribbean and preferred use for subsidiaries.

### NAVY FRONTIER

No turnaround port. In-transit only for mega yachts.

Photos by Sgt. Josue Rivera, Kenneth Wilsey, pyzata | Adobe Stock.

transshipment hub for cargo traveling between South and North America, with shipping agencies incentivized to use it through reduced taxes or a government subsidy (TXN 14).

### Prioritize repairs to roads and bridges, and extend three key highways

PRHTA will repair damaged roads and bridges and restore them to pre-hurricane functionality to ensure the mobility of people, goods, and service providers. Within four years, this initiative will replace missing road signs and inoperable traffic signals and repair or replace collapsed or weakened bridges (TXN 16). PRHTA will harden, re-engineer, or relocate infrastructure in high-risk areas to make it more resilient in future disasters, with a focus on the most cost-effective projects (TXN 2).

Under a new “fix it first” approach, PRHTA will prioritize road maintenance and repair projects over new or expanded infrastructure. This approach improves roadway conditions and makes safety or operational improvements, and it prioritizes projects based on their cost-effectiveness (TXN 5). Projects to extend PR-5 and PR-22 and to complete PR-10, potentially through the use of public private partnerships, are included as surface transportation projects to improve mobility, safety, access, resilience, and emergency response and to complete Puerto Rico’s strategic highway network (TXN 19, TXN 20, TXN 21).

To better manage transportation infrastructure, public agencies will develop infrastructure asset management programs to inventory their assets and track their condition to improve maintenance,

repair, and rehabilitation (TXN 11). In support of this effort, PRHTA has submitted an initial Asset Management Plan to the Federal Highway Administration, which focuses on improved infrastructure conditions and cost-effective asset management. Related to this effort, PRHTA will review its standards on road and bridge design. This will involve updates to include more-innovative standards on roadway marking, lighting, drainage, and signs and signals (including using solar to power them) and better enforcement of both new and existing standards (TXN 1).

In addition, PRHTA will develop an Intelligent Transportation System so that transportation operations across Puerto Rico can provide real-time traveler information, divert traffic away from crashes, clear crashes more quickly, and reduce the possibility of secondary crashes after an initial incident (TXN 9).

### **Develop new mobility options to supplement improvements to bus service**

The Puerto Rico Metropolitan Bus Authority will make bus service more reliable through transit signal priority (which gives buses additional time to cross a signalized intersection) and dedicated bus lanes, as well as bus stops that provide real-time arrival information and use smart card fare media (TXN 8). Developing additional options—such as ride-hailing, ride-sharing, expanded “publico” (jitney) service, inter-city bus service, bike- or scooter-sharing, and peer-to-peer car-sharing—will address the dearth of other mobility services, particularly outside of San Juan (TXN 7). In addition, PRHTA proposes two new high-capacity transit services—likely bus rapid transit—to give travelers another way to reach the San Juan airport (TXN 17), which is currently served by just three bus routes, and to give the 130,000 residents of Caguas a public transit option to reach nearby San Juan (TXN 18).

### **Upgrade San Juan and Aguadilla airports to boost resilience and Porta del Sol tourism**

To ensure that the San Juan airport can operate at full capacity both during normal operations and in an emergency, PRPA and airport operator Aerostar will repair remaining damage to the facilities (TXN 4), update the all-airports emergency plan to take advantage of lessons learned from the hurricanes, and further

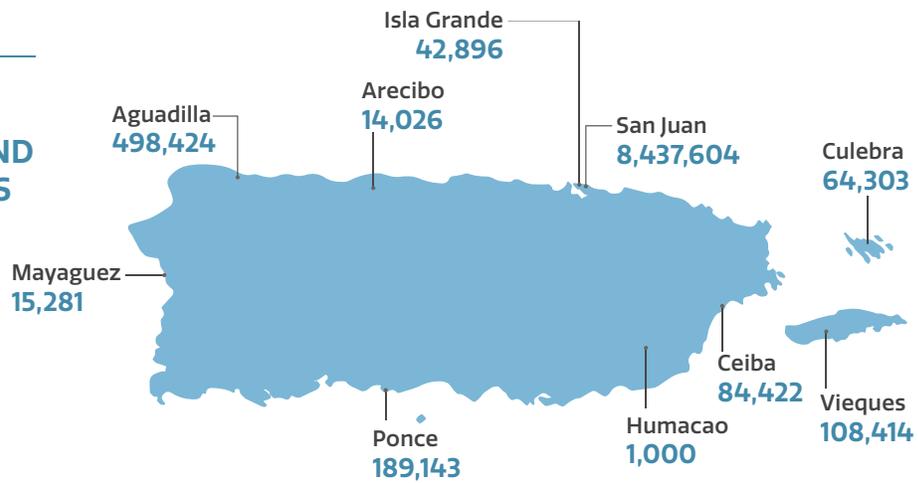


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of **transportation strategies** and details about cost and funding in **Chapter 12** of this plan

## AIRPORTS

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### 2017 TOTAL PASSENGER ARRIVALS AND DEPARTURES



develop a coordinated disaster recovery plan for the various airports across Puerto Rico (TXN 6).

In addition, PRPA proposes to expand and upgrade Rafael Hernández Airport in Aguadilla, including upgrading the runway, taxiways, and terminals. These actions would increase Puerto Rico’s overall capacity for air traffic and boost tourism in Porta del Sol, a region with beautiful beaches that are currently difficult to reach (TXN 3).

A cruise ship docks at a pier in Old San Juan.  
H5OAC



A home destroyed by Hurricane Maria is rebuilt in Maricao.

FEMA/Michael Medina-Latorre



## REPAIR AND REBUILD RESILIENT RESIDENTIAL HOUSING

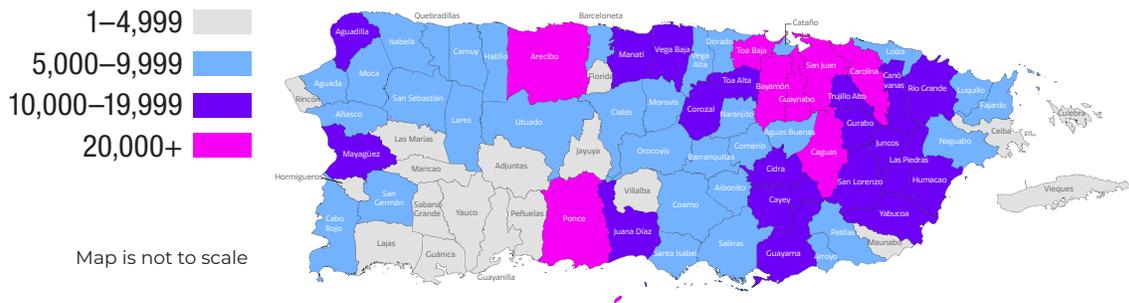
**Repair and rebuild safe and affordable housing to create a better and more resilient physical environment for Puerto Rico's citizens**

### Issues to address

Puerto Rico's housing sector was another sector that was hit hard by the hurricanes: Approximately 90 percent of the Island's nearly 1.23 million households applied for immediate relief and housing assistance from FEMA, with 78 percent of these indicating damage to their structure or personal property (see figure on the next page). Before the hurricanes, the housing market was experiencing significant challenges. As residents have moved away, home values have plunged, dropping 18 percent in Puerto Rico since 2010, while values in the United States have risen 35 percent. As Puerto Rico's economy has faltered, mortgage delinquencies have been increasing steadily for many years. Income disruptions caused by the hurricanes exacerbated this problem, and many households have not caught up on their payments. This has also resulted in an increase in applications for affordable rental housing units, which has not been met with an increase in supply, leading to long waiting lists. Supply problems are exacerbated by the fact that

## Damage to real and personal property, based on FEMA registrants for Individual Assistance

Number of Individual Assistance registrants indicating damage to structures or personal property



construction costs in Puerto Rico are much higher than the average costs in the continental United States.

Given the absence of a culture of code compliance, unsafe residential housing has proliferated. An estimated 55 percent of residential and commercial structures were built without permits, and these buildings are referred to as “informal housing.” These structures were often built on land not owned by the resident or builder. Additionally, proper construction techniques may not have been followed, and the structures may be in areas vulnerable to natural hazard risks, such as flooding, high winds, earthquakes, and landslides.

A compounding challenge is that approximately 70 percent of homes lack homeowner’s insurance that can help with rebuilding after a crisis, leaving the vast majority of Puerto Rican families dependent on disaster aid. In addition, recent estimates suggest that only about 70 percent of property titles are recorded in the land registry, and many of those are likely out of date. The lack of clear title and accurate property records makes collecting property taxes difficult for Puerto Rico’s already underfunded government agencies. Unclear legal ownership of properties also complicates applications for federal aid. An additional complicating factor is the address system, which needs to be improved. In its current state, it makes it difficult for emergency responders and service providers to locate homes and businesses.

## Taking action

The scale of the hurricane damage presents the recovery effort with an opportunity to address some of the challenges just presented. It is an opportunity to transform the housing sector to be safe, resilient, and forward-looking, particularly for those living in vulnerable circumstances. Puerto Rico has a clear vision for its housing sector: provide residents with safe and affordable places to live; retrofit homes to make them less vulnerable to damage; relocate households from the most dangerous areas; increase insurance coverage to help rebuild structures in the event of a disaster; and clarify ownership records to bring the informal housing into the formal sector, which would facilitate government service delivery and collection of property taxes.

### **Make buildings safe and affordable for residents**

Puerto Rico's Department of Housing and the municipalities will use Community Development Block Grant - Disaster Recovery assistance and other funding sources to repair or rebuild substantially damaged owner-occupied homes to code if the structures can be made reasonably safe from natural hazard risks at reasonable costs or relocate the households to safer locations. Households below a specified income limit would be eligible for this type of assistance. Rebuilding and relocation will emphasize safe, resilient, affordable communities with access to good schools, jobs, transit, and health care (HOU 1). In addition, the responsible authorities will inspect homes in high-risk areas without substantial damage to determine the specific risks each structure faces, and then develop strategies to determine which homeowners will be offered relocation and which structures can be secured through mitigation (HOU 3, HOU 4).

Similarly, the Puerto Rico Public Housing Administration and the Puerto Rico Housing Finance Authority will use available funding to repair damaged subsidized housing units and move vulnerable structures from high-risk areas, and make structures less vulnerable to disaster (HOU 2). This effort will also include updates to accommodate people with or without disabilities (such as people with access and functional needs, older adults, and veterans). Given the long waiting lists for public housing and Section 8 units, communities will be encouraged to adopt programs to provide more public or subsidized rental and homeless housing for lower-income households

and those with access and functional needs, older adults, veterans, and others (HOU 7).

Government of Puerto Rico agencies will partner with the municipalities to rehabilitate, redevelop, or demolish abandoned and blighted properties (HOU 10). First, an inventory will distinguish vacant properties from currently unoccupied vacation properties, and then strategies will be developed to quickly gain legal ownership of the property and implement buyout programs. Through a community engagement process, strategies to rehabilitate properties for residential and community uses will be developed, including future homes, affordable rental housing, rent-to-own programs, community centers, clinics, and business incubators.

The number of homeowners whose mortgage payments are delinquent or severely delinquent increased after the hurricanes and remains relatively high. The Federal Housing Administration issued a foreclosure moratorium after the hurricanes, but that is set to expire August 16, 2018, and lenders are unsure how many homeowners will resume payments. To address delinquent mortgages, one proposal is to provide homeowners with financial counseling and education campaigns about options (such as loan modifications) available from lenders. Some homeowners who are capable of sustaining mortgage payments would be provided with financial assistance to bring their mortgage payments up to date (HOU 9).

To help homeowners recover and to lower the reliance on federal and state aid after future disasters, the Office of the Commissioner of Insurance will work with federal and private partners to increase the number of properties with wind and flood insurance by conducting education and outreach campaigns about the coverages and costs, studying whether other types of low-cost products should be developed, and providing financial assistance to low-income households to help reduce premium costs (HOU 8).

### **Restructuring the housing sector**

Creating a central source of data related to the housing stock, including title, permits, land use, property tax, and location, is crucial to the recovery effort (HOU 5). This information can support planning, relocation, and mitigation efforts needed to make these communities safer and more resilient in future disasters. It can also contribute to the development of emergency plans and recovery efforts.

Improving compliance with the building permit process and adopting and enforcing consistent land-use plans are key to a more resilient housing sector. Updated land-use plans will better align new



## **SEE THE FULL PORTFOLIO**

**of housing strategies and details about cost and funding in Chapter 12 of this plan**

construction and rehabilitation of existing homes away from disaster risk and near jobs, schools, health care, and transportation. The responsible authorities, including the Puerto Rico Planning Board, will increase their capacity to enforce both land-use plans and building permit requirements at the state and municipal level, while also working to reduce costs and delays in the building permit process (HOU 6).

The Government of Puerto Rico will implement a process to increase the proportion of properties that are properly titled and registered with the aid of a consistent process for determining title, including the acceptable types of documentation. To get owners on board, nonprofits and nongovernmental organizations will support municipalities in engaging with homeowners to describe the title registration process, the importance and benefits of obtaining a clear property title, and the potential downsides for failure to establish a title and register the property (HOU 12). This will lead to faster payouts of disaster assistance funds, more-effective distribution of social services to targeted populations, reduced property disputes, and a more accurate and precise collection of property taxes.

To improve emergency response, mail delivery, and provision of other services on a government-wide basis, government agencies have been directed to work with municipalities to improve and standardize the address system, install new street signs and address numbers, and update government databases with new property addresses (HOU 11).

A student reads a book after receiving a donated bag of school supplies.

FEMA/Eduardo Martinez



## TRANSFORM THE EDUCATION SYSTEM

**Transform the education system to produce competitive graduates with knowledge and skills needed to adapt to changes in the economy, environment, and technology**

### Issues to address

Education is a cornerstone of Puerto Rico's economy, society, and political systems. Its purpose is to build and sustain the knowledge and skills needed to ensure that individuals, communities, and key institutions can adapt to changes in the world economy, the environment, and technology. Education also plays a role in helping individuals and communities respond to social and cultural changes while maintaining Puerto Rico's unique identity. Yet, Puerto Rico's education system was impacted by the 2017 hurricanes and has for years been weakened by economic crisis, sharp declines in the student population, and governance structures that limit the ability to use community, nonprofit, and business resources most effectively. In fact, 92 percent of municipalities reported that enrollment in public schools had decreased as a result of the disaster.

The Government of Puerto Rico now has the opportunity not only to repair hurricane-related damage but also to fundamentally transform its education system in a way that improves student outcomes; supports the development of children, youth, and adults; and supports

the government’s vision of economic and social development moving forward.

## Taking action

### **Upgrade school infrastructure to support resilience and sustainability**

Many schools suffered significant hurricane-related damage, and some had to be permanently closed. The Government of Puerto Rico proposes that school infrastructure be repaired and upgraded in ways that create thriving environments for student-directed learning and provide collaborative workspaces where students and teachers can share creative, innovative, and developmentally appropriate PreK–12 teaching and learning experiences for PRDE, municipal, and private nonprofit schools (EDU 11, EDU 13). Ensuring that all schools meet current building safety codes means they will be more resilient against future storms or other disasters. Supporting whole community standards and all-access needs (e.g., compliance with the Americans with Disabilities Act) and implementing such practices as using green infrastructure to control runoff can be part of broader efforts to create “storm-smart” schools that adhere to an “Education Is Resilient” approach. Because the extent of damage to private nonprofit school facilities is not known, FEMA’s Education sector is currently conducting a landscape analysis of the private nonprofit infrastructure and will follow with outreach to these schools on eligibility for FEMA Public Assistance funding and other available recovery assistance funding (EDU 13).

Many UPR facilities were damaged by the hurricanes, so UPR will work in collaboration with the private sector to repair and upgrade critical university facilities. In addition, the gradual decline in its student population prior to the 2017 hurricanes has also had a major impact on the university system. To account for this in the rebuilding process, UPR will include an analysis to determine how campus consolidation could best support the students, meet the educational goals of the university system, and ensure the system’s financial stability (EDU 12).

### **Increase K–12 access to vocational, technical, and career education, and strengthen school-to-work transitions**

As the Government of Puerto Rico pushes toward fostering new social and economic opportunities, students need to be well prepared to take advantage of this landscape. In partnership with local schools and private industry, PRDE will launch a one-year pilot program



### **SEE THE FULL PORTFOLIO**

of **education system strategies** and details about **cost and funding** in Chapter 12 of this plan

to expand and update K-12 vocational programs in Puerto Rico to align with changing workforce needs, foster entrepreneurship, and grow economic sectors (EDU 6). Those growth sectors include manufacturing (particularly biopharmaceuticals), finance, renewable energy, construction, hospitality, and health care. The pilot, which will serve 280 to 560 students, can be scaled up over a ten-year period to reach as many 22,000 students. This program will be implemented in tandem with broader efforts to strengthen the workforce development system—discussed throughout the plan—to ensure that students are exposed to career pathways and have on-the-job learning opportunities, such as apprenticeships.

### **Promote preschool and out-of-school learning opportunities**

Extensive research shows the benefits of high-quality preschool and early childhood programs—for example, parenting programs for families and early childhood care settings in the first five years before formal schooling. Such programs support whole child well-being and provide an important foundation that improves children’s academic, social, and health development, as well as increased earning opportunities and other outcomes for parents. These programs also can support better economic outcomes for students later in life. Puerto Rico’s Administration for the Care and Integral Development of Children will lead a landscape analysis of existing needs and resources and propose strategies for strengthening available resources in this area (EDU 3).

Expanding access to after-school, summer, and online learning opportunities can also provide benefits to Puerto Rico’s students. The approaches can increase access to high-quality educational content for students regardless of their geographic location and help address any learning loss resulting from hurricane-related school closures. PRDE will partner with professional development providers to create a repository of online learning resources aligned with the scope and sequence of the curriculum so that students’ education is not disrupted during temporary school closures (EDU 7). Such an online repository—offering free, open, English- and Spanish-language educational resources appropriate for various subject areas, grade levels, and technology platforms (e.g., desktop, laptop, tablet, smartphone)—can help schools and teachers provide “emergency instruction” in the event of school closures lasting more than two weeks. The development of government-sponsored wi-fi hot spots in the municipalities’ public buildings, parks, town squares, and libraries (CIT 19) and in public housing (CIT 26), as well as plans to expand broadband infrastructure

throughout Puerto Rico (CIT 21, CIT 22, CIT 25), will be critical to ensure the success of online learning efforts.

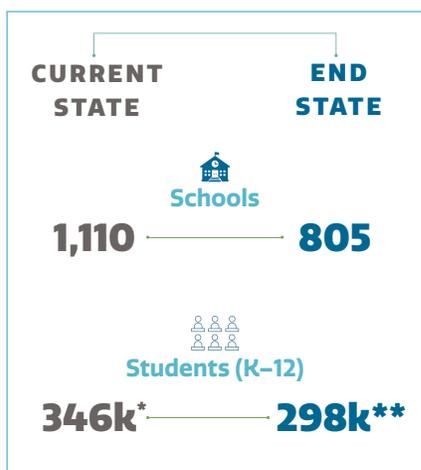
In addition to online learning programs, PRDE will expand existing and implement new summer and after-school learning programs to address post-hurricane learning loss caused by prolonged school closures (EDU 1). Beyond academic challenges, the hurricanes negatively impacted students' mental and physical health, and ongoing changes in the school system might cause students further confusion and distress. Out-of-school learning programs are another way to provide physical and mental health services to address these needs. Such programs can also provide opportunities to link students with vocational, technical, or career education opportunities.

### Strengthen systems to support new education reform package

Finally, significant transformation of Puerto Rico's educational system has already been initiated by Puerto Rico's Education Reform Bill. The bill features (among other things) decentralization into seven local educational agencies (see map on the next page), increased parental choice, and increased focus on school-to-work transitions.

School closure and similar decisions are complicated and must balance schools' links to communities and student well-being with post-hurricane enrollment decreases driven by students leaving Puerto Rico. Completing development of a longitudinal data system will be critical to supporting timely and evidence-driven decisionmaking about school closures and resource allocation, as well as targeted professional development and other operational decisions and

education policymaking (EDU 2). Planned system enhancements include increasing user-friendliness and linking K-12 data to postsecondary outcomes and workforce data to better manage school-to-work transitions. PRDE will provide training on how to integrate data into operations and decisionmaking.



\*Enrolled student count as of August 2017

\*\*Projected number of students for 2018-2019 school year

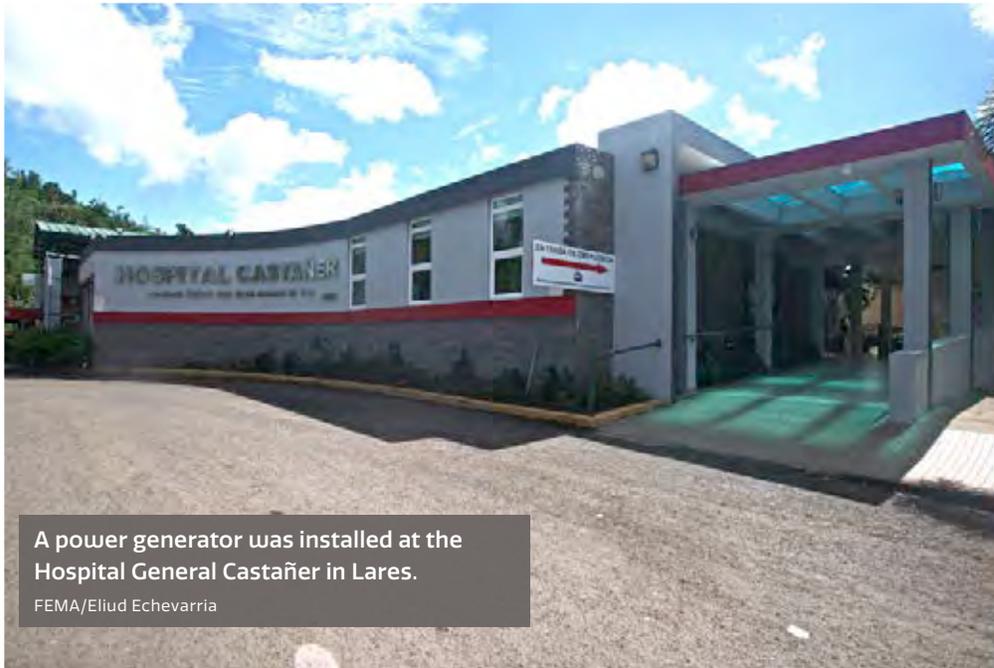
In addition, schools and education systems both influence and are influenced by the communities in which they are located. Inputs from stakeholders will be key to help PRDE and others make future-facing decisions that better align investments in schools (e.g., infrastructure updates, teacher assignments, location of school-to-work programs) with local economic, infrastructure, and community characteristics (EDU 4). To address equity issues, PRDE, local schools, and their partners will review how funds are allocated to schools and identify any funding gaps or regional or municipal inequities. This information can inform whether and how budgeting processes can be redesigned to ensure an equitable match between student needs and resource allocation (EDU 5).

New professional development and talent management systems will be needed to ensure that PRDE’s administrator and teacher workforce is prepared for the performance requirements of 21st-century approaches to learning (EDU 9), that the system has strong leadership in regional superintendent’s offices (EDU 8), and that school directors are well-positioned to function with the greater autonomy given them under the Governor’s new education reform plan. Finally, PRDE will initiate a program that will educate parents and guardians (especially in disadvantaged communities) about the options provided to them through new school choice programs (EDU 10).

### Local educational agencies proposed in the Education Reform Bill



Fewer schools and students are projected for 2018–2019 school year



## REBUILD AND ENHANCE HEALTH AND SOCIAL SERVICE INFRASTRUCTURE AND REGIONAL HEALTH CARE NETWORKS

Rebuild and enhance health and social service infrastructure and regional health care networks to ensure that they provide reliable and equitable access to health and social services and health-promoting communities, including an efficient and effective response to public health crises and other future disasters

### Issues to address

Communities in Puerto Rico faced widespread and persistent challenges with health and social services before the hurricanes, partly because of a fragmented spectrum of health and social services systems, varied access to these services by region, shortages in some health specialties, and differential access to health-promoting

environments. Low Medicaid and Medicare reimbursement rates combined with cost-of-living challenges have put a downward pressure on payments for providers. There is limited access to preventive programs, including psychosocial support, particularly for low-income Puerto Ricans. Exposure to environmental hazards in Puerto Rico—which has 23 contaminated sites that the EPA lists as candidates for Superfund cleanup—has been correlated with a high prevalence of childhood asthma, preterm births, and water- and vector-borne disease outbreaks. Unenforced building codes, informal housing, and storm-related hazards (e.g., mold) also present environmental hazards to residents.

The hurricanes exacerbated these challenges by making health and social services harder to obtain and delaying or interrupting care, which contributed to deaths after the hurricanes. Damage to buildings and electrical, water, and communications infrastructure closed medical and social service facilities and affected health and social service agencies' ability to operate. In some municipalities, federally qualified health centers (i.e., community-based care providers that receive funds from the Health Resources & Services Administration Health Center Program to provide primary care services in underserved areas) were the only open and operational places where emergency and acute health care services were being provided around the clock. In fact, nearly half of municipalities surveyed reported that the hurricanes had damaged health centers, limited access to

**A nurse attends to a young patient at a children's hospital in San Juan after the Island was hit by Hurricane Maria.**

REUTERS/Alvin Baez



health services, or made them inoperable. Municipalities also reported that access to some health services, including dialysis centers and highly specialized medical care, was available in less than half of jurisdictions after the hurricane.

Even at facilities that remained open, services were compromised by intermittent access to power and water, lack of access to client records, and the absence of staff who were unable to come to work. Residents' mental health suffered, and cleanup and other activities exposed them to various environmental hazards after the hurricanes.

More than one-third of municipalities identified mosquito-borne illnesses as the main threat to public health in their jurisdiction, followed by threats to environmental health from contaminated or stagnant water, spikes in mental health conditions, and cardiovascular and respiratory diseases. One-third of municipalities reported that these threats to public health have worsened since the hurricanes, and one-third reported that the threats have been somewhat controlled in certain areas, although gains appear fragile.

Ensuring that residents can live healthy, productive lives in Puerto Rico is essential to a robust economic recovery. To strengthen and expand access to health care and promote healthful living, the Government of Puerto Rico will need such tools as provider retention programs, expanded licensure for advanced practice clinicians, and the ability to utilize nontraditional health providers to promote healthy lifestyles. This effort will also require building resilience in the health and social service systems through emergency preparedness measures, such as building capacity to use administrative and financial waivers that support access and interoperability during and after disasters, and strengthening regional health networks. Greater flexibility in nutrition assistance and social services will provide support for Puerto Ricans in the most vulnerable circumstances. Parallel infrastructure and economic developments will be essential to the ultimate success of these efforts.

## **Taking action**

### **Build health and social service system capacity**

One critical challenge exposed by the hurricanes is the fragility of the health and social system, including medical, behavioral, and environmental services. The Government of Puerto Rico will build resilience to ensure flexibility and agility in response and long-term recovery. This includes the repair and rebuilding of hospitals and primary care centers. Health and social services require reliable

electrical systems to function, so efforts to create a hardened electrical grid supported by alternative energy generators will be required to keep these services available in a future disaster. The government also proposes robust, resilient communications initiatives that will connect community clinics across Puerto Rico using a broad range of technologies—including mobile and telehealth—to ensure real-time access to clinical data from any access point and improve clinical care delivery and adaptation to disaster impacts (HSS 9, CIT 29). The Government of Puerto Rico will develop flex-funding for critical social service centers, such as domestic violence and homeless shelters and child- and elder-care facilities, in order for these centers to tap into additional financial resources during a long-term response and recovery period (HSS 19). Another initiative will implement temporary waivers for a range of emergency health and social service needs (e.g., prescription coverage, mortuary services) to ensure uninterrupted access to care post-disaster and prevent potential delays in time-sensitive care and nutrition support (HSS 31). Finally, the Government of Puerto Rico will build resilience through upgrades and enhancements to the 911 service (CIT 3), a shift toward a regionally integrated approach for emergency preparedness (HSS 22), improved systems for emergency medical stockpiles and supplies (HSS 23, HSS 26), and other initiatives.

Health and social services also must meet the day-to-day needs of Puerto Rico's citizens at all stages of life. To meet these needs, the Government of Puerto Rico will strengthen the backbone of the system by improving the standard of care and increasing access to services. Improving provider retention and maintaining high-quality care means reconsidering the current Medicaid and Medicare reimbursement rates to address the financial viability of the health care system at large and to actively analyze the links between health expenditures and outcomes in ways that are transparent and useable by payers and providers (HSS 7). To support a full array of primary care services and chronic disease prevention and management, primary care options will be expanded by the Government of Puerto Rico, and the Puerto Rico Department of Health specifically; this will enhance the existing network of community health centers and augment relevant primary care supports, including mobile care clinic options, increased training, and supplies (HSS 12). To improve mental health services, the Government of Puerto Rico will expand care for psychological trauma and chronic stress, increase promotion of and referral to existing services (HSS 10), and encourage greater uptake of evidence-based practices to promote health in other settings, such as community centers and schools (HSS 15). These will be paired with a comprehensive suicide prevention campaign promoting wellness

and self-care to ensure that those at risk are identified and referred to appropriate services (HSS 28). Another initiative aims to increase access to care through telehealth options (HSS 9) in conjunction with broader efforts to improve data integration and digitization of health and related information (HSS 14).

However, this expansion of services is possible only if there are doctors and other health providers to support it. Given the shortages in some health specialties and concerns about personnel moving away, the Government of Puerto Rico will expand incentives to retain and train the health care and public health workforce through such initiatives as loan repayment programs and policies that allow nurse practitioners and physician assistants from other states to provide care in Puerto Rico (HSS 11, HSS 13). In addition, the Government of Puerto Rico will increase public health surveillance capacity (HSS 8, HSS 27) and vital records data use (HSS 5), which will be important during disaster-response and under normal circumstances.

### **Strengthen supportive services**

Residents living in the most vulnerable circumstances—for example, home-bound, older adults (especially those who live alone); people who depend on nutritional support; and those with chronic health conditions— have greater needs during and after a disaster. To address these challenges, the Government of Puerto Rico will enhance services and other supports that ensure continuity during and after a disaster and that limit disruptions to food, medication, technology, and other crucial supplies. Puerto Rico provided nutrition assistance through the Food Stamp program from 1974 to 1982 but switched to a capped block grant Nutrition Assistance Program through the Omnibus Budget Reconciliation Act of 1981. Transitioning to the more financially flexible Supplemental Nutrition Assistance Program (SNAP) (formerly known as the Food Stamp program) will allow greater surge capacity post-disaster and provide greater benefit to participants (HSS 16). In the event the transition to SNAP does not occur, long-term waivers to the existing Nutrition Assistance Program regulations (HSS 17), which would be implemented by the USDA Food and Nutrition Service, would enable greater flexibility in how program participants access food during a disaster.

To raise awareness of child and senior abuse and how to report it, public education campaigns and training staff at integrated service centers and disaster shelters are needed to detect and address abuse (HSS 18). The Government of Puerto Rico will support the older adult population through both routine day-to-day efforts and targeted, community-led support post-disaster (HSS 20). These initiatives

include enhancing food stockpiles through a policy change requiring a minimum 14-day, healthy, shelf-stable food supply at all licensed child- and elder-care facilities and providing guidance to them on stockpile contents. Another initiative calls for increasing funding to the Puerto Rico Department of the Family to hire additional child welfare investigators to reduce the backlog of child maltreatment investigations (HSS 24) so that the department is better positioned to quickly address potentially increased incidence of abuse post-disaster.

The Government of Puerto Rico will build capacity that will make all residents more resilient to future disasters. These include developing, updating, and implementing preparedness and response plans across the Island—including for those facing particularly high risk during disasters—so that communities can better sustain themselves immediately after a disaster. Other components include developing a public information and communication capability to continuously engage communities in the recovery process and increase residents' visibility into recovery planning and implementation (CPCB 6) and hiring planners in each municipality and at the state level to support a more robust emergency shelter system for the longer term (CPCB 7). Finally, the Government of Puerto Rico will strengthen the involvement of local nonprofit and nongovernmental organizations in disaster recovery by establishing a unit within the Office for the Socioeconomic and Community Development to maximize the agency's partnership with other government agencies in the recovery process (CPCB 15).

### **Create healthy communities**

Healthy communities support healthy people. Transportation, municipal infrastructure, education, economic development, natural and cultural resources, and telecommunications are all required to improve and protect the health and well-being of communities. Toward that end, the Government of Puerto Rico will implement a range of initiatives, including deploying wi-fi and broadband internet connectivity (increasing access to health information to support healthy lifestyles and chronic disease prevention and management); providing incentives to move from remote communities to urban centers (increasing access to key economic and educational services); and offering better access to transportation and community resources, such as museums, parks, artist workspaces, and community centers, as well as natural resources (promoting access to services, healthy activities, and exercise). For example, an integrated strategy to help artists and arts organizations resume practice and livelihoods post-

hurricane would facilitate community recovery and improve a sense of collective well-being (NCR 2).

Another effort calls for summer and after-school learning programs (described in greater detail in the education section) that incorporate physical and mental health services to promote whole child health and well-being (EDU 1). The Government of Puerto Rico will conduct a landscape analysis of early childhood opportunities to determine the current supply of interventions and care settings, demographics of children 0–5 years old (and their families), and the cost of and possible funding streams for programs that provide high-quality care to all children in Puerto Rico and improve their long-term health and learning trajectories (EDU 3).

Finally, plans to collect and map housing-sector data will directly benefit people’s health through increased accuracy in routing of emergency vehicles (HOU 5), and initiatives to implement healthy housing guidelines for mold mitigation, remediation, and public health will help prevent respiratory-related diseases (HSS 2). The Government of Puerto Rico also intends to reduce water- and vector-borne disease transmission through improved public health surveillance (HSS 4) and innovative mosquito control practices (HSS 6). Closing unpermitted and unregulated dumps will further remove environmental and public health threats to the people of Puerto Rico (NCR 10).



## **SEE THE FULL PORTFOLIO**

**of health and social services strategies and details about cost and funding in Chapter 12 of this plan**

Contractors paint walls as part of the repairs to the Bayamón Police Command Center.

FEMA/Yuisa Ríos



Physical capital

## REPAIR, REBUILD, AND RIGHT-SIZE THE PUBLIC BUILDINGS INVENTORY

**Establish a program to produce stronger and more-resilient public buildings that meet today's standards, mitigate against future disasters, represent innovative designs, and meet communities' needs**

### Issues to Address

In Puerto Rico, ownership of public buildings is a complex issue. Government agencies may have ownership responsibilities for a wide variety of types of buildings, and the type of building does not determine ownership. For example, several different government agencies own schools. One of these agencies, the Public Buildings Authority, also owns police stations, judicial centers, and office buildings. Publicly owned buildings may house activities operated by

other public agencies or private-sector tenants. For example, PRIDCO is a public agency that owns and operates hundreds of buildings that it leases to the private sector with the mission of fostering economic development. This complexity makes it difficult to track the complete inventory of public buildings, and the government lacks a central data set showing the number, type, location, legal status, and condition of the real estate and assets that it owns.

Beyond the ownership conundrum, recession, declining population, and shifting demographics have led to a substantial number of underoccupied buildings. Both occupied and unoccupied buildings often suffer from insufficient maintenance. Given these complications, it has been difficult to assess the extent of damage caused specifically by the hurricanes. Some assessments of this damage, compiled from U.S. Army Corps of Engineers data or FEMA Public Assistance data, estimate that one quarter of police stations were classified as “restricted use” or “unsafe” after the hurricanes and that 85 percent of schools reported damage.

## Taking Action

The vision for Puerto Rico’s public building sector is not only to repair and maintain buildings but also to right-size and redesign buildings to support new ways of providing public services and increasing their resilience to disaster. This effort includes repurposing, reallocating, and refurbishing buildings to meet current demand, population needs, historic building requirements, and economic conditions. To make this sector more efficient, ownership must be realigned, and new systems will make managing them more efficient.

Prior to the hurricanes, various initiatives were already seeking to consolidate and right-size the public building sector, including proposals to consolidate schools and establish integrated service centers, a “one-stop shop” for Puerto Ricans seeking public services. The Government of Puerto Rico plans to build on this effort by further aligning and consolidating functions into fewer buildings (in conjunction with the agency consolidation mandated by the Financial Oversight and Management Board). These buildings will be refurbished, moving critical government operations out of areas at high risk for flooding, repairing hurricane damage and implementing structural retrofits to increase hazard resilience, and developing policies and standards to improve asset management, increase energy efficiency, and ensure that backup power is available.



### **Create a comprehensive inventory of buildings to improve how they are managed**

Puerto Rico’s Planning Board and Public Buildings Authority plan to create a comprehensive, centralized database of government-owned buildings and undeveloped properties to help the owners make better decisions about their structures and to provide accurate information for decisionmaking (PBD 1). Having a clear picture of the entire inventory of schools, courts, prisons, and other public buildings and their condition will facilitate decisionmaking regarding general operations, maintenance, future infrastructure needs, emergency response, and vulnerabilities to future disasters. This database will be used to inform complementary asset inventories that municipalities may create for the same purposes (MUN 6).

### **Repair, retrofit, and relocate public buildings to be resilient**

To ensure that all public buildings meet both today’s standards and future needs, the Government of Puerto Rico will repair hurricane damage (PBD 9), retrofit buildings to meet building safety codes, and upgrade systems when feasible (to reduce vulnerability to natural hazards and improve energy performance) (PBD 11). To increase public buildings’ resilience to power outages, guidelines will be developed

for secondary power systems by building on the nationally recognized standards for emergency and standby power systems that already exist (PBD 12). This effort would prioritize buildings that house essential functions.

The Puerto Rico Planning Board will need to relocate critical government functions to vacant or new buildings in areas with less risk of flooding if retrofitting is not appropriate (PBD 8). Similarly, the Government of Puerto Rico proposes to refurbish 300 community centers and 172 community technology centers and provide them with generators for backup power so they can act as service centers during an emergency (PBD 7). The State Historic Preservation Office and the Institute of Puerto Rican Culture will also undertake activities to preserve historic buildings and protect the character that they provide to their communities (NCR 1, NCR 3).

### **Rebuild with state-of-the-art standards in mind**

The Government of Puerto Rico, in collaboration with municipal governments, will develop new policies and incentives to promote state-of-the-art building design, practices, and technologies, including adherence to the 2018 International Building Codes performance standard. This effort will establish clear standards and incentives for energy and water efficiency in public buildings and incentives for renewable energy systems, innovative redesign or reconfiguration of spaces to better support critical public services, and increased resilience to natural hazards (PBD 10).

### **Right-size the number of public buildings**

The Government of Puerto Rico will right-size the public buildings sector to make efficient use of space and consolidate maintenance costs. This effort involves examining the demand for government services to estimate the appropriate building capacity, program requirements, and proposed improvements for government operations. Public services in private facilities would be moved to public buildings so that buildings are used more efficiently (PBD 5), and services would be clustered in integrated service centers to make them easier for residents to access (PBD 3).

### **Repurpose structures and realign ownership**

The government and its partners will repurpose and refurbish buildings, reallocate space, and sell or demolish unneeded buildings (PBD 2). Where possible, structures will be repurposed by municipalities—for example, as economic development vehicles through public-private partnerships or municipal corporations to



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details about cost  
and funding in  
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plan

house and attract new businesses (MUN 5). Similarly, PRIDCO's abandoned buildings will also be repurposed for use as business incubators (ECN 13). Finally, ownership of some buildings will be transferred to align with how they are used so that buildings of the same type, such as schools or government centers, are all owned by the same agency (PBD 4).

### Evaluate externalization of PRIDCO

An independent analysis will be conducted to examine whether externalizing the services provided by PRIDCO would improve or reduce its ability to support economic development through the private-sector real estate market (PBD 6), given that government competition in an otherwise healthy market can crowd out private business. This analysis will be undertaken by a third-party entity with expertise in economic development, real-estate markets, and the Puerto Rican context.

### INFORMATION THAT THE PUBLIC BUILDINGS INVENTORY DATABASE COULD INCLUDE

- Building purpose
- Current user
- Owning agency
- Occupancy status, including capacity utilization
- Value
- Existing liens and restrictions on use
- Location (street address and geocode)
- Zoning
- Vulnerability assessment results
- International Building Code building risk category
- Year built
- Dimensions (area, height, number of stories)
- Construction characteristics (based on NFPA construction type)
- Subsurface conditions (e.g., garage or basement facilities)
- Utility information
- Condition and remaining life of building, including mechanical, electrical, lighting, roofing, elevator, and backup power systems
- Energy efficiency and natural hazard mitigation features
- Major repair and retrofit records
- Listed on a historic register

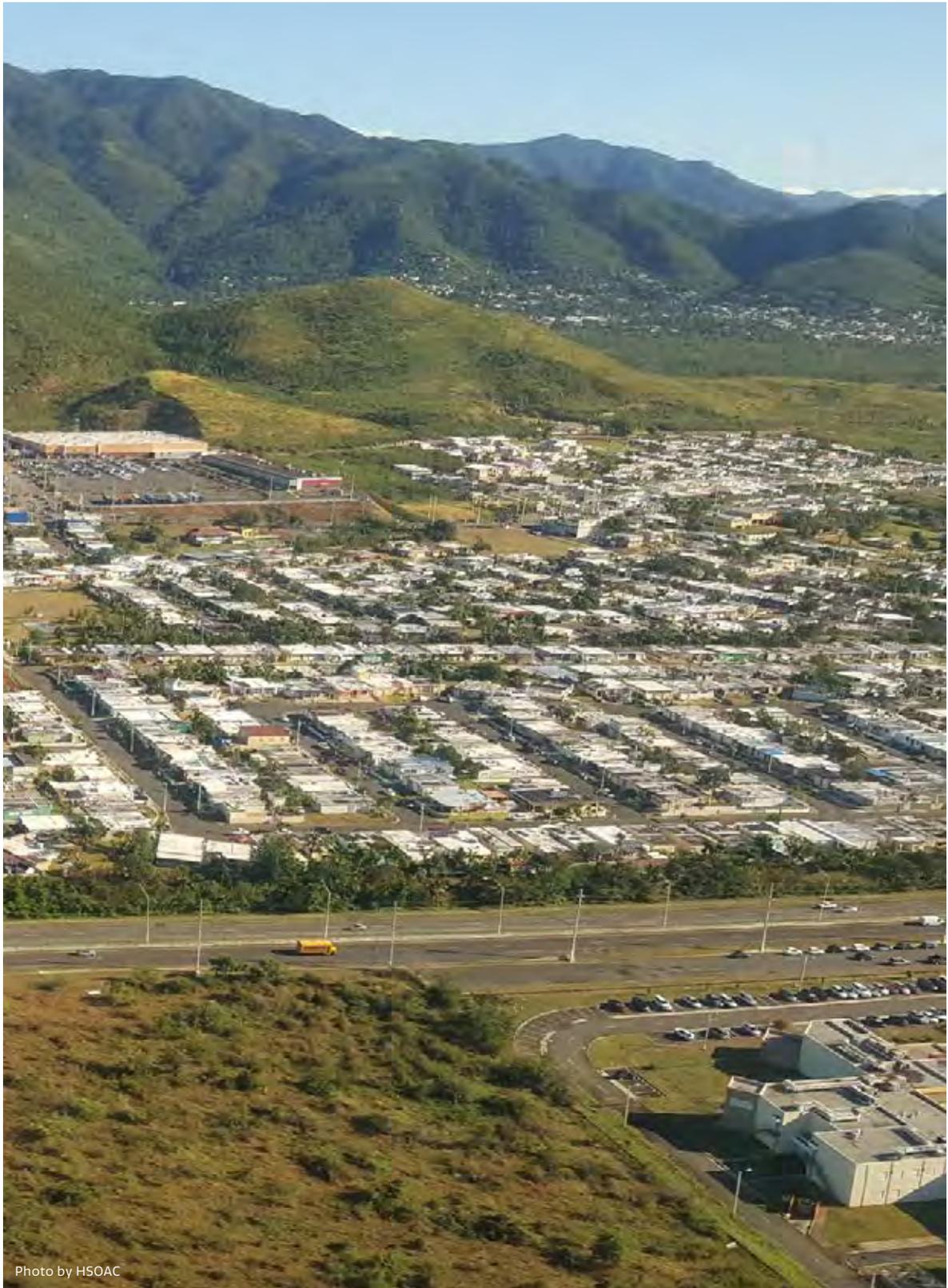


Photo by HSOAC

A diver works to restore damaged coral reefs, off the coast of Culebra.

FEMA/Andrea Bajandas



## RESTORE, PLAN FOR, AND DEVELOP THE NATURAL ENVIRONMENT

Restore, plan, and develop the marine and terrestrial ecosystems so that they coexist sustainably with tourism; promote the economic development of Puerto Rico; and serve as natural infrastructure to protect against storm damage, manage waste, and preserve the natural and cultural heritage of Puerto Ricans

### Issues to address

Puerto Rico's range of coasts, forests, waterways, and diverse endemic species are important assets both for economic development and for the well-being of citizens and visitors (see figure on the next page). However, prior to the 2017 hurricane season, Puerto Rico's natural resources suffered from a lack of investment, human interferences that weakened resiliency, and limited emergency preparedness capacity. Significant destruction from the hurricanes compounded these problems. Damage to forests and coastal resources, such as corals and seagrasses, was severe in many areas. Debris from landslides polluted waterways, blocked roads, and threatened infrastructure and public safety. The waste and debris from the disaster cleanup effort is going to landfills, many of which were already out of capacity or compliance

before the hurricanes, or to unpermitted and unregistered dumps. EPA has ordered registered, unlined dumps to be closed, but local governments say they lack the funds to do so.

To restore and protect Puerto Rico’s natural assets, the Government of Puerto Rico will develop and implement strategies to create healthy, resilient, Island-wide ecosystems that support its people, infrastructure, and economy.

## Taking action

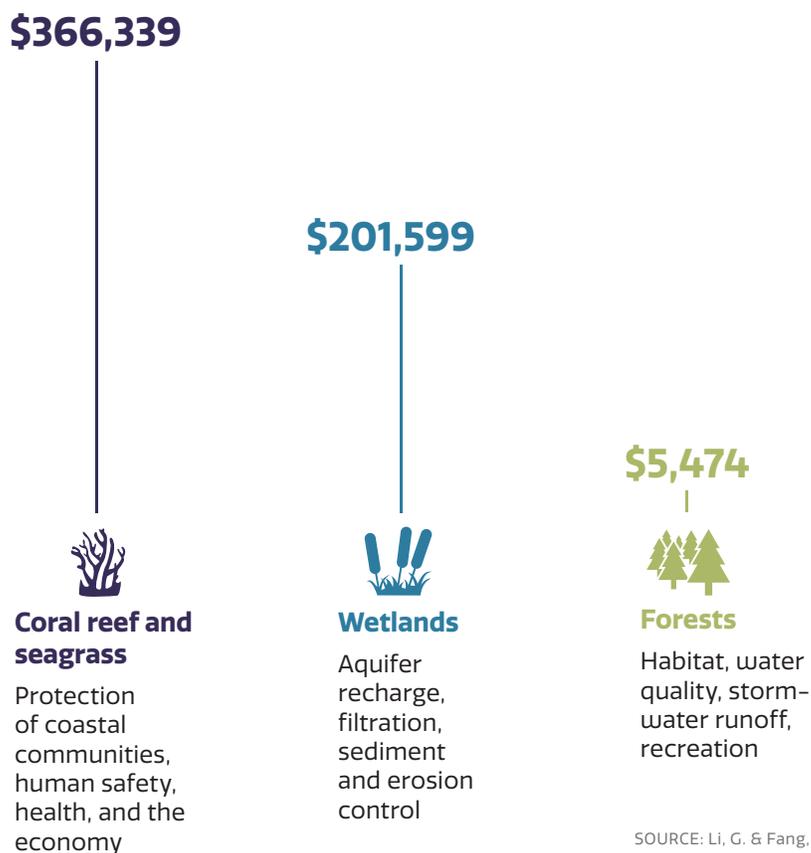
### Implement green infrastructure solutions

Natural, or “green,” infrastructure is often the first line of defense in protecting manmade infrastructure during natural disasters. Beaches and dunes, wetlands, seagrasses, and coral reefs all act as

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## The services that natural capital provides are valuable

(The estimated dollar value of the products and natural services that natural capital provides to communities, measured in international dollars/hectare/year.)



SOURCE: Li, G. & Fang, C., 2014.

barriers to waves and storm surge that cause erosion and damage to communities along the coast. To protect these critical assets, DNER will work with federal agencies to take several actions. One is the restoration of severely damaged coral reef and seagrass sites to maintain and increase the coastal protection services they provide to key communities (NCR 15). Another focus is on restoring coastal wetland capacity and hydrology at ten priority sites across Puerto Rico (NCR 16). These wetlands lessen the impact of storms while protecting coastal communities' infrastructure, agriculture, and habitats. Finally, by 2035, beaches and dunes will be stabilized and protected from human degradation so that they (1) are resilient to storms and sea level rise; (2) protect human life, property, and critical infrastructure in coastal areas; (3) support biodiversity, tourism, and recreation; and (4) help improve the livelihoods of coastal communities (NCR 17). The Puerto Rico Department of Labor and Human Resources proposes to create workforce development programs focused on building capacity and jobs in habitat restoration and other recovery needs to support these restoration efforts (NCR 25). In the long term, this workforce will be able to apply the skills they develop in other sectors, such as construction, education, and tourism.

Developing critical green infrastructure will prevent erosion and sedimentation to increase resilience to disasters and reduce negative impacts to the environment and public health. One component of this effort is stabilizing soils in areas that experienced or are prone to landslides. This will diminish future risk to communities and critical infrastructure (NCR 13). This will also reduce the loss of storage capacity from sedimentation in key reservoirs and other negative effects on both fresh- and marine-water quality. Another component of developing green infrastructure is forest recovery in rural protected areas, private forests, critical watersheds, and urban areas (NCR 5). Through both public and private collaborations, DNER will develop and implement landscape habitat conservation strategies to restore the function and structure of urban and rural forests, which will lessen erosion and sedimentation challenges and provide other ecosystem services, such as enhancing air quality and managing stormwater runoff. Forest restoration will also contribute to species recovery plans that combine habitat restoration, captive breeding, and predation threat reduction for a subset of identified at-risk species (NCR 6).

Finally, DNER is cooperating with federal agencies to develop watershed restoration and management strategies in four priority watersheds: Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor (NCR 14). Similar control efforts are also planned for the highly sensitive coastal areas of Mosquito Bay Natural



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Reserve in Vieques and Tres Palmas Marine Reserve in Rincón. These strategies would not only help communities manage stormwater runoff and soil erosion but also reduce future pollution risks from sewage discharge. Strategically managing natural resources and species at a level that considers the interconnected nature of ecosystems would enhance the resiliency and hazard mitigation of these resources (NCR 21). The creation of conservation corridors and partner networks, for example, would enrich natural resources across the Island and would provide benefits to water and air quality, land stabilization, food production, and the economy.

### **Comprehensively manage waste to protect human health and safety**

Addressing the critical capacity issues of managing solid waste will require a comprehensive understanding of the challenges involved in this undertaking. Working with local partners, DNER will complete repairs to hurricane-damaged landfills within approximately six months of funding availability and will close unlined dumps, which threaten public health and the environment (NCR 9). Initial assessments suggest that Puerto Rico will run out of landfill capacity within a few years—likely two to four years. Therefore, DNER and partners will create new lined landfill cells and transfer stations, increasing staff as necessary to manage permitting and inspection needs (NCR 8).

Tackling the unpermitted, unregistered dumps throughout Puerto Rico will be similarly important. The DNER will take action to clean up and eliminate approximately 1,600–2,000 of these dumps, including those created in the wake of the hurricanes (NCR 10). This effort also aims to prevent new unpermitted and unregistered dumps from forming.

Given the longstanding problems with solid waste management in Puerto Rico, DNER will work with the private sector and federal partners to establish a long-term, sustainable, integrated solid waste management program (NCR 11). This program will develop comprehensive solid waste management strategies and infrastructure, waste reduction initiatives, and composting and recycling practices. In addition to mitigating risks to the environment and public health, a strong integrated approach to waste management will help ensure sufficient landfill capacity in the future.

# FOCUS ON THE FUTURE



While capital investments will allow Puerto Rico to grow and thrive over the coming years, strategic initiatives are sets of actions aimed at driving Puerto Rico's future in specific ways consistent with Governor Ricardo Rosselló's vision. These initiatives reflect an opportunity to capitalize on a unique asset or strength in Puerto Rico (e.g., oceans) or to close a gap that hinders Puerto Rico's economic development or resilience to future events.

The eight strategic initiatives described in this plan are intended to signal Puerto Rico's growing focus on these opportunities. The initiatives comprise crosscutting actions that create an ecosystem of projects, supportive policy, accessible and sustainable resources, and clear targets.

The strategic initiatives build on the robust infrastructure recovery made possible by the capital investments, with specific projects and programs designed to move beyond the recovery precursors and investments in capital assets and toward social and economic growth in the long run. Because these initiatives draw on the infrastructure, human capital, and natural capital

improvements made through capital investments, the additional cost for these initiatives—above and beyond those already covered by capital investments—is approximately \$6.4 billion.

Five strategic initiatives reflect clearly defined initiatives that are crosscutting—they build resilience, improve society, and grow the economy:

- Ocean economy
- Visitor economy
- Emergency services modernization and integration
- Agricultural modernization and processing
- Digital transformation

Three strategic initiatives are much broader and generally reflect aspirational directions for Puerto Rico's future that, in many cases, are reflected within the more crosscutting strategic initiatives:

- 21st-century workforce
- Entrepreneurship
- Advanced manufacturing

## Strategic Initiatives

Eight objectives guide the strategic initiatives selected by the Governor to promote the transformational vision for social and economic progress.



➡ **Visitor Economy** | Develop a strong visitor economy to help position Puerto Rico as a global destination of investment, production, and wealth



① **Ocean Economy** | Integrate and promote all of Puerto Rico's ocean-dependent industries and ecosystems as a cohesive effort to promote economic growth, improve quality of life for residents, and enhance the visitor's experience



➡ **Digital Transformation** | Build digital capabilities and workforce needed to fundamentally transform key industry and government processes to become more user-focused, relevant, and efficient at addressing local needs and delivering basic services



➡ **Emergency Services Modernization and Integration** | Enhance public safety and first responders' ability to deliver reliable, modern, and integrated emergency services



① **Entrepreneurship** | Expand opportunities for entrepreneurship and development of small to medium local business that can compete globally to promote economic development



➡ **Agricultural Modernization and Processing** | Modernize agriculture to promote greater productivity and output, and improve exports



➡ **21st Century Workforce** | Develop and protect human capital to establish a world-class workforce, increase labor force flexibility, and create high-quality employment opportunities aligned with economic growth strategies



① **Advanced Manufacturing** | Address policy and structural barriers to increase opportunities for investment and the growth of private-public partnerships



## THE BLUEtIDE INITIATIVE

An interdisciplinary, collaborative approach anchored in an ocean economy framework is the “BLUEtIDE” initiative, which proposes a whole-of-Puerto Rico approach to disaster mitigation and resilience, workforce development, advanced manufacturing, and tourism by developing coastal resources. This approach will incentivize jobs in advanced manufacturing, fishing, the knowledge economy, and tourism industries, increasing the value of ocean-dependent assets and human capital development, international competitiveness, natural disaster mitigation and resilience, and food security.

Investing in science, data, and technology collaboratives—such as the proposed Marine Business, Innovation, and Research Center of the Caribbean—will support ocean-dependent industries and stakeholders in creating and deploying innovative solutions throughout Puerto Rico and the Caribbean. Such investment will also support the establishment of the Puerto Rico Ocean Technology Complex (PROtech) and Project 12-38, which involves designing, developing, manufacturing, and deploying advanced fish aggregating devices to enhance the sport fishing industry. In addition, a marine innovation center will serve as an international marine field laboratory network hub to foster partnerships across the Caribbean and around the world to enhance disaster resilience research and the knowledge base needed to guide policies for better preparing at-risk communities in advance of future hurricanes.

## Crosscutting Strategic Initiatives

# OCEAN ECONOMY

**Integrate and promote all of Puerto Rico's ocean-dependent industries and ecosystems as a cohesive effort to promote economic growth, improve quality of life for residents, and enhance the visitors' experience**

Puerto Rico has exceptional marine assets that can help promote economic growth and improve quality of life. Leveraging these resources appropriately will require efforts that focus on ensuring the health and sustainability of Puerto Rico's oceans and coastal areas. Thus, an ocean economy approach will help to preserve the long-term benefits of the sustainable use of marine assets and preserve natural marine ecosystems in Puerto Rico while also supporting economic growth. An ocean economy comprises a range of economic sectors and related policies and may include traditional industries, such as fisheries and tourism, as well as emerging industries, such as marine biotechnology and offshore renewable energy. Ocean ecosystems also contribute significantly to human livelihoods and well-being through such services as coastal protection, biodiversity, and storage of carbon dioxide.



### SEE THE FULL PORTFOLIO

of **strategies for the Ocean Economy** and **details about cost and funding in Chapter 12 of this plan**

Creating an ocean economy requires new investments to maximize financial, social, and environmental returns. Investing in and using the best available science, data, and technology will inform management and policy decisions about ocean assets. Investment is needed in diverse marine infrastructure, such as fish aggregating devices, artificial reefs, fish habitats, and near-shore fishery infrastructure (e.g., piers, marinas, and boat docks). Living shorelines are critical to reducing ongoing erosion, stabilizing shorelines, and

enhancing overall coastal resilience.

To guide emerging industries, investments will support business incubators and improve retail options to bolster fisheries (e.g.,

fishing villages, fish markets). Investments to discover and harness the therapeutic potential of compounds biosynthesized by marine organisms and their symbiotic microorganisms will support advancements in manufacturing. Investments in open-ocean aquaculture will help advance methods and associated increases in the sustainable production of edible seafood.

## VISITOR ECONOMY

### Develop a strong visitor economy to help position Puerto Rico as a global destination of investment, production, and wealth

Puerto Rico's unique natural and cultural resources provide an opportunity to enhance existing tourism hubs and diversify by building capacity in additional hubs. Creating a suite of tourism hubs across Puerto Rico will generate economic growth; improve the quality of life in disadvantaged communities; preserve natural, cultural, and historical treasures; and provide unique, authentic experiences for visitors.

Local communities will be empowered to build the industry, work in the industry, and receive the economic benefits of the industry—for example, through tourism workforce training and local entrepreneurship incubators. Preserving the natural, cultural, and historical inheritance of Puerto Rico will help natural resources and cultural communities flourish, contributing to Puerto Rico's competitive advantage as a unique tourism experience. Moreover, tying Puerto Rico's appeal to its unique assets ensures that the growth of the tourism industry will nurture these assets rather than damage them.

Cultivating the visitor economy in Puerto Rico involves countering the narrative of the Island as a place that is still in recovery and rebuilding its reputation as a destination. In addition to developing a destination marketing campaign, this strategic initiative involves revitalizing the existing hubs of traditional mass tourism and potentially creating new hubs of alternative tourism—that is, lower-volume tourism that emphasizes unique, authentic experiences and extended trips. As the primary point of entry, San Juan is particularly key to existing mass tourism, so steps to rehabilitate neighborhoods, plazas, beaches, and piers in the area are needed. Enhancing tourism operations at Puerto Rico's world-famous beaches (e.g., Culebra, Rincón) is also important.

Tourists visit the historic San Felipe del Morro Fortress in Old San Juan on January 23, 2018.

Kenneth Wilsey / FEMA



### SEE THE FULL PORTFOLIO

of **strategies** for the **Visitor Economy** and details about **cost and funding** in **Chapter 12** of this **plan**

Many areas, such as Rio-Grande-Fajardo-Humacao, Aguadilla-Aguada-Moca, and Adjuntas-Peñuelas, have significant potential to serve as alternative tourism hubs. Each region offers some combination of natural assets; archeological sites; historic structures, plazas, and plantations; distinct culture and festivals; and agro-tourism opportunities.

Developing each hub requires investment, including infrastructure improvement; workforce training; support for local entrepreneurship; natural, cultural, and historical preservation; and a commitment to social justice. These hubs will improve Puerto Rico's uniqueness—and therefore its competitive advantage—in the Caribbean tourism market while ensuring that the benefits are more broadly distributed among the population. Alternative tourism hubs will potentially be a boon to the existing mass tourism industry. Cruise ship passengers, a major source of mass tourism revenue, currently stay only a short time and typically do not stray far from the docking piers in San Juan. A network of tourism hubs, linked through coordinated tour packages and cruise schedules, will entice passengers out of San Juan and toward extended stays on the Island.

Additional opportunities exist to transition beyond a tourism economy toward a visitor economy. Using the infrastructure of the tourism economy, Puerto Rico could host workforce training, exchange students, medical tourism, apprenticeship programs, and conventions—especially during tourist off-seasons.



# EMERGENCY SERVICES MODERNIZATION AND INTEGRATION

## Enhance public safety and first responders' ability to deliver reliable, integrated emergency services

Lessons learned from Hurricanes Irma and Maria suggest that the capacity to respond to major emergencies needs to improve at the state and municipal levels. Many needed improvements are captured by the capital investments discussed in the



### SEE THE FULL PORTFOLIO

of **strategies for  
Emergency Ser-  
vices Moderniza-  
tion** and details  
about **cost and  
funding in Chap-  
ter 12 of this plan**

previous chapter, such as upgrading communications channels used by emergency response personnel; establishing data systems and centers to support decisionmaking, particularly during the response phase directly after an event; building capacity for treating acute and chronic conditions during and after an emergency; and ensuring that road conditions allow first responders to reach people with acute needs immediately. In addition, the Government of Puerto Rico and the municipalities will need resources to improve emergency preparedness and support response and recovery planning.

The effectiveness of emergency services also relies on building community capacity and resilience so that emergency services prioritize the highest-risk situations during a major emergency. For example, investments will ensure that more residents can access clean water and power and maintain safe housing, even during a major emergency. Investments that foster social cohesion and address long-term stressors that destabilize communities (e.g., chronic violence) will build community resilience. By improving local economies, addressing environmental sustainability, and engaging in health promotion, Puerto Rico will build communities that can better draw on their own resources during a disaster.

Health care and environmental health personnel prepare for a mass casualties training exercise at a hospital in Bayamón on June 1, 2018.

Yuisa Ríos / FEMA



### MUNICIPAL PERSPECTIVE

Representatives from nearly half of the municipalities surveyed suggested that they need specialized emergency training and citizen awareness campaigns to prepare for future disasters. More than one-third stated that a new and enhanced emergency response and disaster mitigation plan for the municipality—one that surveys capacities and evaluates flood and landslide hazards—was critical. About one-third of municipalities emphasized the need to build and maintain more supply centers and shelters that could be stocked regularly.

Source: HSOAC survey of municipal staff

# AGRICULTURAL MODERNIZATION AND PROCESSING



Young farmers are in short supply on the Island. Here, one farmer tells USDA officials about his plans to grow sorghum for feed in January 25, 2015.

Julie Wright / USDA

## Modernize agriculture to promote greater productivity and output and to improve exports

The Puerto Rican agricultural sector suffers from a lack of critical mass to achieve greater productive capacity for both domestic consumption and export, outdated farming practices, a general failure to attract a younger workforce to sustain operations long term, and insufficient access to needed capital that stifles entrepreneurship and growth.

Direct recovery support to existing farmers for hurricane-related infrastructure damage and crop loss is needed first and foremost to bring the agricultural industry back to its pre-recovery

baseline. New training opportunities are required to overcome the constraints that hinder the industry's growth and to foster greater self-sufficiency and resilience. This training initiative will emphasize both the labor shortages in the industry among younger workers and outdated farming practices, using technology-driven and innovative approaches. It will also assist young, newly trained workers with launching operations in a land- and credit-constrained environment.

One source of support is the Revolving Loan Fund, a new financing program within the Economic Development Bank that expressly supports innovative agricultural enterprises

and can encourage entrepreneurship in the industry. This program helps overcome the common failure of private industry to provide adequate credit access to farmers operating in a risky environment. By providing a workforce trained in modern practices and agricultural technologies, with an initial infusion of credit access from public funds, the industry will collectively demonstrate creditworthiness to attract private financing.



### SEE THE FULL PORTFOLIO

of **strategies for Agricultural Modernization and Processing** and details about **cost and funding in Chapter 12 of this plan**

Finally, investment in underdeveloped Puerto Rico Industrial Development Company parks will support the conversion of unused public buildings into controlled environment agricultural greenhouses that entrepreneurs could lease. These modern “ag parks” will help attract young farmers to the industry and will work in conjunction with the training initiative. In addition, the parks will be built to reduce climate risk by hosting controlled environment agricultural practices (which may further ease private industry credit constraints) and they will ease the land constraints faced by Puerto Rican farmers and increase productive capacity by enabling vertical hydroponics and other technology-driven operations.

## DIGITAL TRANSFORMATION

**Build the digital capabilities and workforce needed to fundamentally transform key industry and government processes, making them more user-focused, relevant, and efficient at addressing local needs and delivering basic services**

Cutting-edge technologies, along with a digitally skilled workforce, have the potential to improve public welfare by transforming industries and public services, such as health care and transportation. Research suggests that technology-



**SEE THE FULL PORTFOLIO**  
of strategies for **Digital Transformation** and details about cost and funding in **Chapter 12** of this plan

empowered governance—sometimes referred to as “Smart Cities”—can enhance public services, improve asset monitoring, increase sustainability, and contribute to infrastructure robustness. This approach leverages internet and communication technologies, mobile sensors, and networked devices to monitor the status of assets, people, and infrastructure. The interconnected data can then be analyzed and synthesized to aid decisionmakers. This crosscutting initiative will require a series of incremental and interdependent improvements. Two main elements



Events like this **Hacker Bootcamp** in San Juan on **June 6, 2013**, can encourage young Puerto Ricans to improve their digital skills.

Kevin Shockey via Flickr

## **IMPROVE WASTE MANAGEMENT WITH TECHNOLOGY**

Mobile applications, such as Recycle Coach, allow officials to broadcast information regarding changes in waste removal schedules, transfer station status, and recycling policies. These applications are specifically developed for state and local governments and have been successfully launched in both the United States and the United Kingdom. Using data from sensors to optimize collection strategies (thus saving money on collection costs) and implementing sensors throughout the process to automatically detect and monitor public health risks related to waste could also improve waste management.

are necessary: (1) a mature technological infrastructure and hardware to collect and integrate relevant data while protecting privacy (much of which is described in the capital investments) and (2) human capital to transform the data into actionable recommendations for key decisionmakers.

Other elements of digital transformation include data and technological enhancements that will improve state and municipal administration and finance systems and help make them more transparent. Data improvement efforts will also enhance decisionmaking for health and social services (e.g., through electronic medical records) and disaster preparedness; improve the surveillance of waterborne diseases, as well as public information and communication about such diseases; and provide the tools needed for greater opportunities in online or tele-education and tele-health.

In addition, efforts to grow Puerto Rico's digitally proficient human capital will be an important foundation for expanding the use of new technologies and innovative processes in Puerto Rico and for reinforcing Governor Ricardo Rosselló's statement that Puerto Rico is "open for business." Expanding internet access—for example, by using a "digital stewards" program to train residents to deploy additional wi-fi access in public housing—will help foster essential skills needed for a digital world (as described in Chapter 6). Other avenues, such as entrepreneurship programs, innovation hubs, and mobile labs, will provide opportunities to nurture the digital literacy needed to proliferate a "Human Cloud" for Puerto Rico—that is, a skilled digital workforce on the Island that will work with companies around the world.

## Broad Areas for Future Focus

In addition to these more focused strategic initiatives, the Government of Puerto Rico will grow and sustain a 21st-century workforce and competitive small and medium businesses that can operate locally but compete globally, and address declining manufacturing capacity in Puerto Rico. Brief descriptions of each of these themes follows.

# 21ST-CENTURY WORKFORCE

## Develop and protect human capital to establish a world-class workforce, increase labor force flexibility, and create high-quality employment opportunities aligned with economic growth strategies

The labor force of Puerto Rico will keep pace with an evolving employment landscape characterized by rapid technological innovations, increased automation, globalization, self-employment opportunities in a “gig” economy (that is, one in which temporary opportunities, such as driving for a ride-share company or running errands for an online service, are common), and increased worker mobility across employers. This landscape requires a labor force that is agile and flexible, with skills that are transferable across employers and industries and are continually updated across a worker’s career and life. In-demand, transferable skills evolve over time and now include digital, scientific, financial, civic, and other literacies; “soft” skills, such as creativity, critical thinking, and problem-solving; and so-called life or workplace skills and competencies, such as communication, leadership, collaboration, the ability to take initiative and learn from feedback, self-direction, accountability, and social and cultural competence.

To date, the structure of most education and training programs has not evolved apace, and most programs operate under the notion that workers will linearly progress through their careers within a single industry, which requires a narrower set of more-or-less static skills to start.

The Government of Puerto Rico’s plans to develop a modern workforce imbued with 21st-century skills require a world-class K-12 and higher education system that is equitable, efficient, and better integrated with the demands of the labor market and

Tesla's 21st century workforce set up solar panels to keep the lights on at a children's hospital in San Juan, shown here on October 25, 2017.

Alvin Baez / Reuters



### SEE THE FULL PORTFOLIO

of strategies for a 21st Century Workforce and details about cost and funding in Chapter 12 of this plan

needs of businesses. This initiative envisions K-12 and higher education institutions, along with employers, keeping pace with changes in technology, innovation, and the evolving workplace and contemporaneously adapting curricula and training programs.

Specific activities will support increasing the number, diversity, and quality of educational, vocational, and training opportunities, with a focus on sector-based models. Activities include developing flexible and worker-centered career pathways; flexible training approaches, such as online, brick-and-mortar, and hybrid classrooms; curriculum and standards that incorporate hands-on, project-based, student-centered learning; public-private partnerships; job portals to match openings with workers; career and technical education centers to complement vocational education; stackable credential models; and on-the-job learning opportunities. This initiative envisions taking advantage of the global trend toward jobs that are geographically independent (e.g., the “Human Cloud”) to encourage people to relocate to Puerto Rico and to bring the advantages of a global economy to Puerto Rico to support a better quality of life for residents. It will provide the needed components to enhance the required Workforce Innovation and Opportunity Act State Plan being crafted by the Department of Economic Development and Commerce.

A 21st-century workforce system, which builds on the capital investments in education, will be needed to address the short-term employment needs of the currently unemployed and underemployed in Puerto Rico, especially those living in the most vulnerable circumstances (e.g., youth, women, veterans) and “middle skill” workers with some postsecondary training, to fill positions in high-demand industries (e.g., health care, construction, energy, and information technology). Furthermore, the government will build on these short-term strategies to develop and refine a more sustainable, longer-term workforce system.

Individuals with transferable 21st-century skills will have the ability to navigate an evolving labor market, improve their employment status and wages, and enhance their resilience to industry-specific shocks. Communities’ economic development will be improved by the resulting expansion of the formal economy, higher employment and labor force participation rates, and a growing tax base. Greater economic opportunities are also likely to (1) reduce the number of potential workers who choose to leave Puerto Rico and (2) help spur former residents to return and new migrants to arrive.

# ENTREPRENEURSHIP

## Expand opportunities for entrepreneurship and development of small to medium-sized local businesses that can compete globally to promote economic development

Increasing entrepreneurial opportunities in Puerto Rico will require a comprehensive approach focused on rewarding initiatives while creating a supportive ecosystem that encourages community collaboration, providing access to startup capital funding, creating a competitive advantage through education, and accelerating growth to gain access to export markets. To accomplish this strategic initiative, migration to Puerto Rico needs to be encouraged among populations likely to create job growth, and new educational and vocational programs need to be developed to help support the workforce. Some elements inhibiting business startups include unduly complex or selective permitting processes and a low survival rate for startup companies in Puerto Rico.



### SEE THE FULL PORTFOLIO

of **Entrepreneurship strategies** and details about **cost and funding** in Chapter 12 of this plan

and economic projections. For example, microfinancing is one way of raising capital for startup businesses.

Partnering entrepreneurs with universities and others in the education system will also be a critical path forward, and doing so will consolidate entrepreneurial expertise that will be applied in a more enterprisewide approach. This approach will facilitate the development of “centers of excellence” linked to the education system to support public policy and industries benefiting from



An Orocovis artist sells artwork at local restaurants on June 12, 2018, as part of an alliance between merchants and the Foundation for Puerto Rico.

GDA via AP Images

regionally aligned accelerators and incubators in Puerto Rico. Private and public investment in various startup opportunities will be made through managed risk, as businesses initially focus on internal markets while eyeing openings to export their goods and services. The ability to more clearly see the investment and business climate in Puerto Rico will give businesses more confidence to launch operations in Puerto Rico. The simplified permitting procedures, increased funding sources, and educational and professional networks developed to expand entrepreneurship will also benefit nonprofit startups.



The general manager of a farming operation talks about the company's difficulties after the hurricanes on the floor of the Santa Isabel packaging plant on February 16, 2018.

Eduardo Martínez / FEMA

## ADVANCED MANUFACTURING

**Address policy and structural barriers to increase opportunities for investment and the growth of public-private partnerships**

This initiative is intended to address Puerto Rico's declining manufacturing capability by helping entrepreneurial startups shift to larger-scale production and develop and employ more-advanced approaches and techniques. For example, investments that support the creation of intellectual property in a sustainable way can support a continuum of local businesses stemming from research and development opportunities in Puerto Rico, attract foreign capital businesses, and create export products to drive Island-wide economic development. These investments could include data systems to develop or track intellectual property and the labor and materials required to innovate.

In addition, joining the National Network for Manufacturing Innovation (also known as Manufacturing USA) will provide access to its 14 institutes, each of which is focused on bringing together capabilities in a specialized technology area to address challenges in advanced manufacturing. The institutes are public-private partnerships with manufacturers of all sizes,



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of strategies for Advanced Manufacturing and details about cost and funding in Chapter 12 of this plan

university partners, regional and state organizations, nonprofit organizations, and federal agencies. Workforce development, institutional partnership development, and advancement in manufacturing techniques and products will transform human capital and intellectual property into an exportable product for Puerto Rico. Current innovation efforts run by different university campuses on the Island will be strengthened so that their services are more connected to government entrepreneurship, business development, and assistance programs.

# ESTIMATED COSTS AND FUNDING FOR PUERTO RICO'S RECOVERY



**T**he portfolios that address the Government of Puerto Rico’s full set of comprehensive plan objectives (including precursors, capital investments, and strategic initiatives) provided the basis for total cost estimates for this plan (see “Detailed Look at How the Plan Was Developed,” Chapter 13).

Most of the courses of action associated with the high-level objectives are focused on the capital investments needed for Puerto Rico to recover. The objectives described in this document will require an estimated \$139 billion to fund, in total. Many individual courses of action include a cost range (described in “Detailed Actions,” Chapter 12), reflecting uncertainty in the estimates (e.g., in the cost of equipment, materials, or labor, or in the current state and number of structures that will be repaired or rebuilt). Using the range of costs associated with each course of action, the sector-based teams selected a “best estimate” for each action and then aggregated these estimates to develop an estimated total cost for the plan.

Some of these costs have already been covered through Federal Emergency Management Agency (FEMA) allocations of existing funds, and some have been or will be covered by the Community Development Block Grant–Disaster Recovery (CDBG-DR) and private insurance. Expected future funding availability from federal and nonfederal sources is detailed later in this chapter. Costs for recovery include repairing damaged assets to pre-hurricane conditions, improving them to meet current regulations (such as building codes and U.S. Environmental Protection Agency regulations), and, when feasible and cost-effective, enhancing and/or relocating assets so that they are more disaster-resilient. Improving the disaster resilience of facilities is proposed when it is judged to lower future disaster recovery costs. Some courses of action involve (1) repairing damaged assets and improving them in other dimensions, such as more-appropriate fuels for power plants or upgraded electricity distribution or communications networks, or (2) establishing new kinds of activities that improve Puerto Rico’s post-recovery

future. Improving facilities and capabilities is proposed when it is judged to raise Puerto Rico's economic prosperity; this will also generally increase its tax base and, thus, its financial ability to respond to disasters. The chart on the next page provides the breakdown of costs (including both initial upfront costs and recurring costs, which reflect 11 years of annual costs from 2018 to 2028 for ongoing activities, such as operations and maintenance) by sector, where cost estimates were available. Actions in the precursor portfolio are foundational to all capital investments, so the cost of this portfolio is reflected along with the cost of the actions for other capital investments.

In addition to outlining the total cost estimates for the recovery plan, this chapter broadly identifies the classes of potential federal and nonfederal funders and estimates the order of magnitude of the funds that may be available from these sources.

## Estimating the costs of recovery

Where possible, for each proposed course of action, the relevant sector team made rough-order-of-magnitude cost estimates to support high-level planning and inform decisionmaking. Where available, costs are presented in 2018 dollars. Costs are included for the period fiscal year (FY) 2018 through FY 2028. They include both initial costs (e.g., construction investment) and future costs (e.g., operations and maintenance) over the 11-year period. Incremental operations and maintenance costs are included if there is an increase from pre-hurricane levels (e.g., because of structural improvements or technological upgrades) and thus would represent a new expense that would have to be covered. Similarly, full operations and maintenance costs are included for facilities that were not being maintained prior to the hurricanes. And it is worthwhile to note that the estimates represent only the costs for which a specific payment is made by some source to carry out a specific action; they do not include all of the costs to society that may be associated with recovery actions (e.g., the costs that better enforcement of regulations incurs on the individuals and business owners who must comply).

The approach to estimating the rough-order-of-magnitude cost of each course of action was based on its specific nature and the available sources of information robust enough to inform the estimate. Thus, ranges and point estimates are given for courses of action depending on the methods and information used. Some cost estimates are more precise than others based on the quality

Costs of the plan: Capital investments and strategic initiatives by sector

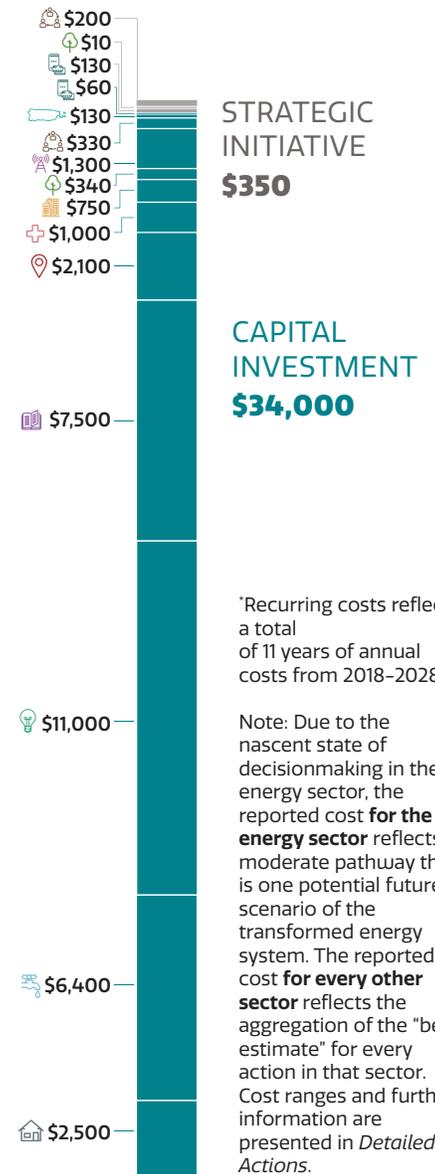
**Total costs  
(in millions)  
\$139,000**



**Upfront costs  
(in millions)  
\$105,000**



**Recurring costs\*  
(in millions)  
\$34,000**

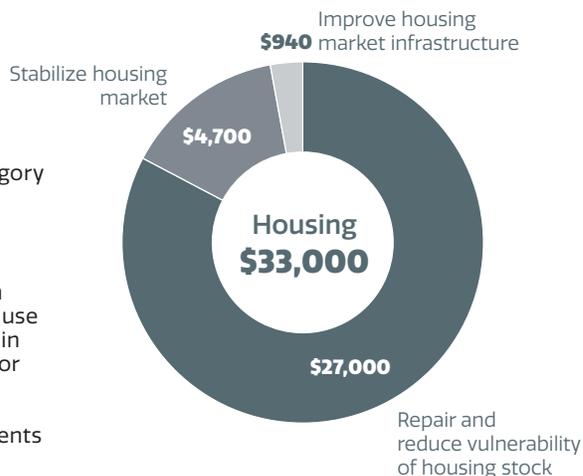
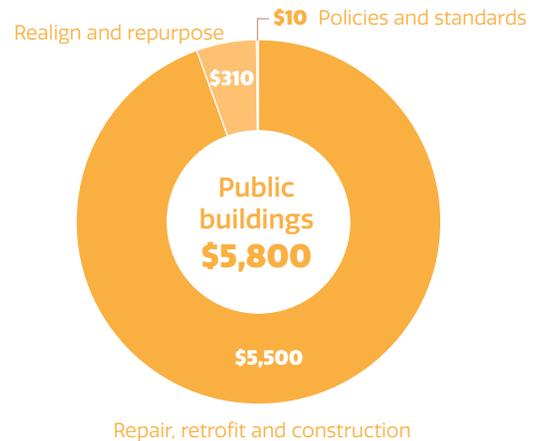
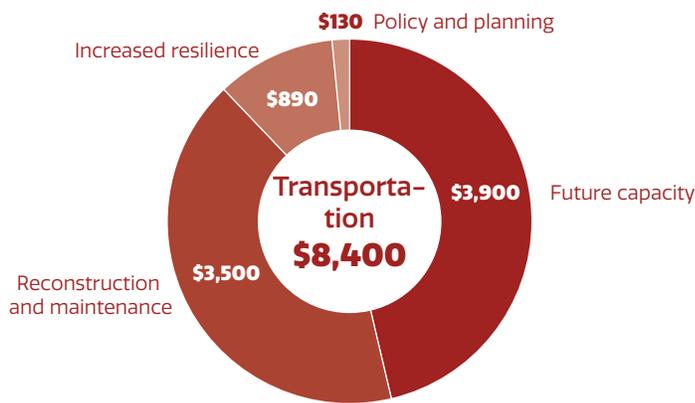
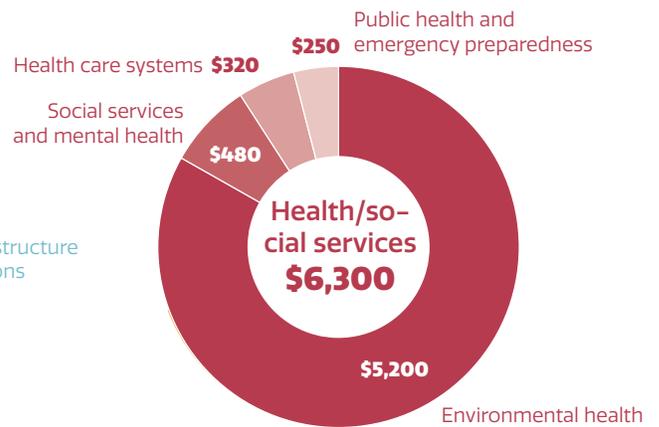
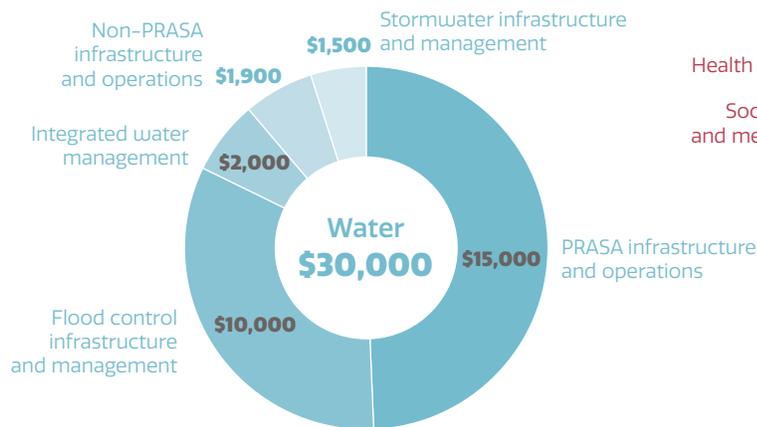
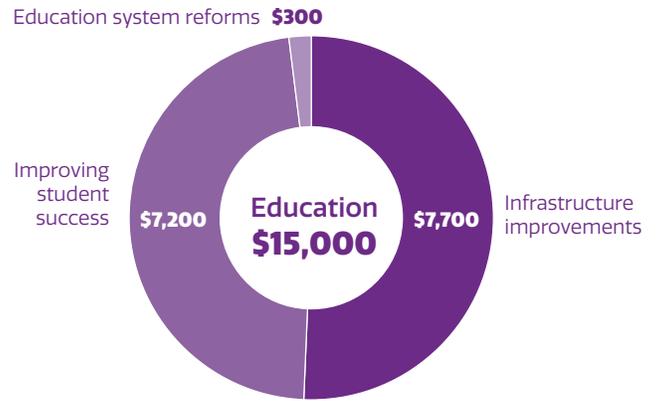
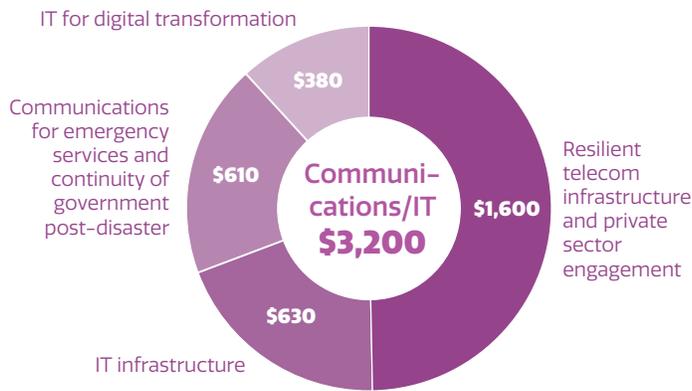


\*Recurring costs reflect a total of 11 years of annual costs from 2018-2028.

Note: Due to the nascent state of decisionmaking in the energy sector, the reported cost for the energy sector reflects a moderate pathway that is one potential future scenario of the transformed energy system. The reported cost for every other sector reflects the aggregation of the "best estimate" for every action in that sector. Cost ranges and further information are presented in *Detailed Actions*.

The three bars are not in proportion to each other for legibility. Sector costs have been rounded and may not add up to the totals shown.

## Cost categories by sector for capital investments (in millions)



Note: Each category represents the overall cost for a set of actions with a common objective within the sector. Because many decisions in the energy sector are ongoing, a breakdown of energy investments is not displayed.

of data available at the time, and the estimated costs may vary based on the scale of implementation. Cost information presented in this plan should be regarded as preliminary because more-specific cost estimates will require both more specificity in the manner in which recovery options will be implemented and the completion of ongoing damage assessments.

Some courses of action do not have costs that require specific recovery funding (policy changes, for example), although these actions may require administrative time or other resources. Actions included in the plan may have other nontrivial costs, including those relating to policy or implementation decisions that are uncertain at this time. Insufficient information is available to provide even rough-order-of-magnitude estimates for all contingencies, so some actions may have incomplete cost estimates.

## Connecting resources to needs

Achieving the Government of Puerto Rico’s vision described in this plan will require substantial resources and close coordination across all sectors over many years.

At this stage of recovery planning, the ability to pair specific funding sources and amounts available to Puerto Rico for each course of action is limited. This information is available for some—but not all—funding sources. Most existing federal funding programs have specific eligibility requirements for applicants and projects. Determining the extent to which courses of action in support of Puerto Rico’s recovery plan conform to those requirements will require more-detailed analysis and reviews with the federal agencies.

Therefore, the Government of Puerto Rico will undertake efforts to identify and secure sufficient funding each year to support recovery and longer-term courses of action over the next decade, particularly for the activities that fall outside of the standard requirements of existing funding programs. The Government of Puerto Rico will be responsible for guiding this process of connecting funding to projects. This process will be coordinated with local private social service agencies and contracted for by the Government of Puerto Rico.

The next section identifies, in broad terms, the classes of potential funders and the levels of support estimated to be available. More detail on potential funding sources for each course of action, from which the finer process of discussion and

A member of the South Carolina National Guard greets a boy who was cheering as the unit helped clear roads in central Puerto Rico.  
Maj. Randy Stillinger / Texas Army National Guard



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**Multiple federal agencies, the Government of Puerto Rico, and the private sector (including philanthropic foundations) will play a part in funding the recovery and longer-term actions described in this plan.**

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application can begin, is included in “Detailed Actions,” Chapter 12 of this plan.

### **Identifying opportunities for recovery funding**

Multiple federal agencies, the Government of Puerto Rico, and the private sector (including philanthropic foundations) will play a part in funding the recovery and longer-term actions described in this plan. Although the funding available to Puerto Rico from some sources is presently uncertain, the Government of Puerto Rico will work with funding organizations to secure the amounts aligned with the full plan implementation. Funding estimates were generated by plan analysts from FEMA and the Homeland Security Operational Analysis Center.

There are three broad categories of potential funding to meet the estimated \$139 billion cost of the plan:

- funding known to be available
- funding for which the amount available is known but the amount that Puerto Rico will receive is uncertain
- funding that will be sought from additional sources; as a result, success obtaining these funds is not guaranteed.

#### **Funding known to be available**

This category includes a portion of funds from the Disaster Relief Fund (DRF); a portion of the funding provided via supplemental appropriations, such as the CDBG-DR funding allocated to Puerto Rico at the time of this plan’s publication; and the estimated compensation from private insurance claims. In some cases, the exact amount that will be available depends on cost and eligibility estimates still to be made, but the CDBG-DR funds are already committed to Puerto Rico.

FEMA administers the **Disaster Relief Fund**, which serves the entire nation. Congress, which is responsible for ensuring that the DRF has adequate funding to meet current and anticipated needs, appropriated \$50 billion to the DRF through the three disaster-related supplemental bills of late FY 2017 and early FY 2018 (Public Laws 115-56, 115-72, and 115-123).

FEMA’s three primary funded programs are as follows:

**Individual Assistance (IA) grants** provide immediate relief and assistance to individuals and households. FEMA estimates that \$0.8 billion will be awarded to qualifying applicants in

Puerto Rico. This estimate includes only Housing Assistance as a recovery funding source, not Other Needs Assistance.

**Public Assistance (PA) grants** for repairing, restoring, and replacing facilities damaged by the disaster. FEMA estimates that \$37.4 billion will be awarded. This estimate includes only Permanent Work (Categories C–G) as a recovery funding source, not Categories A–B. Section 406 hazard mitigation funds are part of PA.

**Hazard Mitigation Grant Program (HMGP) grants** to reduce the hazard risk of damage, hardship, loss, or suffering from future disasters. FEMA estimates that \$3.0 billion will be awarded, which is the existing statutory cap.

Congress appropriated \$35.4 billion to the **CDBG-DR** program in the three disaster-related supplemental bills. These funds are administered by the U.S. Department of Housing and Urban Development (HUD). Of the \$35.4 billion, \$19.9 billion has been directed to Puerto Rico’s recovery effort. CDBG-DR funding does not require recipients to provide a nonfederal matching contribution. In fact, once the funds have been awarded to a state or territory, they may be used as “nonfederal” matching contributions for other federal grants (with the exception of grants from the U.S. Army Corps of Engineers, for which a maximum of \$250,000 may be used for this purpose).

**Private insurance** proceeds will be available to support some recovery activities, although there is uncertainty about the ultimate level of private insurance claim reimbursements for these efforts. Private insurance proceeds are typically the first line of funding to be applied because federal funding is not to be used to pay for costs otherwise covered under insurance. Based on the New Fiscal Plan for Puerto Rico: Restoring Growth and Prosperity certified by FOMB on May 30, 2018, plan analysts project that \$8 billion will be available in insurance proceeds.

The total amount of resources in this funding category is **\$69.1 billion**.

#### **Funding for which the amount available is known but the amount that Puerto Rico will receive is uncertain**

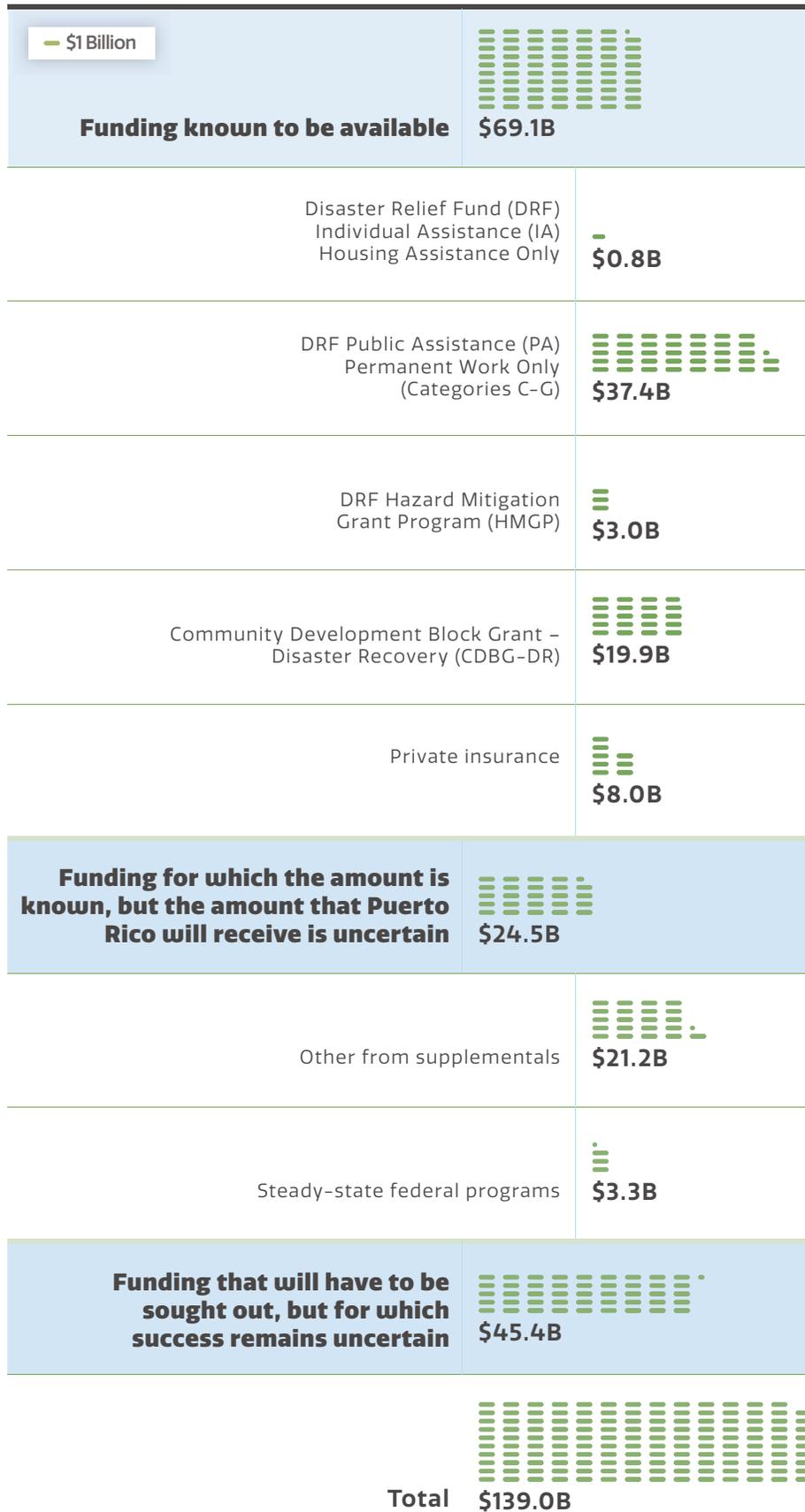
This category includes a portion of DRF funding for costs related to known damages but for which determinations of final eligible amounts have not yet been made (e.g., Section 428 Public Assistance funding). This class of funding also includes a portion of supplemental funds appropriated by Congress but for which a

specific allocation for Puerto Rico has not yet been made by the federal agency. Lastly, this also includes future funding from steady-state federal programs, which are funded through the normal annual appropriations and program budgeting processes of the agencies.

The three disaster-related recovery bills included \$35 billion of non-DRF, non-CDBG-DR appropriations to federal agencies for specific disaster-relief activities. However, not all of the funds will be available to support the actions in Puerto Rico's recovery plan. First, some of the funds—about \$4.5 billion, based on the congressional language—are dedicated to federal expenses (e.g., federal agencies repairing their own hurricane-damaged facilities). Second, Puerto Rico will compete for a share of the remaining \$30.5 billion in disaster funding with other states impacted by Hurricanes Irma and Maria, Hurricane Harvey, recent wildfires, and other disasters. The total that will be allocated to Puerto Rico has not yet been determined, but based on the distribution of CDBG-DR allocations, plan analysts estimate that Puerto Rico will receive \$21.2 billion.

The second type of funding in this category comes from steady-state federal programs, which are funded through normal appropriations and program budgeting. These are authorized, ongoing federal programs that existed before the disaster. Analysts for the plan, in consultation with FEMA, project that Puerto Rico will receive \$9.4 billion per year in steady-state federal grants. This is based on the 2010 value of \$6.9 billion in federal grant aid, escalated to 2018 using the U.S. nominal gross domestic product growth rate of 35.7 percent over that period. Much of this amount will be pass-through funds provided directly to individuals. However, some programs may allow funds to be redirected for recovery needs. Plan analysts project that 32 percent of the funds will allow redirection for recovery needs. This is based on the Estudios Técnicos Inc. finding that 32 percent of grant aid to Puerto Rico is competitively awarded; plan analysts judge that these funds have the flexibility to be partly redirected to recovery activities and estimate that 10 percent of those funds will be reprogrammed to recovery-related activities. Thus, plan analysts estimate that \$300 million of funds will be redirected to meet recovery needs each year. Over the

## Estimated resources available to Puerto Rico for disaster recovery



### **Making investments work for the long term**

In 2013, the Hurricane Sandy Rebuilding Task Force developed a set of Infrastructure Resilience Guidelines to ensure that key principles of resilience were incorporated into the formulation, evaluation, and prioritization of infrastructure investments. The guidelines aim to (1) ensure that federal agencies adopt a consistent approach to building resilience and (2) improve decisionmaking by setting criteria for investment to better protect communities and ensure wise investment of scarce public resources. The guidelines were incorporated into Federal Register notices or requests for proposals with selection criteria reflecting resilience principles. Agencies, organizations, and jurisdictions already familiar with resilience principles reported being more efficient in putting the Sandy supplemental funds to work and prioritizing longer-term results over solving immediate needs. Key lessons learned are that resilience criteria need to be streamlined across federal funding sources and that grantees may need support to address the more substantive issues contained in the guidelines.

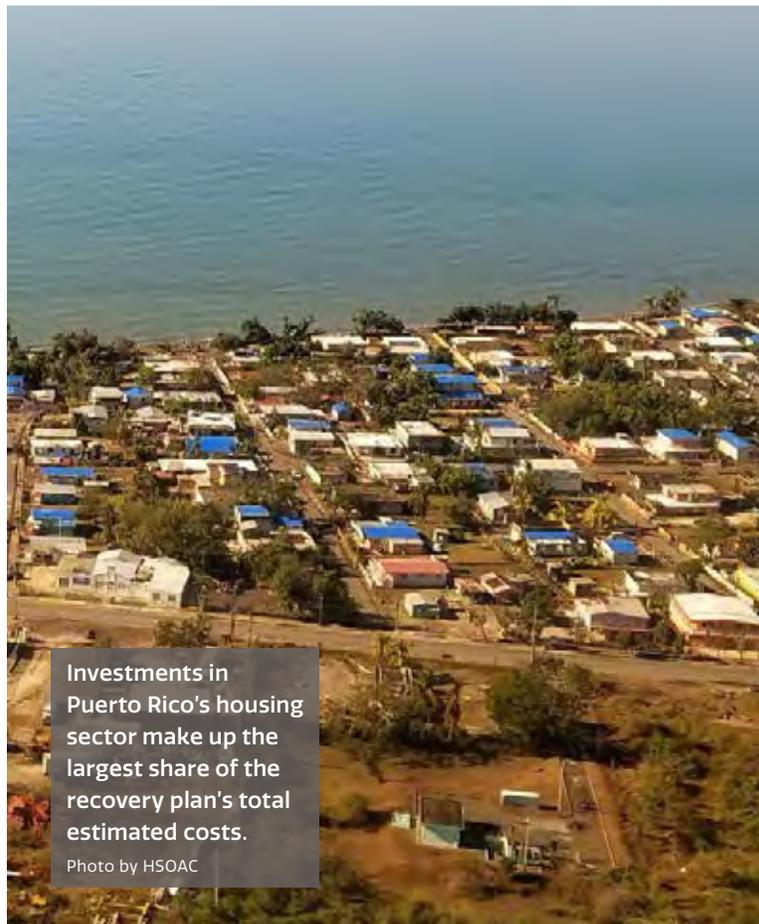
11-year horizon of the analysis, \$3.3 billion of such funds will be available to Puerto Rico.

The total amount of resources estimated to be available to Puerto Rico in this funding category is **\$24.5 billion**.

The chart on the previous page summarizes the funding levels estimated for all three categories.

### **Funding that will be sought from additional sources; as a result, success obtaining these funds is not guaranteed**

Because the estimated cost of the plan is \$139 billion and estimates from the first two funding categories equal \$93.6 billion, this leaves an estimated \$45.4 billion in costs that the Government of Puerto Rico will obtain funding to address. Additional funding sources, including the Government of Puerto Rico, the private sector, and philanthropic contributions, could fill this gap. These potential sources are discussed in the following pages.



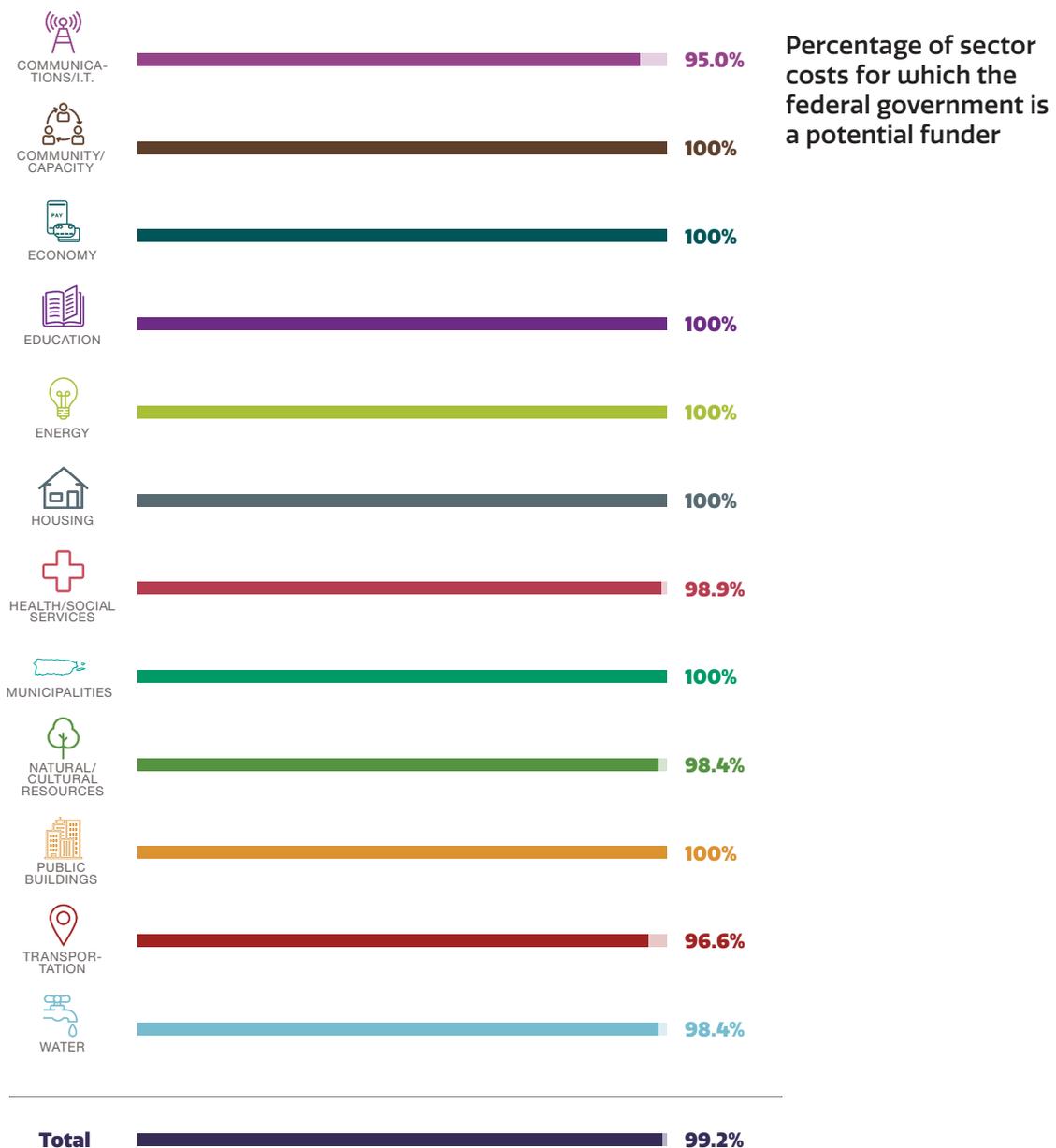
Investments in Puerto Rico's housing sector make up the largest share of the recovery plan's total estimated costs.

Photo by HSOAC

## The federal government as a potential funder

Before turning to a discussion of additional possible funding sources, the chart below shows the percentage of costs in each sector for which the federal government is a potential funder. These values are based on the potential funders list associated with each course of action, reported in “Detailed Actions,” Chapter 12. For information about how these funders were identified, see “Detailed Look at How the Plan Was Developed,” Chapter 13.

The chart shows that a very high percentage—99.2 percent, or \$137.9 billion—of the total cost of the recovery plan is eligible for federal funding. However, just \$85.6 billion of federal funding, as well as \$8 billion of private insurance, has been identified. Although the majority of the recovery plan is eligible for federal funding, a gap remains to meet identified needs.



Several of the federal funding sources have a match requirement; that is, a percentage share of the total cost must be provided from another source. The chart below shows the four funding sources that have this requirement, along with the matching share and the resulting cost that must be provided from another source. The total of this matching share calculation is \$9.5 billion. CDBG-DR is a potential source of such funds. If it were to pay for all of the matching share requirements, \$10.4 billion of its \$19.9 billion total would be available for other projects. To the extent that other matching contributions may be found, available CDBG-DR funds for other purposes would increase. The match requirement is 10 percent for PA and 25 percent for HMGP. The total estimated cost share for PA and HMGP grants is \$5.2 billion, of which the majority would likely be eligible for a cost-share match through CDBG-DR.

### Funds That Require a Matching Share

Total	FUNDS AVAILABLE	MATCHING SHARE	MATCHING SHARE AMOUNT
DRF Public Assistance (PA) Permanent work only (Categories C-G)	 \$37.4B	10%	 \$4.2B
DRF Hazard Mitigation Grant Program (HMGP)	 \$3.0B	25%	 \$1.0B
<b>Subtotal: DRF</b>			 \$5.2B
Other from Supplementals	 \$21.2B	15%	 \$3.7B
Steady-state Federal Programs	 \$3.3B	15%	 \$0.6B
<b>Subtotal: Other Federal Programs</b>			 \$4.3B
<b>Total</b>			 \$9.5B

Note: PA is expected to fund \$37.4 billion, which implies the total cost of PA-eligible projects is \$41.6 billion, given a 10% cost share. Thus, the PA match share is estimated to be \$4.2 billion. Similarly, HMGP is expected to fund \$3.0 billion, which implies the total cost of HMGP-eligible projects is \$4.0 billion, given a 25% cost share. Thus, the HMGP match share is estimated to be \$1.0 billion.

Other federal programs have varying requirements, sometimes dependent on very specific details of the project. Using 15 percent as a baseline figure, an estimated \$4.3 billion would require some type of cost-share match.

The chart on the next page shows potential federal funding sources by sector. Whether a specific course of action in any sector is eligible for funding from any specific program depends on the kinds of activities required to carry out the course of action and on the program's eligibility rules. Courses of action may incur costs across many different categories, such as construction, personnel, equipment and materials, operations and maintenance, financial incentives, and transfer payments. Program eligibility rules vary in their goals and in the costs they will cover.

### **Additional Potential Funding Sources**

As noted earlier, assuming that funds are indeed secured in the first two funding categories, the Government of Puerto Rico will seek the remaining \$45.4 billion from other sources. These sources will include Puerto Rico's own contribution to the recovery and potential support from (1) the private sector, including institutional investors and public-private partnerships, and (2) charitable foundations, including family and corporate foundations. In addition to the funding these sources could provide, they could also bring expertise, innovation, and



Community activists deliver simple water filtration systems to residents in Arecibo. Many nonprofits and nongovernmental organizations have been assisting with Puerto Rico's recovery.

Photo by HSOAC

## Potential Federal Funding Sources, by Sector

	FEMA				HUD		DHHS	DHS	DOC	DoD	Energy	DOJ	DOL	DOT	Education	EPA	FCC	NOAA	NSF	SBA	Treasury	USDA	VA	Non-U.S. Govt.
	IA	PA	HMGF	FEMA (Other) <sup>1</sup>	CDBG-DR	HUD (other) <sup>2</sup>																		
 COMMUNICATIONS/I.T.																								
 COMMUNITY/CAPACITY																								
 ECONOMY																								
 EDUCATION																								
 ENERGY																								
 HEALTH/SOCIAL SERVICES																								
 HOUSING																								
 MUNICIPALITIES																								
 NATURAL/CULTURAL RESOURCES																								
 PUBLIC BUILDINGS																								
 TRANSPORTATION																								
 WATER																								

1. FEMA (other) includes the National Flood Insurance Program, Emergency Management Performance Grant, Dislocated Workers Program, port security grants, and the Pre-Disaster Mitigation Program, among others.

2. HUD (other) includes the CDBG Entitlement Program, Capital Fund Program, Rental Assistance Demonstration Program, Choice Neighborhoods Program, Section 18 (Demolition/Disposal), Energy Performance Contracting, and Housing Choice Voucher Program, among others.

volunteers to the recovery efforts—and many are already contributing.

### Puerto Rico's contribution

Puerto Rico will make a substantial contribution from its own limited resources to support recovery. Many of the actions identified in “Detailed Actions,” Chapter 12, indicate that the Government of Puerto Rico will support the activity to some level. This will include providing personnel, supplies, technical and oversight services, and other critical contributions. Funding may also come from revenue-generating projects, such as user fees for toll roads, leases, or sale of excess broadband capacity to private companies.

### Private investment

Puerto Rico is indeed “open for business,” and the government will encourage private enterprise to invest in projects across the Island. Many of the plan's courses of action include the private sector as a potential source of funds. The Government of Puerto Rico fully realizes that the projects must be profitable for the private investor and is restructuring its processes to be more inviting to private business. In March 2018, the U.S. Treasury Department designated Puerto Rico as an Opportunity Zone under the newly enacted Tax Cuts and Jobs Act (Public Law 115-97). Investments in these Opportunity Zones can receive preferential tax treatment, the goal of which is to foster investment in those communities. Two important subcategories of private investment are institutional investors and public-private partnerships, discussed next.

**Institutional investors** include sovereign wealth funds, mutual funds, and pension funds, as well as a wide range of private financiers, from quasi-philanthropic development banks to corporations engaging in public-private partnerships. Institutional investors can have much larger sums at their disposal, sometimes as much as billions of dollars for a single, complex project. However, the potential to bring in such investors is often limited. Given their fiduciary responsibilities, institutional investors are obligated to protect capital for public purposes, such as funding retirement plans.

Specific risk-reduction strategies, including “blended finance” models, may be required to encourage investment in Puerto Rico's rebuilding. For example, an institutional investor might undertake a large housing overhaul project if the project offers the opportunity for substantial profit with little risk. One way

## EXAMPLES OF CHARITABLE FOUNDATIONS CONTRIBUTING TO THE RECOVERY EFFORT

### Nonprofit

The Red Cross has raised \$31.6 million for relief efforts in Puerto Rico associated with Hurricane Maria.

Catholic Charities has contributed an additional \$1.2 million for Puerto Rico and the U.S. Virgin Islands.

### Charitable foundations

The Knight Foundation has donated \$2.5 million.

The Center for Disaster Philanthropy, a hub of targeted disaster-related donations, raised \$2.6 million for 2017 hurricane relief efforts throughout the Caribbean.

## EXAMPLES OF CORPORATIONS CONTRIBUTING TO THE RECOVERY EFFORT

AbbVie, a pharmaceutical company with a substantial presence in Puerto Rico, has pledged \$100 million to the recovery effort to be split between the nonprofits Direct Relief and Habitat for Humanity.

Pharmaceutical companies Amgen and Merck, which have local operations, have contributed \$5 million and \$4.5 million, respectively.

Walmart contributed more than \$7 million in aid.

FedEx donated \$3 million in cash and transportation support.

Duracell contributed \$2 million worth of batteries to Puerto Rico.

UPS lent the use of two of its freight aircraft to fly in Meals Ready to Eat.

Google donated its experimental solar powered balloons to provide cell and internet service. This philanthropic act also provided important testing of a still-developmental technology.

to mitigate risk is to merge developmental, philanthropic, and public funds with investor funds to lower collective risks, scale up projects, and build momentum for more-widespread investment. For example, the government of Tamil Nadu in India used blended finance—incorporating public resources, private capital, and concessional loans—to create a Water and Sanitation Pooled Fund that addressed key infrastructure needs.

Another means of marshaling nongovernmental resources and reducing governmental costs is to engage **public-private partnerships** to develop infrastructure for a more resilient Puerto Rico. Such partnerships generally use some degree of private funds and financing to address public infrastructure needs in exchange for a percentage of future revenue. They have been used to a limited extent in the United States for expanding toll roads, with private companies and banks funding construction or operations in exchange for retaining toll revenues. Similarly, several cities have supplemented their public housing system with mixed-use development, in which private developers set aside a certain number of units in a building as low-income housing in exchange for government concessions, such as access to specific land or tax incentives. Public-private partnerships are also often used for the redevelopment of downtown city spaces and waterfront areas, in an effort to bring in businesses, new residents, and tourists.

Puerto Rico has already implemented several major public-private partnership projects in transportation since the creation of the Puerto Rico Public-Private Partnerships Authority. Luis Muñoz Marín International Airport in San Juan, the largest passenger airport on the Island, has been operated since 2013 by the public-private partnership AeroStar Airport Holdings. It is the only major privatized airport in the United States. Two toll roads, PR-22 and PR-5, have been operated by Metropistas since 2011. Other third-party operations arrangements, such as the Teodoro Moscoso Bridge and the Tren Urbano, pre-date the Public-Private Partnerships Authority.

Public-private partnerships can be appealing when public funding is tight or politically fraught, but they do carry risks that governments must understand. Even with private financing, the money to recoup the project costs must still come from somewhere, either through taxes or user fees. Private investors usually secure contractual terms that ensure protection of their investment. However, public-private partnerships can be a viable way of injecting immediate funding into much-needed

infrastructure projects, particularly if Puerto Rico is without sufficient funds or access to capital markets to fund such needed investments. The partnerships can add financial flexibility and bring corporate innovation and technology to solve infrastructure problems. In addition, private partners in such a partnership have a strong profit incentive to avoid delays. Public-private partnerships can spread risk among several stakeholders, lightening the burden on government to undertake complex projects.

From a public perspective, these partnerships function best when the process is transparent to the public, the project is accountable through a credible oversight mechanism, the future revenue is predictable and assured, project benefits are equitably shared, and the partnership addresses a fundamental public need. For public-private partnerships to function effectively and efficiently, they should be integrated into a coordinated and centralized plan, be managed by a consistent governing body of leaders and invested stakeholders, and operate under an agreed-upon set of performance metrics.

#### Charitable foundations

Charitable foundations—whether billion-dollar foundations or small-grant, single-issue foundations—tend to focus on “world-changing” ideas, such as protecting and preserving oceans and watersheds, eradicating poverty, or increasing health equity—all of which are important issues in Puerto Rico. Puerto Rico’s social and economic development efforts can be understood and articulated as complementing these ambitious frameworks. Environmental preservation is addressed by clean energy infrastructure in Puerto Rico. Building new rural clinics can address health disparities in underserved areas. A project that fosters women entrepreneurs could be a step in reducing poverty. Such projects could complement ongoing efforts, such as the Sila M. Calderón Foundation’s Centro para Puerto Rico, which provides business training to women to empower women and communities.

The projects presented above are examples of how the planned actions of Puerto Rico can work in concert with the mission of charitable organizations or individuals. For example, the Ford Foundation’s \$5 million contribution to the ReImagina Puerto Rico project aims to help Puerto Rico rebuild while also supporting the foundation’s focus on reducing global inequality. Charitable organizations can fund the work of others—which is most common for foundations and for high-net-worth

#### **ACTION PLAN FOR SPENDING CDBG-DR FUNDING**

This recovery plan aligns with many of the activities that the Government of Puerto Rico laid out in its action plan, submitted on June 14, 2018 and certified by HUD on July 30, 2018, for how it will spend the \$1.5 billion in CDBG-DR funding that it was initially allocated. However, there are some differences in actions and funding levels between the action plan and this recovery plan, primarily because the action plan addressed only a fraction of the anticipated funding—\$1.5 billion allocated in February 2018 out of the \$19.9 billion total CDBG-DR allocation to Puerto Rico. Once HUD publishes the requirements for the additional funding, the Government of Puerto Rico will develop additional action plans for how those funds will be spent.

philanthropists, who often work through foundations—or can themselves help perform the work on the ground, as is common with charitable and religious nonprofits.

**Corporate foundations**, or corporate social responsibility initiatives, can donate funds (usually less than \$2 million to \$3 million per project), employee hours and expertise, and goods and services. Corporate foundations are most likely to invest in rebuilding efforts that help achieve corporate goals, improve corporate reputation, or both. For instance, a corporate foundation for a telecommunications company might fund projects bringing broadband internet to developing countries. The foundation might also fund other types of projects, such as building schools and scholarships, to gain broader visibility and recognition in the community.

#### **PUERTO RICO PUBLIC-PRIVATE PARTNERSHIPS AUTHORITY**

The Puerto Rico Public Private Partnerships Act was passed in 2009 to "identify innovative measures and nontraditional vehicles that promote and render economic development feasible, provide the People with the required public services, and allow the Government to stabilize its finances."

In addition to establishing a policy of creating public-private partnerships, the act created the Public-Private Partnerships Authority, which has broad powers to identify, evaluate, and select projects carried out by such partnerships. These projects will cover diverse aspects of Puerto Rico's economy and government services, including solid waste facilities (e.g., waste-to-energy and recycling facilities); water and energy infrastructure (e.g., renewable energy projects); transportation infrastructure; health care, educational, law enforcement, and penitentiary facilities; affordable housing; communications infrastructure; and recreational, cultural, and tourism facilities.

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# A COMMITMENT TO TRANSPARENCY



## Prioritizing fiscal transparency and strong governance

Transparency is a key guiding principle of Puerto Rico's entire recovery process. To ensure that the economic and disaster recovery actions described in this plan are implemented in a way that promotes fiscal transparency in recovery investments, effective processes are needed to track the progress of these actions and help prevent waste or abuse of disaster funding. In addition to the body of legislation that already addresses these issues (see box), the Government of Puerto Rico has been embedding such processes in the recovery effort, particularly through centralized oversight, strategic plan alignment processes, and procurement and contract policies and procedures of the Central Recovery and Reconstruction Office (later renamed the Central Office of Recovery, Reconstruction, and Resiliency, or COR3).

### Central Office of Recovery, Reconstruction, and Resiliency

Issued by the Governor of Puerto Rico on October 23, 2017, Executive Order 2017-065 established the Central Recovery and Reconstruction Office as a division of the Public-Private Partnerships Authority to centralize control, coordination, and oversight of the recovery and reconstruction of Puerto Rico. Specifically, the Executive Order directs COR3 to provide administrative oversight of all programs related to recovery, using best practices and appropriate processes and incorporating robust ethics, compliance, and audit programs. COR3 will be Puerto Rico's lead in developing short-, medium-, and long-term recovery plans and will coordinate the development of local and regional recovery plans. The COR3 concept follows global best practices for recovery, including those used in New Jersey, Louisiana, New York, and New Zealand, to ensure the accountability and coordination of the disaster recovery efforts. It will ensure that the Government of Puerto Rico can implement economic and disaster recovery efforts with efficiency,

“

**Our commitment is to have the most transparent rebuilding process in the history of disasters in the United States and to make Puerto Rico stronger than before.”**

**—GOVERNOR RICARDO ROSSELLÓ**

(INTERVIEW WITH NATIONAL PUBLIC RADIO, NOVEMBER 2017)

## SAMPLE OF PUERTO RICO LEGISLATION RELATED TO TRANSPARENCY

### Puerto Rico Public Private Partnerships Act

The Public Private Partnerships Act of 2009 requires that "upon completion of the negotiation for the Partnership Contract, the Partnership Committee shall prepare a report, which shall include the reasons for entering into a Partnership, the reasons for selecting the chosen Proponent, a description of the procedure followed, including comparisons between the Proponent and the Partnership Contract recommended and other proposals presented, as well as all other information pertinent to the procedure followed and the evaluation conducted." This report is filed with the Secretary of the Senate and the Clerk of the House of Representatives and published online.

### Anticorruption Code for a New Puerto Rico

On January 4, 2018, the Governor signed into law House Bill 1350, known as the Anticorruption Code for a New Puerto Rico. The law, which consolidates separately enacted anticorruption legislation into a single legislative code, establishes the rights, duties, and ethical responsibilities for current and former government officials. The code also establishes anticorruption requirements for private entities and individuals who provide goods or services to the Government of Puerto Rico, and it specifies protections for whistleblowers.

### Puerto Rico Government Ethics Act of 2011

In 2011, the Government of Puerto Rico approved a comprehensive reform to its Office of Government Ethics. In addition to reasserting the office's duties to identify, analyze, and provide education on such values as trustworthiness, fairness, and responsibility, the act aims to optimize audit and investigation processes and streamline these services to efficiently and effectively prevent and address corruption.

effectiveness, and transparency while capitalizing on opportunities to build back in a way that makes Puerto Rico better, stronger, and more resilient.

As stated in the fiscal plans for Puerto Rico, key among COR3's responsibilities are to

- **develop, present, and administer** the recovery plan
- **monitor** contracting for compliance and effectiveness purposes
- **implement and enforce** checks and balances for procurement and approval of contracts and payments
- **deploy** a proven grant-management software and provide external visibility via frequent status updates to COR3's public website
- **coordinate and channel** all efforts and activities of the government related to recovery efforts
- **process, finance, and execute** works and infrastructure projects related to recovery efforts.

As part of the Government of Puerto Rico's commitment to ensuring a transparent and effective recovery process, COR3 will maintain close ties with stakeholders across the government responsible for oversight of all aspects of recovery and will incorporate best practices for oversight that ensure visibility into the recovery process.

## Tracking recovery in a transparent and clear manner

Given the needs and the level of resources that it will take to support Puerto Rico's recovery, decisionmakers at every level and the public will want to know the extent to which Puerto Rico is recovering from Hurricanes Irma and Maria. They will want to know how much progress has been made toward meeting the Government of Puerto Rico's goals for building a better, stronger, and more resilient Puerto Rico. And they will want to see

and understand the measures of success that are being used to support these efforts.

The Government of Puerto Rico is committed to establishing a strong set of performance measures that tells the story of Puerto Rico's recovery efforts. An array of recovery indicators and an organizing framework for measuring Puerto Rico's progress are being developed and will be shared with stakeholders throughout the life of the recovery effort.

Recovery indicators are being selected using well-established criteria for identifying the right types of indicators for recovery efforts. These initial indicators will be evaluated for their effectiveness and will be updated as the recovery efforts are better defined and additional measures of success are identified. An organizing framework has been designed to assess the improvements that are critical precursors to Puerto Rico's capacity to recover—that is, access to reliable data, effective governance, public engagement, and ease of doing business. Given that this plan is intended to be innovative and transformative in the long run, it is also essential to track progress made on these precursors and other long-term goals.

The Government of Puerto Rico will measure its success and track recovery in a transparent and effective manner. The government will examine whether available, reliable, and valid data exist to support the selected indicators as defined, and baselines and targets for each chosen indicator, as well as timelines for meeting those targets, will be specified.

As a priority, the Government of Puerto Rico will work with federal agencies to ensure that interim data are collected at appropriate intervals as driven by reporting requirements and are collected for at least the critical lifeline systems (energy, telecommunications, water, and transportation).

The recovery indicators, the organizational framework, the baselines and targets, the timelines, and Puerto Rico's successes in meeting these timelines and targets will be shared with stakeholders through COR3's transparency portal, which is currently under development.

### **MEASURING PUERTO RICO'S RECOVERY: AN OPPORTUNITY AND A CHALLENGE**

Putting valid and reliable indicators in place is critical, both because of the significant resources required to support this recovery and because these indicators can provide U.S. communities and those around the world with useful information and lessons learned about recovering from such a catastrophic disaster.

The lack of available data and limited participation in data programs (e.g., U.S. Census Bureau) make it challenging to identify robust and available sources of data. Additionally, Puerto Rico's significant needs and the broad scope of recovery efforts may require a core set of performance indicators, supplemented by a more flexible set of indicators that can be adapted as implementation unfolds and recovery efforts evolve.

## Identifying recovery indicators that provide important information for decisionmakers and the public

To ensure that diverse decisionmakers find recovery indicators useful and usable, the following criteria are used to select them:

- **Meaningful:** Selected indicators provide enough information (typically a rate or percentage) for policymakers to both understand and compare recovery indicators over time and with performance in other states and the nation overall. Indicators that are simple frequencies or counts are generally avoided. Given the commitment to addressing the needs of those living in vulnerable circumstances, the indicators reflect how progress varies by subgroups of interest (e.g., older adults, children).
- **Simple:** Puerto Rico's recovery indicators will be simply worded and easy to understand. Complicated or abstract concepts that are difficult to understand will be avoided so that the information presented is clear and comprehensible.
- **Accessible:** The indicators minimize new data collection efforts to reduce the workload in Puerto Rico, increase the credibility of the recovery actions because progress is being measured by tracking the indicators, and improve access to data outside Puerto Rico. This plan attempts to strike a balance between indicators that rely on existing data and those that require new data.
- **Balanced between short- and long-term focus:** It is key that recovery indicators not only assess the critical systems and community capacities that will be built through the actions described in this plan but also evaluate Puerto Rico's progress toward recovery over the long term. The Government of Puerto Rico will track the local capacity to understand how this progress is being made and what drives long-term recovery in each community. The government will strive to capture the ability of individuals and their communities to adapt to their changing environment, including recovery indicators for economic development, social support and organizational linkages, communication, and community engagement in collective decisionmaking and courses of action. All recovery indicators will be measured over the short and long terms.

- **Streamlined:** Many possible outputs and outcomes could be tracked during Puerto Rico’s recovery. To provide a meaningful, simple, and accessible set of indicators, tough decisions are being made to narrow the field of possible indicators to those that are most reliable and valid.
- **Reliable over time:** Given that Puerto Rico’s full recovery from the hurricanes will take years or even decades to achieve, the Government of Puerto Rico will use measures that are sensitive to long-term change so that they can be tracked over time. Indicators that occur at very low rates (e.g., suicide) or have very little variation will not be included.

### Measuring recovery capacity

A wide range of notional indicators have been selected that can be used to assess Puerto Rico’s capacity to recover. Because improvement in capacity indicators is likely the first marker of progress toward the goals of this plan, these indicators may be more useful for tracking in the short term. These notional indicators for precursors to Puerto Rico’s recovery are listed first because they provide a foundation for the infrastructure capacity that Puerto Rico will build. Within precursors, data are listed first because the availability of quality data will determine whether Puerto Rico is able to completely and accurately track performance using these indicators.





Jonathan's Photos via Adobe Stock

## NEW ORLEANS INDEX AT TEN

Southeast Louisiana has experienced multiple large-scale disasters since 2005, including Hurricane Katrina and the Deepwater Horizon oil spill. Recovery has been tracked by the New Orleans Index at Ten, a set of indicators published by The Data Center, an independent, nonprofit organization.

The index relies on multiple indicators and topical essays to assess the extent to which New Orleans and the surrounding metro area is rebounding from the disasters. Indicators are focused on measures of population, economy, housing, and infrastructure. Five years after Hurricane Katrina, the information collected suggested that much progress had been made in some areas but that meaningful progress toward prosperity had not occurred for those living in vulnerable circumstances.

New Orleans' recovery and transformation continue to be tracked using an expanded set of indicators and methods. The index provides important information for decisionmakers about whether the region's resilience capacity has changed over time and how social and environmental trends may challenge resilience in the future.

The index is available at [https://www.datacenterresearch.org/reports\\_analysis/new-orleans-index-at-ten](https://www.datacenterresearch.org/reports_analysis/new-orleans-index-at-ten).

## Measuring recovery outcomes and the long-term goals of the plan

The extent to which recovery indicators appropriately capture long-term outcomes after a disaster depends on the type of damage sustained, preexisting conditions, the characteristics of the communities impacted, and broader global social and environmental trends. Ultimately, a successful recovery will mean a better quality of life for all Puerto Ricans.

Many of the indicators for recovery capacity and outcomes will provide information about quality of life. This means that physical and emotional needs are being met, as indicated by measures of health, access to health care services, job opportunities, and education. Similarly, indicators that measure the health of the environment and reliable infrastructure (e.g., electricity, water services, and broadband access) also speak to quality of life and a growing economy. Recovery indicators for these areas are likely to move slowly because they are driven by many things, not just specific recovery initiatives (see box on the New Orleans Index at Ten).

In addition, some indicators describe outputs and outcomes from processes that serve as inputs into additional strategic objectives. For example, to jump start economic growth conceptualized by this plan, the government must increase the ease of doing business through continued reform. In turn, increased ease of doing business provides incentives for increased economic activity and subsequent population retention.

The graphic on the next page provides some crosscutting indicators that can be used to track population growth and change associated with Puerto Rico's recovery from the hurricanes more broadly. It then provides a more specific but notional set of indicators for tracking progress toward the recovery plan goals.

## NOTIONAL INDICATORS OF RECOVERY CAPACITY

### PRECURSORS

CAPACITY	INDICATOR NAME	POSSIBLE SOURCE	DEFINITION
Data	Participation in data programs	Federal agencies responsible for data programs	Participation in the U.S. Census Bureau, Bureau of Labor Statistics, Bureau of Justice, Health and Human Services, Energy Information Administration, National Center for Education Statistics, National Center for Health Statistics, and U.S. Department of Agriculture data programs
Public engagement	Public participation in recovery planning	--	Percentage of municipality recovery planning groups with citizen participation; number of public engagements by GPR; percentage of GPR recovery planning efforts that include public participation; percentage of municipality recovery planning groups with citizen participation; percentage of municipalities in which public engagements are held
Ease of doing business	Ease of doing business	World Bank	Ranking on global ease of doing of business index



Liberty Cable crews work to restore fiber-optic lines in Carolina on September 23, 2017. The Government of Puerto Rico intends to incentivize companies to bury their fiber-optic cable to protect it in future hurricanes.

Carlos Giusti via AP Images

## NOTIONAL INDICATORS OF RECOVERY CAPACITY

### INFRASTRUCTURE

Goal: Strengthen Puerto Rico's critical infrastructure by rethinking its design and reconstruction to be more modern, sustainable, and resilient than before the hurricanes, and to support people, industry, and the economy effectively.

SECTOR	INDICATOR NAME	POSSIBLE SOURCE	DEFINITION
Energy	Resilience	PREPA	Time to return power to 50% of the population after a whole-Island power loss
	Affordability	PREPA	Cost per kilowatt hour, compared to average costs in the U.S. overall
	System losses	PREPA	Total electricity billed (GWh) compared to electricity supplied to grid (GWh) to capture theft and non-revenue consumers.
Telecommunications/IT	Broadband communications	FCC Broadband Progress report	Percentage of population with access to broadband service
Transportation	Air traffic	PRPA	Percent change in airports' passenger enplanements
	Multi-port shipping	U.S. Army Corps of Engineers	Percentage of total cargo tons shipped to or from Puerto Rico that do not use the Port of San Juan
	Surface transportation	DTOP	Percentage of roads and bridges in "good" condition as defined by FHWA
Water	Access	EPA and PRDOH	Percentage of population with access to clean, safe water
	Flood control	--	Percentage of dams with risk mitigation measures implemented.
Housing	Growth of formal housing	Puerto Rico Mortgage Bankers Association	Percentage of residential structures that are titled and registered
	Properties insured	Puerto Rico Mortgage Bankers Association	Percentage uptake of insurance
Education	Net intake	--	Ratio of the total number of entrants into grades 1 through 12 to the population of the same age
Health	Timely access to health services	Puerto Rico Community Survey (or more frequently using local hospital discharge data, but this requires extensive analysis)	Percentage of hospitalizations and emergency department visits for ambulatory care sensitive conditions (e.g., asthma, dehydration, hypertension)
Public buildings	Public buildings occupied	Public Building Authority	Average occupancy rate of public buildings

## NOTIONAL INDICATORS OF RECOVERY OUTCOMES

### CROSSCUTTING LONG-TERM RECOVERY

Goal: Strengthen Puerto Rico's critical infrastructure by rethinking its design and reconstruction to be more modern, sustainable, and resilient than before the hurricanes, and to support people, industry, and the economy effectively.

INDICATOR NAME	POSSIBLE SOURCE	DEFINITION
Working-age population growth	Puerto Rico Community Survey	Change in working-age (15-64 years) adults year over year

## NOTIONAL INDICATORS FOR TRACKING PROGRESS TOWARD RECOVERY GOALS

### SOCIETY

Goal: Ground the new Puerto Rico in the needs of its people by promoting a society that is educated, healthy, and sustainable.

RELATED TO GOAL	INDICATOR NAME	POSSIBLE SOURCE	DEFINITION	RELATED TO PLAN OBJECTIVE
Healthy society	General health	Updated PR-Behavioral Risk Factor Surveillance System	Percentage of adults reporting fair or poor health	Health
		Updated PR-Behavioral Risk Factor Surveillance system	Percentage of adults reporting diabetes	Health
		Updated PR-Behavioral Risk Factor Surveillance system	Percentage of adults reporting heart attack or heart disease	Health
Educated	Educational attainment	Puerto Rico Community Survey	Percentage of adults 25-35 years of age with at least some college or a bachelor's degree	Education
	Academic performance	National Assessment of Educational Progress	Percentage of 4th grade students achieving Proficient or Advanced on standardized tests	Education
	Academic performance	National Assessment of Educational Progress	Percentage of 8th grade students achieving Proficient or Advanced on standardized tests	Education
Sustainable	Ocean health	PRASA	Percentage of population with access to clean, safe water	Natural resources, Ocean economy

## NOTIONAL INDICATORS FOR TRACKING PROGRESS TOWARD RECOVERY GOALS

### Resilience

Goal: Enhance Puerto Rico's ability to withstand and recover from future disasters through individual, business, and community preparedness; redundant systems; continuity of operations; and improved codes and standards

RELATED TO GOAL	INDICATOR NAME	POSSIBLE SOURCE	DEFINITION	RELATED TO PLAN OBJECTIVE
Preparedness	Community emergency preparedness	PREMA	a. Percentage of municipalities with emergency operations plans that meet the standards of the FEMA <i>Comprehensive Preparedness Guide (CPG) 101</i> b. Percentage of municipalities that exercised their emergency operations plan in the past year	Emergency service modernization
Continuity of operations	Continuity of operations planning	PREMA	Percentage of municipalities with either an emergency operations plan that include continuity of operations appendixes or stand-alone continuity of operations plans that comply with the FEMA Continuity Assistance Tool (FEMA P-788 / September 2013)	--
Improved codes and standards	Align with best practices	--	Percentage of codes and standards in alignment with international or U.S. best practices	Precursors
Redundant systems	Communications	--	Percentage of public safety nodes with redundant communications capability	Communications
	Water	--	Percentage of drinking water, wastewater, and stormwater systems with redundant power capability	Energy, Water

## NOTIONAL INDICATORS FOR TRACKING PROGRESS TOWARD RECOVERY GOALS

### Economy

Goal: Ensure rebuilding and restoration efforts promote sustainable economic growth and social transformation and contribute to a more vibrant and competitive economy that can provide opportunities for job growth, and personal advancement that produces benefits for Puerto Rico's residents for generations to come.

RELATED TO GOAL	INDICATOR NAME	POSSIBLE SOURCE	DEFINITION	RELATED TO PLAN OBJECTIVE
Growth	Employment growth	Bureau of Labor Statistics	Percent change of private-sector jobs year over year	All strategic initiatives
	Small-business growth	Bureau of Labor Statistics	Net number of start-up businesses year over year	Entrepreneurship
	Tourism	Puerto Rico Tourism Company	Average number of nights of lodging rented	Visitor economy
Personal advancement	Wages	Bureau of Labor Statistics	Average wage for private-sector workers	All strategic initiatives
	Labor force participation	Bureau of Labor Statistics	Labor force participation rate	

# PLAN IN ACTION



This plan describes key priorities and actions intended to propel Puerto Rico toward social and economic transformation. How these priorities and actions are planned, implemented, maintained, and monitored over time will determine whether Puerto Rico is ultimately able to realize its ambitious vision. To support these efforts, a separate, detailed blueprint for implementation will outline the specific steps, and the Government of Puerto Rico will conduct in-depth planning to ensure that a systematic approach is used to prioritize timelines, benchmarks, and targets for implementing recovery activities.

This chapter lays out considerations that the Government of Puerto Rico will address in more detail as plans are made for carrying out specific recovery activities. It is key that the future implementation plan consider the complexities of the process—that is, the interplay among sectors within a system that supports the physical, human, and natural capital that is integral to ongoing resilience development. Steps for recovery will reflect the interdependencies among recovery activities so that they are sequenced appropriately, leverage key cross-sector collaborations, and involve the people of Puerto Rico. These steps will also indicate how implementation of recovery activities relates to the Government of Puerto Rico’s other recovery plans, especially those that are mutually reinforcing.

As recovery activities are planned and implemented, decisionmakers will account for ongoing contextual changes that impact the effectiveness of efforts to enhance community resilience and adaptive capacity in the long term. Projected changes in Puerto Rico’s climate, for instance, pose serious challenges for human and natural communities that underpin economic initiatives. Strategies for managing the Island’s physical, human, and natural resources will be informed with high-quality and timely information that integrates socioeconomic, biological, and climate data and models. Similarly, the impacts of changes in demographics, land use and development, and technology on short-term efforts and long-term resilience will be considered.

Although this recovery plan is not an implementation plan, some sections do suggest notional ideas about potential funding and

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**The Government of Puerto Rico will leverage the principle of innovation to guide its investments and implementation of recovery activities.**

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implementers. However, many decisions can be made only after it is clear how much funding has been acquired. For instance, different types or levels of implementation may be required depending on the funding amount and any special conditions attached to the funding when it is secured.

This chapter summarizes the importance of creating an environment for innovation in Puerto Rico, balancing speed and deliberation over the recovery continuum, preparing for transitioning individuals from federal aid to other programs and support services, and communicating effectively about recovery progress from diverse perspectives.

### **Build an environment to support innovation**

To realize the vision and goals identified in this recovery plan, the Government of Puerto Rico will leverage the principle of innovation to guide its investments and implementation of recovery activities. Equally important, the plan will help create an environment that supports the continued cultivation of innovative ideas, technologies, and policies across Puerto Rico's population and diverse communities. Innovation does not mean merely applying technology to a problem; it is a more expansive—and ultimately more powerful—approach that leverages emerging technologies, methods, and expert advice to turn ideas into solutions that improve Puerto Rico's capabilities. Innovative solutions are problem-oriented, usable, forward-looking, and adaptive. These solutions emphasize doing things more equitably, more efficiently, less expensively, or in a way that is more environmentally sustainable. At a minimum, an innovative solution does not simply repeat what has been done in the past, especially if that path has proved to be unsuccessful, innovative solutions embrace novel or unprecedented approaches when necessary and as the problem dictates.

The Government of Puerto Rico will create an environment conducive to innovation, which will be critical as implementation of recovery activities move forward. Individual projects—and the recovery plan more generally—will be open to feedback. Puerto Rico will capture a sufficient level of detailed data to identify when a course of action does not have the intended result. Assignments of responsibility throughout the government will be made and enforced to identify and implement any necessary course corrections. Recognizing that novelty is a means to an end rather than an end in itself, Puerto Rico will not generate new

solutions for the sake of “innovation” when addressing known problems with well-understood and readily available solutions.

Puerto Rico will also identify courses of action that are working, because these successes will offer lessons that can and will be diffused to other relevant parts of the recovery process. Puerto Rico’s recovery investments must not only support innovative implementation but also embed a strong system of innovation in Puerto Rico for the future. The processes and institutions that drive this approach are interdependent, as existing research shows.

This plan is not a one-time injection of research and development spending or the establishment of an isolated business incubator, but rather a plan focused on innovation through widespread investment in the institutions, infrastructure, and people that allow innovation to flourish. For example, innovative courses of action that streamline business or property registration can give companies more time to develop new ways to satisfy existing customers or reach new markets. Connections between current university campus innovation efforts and government entrepreneurship or business development programs can be strengthened. Actions will focus on establishing strong and resilient infrastructure to facilitate the coordination, cooperation, and exchange of ideas that lead to innovation. Even actions aimed at improving health care delivery can spur innovation by delivering health care at lower cost.

### **Support decisions that balance speed and deliberation and acknowledge the true length of recovery**

The nature, pace, and inclusiveness of recovery across communities may be strongly influenced by decisions made early in the recovery process and by local institutional capacity. On one hand, a speedy approach is important to keep businesses operating, provide temporary and permanent shelter for disaster victims, and rebuild infrastructure that is important to the community and the economy. When official agencies do not act quickly, communities begin to rebuild in their own ways. At the same time, deliberation is an important part of post-disaster reconstruction planning to ensure that land use and infrastructure are coordinated and safe, that approaches to rebuilding improve residents’ quality of life, that the needs and concerns of all citizens are heard, and that cost-effective solutions are identified. For successful long-term recovery, the



**FEMA's Interim Operating Facility (IOF) at the Puerto Rico Convention Center, following Hurricane Maria.**

FEMA/Paul McKellips

Government of Puerto Rico will employ deliberate planning that uses the right information, including scientific data, so that alternative paths forward can be evaluated and robust solutions developed. Science- and stakeholder-informed deliberations will be essential for balancing solutions that quickly address the immense scope of short-term needs with decisions that build long-term resilience.

The National Disaster Recovery Framework portrays recovery as a continuum of overlapping phases: disaster preparedness (continuous), disaster response (usually days or months), an intermediate phase of response and recovery activities (months), and a long-term recovery phase (may start soon after a disaster but can last months or years, depending on the size and scope of the event). These conceptual phases, however, may not reflect the true length of recovery because the process is typically nonlinear, complex, and multidimensional. Recovery planning requires substantial analysis and public debate of difficult tradeoffs as decisions are made about infrastructure repair, economic development, environmental cleanup, restoration of natural systems, urban redevelopment, hazard mitigation, equity

## The recovery continuum

### Simultaneously recovering from one disaster while preparing for another

Puerto Rico was in varying stages of recovery from the 2006 economic decline and 2011's Hurricane Irene, when Hurricanes Irma and Maria hit in 2017.



and justice, and other challenging issues. In addition, multiple disasters may occur one after the other, so periods of response, recovery, and preparation for future risks may overlap or take longer. For example, when Hurricanes Irma and Maria hit in 2017, Puerto Rico was still recovering from 2011's Hurricane Irene (see figure on previous page). The Government of Puerto Rico plans to carefully sequence recovery efforts to avoid bottlenecks and minimize frustration.

### **Prepare for transitioning individuals from federal aid to other programs and support services**

As the recovery period extends over months and years, much of the initial overwhelming support for the Island after the hurricanes will begin to wane. The Government of Puerto Rico will promote coordinated transitions for individuals and families receiving government aid. These transitions include moving from Individual Assistance to disaster case management. Disaster case management provides short- and long-term relief to individuals and families by connecting them with comprehensive services that facilitate recovery. Lessons learned from prior disaster case management approaches suggest that, to be effective, these transitional support services need to be planned with complete and accurate information about numbers of people and their needs. The Government of Puerto Rico will gather the necessary information so its agencies and service providers can strategize appropriately for staffing, resource allocation, and development of a robust resource network.

The Government of Puerto Rico will coordinate closely with the Federal Emergency Management Agency to ensure that individuals receiving disaster case management services who have remaining needs when the program ends are connected with the appropriate steady-state support. This means knowing who these individuals are and coordinating the handoff before the end of case management. Stops and starts of recovery initiatives at both the federal and Island levels can lead to serious discontinuities in recovery.

### **Communicate about recovery progress and projects, and integrate community perspectives in decisionmaking**

Effective engagement with affected communities is important throughout the life cycle of a disaster, including during the

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**The Government of Puerto Rico will employ deliberate planning that uses the right information, including scientific data, so that alternative paths forward can be evaluated and robust solutions developed.**

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implementation of the long-term recovery actions detailed in this plan. All communication will be clear, consistent, effective, and accessible and should acknowledge the needs of those living in vulnerable circumstances. Additionally, a strong emphasis will be placed on inclusive, two-way communication to ensure that community feedback is shared with the Government of Puerto Rico. Two-way communication that facilitates engagement in the recovery process helps highlight the unique and diverse needs of many populations, serves to empower individuals and communities, and, ultimately, provides the context to understand and implement pathways to action.

The Government of Puerto Rico will engage with the general population, Puerto Ricans who have left the Island, and those living in the most vulnerable circumstances to increase the likelihood that the recovery projects will address each population's distinctive needs equitably. The government will connect with community leaders in one-on-one meetings or broader community workshops, seek to establish partnerships with universities to host discussions or facilitate trainings, create a centralized information repository and hotline, and leverage both traditional (i.e., broadcast, print, online media) and social media to promote engagement with all populations at a large scale. Engaging populations to understand their specific needs and priorities can improve support for the recovery process and ensure that communities remain included post-disaster. This is especially important because, in order to implement many recovery efforts, deeper engagement with stakeholders (e.g., experts, resource managers, local leaders, communities) must occur first. Some recovery efforts require identifying partner nongovernmental organizations to implement specific courses of action or securing contracts with agencies to utilize their resources. (e.g., to develop a workforce or volunteer base). Furthermore, residents across diverse communities need to be more readily engaged in future discussions about resilience investments and disaster planning to better integrate information about community assets and needs.

## Possible topics for recovery communication

Edelman conducted an analysis of 275 news articles from 40 top-tier English- and Spanish-language outlets in the United States and Puerto Rico reflecting coverage (from February to April 2018) associated with the hurricanes. The purpose of this analysis was to identify the most frequently covered (both number of times and across multiple outlets) issues in media and recommend some topics that could be prioritized for communication during the recovery process.

The Edelman analysis led to the following conclusions:

- **Preexisting housing conditions and infrastructure challenges** are frequently covered in the media, providing an opportunity to share information about how to manage aid requests in the absence of property ownership evidence.
- **Broader issues of insurance** are highlighted in media as many Puerto Rican residents may receive only a portion of their damage claim requests from insurance companies. Information about how to handle such setbacks can address a noticeable information gap.
- News outlets are still reporting **challenges with temporary housing and education**. Addressing the needs of those who have left the Island but have not found suitable housing and of students experiencing challenges with underenrollment in schools are priorities.
- Residents remain interested in learning about current **progress to ensure stable electricity** to the Island, which provides an opportunity for media updates on the status of the energy system improvement efforts.
- Stories about **aid and other investments by the private sector** can help renew interest in the recovery activities among Island and nationwide audiences.
- Media outlets remain focused on the rising **death toll and long-term impacts**. Communication and resources that can connect residents with unmet needs to health and mental health care services will be provided.
- Sharing details about how local leaders are **preparing for the upcoming hurricane season**, collecting and distributing resources about hurricane preparedness, and using multiple channels (including accessible AM radio stations) are essential to addressing a continued interest in the upcoming hurricane season and how to prepare.



Landslides during the hurricanes damaged all three hydroelectric turbines at the Dos Bocas hydroelectric plant in Utuado.

Photo by HSOAC



# CONCLUSION



Over the past year, Puerto Rico has been creating and putting to work plans to recover from the devastating impacts of Hurricanes Irma and Maria and initiating processes to transform Puerto Rico in terms of both economic reform and disaster recovery. *Transformation and Innovation in the Wake of Devastation* builds on the steps that have already been taken toward transformation and economic reforms in fundamental ways. These steps chart a path to a more equitable and prosperous society for all Puerto Ricans. The vision and goals are centered on the complete recovery across the Island that will strengthen resiliency with a specific focus on innovation and transformation. Puerto Rico's recovery from the two hurricanes is an opportunity to set the standard—to be a model for the nation and the world in both economic reform and disaster recovery.

The voices of citizens and mayors, Puerto Rican agency heads, representatives from the Federal Emergency Management Agency and other federal agencies, subject-matter experts, and other stakeholders have been brought together in this plan. Informed by data and thoughtful analysis, the Government of Puerto Rico has developed a comprehensive plan that goes far beyond simply building back what was destroyed by the hurricanes and looks to a future in which Puerto Rico is resilient, has sustainable economic growth, possesses modern and sustainable infrastructure, and meets the needs and demands of the 21st century.

While working toward these goals, the Government of Puerto Rico will certainly face many challenges that will require perseverance, but, in the end, the benefits will be shared by Americans on the Island and in the continental United States, as well as communities around the world facing similar challenges because they will also learn from Puerto Rico's experience.

As this plan has made clear, the Government of Puerto Rico intends to use the disaster recovery process to support and accelerate its vision for the Island. The short-term disaster recovery assistance to Puerto Rico will greatly improve the

ability to implement plans to restore infrastructure that is stronger and more resilient. Long-term strategies will be developed that protect human capital by creating economic resilience. This focus will increase investments in Puerto Rico, exports of Puerto Rican goods and services, and access to credit markets.

It is the Government of Puerto Rico's obligation to build back stronger and with more resilience, and to maximize innovation throughout the recovery process. To focus on this effort, COR3 was established and is charged with leading the recovery efforts. The Government of Puerto Rico is relying on this team to set the gold standard for recovery and innovation by incorporating new methods and standards in the recovery process, including using the public-private partnership model.

The government is mindful of the need to protect recovery investments in Puerto Rico. The Governor's vision is building back better so that Puerto Rico is stronger, more resilient, and able to withstand a future event, and it will accomplish this in ways that are transparent and reflect accountability in the employment of these investments. In addition, the government will track the performance and outcomes of these investments. Finally, government leaders will do their part to continue to strengthen government to fully support the economic growth across the Island that results in a stronger, vibrant, sustainable, and resilient Puerto Rico. These leaders do not take their responsibility lightly in the daunting recovery and transformation tasks ahead.

The Government of Puerto Rico appreciates the support of the federal government during the recovery process and believes that this plan is the next step on the journey to Puerto Rico's full economic and disaster recovery. This plan builds on the various foundational documents underpinning Puerto Rico's recovery, including the Plan for Puerto Rico, the Build Back Better Puerto Rico plan of November 2017, the New Fiscal Plan of 2018, and the Community Development Block Grant - Disaster Recovery Action Plan. The plan outlined here is a living document, and the courses of action may change as needs evolve and as government leaders continue public outreach and conversations with the many stakeholders. Additionally, the Government of Puerto Rico has made

aggressive commitments in this plan that are subject to its ability to secure appropriate funding for each of the projects.

The government will continue to update Congress at six-month intervals, as required by the Bipartisan Budget Act, to share progress in rebuilding a more resilient Puerto Rico.

**We are now more certain than ever that a better, stronger, smarter, and more resilient Puerto Rico is possible.**

**¡Juntos lo lograremos porque Puerto Rico se levanta ahora más fuerte que nunca!**

# DETAILED ACTIONS



This chapter presents the full set of courses of action—for each plan objective focused on precursors to recovery, capital investments, and strategic initiatives—that have been identified as necessary to support Governor Ricardo Rosselló’s vision for recovery, resilience, and economic growth. As Puerto Rico moves forward with recovery from Hurricanes Irma and Maria, federal agencies will assess whether a particular course of action that requires federal funding is reasonable and justified.

As noted in “Detailed Look at How the Plan Was Developed,” Chapter 13, it was not possible to conduct formal cost-benefit and feasibility analyses for each course of action; however, when developing courses of action, the sector teams considered each action’s characteristics—including responsiveness to needs, level of innovation, and alignment with the evidence base (e.g., based on best or promising practices). Furthermore, the approach to estimating the rough-order-of-magnitude cost of each course of action was based on the specific nature of the action and the available sources of information robust enough to inform the estimate. Total estimated costs include both initial upfront costs and recurring costs, which reflect 11 years of annual costs from 2018 to 2028 for ongoing activities, such as operations and maintenance. These figures should be regarded as preliminary pending greater detail about specific implementation activities and the completion of ongoing damage assessments. A course of action may have a range of costs for several reasons. First, the costs may be highly uncertain, and the range reflects this uncertainty. Second, the course of action may consist of multiple activities, and the range reflects alternative implementation paths involving one or several activities. Details on what the ranges reflect for any specific course of action will be provided in the forthcoming publications that provide additional information for each sector. Arriving at more-precise costing requires decisions about tradeoffs to be made.

Throughout the plan, costs are rounded to reflect uncertainty in the precision of the cost estimates. Therefore, the cost estimates

shown may not appear to sum exactly to the total because of rounding. Costs are not estimated and funders not identified for some actions because these costs or funders are unknown, require more-detailed information on implementation, or are yet to be determined (marked as “–” in this section). A subset of these actions, such as policy changes, do not have costs that require specific recovery funding, although these actions may require administrative time or other resources.

Also as discussed in Chapter 13, analyses of funding sources for the courses of action identified included U.S. government aid and nongovernmental funding sources. At this stage of recovery planning, the ability to pair specific funding sources and amounts available to Puerto Rico for each course of action is limited. Therefore, funding sources identified in this chapter are notional at this time. Suggestions about possible implementers are also preliminary because details about how the courses of action will be put into effect will not be known until there is additional clarity about available funding and associated criteria.

The actions deemed precursors to the recovery objectives throughout the plan appear only in the Precursors section. However, the recovery plan is crosscutting and integrated, so other courses of action support multiple objectives as well. In such cases, the actions appear under each relevant objective. The actions support different objectives to different degrees—that is, the full level of implementation described by an action may not be needed to achieve a particular objective. However, all courses of action are described at their highest level of implementation because the subsets of activities required that would provide more-nuanced breakdowns of cost and implementation level are not available at this time. These different levels of implementation do not affect the overall cost of the proposed recovery plan or the costs by sector because the affected actions all occur more than once, and their costs are counted at the highest level of implementation at which they occur in the plan. In other words, for any action that occurs more than once in the plan, its cost is not counted more than once when estimating the total cost of the proposed recovery plan. Some courses of action identified in this chapter may portray overlapping or complementary activities; as additional details about these activities

become available, refinements will ensure alignment of efforts that avoid duplication.

The following sections contain detailed portfolios of actions for each type of plan objective.

### **Section 1: Precursors**

#### **Section 2: Capital Investments**

- Transform the energy system

- Modernize the telecommunications system

- Rethink water systems

- Rebuild and strengthen maritime, surface, and air transportation

- Repair and rebuild resilient housing

- Transform the education system

- Rebuild and enhance health and social service infrastructure and regional health care networks

- Repair, rebuild, and right-size the public buildings inventory

- Restore, plan for, and develop the natural environment

#### **Section 3: Strategic Initiatives**

- Ocean economy

- Visitor economy

- Emergency services modernization and integration

- Agricultural modernization and processing

- Digital transformation

- 21st-century workforce

- Entrepreneurship

- Advanced manufacturing



LEFT | MARIA TREE SEEDLINGS CULTIVATED FOR PLANTING ACROSS THE ISLAND, MARCH 2018



BELOW | CRUISE SHIPS RETURNED, BRINGING THOUSANDS OF TOURISTS A WEEK, DECEMBER 2017



ABOVE | STUDENTS FIRST DAY OF SCHOOL FOLLOWING HURRICANE MARIA, OCTOBER 2017



RIGHT | OVER 15,000 POLES DELIVERED TO RESTORE ELECTRICITY TO THE ISLAND, JANUARY 2018



# Precursors

START WITH  
A STRONG  
FOUNDATION

**The order of these precursor actions is based on the order in which they were presented in the main text.**

## CPCB 11

### Cross-Sector Coordination in Infrastructure and Implementation

Hire 5 experienced planners to serve as Cross-Sector Infrastructure and Implementation Leaders whose dedicated role within the COR3 will be to ensure collaboration and coordination between sectors when major infrastructure projects are proposed or developed.

**Potential benefits:** Ensures cross-sector integration during infrastructure planning and development projects. Increases transparency of infrastructure planning. Integrates sector needs during development and implementation.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$6.8 million in estimated recurring costs

**Potential total costs:** \$6.8 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, Government of Puerto Rico

**Potential implementer(s):** Government of Puerto Rico, COR3

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## MUN 7

### Create and Implement a Model of Regional Service Delivery and Planning

Design, adopt, and fund a regional public service delivery and planning model based on a collaborative decisionmaking process that includes all levels of government, citizens, and other stakeholders. This action could include the Government of Puerto Rico delegating services to municipalities and regional entities. It could also involve municipalities working together to deliver services regionally.

**Potential benefits:** Helps municipalities plan more effectively and deliver particular services more efficiently. Saves money by using economies of scale. Reduces duplication of efforts. Fills service gaps and improves transparency. Clarifies roles during emergency response.

**Potential upfront costs:** \$7.8 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$7.8 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico, municipal governments

**Potential implementer(s):** Government of Puerto Rico, municipal governments

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## ECN 6

### Improve Data Collection, Analysis, and Presentation

Implement policies to improve the collection, analysis, and presentation of publicly available data, including (1) updating tax rolls and land registries; (2) preparing timely, audited financial reports; (3) improving collection and storage of economic information, such as national and tourism satellite accounts; (4) providing information about public-sector programs and policies; and (5) cataloging current intellectual property and patents held by citizens of Puerto Rico.

**Potential benefits:** Decreases levels of uncertainty for investors and the public, informs resource allocation decisions, and promotes innovation.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$55 million in estimated recurring costs

**Potential total costs:** \$55 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, USDA

**Potential implementer(s):** PRPB, PRTC, Institute of Statistics, other GPR agencies, federal agencies

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## MUN 9

### Enhance Transparency and Improve Service Delivery Through Service Request Fulfillment and Tracking Systems

Implement technology-based mechanisms (such as electronic portals and 311 systems) to increase the accessibility and transparency of government services.

**Potential benefits:** Increases the efficiency, transparency, and accessibility of service delivery. Saves taxpayer money. Improves service outcomes.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$110 million in estimated recurring costs

**Potential total costs:** \$110 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOL, U.S. Department of Education, private-sector, nongovernment sources

**Potential implementer(s):** Government of Puerto Rico

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## MUN 11

### Develop and Publicly Report Key Performance Indicators

Develop key performance indicators—in collaboration with the Government of Puerto Rico, municipal officials, and citizen groups—for services provided by municipal and state-level government. Track and publicly report key performance indicators regularly.

**Potential benefits:** Improves government transparency, citizen confidence, and performance management. Allows rapid identification of issues and reallocation of resources to meet citizens' needs more effectively.

**Potential upfront costs:** \$1.9 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.9 million in total estimated costs

**Potential funder(s):** CDBG-DR, private sector

**Potential implementer(s):** Government of Puerto Rico, municipal governments

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## MUN 4

### Build the Capacity of Municipalities to Apply for, Secure, and Manage Grants

Assess municipal governments' current capacity and skillset to apply for and manage federal and other grants. Provide technical assistance and training to increase grant management capacity and skills. This action will be a critical need as federal and other funding flows to Puerto Rico for recovery-related projects.

**Potential benefits:** Improves ability of municipal governments throughout Puerto Rico to access grants and successfully implement grant-funded programs, particularly federal grants for recovery efforts.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$3.4 million in estimated recurring costs

**Potential total costs:** \$3.4 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico

**Potential implementer(s):** COR3, Puerto Rico Office of Management and Budget, UPR, municipal governments

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## **CPCB 12** **Capacity Building for Financial Management**

Conduct a study to reevaluate the current state of the Government of Puerto Rico's grant management processes and workforce due to the increased volume and pace of work associated with hurricane rebuilding efforts. Anticipate hiring 10 additional full-time equivalent financial management personnel as a result of the study.

**Potential benefits:** Ensures that funds earmarked for rebuilding efforts are spent efficiently and in accordance with regulations and accounting practices. Allows the financial management workforce to cope with the additional workload resulting from rebuilding efforts.

**Potential upfront costs:** \$1 million in estimated upfront costs

**Potential recurring costs:** \$14 million in estimated recurring costs

**Potential total costs:** \$15 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR

**Potential implementer(s):** COR3, Puerto Rico Federal Funds Management Office

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## **NCR 19** **SHPO and ICP Staffing to Meet Project Review Requirements**

Hire extra staff at SHPO and ICP to fulfill National Historic Preservation Act of 1966, Section 106, requirements for review of projects that use federal funds.

**Potential benefits:** Enables timely review of any projects and actions undertaken that may affect historic properties, including demolition, restoration, construction, maintenance, and remodeling. Ensures that these projects proceed in a timely manner without being delayed by the review process.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$5.5 million–\$11 million in estimated recurring costs

**Potential total costs:** \$5.5 million–\$11 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico

**Potential implementer(s):** SHPO, ICP

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### CPCB 13

## Training Workshop on Best Practices in Post-Disaster Procurement

Organize a conference that convenes chief acquisition officers, contract officers, and other procurement experts from the mainland United States who were involved in rebuilding after Hurricanes Katrina, Harvey, and Sandy, along with officers and experts in Puerto Rico. Produce conference proceedings and a guide to post-disaster procurement for innovation and resilience.

**Potential benefits:** Provides a forum for people with post-disaster experience to train Puerto Rico procurement officers and share best practices. Provides a networking opportunity for professionals in disaster management.

**Potential upfront costs:** \$400,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$400,000 in total estimated costs

**Potential funder(s):** CDBG-DR, FEMA

**Potential implementer(s):** COR3, Puerto Rico Federal Funds Management Office, chief acquisition officers, contract officers, procurement experts

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### ECN 34

## Establish Matching Fund Set-Aside

Set aside at least \$10 billion over the time frame of the plan from unrestricted CDBG-DR funding (and/or other eligible sources) to provide the 10 percent–20 percent needed for the Government of Puerto Rico and qualified nonprofits to obtain matching federal grants, which would unlock billions of dollars in additional federal funding.

**Potential benefits:** Allows the Government of Puerto Rico to access the \$50 billion–\$100 billion that the federal government can provide through FEMA, USDA, EPA, DOC EDA, and other federal agencies to help rebuild and repair public buildings, roads, and other infrastructure.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** — (\$10 billion in total estimated costs as a cost-share requirement; no costs applicable to the total cost of the plan)

**Potential funder(s):** CDBG-DR

**Potential implementer(s):** Puerto Rico Executive Branch

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#### **ECN 4**

### **Enact Sound Fiscal Policies**

Implement policies to reduce public spending, adjust the level of public spending relative to revenue, or increase the revenue base of the Government of Puerto Rico by enforcing tax compliance.

**Potential benefits:** Improves access to credit markets and reduces economic uncertainties in the public and private sectors. Increases the confidence of private investors in the Commonwealth of Puerto Rico.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** Puerto Rico Executive Branch

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#### **MUN 1**

### **Establish an Emergency Fund for the Government of Puerto Rico and Municipalities**

Establish an emergency fund for the Government of Puerto Rico that can also be used by municipalities during disaster response and recovery. This fund would provide financial assistance for extraordinary expenses incurred during future disasters, and could be modeled on examples from the continental United States.

**Potential benefits:** Improves the efficiency and effectiveness of emergency response and recovery by allowing municipalities to manage and disburse emergency funds directly. Allows municipalities to continue to fund response and recovery activities while they are awaiting reimbursements from FEMA or payouts from insurance companies.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** Governor, Legislative Assembly, PRPBA

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## **CPCB 9** **Coordinated Local Recovery Planning Process**

Establish a coordinated process for municipalities severely affected by the hurricanes to develop recovery plans that ensure that investments address risk. Integrate recovery plans with other local planning efforts. Provide support—in the form of a Local Disaster Recovery Manager—to municipal governments coordinating the implementation of a large number of recovery projects.

**Potential benefits:** Addresses long-standing problems—specifically, the fragmented delivery of federal resources, which leads to ad hoc decisionmaking and piecemeal recovery. Ensures that recovery investments maximize hazard risk reduction and capitalize on transformative opportunities.

**Potential upfront costs:** \$51 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$51 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOC EDA, nongovernment sources

**Potential implementer(s):** PRPB, municipal governments

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## **MUN 2** **Create Regional Economic Development Plans**

Provide technical assistance to municipalities to create municipal and regional-level economic plans aligned with the overall economic development goals of the Government of Puerto Rico. Plans will include assessing the workforce, identifying industries with the highest potential in each region, identifying needed infrastructure, and providing training.

**Potential benefits:** Ensures that each municipality will be part of an economic development plan to improve workforce training and employment, increases the level of economic activity, and contributes additional revenues to municipal governments and local economies.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, DOL, municipal governments

**Potential implementer(s):** Government of Puerto Rico, municipal governments, SBA

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**ECN 1**  
**Increase Ease of Doing Business**

Increase ease of doing business across Puerto Rico as measured by the World Bank Ease of Doing Business indicators, including lowering labor costs, energy and other input costs, tax costs, and transaction costs in dealing with the government by modifying federal and state-level government policies.

**Potential benefits:** Stimulates investment and economic growth across nearly all sectors by reducing policy-induced barriers to business activity, resulting in fewer residents moving away from the Island due to economic conditions over the short and long terms.

**Potential upfront costs:** –

**Potential recurring costs:** –

**Potential total costs:** –

**Potential funder(s):** –

**Potential implementer(s):** Government of Puerto Rico

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**ECN 39**  
**Exemption of Puerto Rico from the Jones Act After Consideration of Costs and Benefits**

Support efforts to work with the federal government to evaluate the effects of the Jones Act on the well-being of Puerto Rico and, if shown to be detrimental, exempt Puerto Rico from the Jones Act, similar to the exemption in place for the U.S. Virgin Islands.

**Potential benefits:** If the Jones Act disproportionately negatively affects Puerto Rico, the exemption will decrease the cost of shipping, which is expected to (1) lower the price of all imported items used by businesses, consumers, government, and agricultural concerns and (2) lower the cost of exporting items from Puerto Rico. Eases Puerto Rico's evolution evolving as an international transshipment hub serving the U.S. market.

**Potential upfront costs:** –

**Potential recurring costs:** –

**Potential total costs:** –

**Potential funder(s):** –

**Potential implementer(s):** GPR congressional delegation

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#### ECN 40

### Enable Puerto Rico to Become an International Air Cargo and Passenger Hub

Encourage the federal government to amend Title 49, Section 41703(e), of the U.S. Code (the “Stevens Amendment”) to include Puerto Rico and to allow for cargo transfers. The Stevens Amendment allows foreign cargo aircraft that stop in Alaska to proceed to other cargo airports within the United States. Reestablish the “transit-without-visa” program.

**Potential benefits:** Boosts air cargo activity and creates additional economic opportunities for the air industry in Puerto Rico by transforming airports into major international air cargo hubs. Reimplementing the transit-without-visa program in Puerto Rico may help promote tourism by facilitating air travel.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** GPR congressional delegation

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#### ECN 2

### Implement Workforce Development Programs

Implement policies and activities, such as the creation of regional training centers, to support the education and training of the workforce, especially the unemployed, underemployed, and those in training for employment, with a focus on persons disproportionately affected by disasters who are in high-need occupations.

**Potential benefits:** Improves labor force participation rates, engages those not currently or not gainfully employed, and increases the labor force’s years of education and skill set, which should benefit both individuals and the economy.

**Potential upfront costs:** \$68 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$68 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOL, DOC EDA, U.S. Department of Education, FEMA Dislocated Workers Program, nongovernment sources

**Potential implementer(s):** Puerto Rico Department of Labor and Human Resources, DEDC

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# Capital Investments

BUILD RESILIENT  
COMMUNITIES,  
MODERNIZE  
INFRASTRUCTURE,  
AND RESTORE  
THE NATURAL  
ENVIRONMENT

The order of these actions first highlights actions from the sector most relevant to that objective, listed numerically. Numerical assignment is random and does not indicate a specific prioritization. They are then followed by actions from other sectors that are also important to achieving the capital investment objective, which are listed in alphabetical order by code and number.



# Transform the Energy System

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The Energy portfolio is presented here with costs, potential funders, and potential implementers grouped across the entire portfolio. This alternative presentation is a result of the nascent state of decisionmaking in the energy sector and the in-flux nature of the restructuring of PREPA. Costs associated with future scenarios for the transformed energy sector are presented below, but precise costing depends on additional decisions concerning tradeoffs in the sector, modeling and analysis results, and stakeholder engagement.

The potential costs associated with transformation of the energy sector in Puerto Rico will vary greatly depending on choices made between many technical, financial, and policy options and tradeoffs. Strategic-level tradeoffs will need to be made, including the level of decentralization of the system (i.e., inclusion of islanded portions and microgrids), the level of renewable energy production, the extent of distributed energy resources growth, and prioritization of assets for hardening measures. The courses of action described here enumerate the many actions that can be taken, but the specific approach, level, and timing of the activities within these courses of action can vary depending on the strategic goals and constraints.

Because the cost of transforming the energy sector depends on decisions still to be made, the total amount that must be spent is uncertain and could differ by many millions to up to many billions of dollars depending on these choices. Thus, a point estimate or total cost for the energy sector is not possible and cannot be calculated by adding the sum of the costs associated with individual courses of action.

The total cost of deploying a grid that loosely aligns with the vision articulated in *Build Back Better Puerto Rico* and the Puerto Rico Energy Working Group *Build Back Better: Reimagining and Strengthening the Power Grid of Puerto Rico* plans is approximately \$30 billion. In both of these earlier reports, the total cost to “build back better” was estimated to be about \$18 billion, and the analogous scenario here includes policy initiatives, ongoing operations and maintenance, and a few more extensive measures required for resilience, among other differences. More specifically, executing this vision would likely involve extensive construction of new generation capacity in existing locations, rebuilding and upgrading transmission and distribution lines (including some undergrounding of distribution lines that likely exceeds what was included in the earlier plans), adding smart grid capabilities (e.g., metering), and deploying a modern operational technology system.

The estimated costs for this moderate cost pathway are as follows:

**Potential upfront costs:** \$20 billion in estimated upfront costs

**Potential recurring costs:** \$10 billion in estimated recurring costs

**Potential total costs:** \$30 billion in total estimated costs

However, this is not the only possible path forward, and even more—or substantially less—could be invested in this sector. For example, investing only an additional \$2 billion to \$4 billion would likely just enable incremental improvements in the electricity system beyond the repairs to date and would not provide a sufficiently robust and resilient grid, especially in the face of future storms. This low-cost scenario would fully fund permanent repairs to generation, transmission, and distribution assets (i.e., redo all temporary post-hurricane repairs) but would *not* substantially improve on or modernize the existing grid architecture. At the other extreme, deploying enough new renewable energy to



generate 40–50 percent of Puerto Rico's electricity (including sufficient battery storage to ensure system reliability) is estimated to exceed \$30 billion and perhaps as much as \$90 billion, assuming traditional approaches to handling intermittency of renewable resources, such as solar. This scenario also assumes widespread system modernization (e.g., deployment of smart grid technologies) and improved system resilience.

Neither of these extreme scenarios may be the best long-term solution for Puerto Rico, and the right balance of choices and investments is likely some combination of the attributes and choices of these illustrative scenarios. Additionally, substantial cost savings may be possible by modifying the utility's approach to grid operation, including new approaches, such as the Massachusetts Institute of Technology Lincoln Laboratory's innovative concept of "corrective dispatch," which involves adjusting power generation, delivery, and consumption to find feasible services during extreme conditions when a power flow solution does not exist.

Potential funders across these scenarios and the associated Energy courses of action include FEMA (including the HMGP), the Government of Puerto Rico, NOAA, NSF, PREPA, USDA, U.S. Department of Education, U.S. Department of Energy, EPA, HUD (including the CDBG–DR), DOL, nongovernment sources, and the private sector.

Potential implementers across Energy courses of action include FEMA, the Government of Puerto Rico, COR3, PRASA, PREMA, PREPA, PREC, PRIDCO, Puerto Rico Department of Labor and Human Resources, USACE, USDA Rural Development Rural Utilities Service, U.S. Department of Energy, Puerto Rico municipal governments, new private owner/operators, and professional societies.

The potential funders and the potential implementers listed are notional and cannot be definitively identified until long-term planning has been finalized. Note that organizations that could fund or implement planning efforts (including modeling and analyses) related to infrastructure investment are included in these categories. Where listed, federal agencies may potentially require clarification of legislative authorities, in addition to appropriations, in order to successfully participate in a given course of action. Thus, the potential funders and potential implementing partners are presented here as illustrative and not prescriptive.



### ENR 1

## Establish and Enforce Best Practices for the Electrical Grid

Align grid standards with industry best practices—tailored to the unique conditions in Puerto Rico—and ensure timely compliance and enforcement. Utilize USDA RUS standards for grid reconstruction.

**Potential benefits:** Provides a foundation for all investments in the electrical grid by incorporating industry best practices (both for management and technical considerations).

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### ENR 2

## Design, Build, and Maintain “Islandable” Portions of the Electrical Grid

Design and create an “islandable” or sectionalized grid that can balance generation and load to continue delivering locally generated electricity if sections of the transmission grid fail. Determine optimal design of system architecture through modeling and analysis. Strategically install, test, and maintain microgrids with an adequate inventory of replacement assets.

**Potential benefits:** Allows for more resilient electricity and potentially improved environmental performance. May save money depending on relative electricity rates. Promotes economic growth through less price volatility and potentially improved access to electricity.

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### ENR 3

## Harden Supporting Infrastructure for the Electricity System, Including Communications

Strengthen the electricity system by hardening supporting infrastructure, such as control centers, communication systems, and collection systems. This course of action can include an assessment of existing communication infrastructure that supports grid monitoring and control functionality.

**Potential benefits:** Improves communications and systems that allow faster response to disruptive events. Leads to an electricity supply that is less impacted by threats and hazards. Promotes economic growth with a more reliable and resilient energy supply.

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### ENR 4

## Perform Routine Operations and Maintenance Informed by Periodic Risk Assessment

Improve operations and maintenance with ongoing risk assessments and predictive maintenance. This course of action includes periodic risk assessments that will inform maintenance of the electrical system.

**Potential benefits:** Provides the foundation for all investments to the electrical grid by establishing operations and maintenance best practices.

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### ENR 5

## Harden Grid Assets to Support Critical Infrastructure

Prioritize the hardening of electricity and distribution assets. Design assets that enable rapid response time for electricity to support other critical infrastructure.

**Potential benefits:** Promotes a reliable electricity supply that is less impacted by threats/hazards.

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## **ENR 6** **Improve Grid Assets' Resilience to Flooding**

Prioritize hardening the grid to flooding. This course of action could include (1) altering siting requirements in floodplains; (2) altering asset types to reduce vulnerability; (3) reducing exposure by moving, raising, or waterproofing assets; (4) strengthening assets against hydrostatic and hydrodynamic pressures; (5) decommissioning assets where flood risks are too costly to mitigate; and (6) expediting repairs to reduce mold and rot damage.

**Potential benefits:** Creates a more reliable and resilient electricity supply. Reduces maintenance costs.

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## **ENR 7** **Improve Grid Assets' Resilience to High Windspeeds**

Prioritize hardening the grid to high wind speeds. This course of action may include (1) underground high-risk lines for critical loads; (2) designing and installing poles and towers to withstand a minimum of 150 mph winds, per U.S. standards; (3) vegetation management; (4) reducing transmission and distribution distances by moving generation closer to load centers; (5) structural analysis of the transmission system structures and distribution system poles; and (6) establishing dual-use programs to better manage third-party use of assets.

**Potential benefits:** Creates a more reliable and resilient electricity supply. Reduces maintenance costs.

---

## **ENR 8** **Maintain Disaster-Resilient Generation Assets**

Prioritize the maintenance of generation assets that were resilient to hurricane damage or that were newly installed during the power restoration efforts to ensure resilience to future disasters. This course of action could include assessing the current state of generation assets.

**Potential benefits:** Prepares the generation system for disaster impacts.

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## **ENR 9** **Design and Build Fuel Supply Chain to Provide Reliable Energy Source**

Establish a fuel supply chain that is prepared for future disasters. This course of action could include (1) stockpiling fuel (diesel and propane) in strategic locations near critical facilities, (2) establishing "blanket purchase order" contracts with a fuel provider in case of storm emergencies, and (3) coordinating among agencies to determine optimal resource planning (e.g., the number of delivery trucks and trained personnel).

**Potential benefits:** Improves the fuel supply chain from port to end use.

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#### ENR 10

### Improve the Availability of Ancillary Services for the Grid

Improve the availability of ancillary services by (1) upgrading generation black start capacity; (2) repairing or replacing damaged or high-risk supervisory control and data acquisition (SCADA) systems; (3) selectively installing redundant battery systems and backup generators for charging; (4) expanding the use of renewable and distributed energy resources.

**Potential benefits:** Creates a more stable, resilient electricity supply.

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#### ENR 11

### Design and Deploy Technologies to Improve Real-Time Information and Grid Control

Install a distributed energy resource management system and advanced metering infrastructure. Improve grid control and communication systems to stay online during major disturbances and support rapid recovery. Improve the monitoring and analytic capabilities of the energy management system and the supervisory control and data acquisition (SCADA) system for real-time operations and security assessments. Develop control system strategies to maintain adequate operational security margins and system stability under major events and significant system perturbations.

**Potential benefits:** Improves real-time information and grid control for improved reliability and resilience.

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#### ENR 12

### Coordinate Federal and State Emergency Response with the Private Sector

Coordinate federal, state, and private-sector emergency response. This course of action could include incident response improvements, access to information, and efficient resource realignments. Evaluate response efforts and design new incident response plans that efficiently align resources, lines of authority, and areas of need for the power sector.

**Potential benefits:** Increases the speed of response. Uses resources efficiently. Increases support from local populations. Increases access to resources. Allows for more recovery in less time with fewer resources.

---

#### ENR 13

### Pre-Position Materials and Prepare Workforce for Rapid Response

Strategically locate materials and prepare the workforce to facilitate a rapid restoration of electricity service. This course of action could include (1) assessing the optimal level of material and workforce resources necessary for recovery for each portion of the grid and (2) installing the materials and training the workforce (both personnel in Puerto Rico and mutual aid partners).

**Potential benefits:** Creates an electrical supply that is more resilient and more easily recovered following natural disasters. Allows for greater access and reliability.

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#### **ENR 14**

### **Design and Build Grid Assets to Meet Current and Future Demand**

Design and build generation, transmission, and distribution assets to meet current and future demand projections, including right-sizing and relocation as required. This action complements current efforts by PREPA that include updating and strengthening analytical tools, especially for dynamic system monitoring.

**Potential benefits:** Increases efficiency with the use of updated technology. Improves the efficiency and effectiveness of response efforts. Improves access during all types of operations.

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#### **ENR 15**

### **Enable Private Standby Generation to Provide Emergency Power**

Create and enforce policies requiring certain private facilities, such as hospitals and communication towers, to maintain backup generation. Establish enforceable inspection and maintenance measures for compliance with requirements. Remove barriers to consumer investment in distributed energy resources that could provide emergency energy services.

**Potential benefits:** Creates an electricity supply that is better able to provide energy during, and can more easily recover from, emergency situations. Limits vulnerability to the cascading effects of grid failures.

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#### **ENR 16**

### **Provide Backup Generation to Priority Loads**

Maintain electricity delivery to priority loads—water, communications, manufacturing, health services, schools, airports, and seaports—to ensure the sustained delivery of public services in the absence of the bulk power system. This course of action could include targeted energy solutions for households with electricity-dependent medical needs and prioritization of backup generation for facilities that provide the greatest public benefit.

**Potential benefits:** Improves the efficiency and effectiveness of response efforts. Improves access to life-sustaining resources after a disaster.

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#### **ENR 17**

### **Provide Energy and Water to Critical Facilities That Serve as Congregate Shelters**

Ensure that critical facilities that serve as congregate shelters and resilient community services hubs (e.g., public school buildings) have the appropriate energy and water infrastructure. This course of action could include (1) designating facilities as congregate shelters and (2) installing technologies that ensure that these facilities operate and provide continuity of public services.

**Potential benefits:** Creates a reliable energy source after a catastrophe. Enhances emergency response.

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### **ENR 18**

## **Right-Size and Train the Future Energy Workforce**

Train a workforce capable of installing, operating, and maintaining Puerto Rico's future energy system (especially in asset management, system planning, and data management) and of quickly responding to and repairing damages to the electric system.

This course of action may include (1) developing and implementing plans to provide workforce training and capacity building, (2) workforce right-sizing, (3) supporting the integrated resource plan process, and (4) establishing centers of excellence to attract skilled research and engineering talent.

**Potential benefits:** Develops a skilled workforce that can drive energy system transformation and economic growth. Speeds recovery from power loss events.

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### **ENR 19**

## **Design and Deploy Data Systems to Inform Response and Improve Operations and Maintenance**

Establish data systems to inform decisions during response and improve ongoing operations and maintenance. Create a robust data inventory of assets, which could be coordinated and integrated across other critical infrastructure systems. Acquire IT systems to support inventory and asset management.

**Potential benefits:** Improves asset management, enhances operations and maintenance practices, and expedites system restoration.

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### **ENR 20**

## **Design and Build Capital Assets to Reduce Restoration Time and Cost**

This course of action could include (1) investments to enhance maintenance and operations, (2) standardization of components, (3) relocation of transmission and distribution assets to improve access, (4) stockpiling of rapidly deployable grid restoration assets, (5) installation of additional assets to reduce failures, and (6) the redesign of some existing generation and substation units.

**Potential benefits:** Creates an electricity system that can be restored more quickly after a major power loss and that is more resistant to damage in the first place.

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### **ENR 21**

## **Establish Energy Response and Preparedness Plan**

Create and maintain an emergency response and preparedness plan. Reevaluate and update plans on a regular schedule. Establish and update mutual aid agreements. Streamline an incident command system.

**Potential benefits:** Creates a response plan that will allow the electricity supply to be restored faster after future major power loss events.

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## **ENR 22** **Enable and Promote Distributed Generation**

Distribute generation assets in a new way to align generation facilities with the highest demands, decreasing transmission distances and strengthening the system. Integrate distributed energy resources and energy efficiency improvements, and maintain service continuity to critical customers and loads.

**Potential benefits:** Prevents cascading failures. Provides emergency power to critical needs. Provides reliable power options to consumers. Advances clean energy and energy cost goals.

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## **ENR 23** **Design Best Strategies for Renewable Energy Resources**

Determine the appropriate strategies for all types of existing and potential renewable energy resources (e.g., wind, solar, biomass, hydro, tidal). Assess the possibility of revitalizing hydropower facilities across Puerto Rico, especially facilities with black start or "islanding" capabilities. Prioritize the development of ideal renewable energy sites.

**Potential benefits:** Improves resilience and speeds recovery of the energy grid. Increases access and reliability. Reduces environmental and health costs.

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## **ENR 24** **Design Best Strategies for Affordable and Stable Energy Prices**

Prioritize strategies to reduce prices and volatility faced by consumers. Establish goals for the quantity and type of energy sources, including generation and energy efficiency. Evaluate the costs and benefits of alternative generation resources. Evaluate options and establish policies that incentivize private investment.

**Potential benefits:** Establishes a system that provides affordable, reliable, and high-quality electric power to small businesses, commercial and industrial users, and the broader economy of Puerto Rico.

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## **ENR 25** **Build Capacity for Municipality Decisionmaking of Energy Systems**

Increase the capacity for municipalities to make decisions concerning energy systems. Help municipalities manage the decisionmaking and implementation process by providing needed expertise and advice on how to align activities aimed at meeting renewable energy goals. Potential activities include improving public decisionmaking and engagement in energy.

**Potential benefits:** Builds capacity across the Island to facilitate local energy decisions.

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## ENR 26

### Establish Energy Sector Governance Responsibilities for State-Level Agencies

Clarify the roles and responsibilities of GPR agencies in the energy sector in response to the ongoing restructuring of PREPA and potential regulatory changes.

**Potential benefits:** Allows for the maximum benefit to flow to the energy sector and, ultimately, to the people of Puerto Rico. Increases transparency and accountability between regulators, energy system operators, legislators, and executive officers.

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## ENR 27

### Establish Regulations to Transform the Energy Sector

Maintain a strong, independent, knowledgeable, transparent regulatory framework and commission. Establish regulatory policies to (1) align needs, resources, oversight, incentives, and feedback; (2) contribute to economic growth; and (3) facilitate the efficient achievement of energy-related strategic objectives in this plan. This course of action may include establishing guidelines or requirements to reduce vulnerability to flooding or high wind speeds and is supported by ongoing activities, such as PREC's establishment of the microgrid rule.

**Potential benefits:** Helps meet the vision of modernizing the energy system to ensure that it is affordable, renewable, scalable, and redundant.

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# Modernize the Telecommunications System

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## CIT 1

### Land Mobile Radio System

Devise and execute a plan that will assess these options: (1) upgrading and consolidating the current public LMR systems and supporting microwave networks and (2) joining the federal LMR system when available. The plan will also monitor FirstNet's progress as a potential backhaul, complementary service, or potential replacement. The plan's options may differ in the short/long terms and for voice/nonvoice applications.

**Potential benefits:** Achieves a resilient, state-of-the art, cost-effective public LMR system. Allows system interoperability; reduces maintenance and logistics costs; and facilitates repairs, restoration, and equipment upgrades.

**Potential upfront costs:** \$65 million in estimated upfront costs

**Potential recurring costs:** \$77 million in estimated recurring costs

**Potential total costs:** \$140 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR

**Potential implementer(s):** DPS, PRTRB, CIO

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## CIT 2

### Puerto Rico GIS Resource and Data Platform

Acquire a centralized GIS system for all municipal and state-level agencies, along with associated governance to support planning efforts, inform decisionmaking, and enhance resiliency. GIS personnel in this COA will provide IT/GIS technical and system/application support across all sectors.

**Potential benefits:** Collects and shares GIS data in a uniform way to support public safety, emergency response, and community planning following disasters.

**Potential upfront costs:** \$1 million in estimated upfront costs

**Potential recurring costs:** \$41 million–\$44 million in estimated recurring costs

**Potential total costs:** \$42 million–\$45 million in total estimated costs

**Potential funder(s):** FEMA, FCC

**Potential implementer(s):** CIO, CINO

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### CIT 3

## Upgrade and Enhance 911 Service

Upgrade the current 911 network to an Emergency Services IP Network, implement Next Gen 911, consolidate dispatch at the PSAP, and coordinate with GPR agencies in the housing sector for the adoption of E911 address conversion of rural route addresses.

**Potential benefits:** Improves the effectiveness of 911 service through new features (such as text, photo, video, and GPS location sharing), improves 911 response times, and improves system resilience.

**Potential upfront costs:** \$2 million–\$6 million in estimated upfront costs

**Potential recurring costs:** \$1 million in estimated recurring costs

**Potential total costs:** \$3 million–\$7 million in total estimated costs

**Potential funder(s):** DOC

**Potential implementer(s):** Puerto Rico 911 Service Governing Board, NTIA NG911 Grant Program

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### CIT 4

## Rural Area Network Task Force

Establish a task force to develop communication networks and information systems in rural or disconnected areas, particularly for seniors, individuals with mobility disabilities, and caregivers, for use in emergencies.

**Potential benefits:** Initiates the establishment of information systems that will avoid loss of life and improve the health of people in areas with limited communications infrastructure.

**Potential upfront costs:** \$400,000–\$800,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$400,000–\$800,000 in total estimated costs

**Potential funder(s):** Government of Puerto Rico, private sector

**Potential implementer(s):** PRTRB, PREMA

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### CIT 5

## Implement Public Safety/ Government Communications Backup Power

Increase the resilience and redundancy of Puerto Rico's public safety and government communications networks by implementing standardized backup power sources.

**Potential benefits:** Improves resilience and redundancy. Helps ensure continuity of emergency services and essential government operations.

**Potential upfront costs:** \$20 million in estimated upfront costs

**Potential recurring costs:** \$10 million in estimated recurring costs

**Potential total costs:** \$30 million in total estimated costs

**Potential funder(s):** HMGP, CDBG–DR, Government of Puerto Rico

**Potential implementer(s):** Government of Puerto Rico

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### CIT 6

## Modernize the Emergency Operations Center

Upgrade and modernize the EOC according to FEMA guidance.

**Potential benefits:** Improves emergency managers' ability to coordinate with disaster response and recovery.

**Potential upfront costs:** \$250,000–\$6 million in estimated upfront costs

**Potential recurring costs:** \$10 million in estimated recurring costs

**Potential total costs:** \$11 million–\$16 million in total estimated costs

**Potential funder(s):** FEMA EMPG, Government of Puerto Rico

**Potential implementer(s):** PREMA, PRTRB

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### CIT 7

## Establish an Alternate Emergency Operations Center

Establish an alternate EOC, an alternate PSAP, and a center for continuity of operations and continuity of government housed in the same building, located outside the San Juan area.

**Potential benefits:** Provides a backup location for emergency management operations and critical government functions in times of crisis.

**Potential upfront costs:** \$6.3 million in estimated upfront costs

**Potential recurring costs:** \$10 million in estimated recurring costs

**Potential total costs:** \$17 million in total estimated costs

**Potential funder(s):** FEMA EMPG, Government of Puerto Rico

**Potential implementer(s):** PREMA, PRTRB

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### CIT 8

## Mobile EOC Vehicle

Acquire a mobile EOC vehicle to help coordinate disaster recovery and first responder activities in a centralized location in the event that other infrastructure is disabled in remote locations.

**Potential benefits:** Coordinates onsite response to local emergencies or disasters and is independent of power infrastructure. Can function as a command center to monitor special events.

**Potential upfront costs:** \$1.1 million in estimated upfront costs

**Potential recurring costs:** \$1.4 million in estimated recurring costs

**Potential total costs:** \$2.5 million in total estimated costs

**Potential funder(s):** FEMA EMPG, Government of Puerto Rico

**Potential implementer(s):** DPS

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### CIT 9

## Auxiliary Communications—Volunteer Radio Groups and Organizations

Build a skilled, trained volunteer workforce of radio operators to provide auxiliary community communications to support response efforts.

**Potential benefits:** Extends emergency operations at minimal cost.

**Potential upfront costs:** \$100,000 in estimated upfront costs

**Potential recurring costs:** \$1 million in estimated recurring costs

**Potential total costs:** \$1 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** PREMA, PRTRB, volunteer groups

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## CIT 10

### Transoceanic Submarine Cable

Introduce state-of-the-art undersea cable(s) situated in the west, south, or east of the Island (e.g., one for the midterm, two additional drops in the long term with room to grow in bandwidth). Mitigate threats to existing landing stations and related infrastructure after a disaster.

**Potential benefits:** Increases redundancy and on-Island internet capacity/performance and potentially reduces communication network recovery time and consumer costs. Maintains service if a line is damaged, and provides economic benefits.

**Potential upfront costs:** \$25 million–\$130 million in estimated upfront costs

**Potential recurring costs:** \$42 million–\$105 million in estimated recurring costs

**Potential total costs:** \$67 million–\$235 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, private sector, sale of capacity via indefeasible right of use or by lease

**Potential implementer(s):** PRTRB, GPR agencies, private industry

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## CIT 11

### Procure a Mobile Emergency Communications Capability

Develop the capability to reestablish communications for emergency and government operations post-disaster using a network of deployable telecommunications nodes.

**Potential benefits:** Provides reliable and interoperable communications to enable effective and responsive disaster recovery, emergency services, and government operations.

**Potential upfront costs:** \$83 million–\$165 million in estimated upfront costs

**Potential recurring costs:** \$38.5 million–\$58.3 million in estimated recurring costs

**Potential total costs:** \$122 million–\$223 million in total estimated costs

**Potential funder(s):** FEMA EMPG, Government of Puerto Rico

**Potential implementer(s):** PREMA, CIO, DPS

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#### CIT 12

### Perform Site Structural Analysis for All Government Telecom Towers (Both Public and Privately Owned)

Perform a detailed structural analysis every five years of the towers that are considered critical infrastructure and provide the government with emergency and other services. Determine whether all towers used for emergency communications meet the Puerto Rico tower code on structural loading.

**Potential benefits:** Aids in maintaining a resilient communication infrastructure and emergency communications, as well as continuity of government services.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$4 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR

**Potential implementer(s):** DPS, PRTRB

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#### CIT 13

### Streamline the Permitting and Rights of Way Processes for Towers and the Deployment of Fiber Optic Cable

Establish a central rights of way and permitting approval authority to achieve uniform and streamlined approval processes.

**Potential benefits:** Serves as an important step toward providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

**Potential upfront costs:** \$600,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$600,000 in total estimated costs

**Potential funder(s):** FCC

**Potential implementer(s):** PRTRB, DTOP (PRHTA), other GPR agencies, municipal governments

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#### CIT 14

### Consolidated Government Information Systems

Implement an open, modular, standards-based platform for information systems and consolidate Government of Puerto Rico and municipal government systems to improve continuity of government and quality of government services in the context of a disaster.

**Potential benefits:** Eliminates current mix of legacy government systems, reduces operating costs, and improves reliability of government functions, including response and recovery coordination.

**Potential upfront costs:** \$152 million in estimated upfront costs

**Potential recurring costs:** \$330 million in estimated recurring costs

**Potential total costs:** \$482 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico

**Potential implementer(s):** CIO, GPR agencies

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#### CIT 15

### Undersea Fiber Ring System

Expand the submarine communication network using a ring topology to connect regions around the Island.

**Potential benefits:** Ensures a highly resilient, Island-level network with reduced recovery time after failures; provides economic benefits; and improves route availability to, from, and within the Island.

**Potential upfront costs:** \$25 million–\$130 million in estimated upfront costs

**Potential recurring costs:** \$42 million–\$110 million in estimated recurring costs

**Potential total costs:** \$67 million–\$240 million in total estimated costs

**Potential funder(s):** DOC EDA, Government of Puerto Rico, private sector, sale of capacity via indefeasible right of use or by lease

**Potential implementer(s):** PRTRB, private industry

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#### CIT 16

### Government Digital Reform Planning and Capacity Building

Create a roadmap for digital transformation and determine priorities, assess needs, costs, and feasibility for a government-wide digital transformation strategy.

**Potential benefits:** Helps Puerto Rico benefit from best practices and avoid common pitfalls to digital transformation, ensures stakeholder buy-in, and provides a comprehensive strategy and set of metrics.

**Potential upfront costs:** \$14 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$14 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA

**Potential implementer(s):** CINO, CIO

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### CIT 17

#### Puerto Rico Data Center

Establish a robust, disaster-proof, scalable, and cloud-enabled data center for governmental information systems that expands the capacity to perform essential governmental functions and deliver essential services.

**Potential benefits:** Enables highly reliable governmental IT services for tracking, supporting, and coordinating response and recovery needs within Puerto Rico and externally while preserving the integrity of all essential information systems.

**Potential upfront costs:** \$7 million–\$20 million in estimated upfront costs

**Potential recurring costs:** \$61 million–\$170 million in estimated recurring costs

**Potential total costs:** \$68 million–\$190 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, lease of excess capacity, nongovernment sources

**Potential implementer(s):** CIO, GPR agencies

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### CIT 18

#### Data Store and Data Exchange Standards for Critical Infrastructure

Create online data store and data exchange standards for up-to-date, cross-sector data on critical infrastructure (government and private sector), using an open, modular, and standards-based approach to information exchange, interoperability, and storage.

**Potential benefits:** Improves visibility of critical infrastructure status, provides accurate data to inform emergency response, and increases private-sector awareness of government work affecting infrastructure availability.

**Potential upfront costs:** \$1.8 million–\$2.5 million in estimated upfront costs

**Potential recurring costs:** \$6.3 million–\$13 million in estimated recurring costs

**Potential total costs:** \$8.1 million–\$15 million in total estimated costs

**Potential funder(s):** Private sector, Government of Puerto Rico

**Potential implementer(s):** CIO, GPR agencies

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## CIT 19

### Municipal Hotspots

Provide government-sponsored wi-fi in town centers and public buildings to address the digital disparity and provide a priority connection point after a disaster for reaching a large number of residents in one place. Maximize public access to government-sponsored wi-fi from the main centers of public life, including municipal buildings, parks, and town squares across Puerto Rico.

**Potential benefits:** Reduces the “digital divide” and provides a priority post-disaster connection point for reaching a large number of residents in one place.

**Potential upfront costs:** \$1.6 million in estimated upfront costs

**Potential recurring costs:** \$17 million in estimated recurring costs

**Potential total costs:** \$18 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, FCC

**Potential implementer(s):** CINO, PRTRB, GPR agencies, municipal governments

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## CIT 20

### Continuity of Business at PRIDCO Sites

Maintain key business activities at PRIDCO sites to provide continuity of services when primary communications methods are degraded after a disaster by using, for example, fiber optic, satellite, microwave, and cloud-based or hosted services and information systems.

**Potential benefits:** Improves the resilience of business enterprises that are major contributors to the US economy, facilitates cross-sector economic development within Puerto Rico, and supports communications to impacted areas during a disaster.

**Potential upfront costs:** \$24 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$24 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR, Government of Puerto Rico, private insurance

**Potential implementer(s):** PRIDCO

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### CIT 21

## Government-Owned Fiber Optic Conduits to Reduce Aerial Fiber Optic Cable and Incentivize Expansion of Broadband Infrastructure

Design for the deployment of conduit for buried fiber optic cable and other utilities. Trench and lay empty conduit according to the design. Allow telecom providers to install their own fiber optic cable in GPR-owned conduit.

**Potential benefits:** Increases the resilience of telecom services while reducing costs to telecom providers to bury cable, facilitating the burial of aerial fiber optic cable, and provision of broadband deployment throughout the Island. Provides trenching and conduit adequate to accommodate other utilities. Minimizes the need for multiple roadway disturbances.

**Potential upfront costs:** \$1.3 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.3 billion in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, public-private partnership, FCC

**Potential implementer(s):** PRTRB, DTOP (PRHTA), FCC, private telecommunication companies

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### CIT 22

## Use Federal Programs to Spur Deployment of Broadband Internet Island-Wide

Work with the FCC, HUD, other federal agencies, and GPR agencies to streamline and expedite applications and approvals for schools, libraries and clinics to receive funding for broadband services through the FCC's E-rate program, supplemented by other federal programs. Work with the FCC, federal agencies, and GPR agencies to leverage these programs.

**Potential benefits:** Facilitates the deployment of internet services to schools, libraries and clinics as precursor to improving the provision of education, health and other services.

**Potential upfront costs:** \$1.25 million in estimated upfront costs

**Potential recurring costs:** \$37.8 million–\$66.4 million in estimated recurring costs

**Potential total costs:** \$39.0 million–67.6 million in total estimated costs

**Potential funder(s):** FCC, USDA, HUD, DOC EDA, NTIA

**Potential implementer(s):** PRTRB, FCC, PRDE

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### CIT 23

## Data Collection and Standardization for Disaster Preparedness and Emergency Response

Support expansion and ongoing development of status.pr website with data-sharing protocol in partnership with private sector to enable ongoing situational awareness.

**Potential benefits:** Creates a platform to publicly share data in a standardized, user-friendly format; provides valuable information for policymakers, the media, and emergency responders; and makes data available in formats that can be used by software developers.

**Potential upfront costs:** \$100,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$100,000 in total estimated costs

**Potential funder(s):** CDBG-DR

**Potential implementer(s):** CINO, PREMA, GPR agencies

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### CIT 24

## Establish Puerto Rico Communications Steering Committee

Establish a new Government of Puerto Rico Communications Steering Committee with a rotating chairperson to organize planning efforts and coordinate among key public safety and commercial communications stakeholders in the event of a disaster.

**Potential benefits:** Helps ensure proper planning, governance, and collaboration to effectively and efficiently recover, maintain communications infrastructure, and mitigate interoperability challenges and duplication of effort after a disaster.

**Potential upfront costs:** \$1 million in estimated upfront costs

**Potential recurring costs:** \$6 million in estimated recurring costs

**Potential total costs:** \$7 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico

**Potential implementer(s):** Office of the Governor, PREMA, PRTRB, DPS, CIO, CINO, municipal governments

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## CIT 25

### Evaluate and Implement Alternative Methods to Deploy Broadband Internet Service Throughout Puerto Rico

Create a comprehensive plan for deploying broadband internet throughout Puerto Rico by leveraging existing fiber rings and assessing the availability of existing federal programs, particularly those of the FCC.

**Potential benefits:** Serves as an important step toward providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

**Potential upfront costs:** \$900,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$900,000 in total estimated costs

**Potential funder(s):** CDBG-DR, FCC

**Potential implementer(s):** PRTRB, FCC, private telecommunication companies

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## CIT 26

### Wi-fi Hotspots in Public Housing and Digital Stewards Program

Establish a Digital Stewards program to train residents to install and service wi-fi hotspots in public housing and other publicly funded facilities.

**Potential benefits:** Decreases the “digital divide,” reduces costs for low-income residents who previously relied on expensive data plans, and provides a priority post-disaster connection point.

**Potential upfront costs:** \$1 million in estimated upfront costs

**Potential recurring costs:** \$20 million in estimated recurring costs

**Potential total costs:** \$20 million in total estimated costs

**Potential funder(s):** CDBG-DR, PRDH

**Potential implementer(s):** CINO, HUD, PRDH

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## CIT 27 Study Feasibility of Digital Identity

Study existing models and public acceptance of a secure digital identity including its reliance on resilient power and communications to facilitate government and private-sector transactions.

**Potential benefits:** Helps enable secure digital transactions, reduce costs associated with validation and access to government services when privately held records are unavailable, and reduce potential for fraud and identity theft.

**Potential upfront costs:** \$2 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, public-private partnership

**Potential implementer(s):** CINO, GPR agencies

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## CIT 28 Innovation Economy/Human Capital Initiative

Create a public-private initiative to provide digital skills training, entrepreneurship programs, and access to new technologies through a network of innovation hubs and entrepreneur centers, training partnerships with schools, and outreach via mobile labs to rural and underserved areas.

**Potential benefits:** Promotes a digitally literate employment pool for tech-reliant industries.

**Potential upfront costs:** \$1 million–\$4 million in estimated upfront costs

**Potential recurring costs:** \$30 million–\$70 million in estimated recurring costs

**Potential total costs:** \$30 million–\$70 million in total estimated costs

**Potential funder(s):** DOC EDA, NSF, U.S. Department of Education, nongovernment sources

**Potential implementer(s):** CINO, GPR agencies, universities, municipal governments

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### CIT 29

## Health Care Connectivity to Strengthen Resilience and Disaster Preparedness

Provide robust, resilient, multimodal connectivity to the 86 community clinics across Puerto Rico using satellite, low-power radio, and line-of-site technologies to complement fiber and cell systems and allow clinics to share bandwidth to support other recovery activities.

**Potential benefits:** Improves health care, emergency response, and medical innovation; provides real-time access to electronic health records, clinical data, and services; and bolsters situational awareness after a disaster.

**Potential upfront costs:** \$5.6 million–\$12 million in estimated upfront costs

**Potential recurring costs:** \$140 million–\$260 million in estimated recurring costs

**Potential total costs:** \$140 million–\$280 million in total estimated costs

**Potential funder(s):** CDBG-DR, FCC, DHHS, VA, DoD, Government of Puerto Rico

**Potential implementer(s):** CINO, PREMA, PRTRB, PRDOH

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### CIT 30

## Resiliency Innovation Network Leading to Development of a Resiliency Industry

Create a Resiliency Innovation Network to build on existing PRSTRT and university facilities to develop, teach, test, and refine resiliency products and services.

**Potential benefits:** Stimulates new commercial ventures and jobs, empowers communities and individuals, and increases resilience to disasters.

**Potential upfront costs:** \$2.2 million in estimated upfront costs

**Potential recurring costs:** \$26 million in estimated recurring costs

**Potential total costs:** \$29 million in total estimated costs

**Potential funder(s):** DOC EDA, NSF, PRSTRT, PRIDCO, private sector

**Potential implementer(s):** COR3, CINO, universities, PRSTRT, Resilient Puerto Rico Advisory Commission, DEDC, PRIDCO

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### CIT 31

## Resilience/e-Construction Learning Lab

Establish a Resilience/e-Construction Learning Lab in partnership with universities as a one-year pilot project in one municipality to digitize resilient construction assessment, permitting, and reporting processes.

**Potential benefits:** Streamlines construction, saves document printing and storage costs, decreases communication delays and transmittal times, and increases transparency and tax collection.

**Potential upfront costs:** \$500,000–\$10 million in estimated upfront costs

**Potential recurring costs:** \$20 million–\$60 million in estimated recurring costs

**Potential total costs:** \$20 million–\$70 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, DOT

**Potential implementer(s):** COR3, CINO, PRDH

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### CIT 32

## Digital Citizen Services

Expand the scope of PRITS to include a focus on citizen-centered services and prioritizing a “one-stop-shop” experience for accessing government services and information in an easy-to-use fashion.

**Potential benefits:** Increases public trust, transparency, and accountability; increases adoption of digital services; and streamlines government processes.

**Potential upfront costs:** \$400,000 in estimated upfront costs

**Potential recurring costs:** \$33 million in estimated recurring costs

**Potential total costs:** \$33 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, Government of Puerto Rico

**Potential implementer(s):** CINO, GPR agencies

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### CIT 33

## Government Digital Process Reform

Establish people-centered digital design and data science teams within the Government of Puerto Rico to tackle cross-cutting policy and operational challenges and coordinate government agencies.

**Potential benefits:** Establishes a “whole-of-government,” people-centered digital design and data-driven approach to continuously improve services, spend resources effectively, improve service delivery, better serve the public, and make better policy.

**Potential upfront costs:** \$300,000 in estimated upfront costs

**Potential recurring costs:** \$70 million in estimated recurring costs

**Potential total costs:** \$70 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, Government of Puerto Rico

**Potential implementer(s):** CINO, GPR agencies

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# Rethink Water Systems

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## WTR 1

### Resilient Repair or Replacement of the PRASA Drinking Water System

Repair or replace PRASA drinking water system assets and facilities in a manner that enhances future resilience to extreme events.

**Potential benefits:** Ensures quality and quantity of service to PRASA clients, which safeguards public health and supports economic activity, including tourism and industry. Strengthens PRASA financial sustainability through a more resilient infrastructure system.

**Potential upfront costs:** \$1.34 billion in estimated upfront costs

**Potential recurring costs:** \$3.621 billion in estimated recurring costs

**Potential total costs:** \$4.961 billion in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, DOC EDA, USDA, Government of Puerto Rico, PRASA, private insurance

**Potential implementer(s):** PRASA, PRDOH, EPA

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## WTR 2

### Improve the Operational Efficiency and Performance of PRASA Water and Wastewater Systems

Improve operational efficiency of PRASA's systems by leveraging technology, enhancing monitoring and strengthening use of industry best practices to improve quantity and quality of service.

**Potential benefits:** Ensures quality and quantity of service to PRASA clients, which safeguards public health and supports economic activity, including tourism and industry. Strengthens PRASA financial sustainability through increased efficiency and performance as well as reduced operating costs.

**Potential upfront costs:** \$1.449 billion in estimated upfront costs

**Potential recurring costs:** \$16.4 million in estimated recurring costs

**Potential total costs:** \$1.465 billion in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, Government of Puerto Rico, PRASA, public-private partnership

**Potential implementer(s):** PRASA, EQB, PRDOH, EPA

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### **WTR 3**

## **Enhance the Efficiency and Resilience of PRASA Electricity Services**

Enhance the efficiency and resilience of electricity services for PRASA assets and facilities by developing an energy diversification strategy that ensures adequate backup power for essential facilities and reduces electricity demand.

**Potential benefits:** Ensures quality and quantity of service to PRASA clients during electricity disruptions, which safeguards public health and supports economic activity, including tourism and industry. Strengthens PRASA financial sustainability through cost-saving reductions in energy demand and greater use of self-supplied energy sources.

**Potential upfront costs:** \$2.183 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.183 billion in total estimated costs

**Potential funder(s):** PA, HMGP, USDA, CDBG-DR, Government of Puerto Rico, PRASA, public-private partnership

**Potential implementer(s):** PRASA, EQB, PRDOH, EPA

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### **WTR 4**

## **Enhance Ability to Transfer Potable Water Among PRASA Service Zones**

Enhance ability to transfer potable water among PRASA service zones by improving interconnections and operations.

**Potential benefits:** Ensures quality and quantity of service to PRASA clients, tourism and industry by enhancing flexibility and reducing the likelihood of service disruptions to households and businesses. Strengthens PRASA financial sustainability through cost-effective interconnections between PRASA service areas.

**Potential upfront costs:** \$1.450 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.450 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, USDA, Government of Puerto Rico, PRASA

**Potential implementer(s):** PRASA, PRDOH, EPA

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## **WTR 5** **Improve Treatment and Storage Capacity to Handle High Turbidity Events**

Improve treatment and storage capacity to handle high turbidity events by upgrading drinking water treatment plants in vulnerable service zones and better protecting water sources.

**Potential benefits:** Increases the safety of PRASA drinking water services by reducing the public health risks associated with high turbidity water entering the drinking water distribution system.

**Potential upfront costs:** \$183.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$183.5 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR, EPA, USDA, Government of Puerto Rico, PRASA

**Potential implementer(s):** PRASA, DNER, PRDOH, EPA

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## **WTR 6** **Expand PRASA Services to Unconnected Areas**

Connect and convert non-PRASA systems to PRASA drinking water systems and connect communities with septic tanks and publicly owned wastewater systems to PRASA sewerage, where technically and financially practical.

**Potential benefits:** Eliminates risk of discharge of untreated wastewater into the environment, centralizes operation and maintenance of water and wastewater infrastructure, and improves quality of service and health outcomes.

**Potential upfront costs:** \$1.249 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.249 billion in total estimated costs

**Potential funder(s):** CDBG-DR, EPA, USDA

**Potential implementer(s):** PRASA, non-PRASA systems, EQB, PRDOH, EPA

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## **WTR 7** **Strengthen PRASA's Asset Management Program**

Conduct an asset needs assessment and implement an enhanced asset management program for PRASA drinking water and wastewater assets to decrease lifecycle costs and improve performance.

**Potential benefits:** Supports cost-effective and reliable drinking water and wastewater service delivery, which is critical for economic activity and public health. Strengthens PRASA financial sustainability through decreases in lifecycle costs for infrastructure assets and improved investment planning.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$11.5 million in estimated recurring costs

**Potential total costs:** \$11.5 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, PRASA, DOL, EPA, USDA, nongovernment sources

**Potential implementer(s):** PRASA, EQB, PRDOH, EPA

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## **WTR 8** **Implementation of New Initiatives to Achieve Financial Sustainability for PRASA**

Improve financial sustainability of PRASA by developing and implementing plans that include asset divestment, reducing operating costs and customer delinquencies, enhancing revenue collection, as well as exploring alternative pricing mechanisms and public-private partnerships.

**Potential benefits:** Ensures sustainability of Puerto Rico's dominant water and wastewater service provider, which supports economic activity, safeguards public health, and facilitates provision of public services.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$1.8 million in estimated recurring costs

**Potential total costs:** \$1.8 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, PRASA, USDA, nongovernment sources

**Potential implementer(s):** PRASA

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### **WTR 9**

## **Conduct a Water “Rebuild by Design” Competition**

Fund the implementation of projects under a new “Rebuild by Design” competition to spur innovative water sector resilience projects that are developed collaboratively by community members, civic leaders, and nationally recognized design and engineering firms.

**Potential benefits:** Connects local communities with some of the nation’s leading design firms to collaboratively address vulnerabilities that were exposed by Hurricanes Maria and Irma.

**Potential upfront costs:** \$300 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$300 million in total estimated costs

**Potential funder(s):** CDBG-DR, U.S. Department of Energy

**Potential implementer(s):** Government of Puerto Rico, HUD

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### **WTR 10**

## **Curtail Unauthorized Releases into Sanitary Sewers**

Curtail the disposal of fats, oil, and grease (FOG) and unauthorized releases into wastewater collection systems by enhancing PRASA’s cleaning and maintenance of sanitary sewer collection systems and introducing public education programs, implementing mitigation measures, and creating incentive programs.

**Potential benefits:** Improves the performance of sanitary sewer systems, reduces overflow events and raw sewage exposure, and improves human health and the quality of receiving waters.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$23.5 million in estimated recurring costs

**Potential total costs:** \$24 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, PRASA, EPA, USDA

**Potential implementer(s):** PRASA, EQB, EPA

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**WTR 11**  
**Repair, Replace, and Improve PRASA Wastewater Treatment Plants and Sanitary Sewer Collection Systems**

Repair, replace, and update wastewater treatment plants as well as sanitary sewer collection systems to maintain regulatory standards, anticipate future capacity needs and follow industry best practices.

**Potential benefits:** Eliminates discharge of untreated sewage into the environment. Reduces risk of impacts to human health and closures of beaches and waterways due to contamination.

**Potential upfront costs:** \$1.017 billion in estimated upfront costs

**Potential recurring costs:** \$1.813 billion in estimated recurring costs

**Potential total costs:** \$2.83 billion in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, USDA, Government of Puerto Rico, PRASA, private insurance

**Potential implementer(s):** PRASA, EQB, EPA

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**WTR 12**  
**Enhance Electricity Reliability and Redundancy for Non-PRASA and Nonregulated Systems**

Enhance electricity reliability for non-PRASA systems under both normal and emergency operations by assessing opportunities for resilient energy systems, diversifying energy sources with solar hybrid power generation, upgrading electrical systems, increasing water supply equipment capacity, locating backup generation and storage systems to reduce single points of failure, and training communities to install, operate, and maintain off-grid energy systems.

**Potential benefits:** Increases the reliability and resilience of rural drinking water systems.

**Potential upfront costs:** \$54 million in estimated upfront costs

**Potential recurring costs:** \$9.8 million in estimated recurring costs

**Potential total costs:** \$63.8 million in total estimated costs

**Potential funder(s):** USDA

**Potential implementer(s):** Non-PRASA and nonregulated system operators, PRDOH

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### **WTR 13**

## **Develop Reuse Practices for Treatment Byproducts**

Find economically viable uses for drinking water and wastewater treatment byproducts by developing reuse practices and processes that enable the use of biosolids in the energy, industrial, and agricultural sectors.

**Potential benefits:** Mitigates the costs associated with byproduct disposal and develops an additional revenue stream for PRASA.

**Potential upfront costs:** \$90 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$90 million in total estimated costs

**Potential funder(s):** CDBG-DR, EPA, USDA, public-private partnership, Government of Puerto Rico, PRASA

**Potential implementer(s):** PRASA, EQB, PRDOH, EPA

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### **WTR 14**

## **Improve Equity in Drinking Water Provision for Nonregulated Systems**

Develop equitable and resilient solutions to household drinking water provision in geographically remote areas by expanding mechanisms to coordinate NGO and municipal efforts for the provision of safe drinking water in nonregulated systems.

**Potential benefits:** Increases equity in water service provision, reduces public health impacts and exposure to waterborne disease, and institutionalizes support for nonregulated systems.

**Potential upfront costs:** \$7 million in estimated upfront costs

**Potential recurring costs:** \$5.5 million in estimated recurring costs

**Potential total costs:** \$12.5 million in total estimated costs

**Potential funder(s):** EPA, USDA, nongovernment sources

**Potential implementer(s):** Nonregulated systems, NGOs, PRDOH, Puerto Rico Public Service Commission, universities, DNER

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## **WTR 15** **Improve Reliability and Safety of Non-PRASA Systems**

Repair or replace equipment, improve water treatment, enhance monitoring, and expand contingency planning to improve reliability and safety of water provision for non-PRASA drinking water systems.

**Potential benefits:** Increases capacity to provide reliable, safe drinking water and improves compliance with the Safe Drinking Water Act.

**Potential upfront costs:** \$10.4 million in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$21.4 million in total estimated costs

**Potential funder(s):** EPA, USDA, Government of Puerto Rico

**Potential implementer(s):** Non-PRASA drinking water systems, Puerto Rico Public Service Commission, EPA, PRDOH (Potable Water Division, Environmental Health Regional Offices), NGOs

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## **WTR 16** **Build Capacity of Non-PRASA Systems**

Build the technical, managerial, administrative, and financial capacity of non-PRASA communities and their users by enhancing and institutionalizing communications and outreach to non-PRASA system operators and communities.

**Potential benefits:** Builds capacity by giving community members the skills and experience to run their own systems, resulting in better service and improved public health.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$13.9 million in estimated recurring costs

**Potential total costs:** \$13.9 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR, EPA, USDA, Government of Puerto Rico

**Potential implementer(s):** Non-PRASA systems, Puerto Rico Public Service Commission, NGOs, EPA, PRDOH

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## **WTR 17** **Reduce Incidence of Raw Sewage Exposure**

Reduce incidence of raw sewage leakage from septic tanks, as well as human and environmental exposure to sewage, by (1) establishing or equipping an institution to build technical capacity, and (2) enhancing regulatory and enforcement actions for septic tank design standards and best maintenance practices, (3) implementing financial assistance programs.

**Potential benefits:** Reduces exposure to harmful bacteria in raw sewage and ensuing health risks. Improves community and environmental stewardship.

**Potential upfront costs:** \$1.801 billion in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$1.812 billion in total estimated costs

**Potential funder(s):** CDBG-DR, EPA, USDA, homeowners

**Potential implementer(s):** EPA, OGP, OIGPe, EQB, NGOs

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## **WTR 18** **Invest in Stormwater System Management**

Invest in stormwater system cleaning, monitoring, maintenance and assessment through (1) comprehensive and routine asset mapping, (2) hydrologic and hydraulic analyses, (3) illicit discharge detection and elimination (IDDE) program expansion, (4) education and technical assistance, (5) assessment of system capacity and condition, (6) removal of debris and blockages, and (7) inventory management of parts and equipment.

**Potential benefits:** Improves water and environmental quality and human health. Reduces damages to public and private property from urban flood events.

**Potential upfront costs:** \$121 million in estimated upfront costs

**Potential recurring costs:** \$297.7 million in estimated recurring costs

**Potential total costs:** \$418.7 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, EPA, USDA

**Potential implementer(s):** Municipal governments, DNER, PRASA, EPA, USGS, PRPB, OGP, NOAA, EQB, DTOP, private industry and NGOs

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## **WTR 19** **Reduce Urban Nuisance Flooding**

Reduce urban nuisance flooding and mitigate the discharge of contaminated stormwater runoff into bodies of water through improved stormwater infrastructure design standards, green infrastructure, enhanced stormwater permitting processes and land use regulations, enhanced enforcement of floodplain ordinances, improved system capacity, incentive programs for stormwater retention, and public outreach campaigns.

**Potential benefits:** Improves water and environmental quality and human health. Reduces damages to public and private property from urban flood events.

**Potential upfront costs:** \$964.2 million in estimated upfront costs

**Potential recurring costs:** \$40.7 million in estimated recurring costs

**Potential total costs:** \$1.005 billion in total estimated costs

**Potential funder(s):** EPA, HMGP, USDA, Government of Puerto Rico, DNER

**Potential implementer(s):** Municipal governments, DNER, PRASA, EPA, USGS, PRPB, OGPe, NOAA, EQB, DTOP, private industry and NGOs

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## **WTR 20** **Relocate or Redesign Assets in Flood Zones**

Relocate or redesign assets in flood zones according to the latest building codes and standards and updated hydrologic guidelines to reduce the likelihood of service disruption or infrastructure failure during 100- and 500-year flood events.

**Potential benefits:** Decreases flood risk and increases water sector resilience to future disasters by preventing flooding, damage, and service interruption.

**Potential upfront costs:** \$1.183 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.183 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOC EDA, USDA

**Potential implementer(s):** PRASA, PREPA, DNER, municipal governments, DTOP, non-PRASA systems, FEMA

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## **WTR 21** **Centralize Stormwater System Support and Management**

Enhance the performance of stormwater systems by centralizing stormwater management, building a workforce of stormwater practitioners, streamlining permitting processes, and enhancing technical capacity, community outreach, and best management practices for stormwater.

**Potential benefits:** Enhances the performance of stormwater systems, reduces risks to human health and the environment, expands the trained workforce for stormwater management, reduces risk of flooding and runoff in urban areas, and improves stormwater systems' financial sustainability.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$67.7 million in estimated recurring costs

**Potential total costs:** \$67.7 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, DNER, municipal governments, USDA

**Potential implementer(s):** Municipal governments, Governor-appointed special commission

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## **WTR 22** **Upgrade Reservoir and Dam Safety Management**

Enhance dam safety and upgrade reservoir management rules to optimize operations across multiple water management objectives including drinking water supply, flood control, and hydroelectric generation.

**Potential benefits:** Improves dam and reservoir management to reduce the impact of future disasters and extreme weather and increases the resiliency of the reservoir water supply.

**Potential upfront costs:** \$118 million in estimated upfront costs

**Potential recurring costs:** \$7 million in estimated recurring costs

**Potential total costs:** \$125 million in total estimated costs

**Potential funder(s):** EPA, USACE, Government of Puerto Rico, PRASA, PREPA, nongovernment sources

**Potential implementer(s):** DNER, PRASA, EPA, USGS, PREPA, USACE

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### WTR 23

## Evaluate, Repair, and Improve Flood Control Infrastructure

Evaluate, repair, and improve the performance and resilience of flood control infrastructure, including dams, levees, channels, and water control structures, to safely manage 100-year floods events.

**Potential benefits:** Reduces flood risk for communities and infrastructure assets.

**Potential upfront costs:** \$4.639 billion in estimated upfront costs

**Potential recurring costs:** \$27.7 million in estimated recurring costs

**Potential total costs:** \$4.667 billion in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, EPA, USDA, USACE, private insurance

**Potential implementer(s):** DNER, PRPB, PREMA, municipal governments, USACE, EPA, USGS

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### WTR 24

## Reduce Sedimentation of Water Bodies

Ensure the downstream water quality of reservoirs and channels while maintaining flood control and water supply capacity through sediment control plans and reduction measures, land use planning and practices, and dredging operations.

**Potential benefits:** Improves flood control capability and reduces future dredging needs and costs.

**Potential upfront costs:** \$3.715 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$3.715 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, EPA, USDA, USACE, DOC EDA, Government of Puerto Rico, PRASA, PREPA, DNER, nongovernment sources

**Potential implementer(s):** USACE, EPA, USGS, FEMA, DNER, PRASA, PREPA, PRPB, EQB, municipal governments, PRDOH

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## **WTR 25** **Rationalize Ownership and Management of Flood Control Infrastructure**

Rationalize ownership and management of hydroelectric dams and other flood control infrastructure, including transferring ownership of infrastructure assets, and enhancing cooperation to increase operational efficiency and achieve flood control objectives.

**Potential benefits:** Enhances the operational efficiency, performance, and management of transferred assets.

**Potential upfront costs:** \$2.8 million in estimated upfront costs

**Potential recurring costs:** \$336.6 million in estimated recurring costs

**Potential total costs:** \$339.4 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, PRASA

**Potential implementer(s):** PRASA, PREPA, DNER, municipal governments

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## **WTR 26** **Build Trust and Engage PRASA Clients**

Enhance communication, education, and outreach to PRASA customers on conservation and emergency preparedness and increase public understanding of water and wastewater system planning, performance, and investments to foster strong relationships between PRASA and its clients.

**Potential benefits:** Helps PRASA communicate its management priorities to clients and customers and provides a mechanism for clients and customers to play a more active role in helping PRASA meet its objectives.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$66.3 million in estimated recurring costs

**Potential total costs:** \$66.3 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, PRASA, nongovernment sources

**Potential implementer(s):** PRASA

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## WTR 27

### Protect and Rehabilitate Groundwater Systems

Protect and rehabilitate groundwater systems from saltwater intrusion, contamination, and overexploitation. Implement artificial recharge programs, monitoring networks, and groundwater modeling.

**Potential benefits:** Secures the quantity and quality of groundwater supply sources for agricultural, environmental, and domestic uses and mitigates the negative impacts of groundwater exploitation.

**Potential upfront costs:** \$162.3 million in estimated upfront costs

**Potential recurring costs:** \$25.6 million in estimated recurring costs

**Potential total costs:** \$187.9 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, DOC EDA, EPA, USDA, U.S. Bureau of Reclamation

**Potential implementer(s):** DNER, EQB, USGS, EPA

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## WTR 28

### Secure Drinking Water Sources Against Contamination

Secure drinking water sources against contamination from domestic, agricultural, and industrial wastewater runoff and hazardous waste sites by raising awareness of source water protection measures, enforcing land use restrictions, and remediating contaminated areas.

**Potential benefits:** Improves water source protection and safeguards water supply, human health, and ecosystems.

**Potential upfront costs:** \$39.4 million in estimated upfront costs

**Potential recurring costs:** \$9.9 million in estimated recurring costs

**Potential total costs:** \$49.3 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, DOC EDA, EPA, U.S. Bureau of Reclamation, USDA

**Potential implementer(s):** PRASA, non-PRASA systems, DNER, EQB, PRDOH, EPA

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## **WTR 29** **Strengthen Redundancy and Diversify Water Supply Sources**

Ensure the sustainability of water supply sources through integrated water management plans that include conservation and demand management strategies that balance environmental needs with the demands of communities, industry and agriculture. Enhance resilience to drought and climate change through diversification of water supplies and implementation of water efficiency standards.

**Potential benefits:** Safeguards water supply and ensures adequate availability for the provision of drinking water during periods of drought.

**Potential upfront costs:** \$1.466 billion in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$1.477 billion in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, public-private partnership, Government of Puerto Rico, PRASA

**Potential implementer(s):** PRASA, DNER, PRDOH, EPA

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## **WTR 30** **Enhance PRASA's Emergency Management Operations**

Enhance PRASA's capacity to deliver reliable services to critical facilities by designing and executing emergency management protocols that prioritize disaster response actions.

**Potential benefits:** Promotes water sector resilience, mitigates adverse consequences of extreme events, and can reduce the time required for emergency response and recovery, with downstream benefits for economic activity, public health, and safety.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$8.8 million in estimated recurring costs

**Potential total costs:** \$8.8 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico, PRASA

**Potential implementer(s):** PRASA, DNER, EQB, PRDOH, EPA

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## CIT 6

### Modernize the Emergency Operations Center

Upgrade and modernize the EOC according to FEMA guidance.

**Potential benefits:** Improves emergency managers' ability to coordinate with disaster response and recovery.

**Potential upfront costs:** \$250,000–\$6 million in estimated upfront costs

**Potential recurring costs:** \$10 million in estimated recurring costs

**Potential total costs:** \$11 million–\$16 million in total estimated costs

**Potential funder(s):** FEMA EMPG, Government of Puerto Rico

**Potential implementer(s):** PREMA, PRTRB

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## CIT 7

### Establish an Alternate Emergency Operations Center

Establish an alternate EOC, an alternate PSAP, and a center for continuity of operations and continuity of government housed in the same building, located outside the San Juan area.

**Potential benefits:** Provides a backup location for emergency management operations and critical government functions in times of crisis.

**Potential upfront costs:** \$6.3 million in estimated upfront costs

**Potential recurring costs:** \$10 million in estimated recurring costs

**Potential total costs:** \$17 million in total estimated costs

**Potential funder(s):** FEMA EMPG, Government of Puerto Rico

**Potential implementer(s):** PREMA, PRTRB

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#### **CIT 14**

### **Consolidated Government Information Systems**

Implement an open, modular, standards-based platform for information systems and consolidate Government of Puerto Rico and municipal government systems to improve continuity of government and quality of government services in the context of a disaster.

**Potential benefits:** Eliminates current mix of legacy government systems, reduces operating costs, and improves reliability of government functions, including response and recovery coordination.

**Potential upfront costs:** \$152 million in estimated upfront costs

**Potential recurring costs:** \$330 million in estimated recurring costs

**Potential total costs:** \$482 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico

**Potential implementer(s):** CIO, GPR agencies

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#### **CIT 18**

### **Data Store and Data Exchange Standards for Critical Infrastructure**

Create online data store and data exchange standards for up-to-date, cross-sector data on critical infrastructure (government and private sector), using an open, modular, and standards-based approach to information exchange, interoperability, and storage.

**Potential benefits:** Improves visibility of critical infrastructure status, provides accurate data to inform emergency response, and increases private-sector awareness of government work affecting infrastructure availability.

**Potential upfront costs:** \$1.8 million–\$2.5 million in estimated upfront costs

**Potential recurring costs:** \$6.3 million–\$13 million in estimated recurring costs

**Potential total costs:** \$8.1 million–\$15 million in total estimated costs

**Potential funder(s):** Private sector, Government of Puerto Rico

**Potential implementer(s):** CIO, GPR agencies

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## CPCB 1 Disaster Preparedness Data Analysis and Decision Support Capability

Enhance disaster-related data analysis and decision support capability within PREMA and in partnership with the Puerto Rico Planning Board (PRPB) to support disaster preparedness and hazard mitigation activities. Collect and analyze data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc., by geography and disseminate this information to planners in PREMA, other state-level agencies, and municipalities.

**Potential benefits:** Allows the Government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$21 million in estimated recurring costs

**Potential total costs:** \$21 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, PREMA

**Potential implementer(s):** Government of Puerto Rico, municipal governments, PRPB

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## CPCB 2 Capacity Building for Community-Level Preparedness and Response

Develop and implement community-level response and recovery preparedness activities for priority communities that face particularly high risk during disasters. Recruit, train, and equip Community Emergency Response Teams so that these communities can better sustain themselves during the disaster response period, when emergency responders and access to communities will be limited. Work with community leaders and community-based organizations to establish community-specific approaches for checking on people with access and functional needs.

**Potential benefits:** Puts into place fundamental preparedness and response capabilities at the state and municipal levels.

**Potential upfront costs:** \$3 million in estimated upfront costs

**Potential recurring costs:** \$34 million in estimated recurring costs

**Potential total costs:** \$37 million in total estimated costs

**Potential funder(s):** CDBG-DR, PREMA

**Potential implementer(s):** FEMA, PREMA, municipal governments

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### CPCB 3 **Capacity Building to Incorporate Hazard Risk Reduction into Planning and Design**

Strengthen hazard mitigation assessment, monitoring, and evaluation capabilities within the PRPB so that the board can promote the incorporation of risk reduction in all planning and design decisions. This action includes (1) enhancing GIS capabilities to generate hazard maps for each municipality to inform zoning decisions and improve municipal hazard mitigation planning capacity, and (2) hiring a risk officer for each of the 27 state-level agencies.

**Potential benefits:** Enables a standardized and systematic approach to hazard mitigation. Encourages a more data-driven implementation of Puerto Rico's hazard mitigation plan.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$84 million in estimated recurring costs

**Potential total costs:** \$84 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR

**Potential implementer(s):** PRPB, infrastructure sectors

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### CPCB 4 **Resilience Building in Collaboration with High-Risk Communities**

Develop and implement disaster resilience plans in collaboration with 50–100 selected communities. This action includes (1) investments into programs—e.g., workforce development, microfinance, education—that address long-term stressors, as well as the improvement of essential services; and (2) resilience building events for community residents and local businesses, including fostering connections among governmental agencies, community groups, and NGOs.

**Potential benefits:** Builds community and individual resilience for both disaster response and long-term recovery.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$83 million in estimated recurring costs

**Potential total costs:** \$83 million in total estimated costs

**Potential funder(s):** CDBG-DR, HMGP, DOC EDA

**Potential implementer(s):** Government of Puerto Rico, municipal governments, local NGOs

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**CPCB 6**  
**Public Information and Communication Capability for Coordinated Recovery**

Build a Public Information and Communication capability to maintain engagement with communities that are recovering and to support local engagement with recovery planning. Establish and maintain methods of two-way communication with residents about recovery planning and implementation. Establish effective communication with Puerto Rican communities on the mainland to better understand whether and when people decide to return to Puerto Rico for recovery planning purposes.

**Potential benefits:** Allows the Government of Puerto Rico to communicate more clearly with the public, thus increasing transparency and improving public trust.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$8.8 million in estimated recurring costs

**Potential total costs:** \$8.8 million in total estimated costs

**Potential funder(s):** CDBG-DR, PREMA

**Potential implementer(s):** Government of Puerto Rico

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**CPCB 10**  
**Incentivize Resilient, Creative Design Solutions for Addressing Hazards**

Fund a design competition that fosters innovative solutions for risk reduction—specifically aimed at mitigating hazards and including, but not limited to, hurricanes and flooding—while also offering added social or economic benefits to the community.

**Potential benefits:** Elicits original ideas, out-of-the-box solutions, and transdisciplinary approaches to mitigating disaster risks. Provides a valuable community-level perspective on existing problems and areas in need of improvement.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, PREMA

**Potential implementer(s):** PRPB, COR3, FEMA, PREMA, general public of Puerto Rico

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#### **CPCB 14**

### **Building Grant Writing Capacity**

Establish a set of 100 scholarships each year, for 5 years, for municipal government and local NGO staff to receive training in grant writing over a one-year period from university-based certification programs (at UPR or other academic centers on the mainland). This action builds on existing policy set by the Governor's Executive Order that all executive branch agencies must contract with UPR for capacity building.

**Potential benefits:** Provides professional development for municipal government staff to prepare competitive grant proposals to fund state-financed projects, including disaster recovery. Empowers citizens to seek solutions for their communities.

**Potential upfront costs:** \$3.2 million in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$14 million in total estimated costs

**Potential funder(s):** CDBG-DR, nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, COR3, municipal governments

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#### **CPCB 15**

### **Strengthen Local Nonprofit and NGO Involvement in Disaster Recovery**

Establish a unit within Puerto Rico's Office for the Socioeconomic and Community Development (ODSEC) to strengthen the engagement of local nonprofits and NGOs with government agencies and maximize their contributions as partners in the recovery process.

**Potential benefits:** Strengthens partnerships and drives more successful cross-sector collaboration. Improves coordination and communication among government agencies and NGOs, and enhances resource allocation. Builds community resilience. Increases nonprofit and NGO capacity while helping them develop more long-term, sustainable funding.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$9 million in estimated recurring costs

**Potential total costs:** \$9 million in total estimated costs

**Potential funder(s):** CDBG-DR, nongovernment sources

**Potential implementer(s):** ODSEC, NGOs, local nonprofits

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## HOU 5

### Collect, Integrate, and Map Housing Sector Data

Conduct research, data analysis, planning, and integrated mapping of housing data through the creation of an integrated database.

**Potential benefits:** Supports planning, relocation, and mitigation efforts needed to make these communities safer and more resilient. Aids civic planning for efficient location of emergency and other public services, such as fire stations, hospitals, and schools. Improves overall GPR and municipal efforts to increase property tax revenues.

**Potential upfront costs:** \$30 million–\$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$30 million–\$50 million in total estimated costs

**Potential funder(s):** CDBG–DR

**Potential implementer(s):** PRPB, PRDH, PRDOJ, OGPe, CRIM, private sector firms (banks, insurance)

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## HOU 6

### Enforce Land Use Plans and Improve Compliance with Building Permitting

Provide funding to update current municipal plans and align them with the State Land Use Plan to align zoning and regulations for permitted land use and construction. Provide funding for municipalities to develop municipal plans when lacking. Increase capacity to enforce both land use and building codes through permitting and inspections.

**Potential benefits:** Avoids construction in high-risk areas. Provides access to local jobs, services, and economic and transportation hubs. Reduces burden of providing services in new construction areas and remote areas.

**Potential upfront costs:** \$25 million–\$64 million in estimated upfront costs

**Potential recurring costs:** \$77 million–\$250 million in estimated recurring costs

**Potential total costs:** \$100 million–\$320 million in total estimated costs

**Potential funder(s):** CDBG–DR, HMGP, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** PRPB, OGPe, municipal governments

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**HSS 3**  
**Implement Integrated Waste Management Program and Expand Programs to Increase Recycling Rates**

Establish an integrated materials recovery and waste management program and increase the proportion of waste that is diverted from landfills. This action includes a comprehensive cost analysis, enforceable recycling and composting mandates, and public education.

**Potential benefits:** Creates a waste management program that would decrease negative health impacts across Puerto Rico.

**Potential upfront costs:** \$220,000 in estimated upfront costs

**Potential recurring costs:** \$6.2 million in estimated recurring costs

**Potential total costs:** \$6.4 million in total estimated costs

**Potential funder(s):** EPA, nongovernment sources

**Potential implementer(s):** EPA, DNER, EQB, PR Recycling Partnership, universities

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**HSS 4**  
**Improve Surveillance of Waterborne Disease**

Increase the robustness of the surveillance system for waterborne disease by (1) ensuring that equipment is operational through QA/QC, (2) developing communication tools, and (3) establishing interagency partnerships.

**Potential benefits:** Reduces the transmission of infectious pathogens and harmful chemicals and toxins in the water system.

**Potential upfront costs:** \$90,000 in estimated upfront costs

**Potential recurring costs:** \$2.8 million in estimated recurring costs

**Potential total costs:** \$2.9 million in total estimated costs

**Potential funder(s):** EPA

**Potential implementer(s):** PRDOH, PRASA, CDC

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**HSS 6**  
**Reduce Opportunities for Vector-Borne Diseases**

Support ongoing monitoring and engagement for mosquito control and provide support to establish additional innovative practices for mosquito control, including but not limited to using drones to detect breeding grounds and apply larvicide at abandoned properties.

**Potential benefits:** Improves mosquito control in areas that have been difficult to reach.

**Potential upfront costs:** \$370,000–\$3.4 million in estimated upfront costs

**Potential recurring costs:** \$170,000–\$350,000 in estimated recurring costs

**Potential total costs:** \$530,000–\$3.8 million in total estimated costs

**Potential funder(s):** DHHS

**Potential implementer(s):** PRVCU, PRDOH, municipal governments

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## **HSS 27**

### **Improve Current Epidemiological Surveillance to Better Respond to Natural and Man-Made Disasters**

Develop a comprehensive epidemiological surveillance system with the following components: infectious diseases, chronic diseases, maternal and child health, environmental health, injury, occupational health, and behavioral health. Increase workforce access to technological advancements to support surveillance activities.

**Potential benefits:** Improves Puerto Rico's response capacity for monitoring short- and long-term adverse health hazards and health effects as a result of any disaster. Lessens disease burden and health-related costs after a disaster.

**Potential upfront costs:** \$9 million in estimated upfront costs

**Potential recurring costs:** \$90 million in estimated recurring costs

**Potential total costs:** \$100 million in total estimated costs

**Potential funder(s):** DHHS, nongovernment sources

**Potential implementer(s):** PRDOH, FEMA, EPA, USDA, DoD, DHHS

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## **MUN 6**

### **Create and Maintain Central Repository of Municipal Assets and Associated Conditions**

Collect or update data on municipal assets. Create and maintain a central database of this information, including documentation of property condition.

**Potential benefits:** Helps municipalities and the Government of Puerto Rico identify, manage, and maintain assets. Helps with filing claims with the federal government for damage repair. Enables more efficient budgeting and disaster mitigation. Facilitates leveraging resources and utilization of assets.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$13 million in estimated recurring costs

**Potential total costs:** \$13 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, municipal mayors

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**MUN 8**  
**Provide Municipalities with Technical Assistance and Support for Best Practices in Public Management and Operations**

Provide municipal governments with technical assistance and other forms of support to implement best practices in public management including human resources and fiscal issues. Improve municipal workforces by standardizing salary rates, position descriptions, and qualification requirements and by providing professional development and training.

**Potential benefits:** Improves public management at the municipal level by promoting best practices in core operations. Improves ability of municipal governments to provide an array of services maintaining fiscal well-being. Leads to a more highly skilled, professional workforce.

**Potential upfront costs:** \$3.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$3.5 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOL

**Potential implementer(s):** Government of Puerto Rico, municipal governments

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**MUN 10**  
**Provide Technical Assistance to Improve Municipal Finances by Generating Additional Revenues, Reducing Costs, and Balancing Budgets**

Design and implement technical assistance programs to help municipalities find innovative ways to improve their finances by generating more revenue, cutting unnecessary costs, increasing productivity, and improving their ability to forecast revenue and spending.

**Potential benefits:** Helps municipalities balance their budgets. Improves their capacity to function and deliver services. Leads to an improved fiscal situation throughout Puerto Rico.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** CDBG-DR

**Potential implementer(s):** Independent research partner, municipal governments

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## NCR 5

### Forest Recovery in Rural Protected Areas, Private Forests, Critical Watersheds, and Urban Areas

Develop and implement strategic forest recovery and conservation strategies throughout Puerto Rico through public and private collaborations. Strategies should be developed with a focus on rural protected forests, ecological corridors, private forested lands, agroforestry, and urban forests. Restore tree nurseries and seed banks to aid in the recovery process.

**Potential benefits:** Restores ecological functions of forests and the provision of ecosystem services, boosts economic viability of forest conservation, provides employment opportunities, improves public safety, and reduces the risk of pest and disease damage.

**Potential upfront costs:** \$70 million–\$120 million in estimated upfront costs

**Potential recurring costs:** \$4.5 million in estimated recurring costs

**Potential total costs:** \$75 million–\$120 million in total estimated costs

**Potential funder(s):** DOI, USDA, public-private partnership, Government of Puerto Rico, DNER, municipal governments, nongovernment sources

**Potential implementer(s):** DNER, USFS, municipal governments

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## NCR 8

### Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to allow new capacity and inspect existing landfills.

**Potential benefits:** Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

**Potential upfront costs:** \$176 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$176 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, municipal governments

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## **NCR 9** **Landfill Repair and Closure**

Explore options for repairing landfills that sustained hurricane damage, and close unlined registered dumps.

**Potential benefits:** Reduces or eliminates the impact of damaged landfills and unlined dumps on natural resources (including soil, air, and water quality) and helps bring lined landfills back into compliance. Reduces the risk to public health and the environment.

**Potential upfront costs:** \$160 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$160 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, municipal governments, Solid Waste Authority

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## **NCR 10** **Clean Up and Eliminate Use of Unpermitted, Unregistered Dumps**

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 unpermitted, unregistered dumps throughout Puerto Rico and identify steps to prevent future use of such dumps.

**Potential benefits:** Removes environmental and public health threats associated with unpermitted, unregistered dumps and helps ensure the overall success of a sustainable solid waste management plan.

**Potential upfront costs:** \$104 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$104 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, EPA

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## NCR 11

### Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

**Potential benefits:** Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to landfills, provides economic opportunities, improves soil for agriculture, and provides opportunities for public engagement, including helping to ensure that information about the waste management process is communicated to users.

**Potential upfront costs:** \$101 million in estimated upfront costs

**Potential recurring costs:** \$263 million in estimated recurring costs

**Potential total costs:** \$363 million in total estimated costs

**Potential funder(s):** CDBG-DR, HUD, USDA, public-private partnership

**Potential implementer(s):** DNER, EQB, EPA, USDA

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## NCR 13

### Reduce Sediment Pollution and Risk from Landslides

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides during Hurricane Maria or are at high risk of future landslides, through vegetative, bioengineering, and structural approaches.

**Potential benefits:** Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

**Potential upfront costs:** \$1.05 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.05 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, USDA, USACE, DOT

**Potential implementer(s):** DNER, federal agencies

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## **NCR 14** **Water Quality Improvements at the Watershed Scale**

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

**Potential benefits:** Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves inland and coastal water quality, and restores coastal areas.

**Potential upfront costs:** \$142 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$142 million in total estimated costs

**Potential funder(s):** HMGP, USDA, EPA, DOI, NOAA, EQB

**Potential implementer(s):** DNER, federal agencies

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## **NCR 16** **Wetlands Restoration**

Restore the capacity, resiliency, and ecological function of 10 priority coastal wetlands through site-specific actions. Coordinate with other land use activities such as stormwater management and port construction.

**Potential benefits:** Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

**Potential upfront costs:** \$24.8 million–\$31.4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$24.8 million–\$31.4 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

**Potential implementer(s):** DNER, EQB, USACE

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## **NCR 20** **Redesign, Reorganize, and Rebuild Puerto Rican Parks**

Conduct assessments to help the Puerto Rican parks system improve governance/operations efficiency, align park amenities to community needs, and reengineer parks to serve as stormwater infrastructure. Rebuild parks in compliance with building codes for hurricane-prone areas to be consistent with assessment findings.

**Potential benefits:** Promotes active recreation and reduces health care costs; improves flood control capability and mitigates future damage to community; promotes alternative transportation modes and reduces traffic congestion; and boosts economy through area attractiveness to tourists, businesses, and consumers.

**Potential upfront costs:** \$335 million–\$651 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$335 million–\$651 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG–DR, DOI, EPA, DOT, public–private partnership, private insurance, nongovernment sources

**Potential implementer(s):** DRD, DNER

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## **NCR 30** **Create an Accessible Data Repository of Natural and Cultural Resources**

Create a complete and accessible geo-referenced data repository of Puerto Rico's natural and cultural resources using reliable data standards and systems (such as cloud-based computing) to facilitate response and recovery and inform investment decisions.

**Potential benefits:** Provides data to inform damage assessments and strengthens support for decisions about natural and cultural resource recovery options. Benefits infrastructure, community capacity building, economics, and education.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$12 million in estimated recurring costs

**Potential total costs:** \$12 million in total estimated costs

**Potential funder(s):** DOI, USGS, NOAA, Government of Puerto Rico, DNER, SHPO

**Potential implementer(s):** GPR agencies (DNER, SHPO, ICP), NGOs (PRSTRT), PRTC

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**PBD 10**  
**Incentivize State-of-the-Art Building Design, Practices, and Technologies**

Modify or develop policies and programs that establish clear standards for energy and water efficiency in public buildings and provide incentives for energy and water efficiency, renewable energy systems, increased resilience to natural hazards, and innovative redesign or reconfiguration of spaces to better support delivery of critical public services.

**Potential benefits:** Reduces resource use and building operational costs, meets Government of Puerto Rico energy goals, reduces potential future damages, increases reliability of critical public services, and potentially creates jobs.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$7 million in estimated recurring costs

**Potential total costs:** \$7 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, U.S. Department of Energy

**Potential implementer(s):** GPR agencies, municipal governments

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**TXN 11**  
**Support Infrastructure Asset Management**

Help public agencies inventory their transportation infrastructure, including roads, bridges, culverts, and signs. Improve systems for tracking the condition of that infrastructure and for scheduling maintenance, repair, and rehabilitation.

**Potential benefits:** Reduces infrastructure maintenance costs, vehicle operating costs, travel times, pollutant emissions, and the rate and severity of vehicle crashes. Ensures compliance with Transportation Performance Management regulations issued by the DOT.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$1 million in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** DOT

**Potential implementer(s):** PRHTA

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# Rebuild and Strengthen Maritime, Surface, and Air Transportation

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## TXN 1

### Refine and Enforce Design Standards for Roads and Bridges

Collect and refine guidance on road design (e.g., "Complete Streets" policies that address needs of all road users, including pedestrians and bicyclists), develop a set of engineering standards that promote innovative and resilient features, and ensure that roads meet these standards.

**Potential benefits:** Improves road safety through better roadway markings, signs, and lighting. Reduces maintenance costs, increases roadway life, and prevents damage from future disasters through improved roadway drainage systems and bridge design. Encourages people to walk and bicycle instead of driving by promoting sidewalks and bicycle lanes, which provides public health benefits and reduces traffic congestion.

**Potential upfront costs:** \$2 million–\$100 million in estimated upfront costs

**Potential recurring costs:** \$3 million–\$4 million in estimated recurring costs

**Potential total costs:** \$6 million–\$100 million in total estimated costs

**Potential funder(s):** DOT

**Potential implementer(s):** PRHTA

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## TXN 2

### Harden Vulnerable Transportation Infrastructure

Analyze transportation infrastructure vulnerability to natural hazards, beginning with floodplain mapping and landslide risk analysis, and then undertake cost-effective engineering projects to mitigate risk, including road relocation, traffic rerouting, and bridge, pavement, and culvert reconstruction.

**Potential benefits:** Increases the chances that the transportation system will continue functioning after future natural disasters.

**Potential upfront costs:** \$1.3 million–\$380 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.3 million–\$380 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOT, U.S. Department of Energy

**Potential implementer(s):** PRHTA

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### TXN 3 Redevelop Rafael Hernández Airport

Improve infrastructure at Rafael Hernández Airport in Aguadilla, northwest Puerto Rico. Specifically, upgrade the runway, taxiways, apron area, and the terminals.

**Potential benefits:** Preserves airport capacity, improves service to airport passengers, and boosts local economic activity by attracting more visitors.

**Potential upfront costs:** \$400 million–\$500 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$400 million–\$500 million in total estimated costs

**Potential funder(s):** PA, CDBG–DR, DOT, PRPA, municipal government, public-private partnership, private insurance

**Potential implementer(s):** PRPA

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### TXN 4 Repair Airport Damage

Make repairs to airport facilities that were damaged during Hurricanes Irma and Maria, including runways, roofs, fences, commercial back-up power and fuel-operated generators and electrical systems, and heating/cooling and fire suppression.

**Potential benefits:** Ensures that airports can operate at full capacity and receive relief and recovery supplies, improves airport safety, and boosts local economic activity.

**Potential upfront costs:** \$250 million in estimated upfront costs

**Potential recurring costs:** \$12 million in estimated recurring costs

**Potential total costs:** \$270 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG–DR, DOT, private insurance

**Potential implementer(s):** PRPA, Aerostar (San Juan Airport operator), private sector

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### TXN 5 Road Maintenance and Repair Program

Adopt a “fix it first” policy: Give priority to cost-effective road maintenance and repair projects over new construction or expanding existing roadways. Select projects on the advice of traffic engineers to improve the condition, safety, and operation of roadways.

**Potential benefits:** Reduces vehicle operating costs, travel times, crash rates, the severity of crashes, pollutant emissions, and future road maintenance costs while increasing resilience.

**Potential upfront costs:** \$100 million–\$5.5 billion in estimated upfront costs

**Potential recurring costs:** \$ 900 million in estimated recurring costs

**Potential total costs:** \$1.0 billion–\$6.4 billion in total estimated costs

**Potential funder(s):** DOT, DTOP

**Potential implementer(s):** PRHTA

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## **TXN 6** **Update the All-Airports Emergency Plan**

Update the All-Airports Emergency Plan and disaster preparedness plans at general aviation airports to identify reserve capacity, test and evaluate for continuity of operations, ensure the readiness and pre-positioning of items needed for response efforts before an emergency, develop a communications protocol for first responders, and integrate disaster protection measures to ensure the safety of the airport populace and the community in which the airport is located.

**Potential benefits:** Supports quicker recovery in the event of a future disaster, and promotes the health, safety, and security of communities near airports.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$1 million in estimated recurring costs

**Potential total costs:** \$5 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOT, Government of Puerto Rico, PRPA

**Potential implementer(s):** PRPA, Aerostar (San Juan Airport operator)

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## **TXN 7** **Incentivize a Variety of Mobility Options**

Provide additional travel options for people who do not drive or prefer to use other modes of transportation. Examples include ride-hailing/ride-sharing, expanded “publico” (jitney) service, inter-city bus service, bike/scooter-sharing, and peer-to-peer car-sharing.

**Potential benefits:** Increases mobility and quality of life for people who do not drive, reduces traffic congestion, reduces costs for people who give up driving, and promotes public health and decreases air pollution through the use of nonmotorized transportation.

**Potential upfront costs:** \$450,000–\$17 million in estimated upfront costs

**Potential recurring costs:** \$4.4 million–\$170 million in estimated recurring costs

**Potential total costs:** \$4.9 million–\$190 million in total estimated costs

**Potential funder(s):** DOT, users, private sector

**Potential implementer(s):** PRHTA, private companies, Puerto Rico Metropolitan Bus Authority

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## TXN 8 Improve Bus Service

Improve existing bus service by giving priority to buses at intersections, providing real-time arrival information, upgrading bus stops, updating the payment system to use smart cards, adding dedicated bus lanes to some roads, and expanding the bus fleet.

**Potential benefits:** Increases the reliability and comfort of bus travel and expands transportation options for people who do not drive.

**Potential upfront costs:** \$200,000–\$79 million in estimated upfront costs

**Potential recurring costs:** \$7.9 million–\$650 million in estimated recurring costs

**Potential total costs:** \$8 million–\$730 million in total estimated costs

**Potential funder(s):** DOT, users, public–private partnership

**Potential implementer(s):** Puerto Rico Metropolitan Bus Authority

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## TXN 9 Develop an Intelligent Transportation System

Support transportation agencies in providing real-time travel information to highway users, optimizing traffic signals on key roadways, and develop a plan to ensure that crashes and roadway obstructions are cleared from travel lanes as quickly as possible.

**Potential benefits:** Diverts traffic away from incidents, decreases incident response time, reduces probability of crashes after an initial incident, and provides data to inform transportation planning decisions.

**Potential upfront costs:** \$30 million in estimated upfront costs

**Potential recurring costs:** \$48 million in estimated recurring costs

**Potential total costs:** \$78 million in total estimated costs

**Potential funder(s):** CDBG–DR, DOT

**Potential implementer(s):** PRHTA

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## TXN 10 Develop Redundant Seaport Capacity

Expand an existing seaport (possibly Ceiba, Ponce, or Mayaguez) to mitigate the effects of major disruptions to San Juan Port that could prevent goods from being delivered in a timely manner.

**Potential benefits:** Helps ensure that residents receive food and fuel in case of an emergency that disrupts operations at the main port in San Juan.

**Potential upfront costs:** \$87 million–\$160 million in estimated upfront costs

**Potential recurring costs:** \$14 million–\$23 million in estimated recurring costs

**Potential total costs:** \$100 million–\$180 million in total estimated costs

**Potential funder(s):** PA, FEMA Port Security grants, PRPA, private sector, private insurance

**Potential implementer(s):** PRPA, port authorities and operators

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## TXN 11

### Support Infrastructure Asset Management

Help public agencies inventory their transportation infrastructure, including roads, bridges, culverts, and signs. Improve systems for tracking the condition of that infrastructure and for scheduling maintenance, repair, and rehabilitation.

**Potential benefits:** Reduces infrastructure maintenance costs, vehicle operating costs, travel times, pollutant emissions, and the rate and severity of vehicle crashes. Ensures compliance with Transportation Performance Management regulations issued by the DOT.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$1 million in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** DOT

**Potential implementer(s):** PRHTA

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## TXN 12

### Repair Damage to Ports and Ferry Terminals

Repair damage to ports and ferry terminals/ vessels that limits their use or poses long-term safety or operational concerns. Repairs will take water quality and environmental impacts into account.

**Potential benefits:** Ensures that ports can operate at full capacity and provides some redundancy in the event of a disaster that disrupts a major port.

**Potential upfront costs:** \$940 million in estimated upfront costs

**Potential recurring costs:** \$46 million in estimated recurring costs

**Potential total costs:** \$990 million in total estimated costs

**Potential funder(s):** PA, DOT, CDBG-DR, private sector, private insurance

**Potential implementer(s):** PRPA, Port of Ponce Authority, Mayaguez Ports Commission, private port operators, Puerto Rico Maritime Transportation Authority

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**TXN 13**  
**Reassess the Maritime Transportation System Recovery Plan**

Reevaluate the Maritime Transportation System recovery plan to ensure preparation for future disasters, including coordination among various partners and measures to protect critical resources. Establish an integrated operations center and a communications protocol for first responders during a disaster.

**Potential benefits:** Uses lessons learned from Hurricanes Irma and Maria to ensure that disaster response plans are in place at ports and that ports can recover quickly.

**Potential upfront costs:** \$100,000–\$300,000 in estimated upfront costs

**Potential recurring costs:** \$200,000 in estimated recurring costs

**Potential total costs:** \$300,000–\$500,000 in total estimated costs

**Potential funder(s):** USCG, FEMA PDM, PRPA

**Potential implementer(s):** PRPA, USCG, maritime stakeholders

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**TXN 14**  
**Long-Term Planning to Develop Port of Ponce as a Regional Transshipment Hub**

Begin long-term strategic planning for the Port of Ponce in southern Puerto Rico to serve as a transshipment hub. Provide economic incentives (through reduced taxes or government subsidies) for shipping agencies to use Ponce as an intermediate destination for goods heading to South and North America, Europe, and potentially other foreign locations.

**Potential benefits:** Encourages economic growth of Puerto Rico's maritime transportation sector and makes Puerto Rico's ports more attractive to investors and shipping companies.

**Potential upfront costs:** \$50 million–\$300 million in estimated upfront costs

**Potential recurring costs:** \$50 million–\$200 million in estimated recurring costs

**Potential total costs:** \$100 million–\$500 million in total estimated costs

**Potential funder(s):** Private sector, nongovernment sources

**Potential implementer(s):** Port of Ponce Authority, PRPA

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### TXN 15

#### Consolidate Port Ownership

Consolidate ownership and oversight of Puerto Rico's nine main ports to better manage maritime transportation.

**Potential benefits:** Increases the efficiency and profitability of Puerto Rico's ports, improves coordination among port owners, increases port response and recovery operations, and makes Puerto Rico's ports more attractive to investors and shipping companies.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** PRPA, private sector

**Potential implementer(s):** PRPA, private sector

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### TXN 16

#### Repair Damage to Surface Transportation Network

Repair roads that remain damaged and replace bridges that failed or were severely damaged during the hurricanes. Repair transit systems to meet codes.

**Potential benefits:** Restores Puerto Rico's surface transportation network to its pre-hurricane state and ensures efficient transportation of people, goods, and services.

**Potential upfront costs:** \$800 million in estimated upfront costs

**Potential recurring costs:** \$16 million in estimated recurring costs

**Potential total costs:** \$820 million in total estimated costs

**Potential funder(s):** DOT, FEMA, Government of Puerto Rico

**Potential implementer(s):** PRHTA

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### TXN 17

#### Provide High-Capacity Transit Service to San Juan Airport

Establish high-capacity bus rapid transit service to San Juan Airport.

**Potential benefits:** Provides an alternative means of transportation to Puerto Rico's busiest airport and reduces pollutant emissions and traffic congestion.

**Potential upfront costs:** \$400 million in estimated upfront costs

**Potential recurring costs:** \$170 million in estimated recurring costs

**Potential total costs:** \$570 million in total estimated costs

**Potential funder(s):** DOT, public-private partnership, DTOP

**Potential implementer(s):** P3 Authority, PRHTA

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### TXN 18

#### Provide High-Capacity Transit Service between San Juan and Caguas

Establish high-capacity bus rapid transit service between San Juan and Caguas, probably along the route of PR-52.

**Potential benefits:** Provides an alternative means of transportation between San Juan and Caguas and reduces pollutant emissions and traffic congestion.

**Potential upfront costs:** \$200 million in estimated upfront costs

**Potential recurring costs:** \$170 million in estimated recurring costs

**Potential total costs:** \$370 million in total estimated costs

**Potential funder(s):** DOT, public-private partnership, DTOP

**Potential implementer(s):** P3 Authority, PRHTA

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### **TXN 19** **Extend PR-5**

Extend privately operated PR-5 in Bayamón between PR-199 and PR-167, and ensure that environmental risks are mitigated and a resilient design is used.

**Potential benefits:** Provides upgraded connections between the San Juan metro area and mountain municipalities.

**Potential upfront costs:** \$220 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$220 million in total estimated costs

**Potential funder(s):** DOT, public-private partnership, DTOP

**Potential implementer(s):** P3 Authority, PRHTA

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### **TXN 20** **Extend PR-22**

Extend privately operated PR-22 for roughly 25 miles to the area currently served by PR-2, and ensure that environmental risks are mitigated and a resilient design is used.

**Potential benefits:** Improves connections between San Juan and western Puerto Rico and serves Rafael Hernández Airport in Aguadilla.

**Potential upfront costs:** \$1 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1 billion in total estimated costs

**Potential funder(s):** DOT, public-private partnership, Government of Puerto Rico, DTOP

**Potential implementer(s):** P3 Authority, PRHTA

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### **TXN 21** **Complete PR-10**

Fill gaps in Puerto Rico's highway network by completing work on PR-10, one of the few north-south routes, and ensure that environmental risks are mitigated and a resilient design is used.

**Potential benefits:** Improves mobility between Puerto Rico's interior and the north and south coasts, spurs local economic activity, and improves infrastructure resilience and road safety.

**Potential upfront costs:** \$370 million in estimated upfront costs

**Potential recurring costs:** \$510,000 in estimated recurring costs

**Potential total costs:** \$370 million in total estimated costs

**Potential funder(s):** DOT, public-private partnership, DTOP

**Potential implementer(s):** PRHTA

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### **TXN 22** **Increase Port Facility Resilience**

Improve and rehabilitate piers and associated buildings at ports to increase their resilience to disasters, storm surge, damaging winds, and sea level rise. Upgrades will take water quality and environmental impacts into account.

**Potential benefits:** Helps ensure continuity of operations at ports and increases the structural integrity of port infrastructure.

**Potential upfront costs:** \$360 million–\$540 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$360 million–\$540 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOC EDA

**Potential implementer(s):** PRPA, Port of Ponce Authority, Mayaguez Ports Commission

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### CIT 13

## Streamline the Permitting and Rights of Way Processes for Towers and the Deployment of Fiber Optic Cable

Establish a central rights of way and permitting approval authority to achieve uniform and streamlined approval processes.

**Potential benefits:** Serves as an important step toward providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

**Potential upfront costs:** \$600,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$600,000 in total estimated costs

**Potential funder(s):** FCC

**Potential implementer(s):** PRTRB, DTOP (PRHTA), other GPR agencies, municipal governments

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### CIT 17

## Puerto Rico Data Center

Establish a robust, disaster-proof, scalable, and cloud-enabled data center for governmental information systems that expands the capacity to perform essential governmental functions and deliver essential services.

**Potential benefits:** Enables highly reliable governmental IT services for tracking, supporting, and coordinating response and recovery needs within Puerto Rico and externally while preserving the integrity of all essential information systems.

**Potential upfront costs:** \$7 million–\$20 million in estimated upfront costs

**Potential recurring costs:** \$61 million–\$170 million in estimated recurring costs

**Potential total costs:** \$68 million–\$190 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, lease of excess capacity, nongovernment sources

**Potential implementer(s):** CIO, GPR agencies

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## CIT 22

### Use Federal Programs to Spur Deployment of Broadband Internet Island-Wide

Work with the FCC, HUD, other federal agencies, and GPR agencies to streamline and expedite applications and approvals for schools, libraries and clinics to receive funding for broadband services through the FCC's E-rate program, supplemented by other federal programs. Work with the FCC, federal agencies, and GPR agencies to leverage these programs.

**Potential benefits:** Facilitates the deployment of internet services to schools, libraries and clinics as precursor to improving the provision of education, health and other services.

**Potential upfront costs:** \$1.25 million in estimated upfront costs

**Potential recurring costs:** \$37.8 million–\$66.4 million in estimated recurring costs

**Potential total costs:** \$39.0 million–67.6 million in total estimated costs

**Potential funder(s):** FCC, USDA, HUD, DOC EDA, NTIA

**Potential implementer(s):** PRTRB, FCC, PRDE

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## HOU 5

### Collect, Integrate, and Map Housing Sector Data

Conduct research, data analysis, planning, and integrated mapping of housing data through the creation of an integrated database.

**Potential benefits:** Supports planning, relocation, and mitigation efforts needed to make these communities safer and more resilient. Aids civic planning for efficient location of emergency and other public services, such as fire stations, hospitals, and schools. Improves overall GPR and municipal efforts to increase property tax revenues.

**Potential upfront costs:** \$30 million–\$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$30 million–\$50 million in total estimated costs

**Potential funder(s):** CDBG–DR

**Potential implementer(s):** PRPB, PRDH, PRDOJ, OGPe, CRIM, private sector firms (banks, insurance)

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## HOU 6 Enforce Land Use Plans and Improve Compliance with Building Permitting

Provide funding to update current municipal plans and align them with the State Land Use Plan to align zoning and regulations for permitted land use and construction. Provide funding for municipalities to develop municipal plans when lacking. Increase capacity to enforce both land use and building codes through permitting and inspections.

**Potential benefits:** Avoids construction in high-risk areas. Provides access to local jobs, services, and economic and transportation hubs. Reduces burden of providing services in new construction areas and remote areas.

**Potential upfront costs:** \$25 million–\$64 million in estimated upfront costs

**Potential recurring costs:** \$77 million–\$250 million in estimated recurring costs

**Potential total costs:** \$100 million–\$320 million in total estimated costs

**Potential funder(s):** CDBG–DR, HMGP, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** PRPB, OGPe, municipal governments

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## HOU 11 Improve the Address System

Revise address system to decrease complexity. Install new street signs and address numbers. Update government databases with new property addresses.

**Potential benefits:** Improves the ability of emergency responders to locate properties. Improves the ability of planners and social service providers to map and analyze urban problems and develop solutions. Improves the efficiency of mail delivery and simplifies operations of other entities that rely on property addresses to provide or bill for services.

**Potential upfront costs:** \$75 million–\$200 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$75 million–\$200 million in total estimated costs

**Potential funder(s):** CDBG–DR, Government of Puerto Rico

**Potential implementer(s):** PRDH, PRPB, PRDOJ, CRIM, OGPe, municipal governments, USPS

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### **NCR 13**

## **Reduce Sediment Pollution and Risk from Landslides**

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides during Hurricane Maria or are at high risk of future landslides, through vegetative, bioengineering, and structural approaches.

**Potential benefits:** Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

**Potential upfront costs:** \$1.05 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.05 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, USDA, USACE, DOT

**Potential implementer(s):** DNER, federal agencies

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### **NCR 16**

## **Wetlands Restoration**

Restore the capacity, resiliency, and ecological function of 10 priority coastal wetlands through site-specific actions. Coordinate with other land use activities such as stormwater management and port construction.

**Potential benefits:** Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

**Potential upfront costs:** \$24.8 million–\$31.4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$24.8 million–\$31.4 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

**Potential implementer(s):** DNER, EQB, USACE

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## **NCR 17** **Reduce Coastal Erosion and Provide Disaster Protection Through Beaches and Dunes**

Restore, monitor, and maintain beaches and sand dunes to make them stable and resilient to both seasonal- and disaster-related coastal flooding, as well as long-term sea level rise.

**Potential benefits:** Increases coastal resilience and protects coastal infrastructure, human health and safety, wildlife habitats, and commerce from erosion and flood hazards.

**Potential upfront costs:** \$80 million–\$82 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$80 million–\$82 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOI, USACE, NOAA

**Potential implementer(s):** DNER, municipal governments, USACE

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## **WTR 18** **Invest in Stormwater System Management**

Invest in stormwater system cleaning, monitoring, maintenance and assessment through (1) comprehensive and routine asset mapping, (2) hydrologic and hydraulic analyses, (3) illicit discharge detection and elimination (IDDE) program expansion, (4) education and technical assistance, (5) assessment of system capacity and condition, (6) removal of debris and blockages, and (7) inventory management of parts and equipment.

**Potential benefits:** Improves water and environmental quality and human health. Reduces damages to public and private property from urban flood events.

**Potential upfront costs:** \$121 million in estimated upfront costs

**Potential recurring costs:** \$297.7 million in estimated recurring costs

**Potential total costs:** \$418.7 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, EPA, USDA

**Potential implementer(s):** Municipal governments, DNER, PRASA, EPA, USGS, PRPB, OGP, NOAA, EQB, DTOP, private industry and NGOs

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## **WTR 19** **Reduce Urban Nuisance Flooding**

Reduce urban nuisance flooding and mitigate the discharge of contaminated stormwater runoff into bodies of water through improved stormwater infrastructure design standards, green infrastructure, enhanced stormwater permitting processes and land use regulations, enhanced enforcement of floodplain ordinances, improved system capacity, incentive programs for stormwater retention, and public outreach campaigns.

**Potential benefits:** Improves water and environmental quality and human health. Reduces damages to public and private property from urban flood events.

**Potential upfront costs:** \$964.2 million in estimated upfront costs

**Potential recurring costs:** \$40.7 million in estimated recurring costs

**Potential total costs:** \$1.005 billion in total estimated costs

**Potential funder(s):** EPA, HMGP, USDA, Government of Puerto Rico, DNER

**Potential implementer(s):** Municipal governments, DNER, PRASA, EPA, USGS, PRPB, OGPe, NOAA, EQB, DTOP, private industry and NGOs

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## **WTR 20** **Relocate or Redesign Assets in Flood Zones**

Relocate or redesign assets in flood zones according to the latest building codes and standards and updated hydrologic guidelines to reduce the likelihood of service disruption or infrastructure failure during 100- and 500-year flood events.

**Potential benefits:** Decreases flood risk and increases water sector resilience to future disasters by preventing flooding, damage, and service interruption.

**Potential upfront costs:** \$1.183 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.183 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOC EDA, USDA

**Potential implementer(s):** PRASA, PREPA, DNER, municipal governments, DTOP, non-PRASA systems, FEMA

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# Repair and Rebuild Resilient Housing

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## HOU 1

### **Assess, Repair, Rehabilitate, or Relocate Substantially Damaged Owner-Occupied Homes**

Identify priority homes for repair or rebuilding—those with substantial damage, located in the most vulnerable areas or areas distant from core infrastructure, and identified as low-income households. Repair or rebuild homes onsite if locations are safe from future natural hazard risk. Offer residents of homes on unsafe sites assistance with relocation and temporary housing.

**Potential benefits:** Repairs or rebuilds homes to withstand future disasters and eliminates housing in high-risk areas. Takes community needs and approved land use plan into consideration.

**Potential upfront costs:** \$8 billion–\$12 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$8 billion–\$12 billion in total estimated costs

**Potential funder(s):** IA, HMGP, CDBG-DR, SBA, USDA, private insurance, nongovernment sources

**Potential implementer(s):** PRDH, municipal governments

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## HOU 2

### **Assess, Repair, and Mitigate Damaged Subsidized Rental Housing**

Assess damage and resiliency improvement needs for public housing and privately owned rental housing that receives government subsidies. Rehabilitate and/or modernize subsidized rental housing to accommodate people with or without disabilities, including people with access and functional needs, seniors, veterans, the homeless, and others.

**Potential benefits:** Provides safe, secure housing for low-income and homeless persons. Repairs damaged properties. Provides energy conservation upgrades. Mitigates damage from future disaster events.

**Potential upfront costs:** \$1 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1 billion in total estimated costs

**Potential funder(s):** PA, CDBG-DR, HUD, private insurance

**Potential implementer(s):** Puerto Rico Public Housing Authority, HUD, Puerto Rico Housing Finance Authority, USDA RD

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### HOU 3

## Assess Vulnerability of Non-Substantially Damaged Homes

Engage in long-term resilience planning by assessing housing stock in high-risk areas through property inspections, developing strategies to determine which structures can be secured through mitigation or relocation, and counseling homeowners on flood risk and mitigation.

**Potential benefits:** Improves understanding of risks to housing structures that may not have manifested themselves during Hurricanes Irma or Maria. Increases resiliency of communities and the entire Island if high-risk houses are identified and repaired or strengthened.

**Potential upfront costs:** \$30 million–\$80 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$30 million–\$80 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, nongovernment sources

**Potential implementer(s):** PRPB, PRDH, municipal governments

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### HOU 4

## Make Owner-Occupied Homes More Resilient (Less Vulnerable to Natural Hazards)

Provide funding to perform mitigation work on homes not directly damaged by Hurricanes Maria or Irma but at increased risk of future damage from weather, climate, or other natural disasters.

**Potential benefits:** Increases the resilience of housing, which should lessen the impact of future disasters for residents and communities and reduce the need for dependence on federal programs to support repair and recovery or rebuilding. Seeks to leverage existing federal home improvement programs, such as the Home Protection Roofing Program, to potentially reduce costs and maximize funds available for mitigation efforts.

**Potential upfront costs:** \$12 billion–\$18 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$12 billion–\$18 billion in total estimated costs

**Potential funder(s):** HMGP, FEMA PDM, CDBG-DR, USDA, private insurance, nongovernment sources

**Potential implementer(s):** PRDH, municipal governments

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## HOU 5

### Collect, Integrate, and Map Housing Sector Data

Conduct research, data analysis, planning, and integrated mapping of housing data through the creation of an integrated database.

**Potential benefits:** Supports planning, relocation, and mitigation efforts needed to make these communities safer and more resilient. Aids civic planning for efficient location of emergency and other public services, such as fire stations, hospitals, and schools. Improves overall GPR and municipal efforts to increase property tax revenues.

**Potential upfront costs:** \$30 million–\$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$30 million–\$50 million in total estimated costs

**Potential funder(s):** CDBG–DR

**Potential implementer(s):** PRPB, PRDH, PRDOJ, OGPe, CRIM, private sector firms (banks, insurance)

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## HOU 6

### Enforce Land Use Plans and Improve Compliance with Building Permitting

Provide funding to update current municipal plans and align them with the State Land Use Plan to align zoning and regulations for permitted land use and construction. Provide funding for municipalities to develop municipal plans when lacking. Increase capacity to enforce both land use and building codes through permitting and inspections.

**Potential benefits:** Avoids construction in high-risk areas. Provides access to local jobs, services, and economic and transportation hubs. Reduces burden of providing services in new construction areas and remote areas.

**Potential upfront costs:** \$25 million–\$64 million in estimated upfront costs

**Potential recurring costs:** \$77 million–\$250 million in estimated recurring costs

**Potential total costs:** \$100 million–\$320 million in total estimated costs

**Potential funder(s):** CDBG–DR, HMGP, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** PRPB, OGPe, municipal governments

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## HOU 7

### **Assess Need for—and Adopt and Implement Programs to Provide—Additional Subsidized Rental Housing and Special Housing**

Assess the current and future need for public or subsidized rental housing for lower-income households and special housing for people with or without disabilities, including people with access and functional needs, seniors, veterans, the homeless, and others. Identify programs to increase the supply of affordable housing.

**Potential benefits:** Provides safe, secure housing for low-income populations, people with disabilities, and others with access or functional needs.

**Potential upfront costs:** \$250 million–\$1.7 billion in estimated upfront costs

**Potential recurring costs:** \$1.1 billion–\$2.8 billion in estimated recurring costs

**Potential total costs:** \$1.4 billion–\$4.4 billion in total estimated costs

**Potential funder(s):** HUD, USDA, Low-Income Housing Tax Credit, Puerto Rico Public Housing Authority, nongovernment sources

**Potential implementer(s):** Puerto Rico Housing Finance Authority, Puerto Rico Public Housing Authority, HUD, USDA RD

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## HOU 8

### **Increase Adoption of Adequate Wind and Flood Insurance for Homeowners and Renters**

Increase the number of homeowners and renters who carry adequate homeowners and renters insurance, including flood coverage. Conduct education and outreach campaigns about benefits, coverage, and costs. Assess whether other types of products should be developed and offered at lower cost. Provide financial assistance to low-income households to help reduce premium costs.

**Potential benefits:** Increases the number of homeowners and renters with flood insurance. Decreases reliance on local and federal aid.

**Potential upfront costs:** \$10 million–\$40 million in estimated upfront costs

**Potential recurring costs:** \$440 million–\$1.1 billion in estimated recurring costs

**Potential total costs:** \$450 million–\$1.1 billion in total estimated costs

**Potential funder(s):** CDBG–DR, FEMA NFIP, HMGP, private insurance, Puerto Rico Housing Finance Authority, PRDH

**Potential implementer(s):** Office of the Commissioner of Insurance, Office of the Commissioner of Financial Institutions, insurance companies

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## HOU 9

### Reduce Mortgage Delinquencies and Foreclosures

Reduce mortgage delinquencies and foreclosures that have increased since Hurricane Maria by allowing delinquent borrowers to catch up on mortgage payments through an assistance program.

**Potential benefits:** Stabilizes rates of foreclosure to pre-hurricane levels. Promotes financial and residential stability.

**Potential upfront costs:** \$85 million–\$235 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$85 million–\$235 million in total estimated costs

**Potential funder(s):** CDBG–DR, private sector, nongovernment sources

**Potential implementer(s):** Puerto Rico Housing Finance Authority, PRDH, Mortgage Bankers Association, private lenders, insurance companies

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## HOU 10

### Assess and Renovate Vacant and Blighted Properties

Inventory vacant properties. Develop strategies to clarify legal ownership of properties and ways to incentivize redevelopment or relinquishing of properties for demolition or rehabilitation. Rehabilitate, redevelop, or demolish abandoned and blighted residential and commercial properties. Determine end uses of properties, including development of affordable rental housing and rent-to-own programs.

**Potential benefits:** Increases the value of properties surrounding formerly blighted properties. Increases economic opportunities. Increases the supply of available housing.

**Potential upfront costs:** \$2 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG–DR, DOI, private sector, nongovernment sources

**Potential implementer(s):** Puerto Rico Housing Finance Authority, PRDH, PRPB, municipal governments, SHPO

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## HOU 11 Improve the Address System

Revise address system to decrease complexity. Install new street signs and address numbers. Update government databases with new property addresses.

**Potential benefits:** Improves the ability of emergency responders to locate properties. Improves the ability of planners and social service providers to map and analyze urban problems and develop solutions. Improves the efficiency of mail delivery and simplifies operations of other entities that rely on property addresses to provide or bill for services.

**Potential upfront costs:** \$75 million–\$200 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$75 million–\$200 million in total estimated costs

**Potential funder(s):** CDBG–DR, Government of Puerto Rico

**Potential implementer(s):** PRDH, PRPB, PRDOJ, CRIM, OGPe, municipal governments, USPS

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## HOU 12 Register Properties and Resolve Titling Issues

Resolve homeowner title issues, improve the titling process, and promote the registration of all titles in the official property registry maintained by the government. Create and publicize the title registration process, the importance and benefits of obtaining a clear title and registering that title, and potential downsides for failure to establish title and register properties.

**Potential benefits:** Reduces future uncertainty regarding property ownership and property disputes. Creates a consistent process for establishing title. Improves the accuracy of property tax collection.

**Potential upfront costs:** \$800 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$800 million in total estimated costs

**Potential funder(s):** IA, CDBG–DR, Government of Puerto Rico

**Potential implementer(s):** Municipal governments, PRDOJ, OGPe, PRPB, CRIM, PRDH

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### CIT 3

## Upgrade and Enhance 911 Service

Upgrade the current 911 network to an Emergency Services IP Network, implement Next Gen 911, consolidate dispatch at the PSAP, and coordinate with GPR agencies in the housing sector for the adoption of E911 address conversion of rural route addresses.

**Potential benefits:** Improves the effectiveness of 911 service through new features (such as text, photo, video, and GPS location sharing), improves 911 response times, and improves system resilience.

**Potential upfront costs:** \$2 million–\$6 million in estimated upfront costs

**Potential recurring costs:** \$1 million in estimated recurring costs

**Potential total costs:** \$3 million–\$7 million in total estimated costs

**Potential funder(s):** DOC

**Potential implementer(s):** Puerto Rico 911 Service Governing Board, NTIA NG911 Grant Program

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### CIT 4

## Rural Area Network Task Force

Establish a task force to develop communication networks and information systems in rural or disconnected areas, particularly for seniors, individuals with mobility disabilities, and caregivers, for use in emergencies.

**Potential benefits:** Initiates the establishment of information systems that will avoid loss of life and improve the health of people in areas with limited communications infrastructure.

**Potential upfront costs:** \$400,000–\$800,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$400,000–\$800,000 in total estimated costs

**Potential funder(s):** Government of Puerto Rico, private sector

**Potential implementer(s):** PRTRB, PREMA

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## CIT 16

### Government Digital Reform Planning and Capacity Building

Create a roadmap for digital transformation and determine priorities, assess needs, costs, and feasibility for a government-wide digital transformation strategy.

**Potential benefits:** Helps Puerto Rico benefit from best practices and avoid common pitfalls to digital transformation, ensures stakeholder buy-in, and provides a comprehensive strategy and set of metrics.

**Potential upfront costs:** \$14 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$14 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA

**Potential implementer(s):** CINO, CIO

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## CIT 23

### Data Collection and Standardization for Disaster Preparedness and Emergency Response

Support expansion and ongoing development of status.pr website with data-sharing protocol in partnership with private sector to enable ongoing situational awareness.

**Potential benefits:** Creates a platform to publicly share data in a standardized, user-friendly format; provides valuable information for policymakers, the media, and emergency responders; and makes data available in formats that can be used by software developers.

**Potential upfront costs:** \$100,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$100,000 in total estimated costs

**Potential funder(s):** CDBG-DR

**Potential implementer(s):** CINO, PREMA, GPR agencies

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### CIT 25

## Evaluate and Implement Alternative Methods to Deploy Broadband Internet Service Throughout Puerto Rico

Create a comprehensive plan for deploying broadband internet throughout Puerto Rico by leveraging existing fiber rings and assessing the availability of existing federal programs, particularly those of the FCC.

**Potential benefits:** Serves as an important step toward providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

**Potential upfront costs:** \$900,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$900,000 in total estimated costs

**Potential funder(s):** CDBG-DR, FCC

**Potential implementer(s):** PRTRB, FCC, private telecommunication companies

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### CIT 26

## Wi-fi Hotspots in Public Housing and Digital Stewards Program

Establish a Digital Stewards program to train residents to install and service wi-fi hotspots in public housing and other publicly funded facilities.

**Potential benefits:** Decreases the “digital divide,” reduces costs for low-income residents who previously relied on expensive data plans, and provides a priority post-disaster connection point.

**Potential upfront costs:** \$1 million in estimated upfront costs

**Potential recurring costs:** \$20 million in estimated recurring costs

**Potential total costs:** \$20 million in total estimated costs

**Potential funder(s):** CDBG-DR, PRDH

**Potential implementer(s):** CINO, HUD, PRDH

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### **CPCB 1**

## **Disaster Preparedness Data Analysis and Decision Support Capability**

Enhance disaster-related data analysis and decision support capability within PREMA and in partnership with the Puerto Rico Planning Board (PRPB) to support disaster preparedness and hazard mitigation activities. Collect and analyze data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc., by geography and disseminate this information to planners in PREMA, other state-level agencies, and municipalities.

**Potential benefits:** Allows the Government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$21 million in estimated recurring costs

**Potential total costs:** \$21 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, PREMA

**Potential implementer(s):** Government of Puerto Rico, municipal governments, PRPB

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### **CPCB 3**

## **Capacity Building to Incorporate Hazard Risk Reduction into Planning and Design**

Strengthen hazard mitigation assessment, monitoring, and evaluation capabilities within the PRPB so that the board can promote the incorporation of risk reduction in all planning and design decisions. This action includes (1) enhancing GIS capabilities to generate hazard maps for each municipality to inform zoning decisions and improve municipal hazard mitigation planning capacity, and (2) hiring a risk officer for each of the 27 state-level agencies.

**Potential benefits:** Enables a standardized and systematic approach to hazard mitigation. Encourages a more data-driven implementation of Puerto Rico's hazard mitigation plan.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$84 million in estimated recurring costs

**Potential total costs:** \$84 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR

**Potential implementer(s):** PRPB, infrastructure sectors

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#### **CPCB 4**

### **Resilience Building in Collaboration with High-Risk Communities**

Develop and implement disaster resilience plans in collaboration with 50–100 selected communities. This action includes (1) investments into programs—e.g., workforce development, microfinance, education—that address long-term stressors, as well as the improvement of essential services; and (2) resilience building events for community residents and local businesses, including fostering connections among governmental agencies, community groups, and NGOs.

**Potential benefits:** Builds community and individual resilience for both disaster response and long-term recovery.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$83 million in estimated recurring costs

**Potential total costs:** \$83 million in total estimated costs

**Potential funder(s):** CDBG-DR, HMGP, DOC EDA

**Potential implementer(s):** Government of Puerto Rico, municipal governments, local NGOs

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#### **CPCB 7**

### **Capacity Building for Emergency Shelter Planning**

Conduct an assessment and develop a shelter plan that includes a comprehensive and strategic approach to sheltering Island-wide. Hire planners in each municipality and at the state level to build a robust emergency shelter system. Develop parameters, standards, and design guidelines for shelters to support residents over the longer term. Establish a protocol in coordination with the National Guard to support local and state-level agencies' efforts for management of response commodities for shelters.

**Potential benefits:** Improves access to local, safe, and resourced shelters that can accommodate community needs, such as disabilities and medical conditions.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$57 million in estimated recurring costs

**Potential total costs:** \$57 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico, municipal governments

**Potential implementer(s):** FEMA, PREMA, public buildings sector

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## HSS 1

### Increase Use of Solar-Powered Generators and Solar Backup Power Sources

Promote solar-powered generators for residential properties to reduce air and noise pollution.

**Potential benefits:** Reduces noise and air pollution and the risk for respiratory and hearing-related illnesses. Reduces the number of residents who need to be evacuated due to lack of power. Reduces morbidity among residents with technological dependence for health issues, and mortality and risk associated with fossil fueled generators.

**Potential upfront costs:** \$4.2 billion–\$6.2 billion in estimated upfront costs

**Potential recurring costs:** \$1.4 million in estimated recurring costs

**Potential total costs:** \$4.2 billion–\$6.2 billion in total estimated costs

**Potential funder(s):** EPA, USDA, EQB, private sector

**Potential implementer(s):** EQB, EPA's Caribbean Division

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## HSS 2

### Prevent Disease Through a Capacity-Building Healthy Housing Initiative: Targeting Mold, Lead, and Other Stressors

Build capacity for the identification and management of mold and other environmental stressors through an integrated healthy homes/housing and buildings initiative to prevent respiratory-related and other health exacerbations. This includes training for implementation, capacity-building mechanisms within agencies for enforcement, and promotion of NHLBI Expert Panel Report 3 guidelines for asthma management.

**Potential benefits:** Contributes to decreased public health burden of asthma and other respiratory-related diseases, as well as a reduction in health care costs.

**Potential upfront costs:** \$1.2 million–\$5.3 million in estimated upfront costs

**Potential recurring costs:** \$14 million–\$18 million in estimated recurring costs

**Potential total costs:** \$16 million–\$23 million in total estimated costs

**Potential funder(s):** DHHS

**Potential implementer(s):** EPA, CDC, other federal agencies, PRDH, PRDOH, other GPR agencies

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## HSS 10 Expand Care for Trauma and Chronic Stress

Expand the networks to provide relief for trauma, stress, and anxiety-related behavioral health issues by training nontraditional providers and providing care in nontraditional medical settings. Empower faith-based organizations, schools, and NGOs to better understand and support their constituents in managing post-disaster stressors in a culturally compatible way.

**Potential benefits:** Improves quality of care outcomes for traumatic stress and addresses the mental health care provider shortage and distribution issues.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$3 million in estimated recurring costs

**Potential total costs:** \$3 million in total estimated costs

**Potential funder(s):** DHHS, nongovernment sources

**Potential implementer(s):** Mental health providers

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## HSS 20 Improve Supports for Seniors, Particularly Those Living Alone

Provide pre-disaster support to seniors by investigating reimbursement policies for home care visits to allow greater independence and promote economic opportunities. Encourage communities to participate in local emergency planning through activities, such as community mapping, that would help identify who might be at increased risk in a disaster, such as seniors who live alone.

**Potential benefits:** Increases the resiliency of the older adult population, including their ability to access aid or other needed supplies. Avoids the worsening of chronic conditions due to insufficient medicines or nutrition and promotes overall well-being.

**Potential upfront costs:** \$5.2 million in estimated upfront costs

**Potential recurring costs:** \$57 million in estimated recurring costs

**Potential total costs:** \$62 million in total estimated costs

**Potential funder(s):** DHHS, OPPEA, PRDF, CDBG-DR

**Potential implementer(s):** OPPEA, PREMA, PRDF

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### **MUN 3**

## **Provide Technical Assistance to Repopulate Urban Centers**

Provide technical assistance to establish incentives for individuals and families living in outlying communities to relocate to urban centers, and identify and coordinate funding that can be used for this purpose.

**Potential benefits:** Helps improve community and municipal resilience by concentrating residents in easily accessible urban areas with more resilient infrastructure and services. Reduces the costs of providing these services and improves access for these populations after emergencies. Eases the repurposing of abandoned properties in urban centers and reduces blight while spurring economic development in all sectors.

**Potential upfront costs:** \$1.9 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.9 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico

**Potential implementer(s):** Governor, municipal governments

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### **MUN 8**

## **Provide Municipalities with Technical Assistance and Support for Best Practices in Public Management and Operations**

Provide municipal governments with technical assistance and other forms of support to implement best practices in public management including human resources and fiscal issues. Improve municipal workforces by standardizing salary rates, position descriptions, and qualification requirements and by providing professional development and training.

**Potential benefits:** Improves public management at the municipal level by promoting best practices in core operations. Improves ability of municipal governments to provide an array of services maintaining fiscal well-being. Leads to a more highly skilled, professional workforce.

**Potential upfront costs:** \$3.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$3.5 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOL

**Potential implementer(s):** Government of Puerto Rico, municipal governments

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## NCR 8

### Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to allow new capacity and inspect existing landfills.

**Potential benefits:** Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

**Potential upfront costs:** \$176 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$176 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, municipal governments

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## NCR 11

### Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

**Potential benefits:** Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to landfills, provides economic opportunities, improves soil for agriculture, and provides opportunities for public engagement, including helping to ensure that information about the waste management process is communicated to users.

**Potential upfront costs:** \$101 million in estimated upfront costs

**Potential recurring costs:** \$263 million in estimated recurring costs

**Potential total costs:** \$363 million in total estimated costs

**Potential funder(s):** CDBG-DR, HUD, USDA, public-private partnership

**Potential implementer(s):** DNER, EQB, EPA, USDA

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### **NCR 13**

## **Reduce Sediment Pollution and Risk from Landslides**

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides during Hurricane Maria or are at high risk of future landslides, through vegetative, bioengineering, and structural approaches.

**Potential benefits:** Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

**Potential upfront costs:** \$1.05 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.05 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, USDA, USACE, DOT

**Potential implementer(s):** DNER, federal agencies

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### **NCR 14**

## **Water Quality Improvements at the Watershed Scale**

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

**Potential benefits:** Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves inland and coastal water quality, and restores coastal areas.

**Potential upfront costs:** \$142 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$142 million in total estimated costs

**Potential funder(s):** HMGP, USDA, EPA, DOI, NOAA, EQB

**Potential implementer(s):** DNER, federal agencies

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## **NCR 22** **Promote Alternative Tourism for Economic Development**

Catalyze experience-based tourism in key hub areas and enhance efforts to preserve unique natural, cultural, and historical assets.

**Potential benefits:** Supports economic growth; improves services and access; protects historical, cultural, and natural assets; incubates local entrepreneurship; and improves quality of life in underserved communities.

**Potential upfront costs:** \$140 million–\$233.4 million in estimated upfront costs

**Potential recurring costs:** \$3.457 million in estimated recurring costs

**Potential total costs:** \$143.5 million–\$236.9 million in total estimated costs

**Potential funder(s):** DOC EDA, USDA, DOI, NOAA, NEH, NARA, IMLS, NEA, DOL

**Potential implementer(s):** ICP, PRTC, DOC EDA, SBA, DNER

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## **PBD 3** **Establish Integrated Service Centers**

Continue supporting the Government of Puerto Rico's ongoing project to cluster public services in a single location to improve efficiency and accessibility to the public. A center is already operating in San Juan, where residents can access a variety of social services in a single location.

**Potential benefits:** Simplifies access to services for the population and streamlines maintenance processes.

**Potential upfront costs:** \$5 million–\$10 million in estimated upfront costs

**Potential recurring costs:** \$6 million–\$7 million in estimated recurring costs

**Potential total costs:** \$10 million–\$20 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR, Government of Puerto Rico, USDA

**Potential implementer(s):** Puerto Rico Department of State, PRPBA

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**PBD 9**  
**Repair All Essential Public Buildings Damaged by Hurricanes Irma and Maria**

Complete repairs to essential public buildings that sustained hurricane damage, ensuring that repairs meet current building safety codes for wind, flood, and seismic events.

**Potential benefits:** Fixes damaged buildings and ensures that public buildings are more resilient to future hurricanes and other disasters.

**Potential upfront costs:** \$1 billion in estimated upfront costs

**Potential recurring costs:** \$700 million in estimated recurring costs

**Potential total costs:** \$2 billion in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, private insurance

**Potential implementer(s):** PRIFA

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**PBD 10**  
**Incentivize State-of-the-Art Building Design, Practices, and Technologies**

Modify or develop policies and programs that establish clear standards for energy and water efficiency in public buildings and provide incentives for energy and water efficiency, renewable energy systems, increased resilience to natural hazards, and innovative redesign or reconfiguration of spaces to better support delivery of critical public services.

**Potential benefits:** Reduces resource use and building operational costs, meets Government of Puerto Rico energy goals, reduces potential future damages, increases reliability of critical public services, and potentially creates jobs.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$7 million in estimated recurring costs

**Potential total costs:** \$7 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, U.S. Department of Energy

**Potential implementer(s):** GPR agencies, municipal governments

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### **TXN 5**

## **Road Maintenance and Repair Program**

Adopt a “fix it first” policy: Give priority to cost-effective road maintenance and repair projects over new construction or expanding existing roadways. Select projects on the advice of traffic engineers to improve the condition, safety, and operation of roadways.

**Potential benefits:** Reduces vehicle operating costs, travel times, crash rates, the severity of crashes, pollutant emissions, and future road maintenance costs while increasing resilience.

**Potential upfront costs:** \$100 million–\$5.5 billion in estimated upfront costs

**Potential recurring costs:** \$900 million in estimated recurring costs

**Potential total costs:** \$1.0 billion–\$6.4 billion in total estimated costs

**Potential funder(s):** DOT, DTOP

**Potential implementer(s):** PRHTA

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### **TXN 7**

## **Incentivize a Variety of Mobility Options**

Provide additional travel options for people who do not drive or prefer to use other modes of transportation. Examples include ride-hailing/ride-sharing, expanded “publico” (jitney) service, inter-city bus service, bike/scooter-sharing, and peer-to-peer car-sharing.

**Potential benefits:** Increases mobility and quality of life for people who do not drive, reduces traffic congestion, reduces costs for people who give up driving, and promotes public health and decreases air pollution through the use of nonmotorized transportation.

**Potential upfront costs:** \$450,000–\$17 million in estimated upfront costs

**Potential recurring costs:** \$4.4 million–\$170 million in estimated recurring costs

**Potential total costs:** \$4.9 million–\$190 million in total estimated costs

**Potential funder(s):** DOT, users, private sector

**Potential implementer(s):** PRHTA, private companies, Puerto Rico Metropolitan Bus Authority

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## **TXN 16** **Repair Damage to Surface Transportation Network**

Repair roads that remain damaged and replace bridges that failed or were severely damaged during the hurricanes. Repair transit systems to meet codes.

**Potential benefits:** Restores Puerto Rico's surface transportation network to its pre-hurricane state and ensures efficient transportation of people, goods, and services.

**Potential upfront costs:** \$800 million in estimated upfront costs

**Potential recurring costs:** \$16 million in estimated recurring costs

**Potential total costs:** \$820 million in total estimated costs

**Potential funder(s):** DOT, FEMA, Government of Puerto Rico

**Potential implementer(s):** PRHTA

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## **WTR 1** **Resilient Repair or Replacement of the PRASA Drinking Water System**

Repair or replace PRASA drinking water system assets and facilities in a manner that enhances future resilience to extreme events.

**Potential benefits:** Ensures quality and quantity of service to PRASA clients, which safeguards public health and supports economic activity, including tourism and industry. Strengthens PRASA financial sustainability through a more resilient infrastructure system.

**Potential upfront costs:** \$1.34 billion in estimated upfront costs

**Potential recurring costs:** \$3.621 billion in estimated recurring costs

**Potential total costs:** \$4.961 billion in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, DOC EDA, USDA, Government of Puerto Rico, PRASA, private insurance

**Potential implementer(s):** PRASA, PRDOH, EPA

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## **WTR 10** **Curtail Unauthorized Releases into Sanitary Sewers**

Curtail the disposal of fats, oil, and grease (FOG) and unauthorized releases into wastewater collection systems by enhancing PRASA's cleaning and maintenance of sanitary sewer collection systems and introducing public education programs, implementing mitigation measures, and creating incentive programs.

**Potential benefits:** Improves the performance of sanitary sewer systems, reduces overflow events and raw sewage exposure, and improves human health and the quality of receiving waters.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$23.5 million in estimated recurring costs

**Potential total costs:** \$24 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, PRASA, EPA, USDA

**Potential implementer(s):** PRASA, EQB, EPA

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## **WTR 19** **Reduce Urban Nuisance Flooding**

Reduce urban nuisance flooding and mitigate the discharge of contaminated stormwater runoff into bodies of water through improved stormwater infrastructure design standards, green infrastructure, enhanced stormwater permitting processes and land use regulations, enhanced enforcement of floodplain ordinances, improved system capacity, incentive programs for stormwater retention, and public outreach campaigns.

**Potential benefits:** Improves water and environmental quality and human health. Reduces damages to public and private property from urban flood events.

**Potential upfront costs:** \$964.2 million in estimated upfront costs

**Potential recurring costs:** \$40.7 million in estimated recurring costs

**Potential total costs:** \$1.005 billion in total estimated costs

**Potential funder(s):** EPA, HMGP, USDA, Government of Puerto Rico, DNER

**Potential implementer(s):** Municipal governments, DNER, PRASA, EPA, USGS, PRPB, OGP, NOAA, EQB, DTOP, private industry and NGOs

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### WTR 23

## Evaluate, Repair, and Improve Flood Control Infrastructure

Evaluate, repair, and improve the performance and resilience of flood control infrastructure, including dams, levees, channels, and water control structures, to safely manage 100-year floods events.

**Potential benefits:** Reduces flood risk for communities and infrastructure assets.

**Potential upfront costs:** \$4.639 billion in estimated upfront costs

**Potential recurring costs:** \$27.7 million in estimated recurring costs

**Potential total costs:** \$4.667 billion in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, EPA, USDA, USACE, private insurance

**Potential implementer(s):** DNER, PRPB, PREMA, municipal governments, USACE, EPA, USGS

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### WTR 28

## Secure Drinking Water Sources Against Contamination

Secure drinking water sources against contamination from domestic, agricultural, and industrial wastewater runoff and hazardous waste sites by raising awareness of source water protection measures, enforcing land use restrictions, and remediating contaminated areas.

**Potential benefits:** Improves water source protection and safeguards water supply, human health, and ecosystems.

**Potential upfront costs:** \$39.4 million in estimated upfront costs

**Potential recurring costs:** \$9.9 million in estimated recurring costs

**Potential total costs:** \$49.3 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, DOC, EDA, EPA, U.S. Bureau of Reclamation, USDA

**Potential implementer(s):** PRASA, non-PRASA systems, DNER, EQB, PRDOH, EPA

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# Transform the Education System

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## EDU 1

### Create New—and Enhance Existing—After-School and Summer Learning Opportunities

Expand existing and implement new summer and after-school learning programs—including academic, vocational education, health, nutrition, and mental health services—to address potential learning loss due to long school closures post-hurricane, ensure access to the full range of educational opportunities, and provide consistency to meal programs.

**Potential benefits:** Promotes faster recovery in student achievement from post-hurricane learning loss; a stronger sense of stability; and better understanding of students' education, health, and mental health needs. Creates employment for teachers and other Puerto Ricans as program instructors.

**Potential upfront costs:** \$1 million in estimated upfront costs

**Potential recurring costs:** \$3.9 billion in estimated recurring costs

**Potential total costs:** \$3.9 billion in total estimated costs

**Potential funder(s):** U.S. Department of Education, USDA, nongovernment sources

**Potential implementer(s):** PRDE, U.S. Department of Education, USDA Summer Food Program, Echar Pa'lante alliance

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## EDU 2

### Improve Longitudinal Data System to Support Evidence-Based Policy

Complete prior work to develop a longitudinal data system. Provide training on how to integrate data into operations and decisionmaking. Link K–12 data to postsecondary outcomes and workforce data to better manage school-to-work transitions.

**Potential benefits:** Supports decisions by teachers and administrators in everyday practice and helps inform students and their parents. Supports timely, data-driven decisions about school closures, reallocation of teachers and students to consolidated schools, resource allocation, and targeted professional development.

**Potential upfront costs:** \$2.2 million in estimated upfront costs

**Potential recurring costs:** \$5.5 million in estimated recurring costs

**Potential total costs:** \$7.7 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources

**Potential implementer(s):** PRDE

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### EDU 3

## Landscape Analysis of Early Childhood Interventions and Care Opportunities

Determine the demographics of children 0–5 years of age (and their families), the current supply of interventions and care settings, and the cost of—and possible funding streams for—providing high-quality care to all children in Puerto Rico.

**Potential benefits:** Promotes children's school readiness and provides an important foundation for children's later academic and social success, as well as their health and well-being.

**Potential upfront costs:** \$1 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico, municipal governments, nongovernment sources

**Potential implementer(s):** Puerto Rico's Administration for the Care and Integral Development of Children, PRDE

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### EDU 4

## Multisector Analysis to Support Resource Allocation Decisions Related to Schools

Engage a multidisciplinary group of analysts and stakeholders to (1) review how economic, infrastructure, educational, and teacher workforce resources are currently co-located across communities and (2) recommend strategies, ongoing analysis, decision rules, and other approaches to deciding where to invest in school infrastructure updates, where to reassign teachers, where to invest in school-to-work programs, and other related decisions.

**Potential benefits:** Improves educational outcomes and community impacts, and leads to better value for money.

**Potential upfront costs:** \$2.2 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.2 million in total estimated costs

**Potential funder(s):** Nongovernment sources

**Potential implementer(s):** PRDE

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## EDU 5

### Implement a Student-Based Budget System

Review current budget practices to assess how funds are allocated to schools and identify unmet funding needs and inequities based on geographic location or school characteristics. Determine whether and how a new student-based budget formula would allow funding to be distributed more equitably, effectively, and transparently across both public and new charter schools.

**Potential benefits:** Helps increase equity, allocate more dollars to higher-need schools, and ensure consistency across all regions in access to resources.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$1.1 million in estimated recurring costs

**Potential total costs:** \$1.6 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources

**Potential implementer(s):** PRDE (Office of Public School Improvement)

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## EDU 6

### Expanding and Updating K–12 Vocational Programs

Implement a one-year pilot program and subsequent full-scale program to expand and update K–12 vocational programs to include entrepreneurship training and accommodate growth in economic sectors, such as manufacturing, finance, renewable energy, construction, hospitality, and health care.

**Potential benefits:** Helps build a skilled labor force for sectors that are key to recovery. Helps address the needs of those disproportionately affected by disasters. Helps create and/or strengthen private–public consortiums to support long-term recovery. Creates closer ties between K–12 schools and universities.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$3 billion in estimated recurring costs

**Potential total costs:** \$3 billion in total estimated costs

**Potential funder(s):** U.S. Department of Education, NSF, DoD, DHHS, DOL, public–private partnership, DEDC, Puerto Rico Department of Labor and Human Resources, nongovernment sources

**Potential implementer(s):** PRDE, PRITS, Echar Pa'lante alliance, schools, private industry

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## EDU 7

### Augment Tele-Education/ Online Education

Provide "emergency instruction" in the event of a school closure of more than 2 weeks. This action includes building an online repository of free, open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K–12), and technology platforms.

**Potential benefits:** Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE's initiative to integrate technology into the classroom.

**Potential upfront costs:** \$3.7 million in estimated upfront costs

**Potential recurring costs:** \$18 million in estimated recurring costs

**Potential total costs:** \$22 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources, private sector

**Potential implementer(s):** PRDE, Echar Pa'lante alliance, professional development partners

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## EDU 8

### Strengthen School Leadership Pipeline

Strengthen the school director and district leader pipeline by improving recruitment, embedded training, support (e.g., mentoring, coaching, supporting entrepreneurship), and retention practices. Conduct analysis to understand future skill demands on education leaders.

**Potential benefits:** Contributes to student learning, reduction in teacher and leadership turnover, improved understanding of local education needs, and improved communication between schools and regional administrators. Increases the capacity to function within a newly decentralized system.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$290 million in estimated recurring costs

**Potential total costs:** \$290 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources

**Potential implementer(s):** PRDE, professional development partners

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## EDU 9

### Develop and Implement Teacher Pipeline Program

Improve teacher preparation programs and instructional practice by (1) creating a residency model for training, (2) reviewing certification requirements, (3) aligning personnel decisionmaking processes with teacher assessments, (4) strengthening supports and career pathways, and (5) rewarding high-quality teachers working in demanding environments.

**Potential benefits:** Helps ensure a good match between teacher skills and student needs. Sustains a pipeline of teachers who can engage in and support high-quality instruction. Reduces teacher turnover and promotes a closer relationship between PreK–12 schools and UPR.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$350 million in estimated recurring costs

**Potential total costs:** \$350 million in total estimated costs

**Potential funder(s):** U.S. Department of Education

**Potential implementer(s):** PRDE, UPR, professional development partners, schools

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## EDU 10

### Develop and Implement a Parent Education Program on School Choice

Develop outreach and public education programs, with special emphasis on disadvantaged families, to ensure that all parents and guardians have the knowledge and tools they need to be effective consumers in a school-choice environment.

**Potential benefits:** Improves parents' knowledge about their school choices while also making parents and families happier and more invested in their chosen schools.

**Potential upfront costs:** \$200,000 in estimated upfront costs

**Potential recurring costs:** \$5.5 million in estimated recurring costs

**Potential total costs:** \$5.7 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, PRDE, nongovernment sources

**Potential implementer(s):** PRDE (Family Engagement Office)

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## EDU 11

### Rebuilding of Public (PRDE and Municipal) PreK–12 School Infrastructure

Rebuild PRDE and municipal schools according to an “Education Is Resilient” approach. Build school facilities that promote 21st-century approaches to learning by creating learning environments that promote student-directed learning and provide collaborative workspaces where students and teachers share creative, innovative, and developmentally appropriate teaching and learning experiences.

**Potential benefits:** Rebuilds schools. Creates learning environments that promote student-directed learning and reflects efforts to make the education system more focused on 21st-century approaches to learning.

**Potential upfront costs:** \$3.5 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$3.5 billion in total estimated costs

**Potential funder(s):** PA, private sector, nongovernment sources, private insurance

**Potential implementer(s):** PRDE

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## EDU 12

### Consolidate and Rebuild University of Puerto Rico Infrastructure

Conduct an analysis of the UPR system to determine how campus consolidation could best meet the educational goals of the university system and ensure the system's financial stability. Repair storm damage to UPR facilities.

**Potential benefits:** Ensures that campus consolidation efforts serve Puerto Rico's workforce development goals.

**Potential upfront costs:** \$2.5 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.5 billion in total estimated costs

**Potential funder(s):** PA, private insurance

**Potential implementer(s):** UPR

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### EDU 13

## Landscape Analysis and Rebuilding of Private Nonprofit (PNP) PreK–12 School Infrastructure

Complete a landscape analysis of PNP school infrastructure, and conduct outreach to PNP schools about eligibility for FEMA PA. Rebuild PNP schools according to an "Education Is Resilient" approach. Build school facilities that promote 21st-century approaches to learning by creating environments that promote student-directed learning and provide collaborative workspaces where students and teachers share innovative, developmentally appropriate teaching and learning experiences.

**Potential benefits:** Rebuilds schools. Creates learning environments that promote student-directed learning and reflects efforts to focus the education system on 21st-century approaches to learning.

**Potential upfront costs:** \$1.7 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.7 billion in total estimated costs

**Potential funder(s):** PA, private sector, nongovernment sources, private insurance

**Potential implementer(s):** PRDE

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### CIT 4

## Rural Area Network Task Force

Establish a task force to develop communication networks and information systems in rural or disconnected areas, particularly for seniors, individuals with mobility disabilities, and caregivers, for use in emergencies.

**Potential benefits:** Initiates the establishment of information systems that will avoid loss of life and improve the health of people in areas with limited communications infrastructure.

**Potential upfront costs:** \$400,000–\$800,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$400,000–\$800,000 in total estimated costs

**Potential funder(s):** Government of Puerto Rico, private sector

**Potential implementer(s):** PRTRB, PREMA

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## CIT 19

### Municipal Hotspots

Provide government-sponsored wi-fi in town centers and public buildings to address the digital disparity and provide a priority connection point after a disaster for reaching a large number of residents in one place. Maximize public access to government-sponsored wi-fi from the main centers of public life, including municipal buildings, parks, and town squares across Puerto Rico.

**Potential benefits:** Reduces the “digital divide” and provides a priority post-disaster connection point for reaching a large number of residents in one place.

**Potential upfront costs:** \$1.6 million in estimated upfront costs

**Potential recurring costs:** \$17 million in estimated recurring costs

**Potential total costs:** \$18 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, FCC

**Potential implementer(s):** CINO, PRTRB, GPR agencies, municipal governments

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## CIT 20

### Continuity of Business at PRIDCO Sites

Maintain key business activities at PRIDCO sites to provide continuity of services when primary communications methods are degraded after a disaster by using, for example, fiber optic, satellite, microwave, and cloud-based or hosted services and information systems.

**Potential benefits:** Improves the resilience of business enterprises that are major contributors to the US economy, facilitates cross-sector economic development within Puerto Rico, and supports communications to impacted areas during a disaster.

**Potential upfront costs:** \$24 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$24 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR, Government of Puerto Rico, private insurance

**Potential implementer(s):** PRIDCO

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## CIT 21

### **Government-Owned Fiber Optic Conduits to Reduce Aerial Fiber Optic Cable and Incentivize Expansion of Broadband Infrastructure**

Design for the deployment of conduit for buried fiber optic cable and other utilities. Trench and lay empty conduit according to the design. Allow telecom providers to install their own fiber optic cable in GPR-owned conduit.

**Potential benefits:** Increases the resilience of telecom services while reducing costs to telecom providers to bury cable, facilitating the burial of aerial fiber optic cable, and provision of broadband deployment throughout the Island. Provides trenching and conduit adequate to accommodate other utilities. Minimizes the need for multiple roadway disturbances.

**Potential upfront costs:** \$1.3 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.3 billion in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, public-private partnership, FCC

**Potential implementer(s):** PRTRB, DTOP (PRHTA), FCC, private telecommunication companies

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## CIT 22

### **Use Federal Programs to Spur Deployment of Broadband Internet Island-Wide**

Work with the FCC, HUD, other federal agencies, and GPR agencies to streamline and expedite applications and approvals for schools, libraries and clinics to receive funding for broadband services through the FCC's E-rate program, supplemented by other federal programs. Work with the FCC, federal agencies, and GPR agencies to leverage these programs.

**Potential benefits:** Facilitates the deployment of internet services to schools, libraries and clinics as precursor to improving the provision of education, health and other services.

**Potential upfront costs:** \$1.25 million in estimated upfront costs

**Potential recurring costs:** \$37.8 million–\$66.4 million in estimated recurring costs

**Potential total costs:** \$39.0 million–67.6 million in total estimated costs

**Potential funder(s):** FCC, USDA, HUD, DOC EDA, NTIA

**Potential implementer(s):** PRTRB, FCC, PRDE

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## CIT 25

### Evaluate and Implement Alternative Methods to Deploy Broadband Internet Service Throughout Puerto Rico

Create a comprehensive plan for deploying broadband internet throughout Puerto Rico by leveraging existing fiber rings and assessing the availability of existing federal programs, particularly those of the FCC.

**Potential benefits:** Serves as an important step toward providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

**Potential upfront costs:** \$900,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$900,000 in total estimated costs

**Potential funder(s):** CDBG-DR, FCC

**Potential implementer(s):** PRTRB, FCC, private telecommunication companies

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## CIT 26

### Wi-fi Hotspots in Public Housing and Digital Stewards Program

Establish a Digital Stewards program to train residents to install and service wi-fi hotspots in public housing and other publicly funded facilities.

**Potential benefits:** Decreases the “digital divide,” reduces costs for low-income residents who previously relied on expensive data plans, and provides a priority post-disaster connection point.

**Potential upfront costs:** \$1 million in estimated upfront costs

**Potential recurring costs:** \$20 million in estimated recurring costs

**Potential total costs:** \$20 million in total estimated costs

**Potential funder(s):** CDBG-DR, PRDH

**Potential implementer(s):** CINO, HUD, PRDH

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# Rebuild and Enhance Health and Social Services Infrastructure and Regional Health Care Networks

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## HSS 1

### **Increase Use of Solar-Powered Generators and Solar Backup Power Sources**

Promote solar-powered generators for residential properties to reduce air and noise pollution.

**Potential benefits:** Reduces noise and air pollution and the risk for respiratory and hearing-related illnesses. Reduces the number of residents who need to be evacuated due to lack of power. Reduces morbidity among residents with technological dependence for health issues, and mortality and risk associated with fossil fueled generators.

**Potential upfront costs:** \$4.2 billion–\$6.2 billion in estimated upfront costs

**Potential recurring costs:** \$1.4 million in estimated recurring costs

**Potential total costs:** \$4.2 billion–\$6.2 billion in total estimated costs

**Potential funder(s):** EPA, USDA, EQB, private sector

**Potential implementer(s):** EQB, EPA's Caribbean Division

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## HSS 2

### **Prevent Disease Through a Capacity-Building Healthy Housing Initiative: Targeting Mold, Lead, and Other Stressors**

Build capacity for the identification and management of mold and other environmental stressors through an integrated healthy homes/housing and buildings initiative to prevent respiratory-related and other health exacerbations. This includes training for implementation, capacity-building mechanisms within agencies for enforcement, and promotion of NHLBI Expert Panel Report 3 guidelines for asthma management.

**Potential benefits:** Contributes to decreased public health burden of asthma and other respiratory-related diseases, as well as a reduction in health care costs.

**Potential upfront costs:** \$1.2 million–\$5.3 million in estimated upfront costs

**Potential recurring costs:** \$14 million–\$18 million in estimated recurring costs

**Potential total costs:** \$16 million–\$23 million in total estimated costs

**Potential funder(s):** DHHS

**Potential implementer(s):** EPA, CDC, other federal agencies, PRDH, PRDOH, other GPR agencies

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#### **HSS 4**

### **Improve Surveillance of Waterborne Disease**

Increase the robustness of the surveillance system for waterborne disease by (1) ensuring that equipment is operational through QA/QC, (2) developing communication tools, and (3) establishing interagency partnerships.

**Potential benefits:** Reduces the transmission of infectious pathogens and harmful chemicals and toxins in the water system.

**Potential upfront costs:** \$90,000 in estimated upfront costs

**Potential recurring costs:** \$2.8 million in estimated recurring costs

**Potential total costs:** \$2.9 million in total estimated costs

**Potential funder(s):** EPA

**Potential implementer(s):** PRDOH, PRASA, CDC

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#### **HSS 5**

### **Develop and Implement an Integrated Electronic Reporting System for Vital Records**

Develop and implement an electronic reporting system for vital events at the Puerto Rico Demographic Registry (PRDR).

**Potential benefits:** Improves the accuracy of reports through timely data entry and increased accuracy and completeness of vital records, which will support public health surveillance systems. Increases efficiency in the death reporting process after a disaster and will allow the ability to monitor mortality data.

**Potential upfront costs:** \$1.5 million in estimated upfront costs

**Potential recurring costs:** \$13 million in estimated recurring costs

**Potential total costs:** \$14 million in total estimated costs

**Potential funder(s):** DHHS, NAPHSIS, PAHO, nongovernment sources

**Potential implementer(s):** PRDOH (PRDR, Office of Informatics and Technological Affairs, Planning and Development Office)

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## HSS 6

### Reduce Opportunities for Vector-Borne Diseases

Support ongoing monitoring and engagement for mosquito control and provide support to establish additional innovative practices for mosquito control, including but not limited to using drones to detect breeding grounds and apply larvicide at abandoned properties.

**Potential benefits:** Improves mosquito control in areas that have been difficult to reach.

**Potential upfront costs:** \$370,000–\$3.4 million in estimated upfront costs

**Potential recurring costs:** \$170,000–\$350,000 in estimated recurring costs

**Potential total costs:** \$530,000–\$3.8 million in total estimated costs

**Potential funder(s):** DHHS

**Potential implementer(s):** PRVCU, PRDOH, municipal governments

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## HSS 7

### Reduce Gap in Medicaid/Medicare Reimbursement Rate

Analyze the extent to which reimbursement rates can be raised (within the existing authorities and capabilities of the law) to help address the financial viability of the health care system, particularly in the context of disaster recovery needs over the long-term and future system robustness.

**Potential benefits:** Allows for a better understanding of the health care system's fragility, as well as where positive health care outcomes can be achieved by changes in payment structure.

**Potential upfront costs:** –

**Potential recurring costs:** –

**Potential total costs:** –

**Potential funder(s):** Government of Puerto Rico, nongovernment sources, DHHS

**Potential implementer(s):** Independent research organization, Congress

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## **HSS 8** **Increase Public Health Laboratory Capacity**

Rebuild and/or develop up-to-date and well-equipped laboratories and staff appropriately. Engage advanced systems integrating laboratory and epidemiological activities. Provide a laboratory network infrastructure (including a patient information management system) through which data can be communicated and shared between health care facilities that can access data in a timely manner for rapid response.

**Potential benefits:** Allows for the implementation of early detection methodologies that will facilitate timely implementation of needed control measures to minimize disease transmission and additional health-related costs.

**Potential upfront costs:** \$9 million in estimated upfront costs

**Potential recurring costs:** \$62 million in estimated recurring costs

**Potential total costs:** \$71 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, DHHS, DOL, nongovernment sources

**Potential implementer(s):** PRDOH, DHHS

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## **HSS 9** **Increase Access to Tele-Health Options as Telecommunication Supports Become More Robust**

Expand the use of tele-health across Puerto Rico and train the health care workforce in its use, including mental health. This action includes using social media to screen and enroll more geographically isolated populations in services and using phone and online applications to target those with trauma-related mental illness.

**Potential benefits:** Provides greater access to specialty care for nonurban populations and quicker networking and best-practice sharing among health care professionals in an emergency.

**Potential upfront costs:** \$1.8 million in estimated upfront costs

**Potential recurring costs:** \$19 million in estimated recurring costs

**Potential total costs:** \$21 million in total estimated costs

**Potential funder(s):** DHHS

**Potential implementer(s):** Health care providers, mental health care providers, private industry

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## **HSS 10** **Expand Care for Trauma and Chronic Stress**

Expand the networks to provide relief for trauma, stress, and anxiety-related behavioral health issues by training nontraditional providers and providing care in nontraditional medical settings. Empower faith-based organizations, schools, and NGOs to better understand and support their constituents in managing post-disaster stressors in a culturally compatible way.

**Potential benefits:** Improves quality of care outcomes for traumatic stress and addresses the mental health care provider shortage and distribution issues.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$3 million in estimated recurring costs

**Potential total costs:** \$3 million in total estimated costs

**Potential funder(s):** DHHS, nongovernment sources

**Potential implementer(s):** Mental health providers

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## **HSS 11** **Add Incentives and Other Supports to Increase and Retain Supply of Health Care Providers and Public Health Practitioners**

Use incentives and loan repayment programs to ensure that Puerto Rico has a robust and stable health care provider and public health practitioner workforce, including primary care providers, specialists, and mental health practitioners, for both disaster-related health issues and for the long term.

**Potential benefits:** Helps retain high-quality talent in health care, and creates communities of practitioners that can better serve their populations due to increased work satisfaction.

**Potential upfront costs:** \$39 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$39 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** Puerto Rican universities, associated hospitals and health care facilities

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## HSS 12

### **Augment Community Health Centers and Elements for Primary Care and Chronic Disease Prevention and Management**

Ensure that timely and accessible care can be provided after a disaster and over the long term—particularly with respect to chronic disease prevention and management—by strengthening Puerto Rico's network of community health centers (CHCs) and augmenting supporting elements, such as all-terrain vehicles and CHC mobile care clinics, especially in places with sustained damages or in isolated areas.

**Potential benefits:** Provides relatively efficient alternatives to standing up new hospitals or larger health care facilities. Improves access to services, especially in communities with health care provider shortages and significant hurricane-related damage.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$250 million in estimated recurring costs

**Potential total costs:** \$250 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico, PRDOH, nongovernment sources

**Potential implementer(s):** CHCs, PRDOH

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## HSS 13

### **Expand Practice Laws for Health Care Providers**

Increase the supply and practice capacity of licensed health care providers and public health practitioners in Puerto Rico. This action includes (1) allowing nurse practitioners and physician assistants from other states to provide care in Puerto Rico, (2) providing incentives to attract licensed nurse practitioners and physician assistants from other locations, and (3) establishing and expanding nurse practitioner and physician assistant degree programs in Puerto Rico.

**Potential benefits:** Increases access to quality care. Helps identify and control diseases or outbreaks in a timely manner.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$8 million in estimated recurring costs

**Potential total costs:** \$8 million in total estimated costs

**Potential funder(s):** Medicaid/Mi Salud reimbursement

**Potential implementer(s):** Independent health care licensure body, PRDOH

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#### HSS 14

### Develop a More Robust and Resilient Data System of Health Costs and Links to Health Outcomes

Create supports for measuring health care costs systematically, including (1) merging claims data, hospital and other health center discharge data, and disease and health outcome information; (2) solidifying the robustness of data systems for health outcomes information and inclusive or related social and human service data; and (3) ensuring greater data digitization to facilitate analysis.

**Potential benefits:** Ensures that systematic data are collected, through robust and resilient data systems, and that there is a mechanism to integrate and report on findings for overall health quality improvement.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$3.3 million in estimated recurring costs

**Potential total costs:** \$3.3 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico

**Potential implementer(s):** Institute for Statistics, health care payers, health care providers, PRDOH

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#### HSS 15

### Advance Uptake of Evidence-based Practices/Quality of Care for Mental Health

Identify gaps in evidence-based mental health practice in Puerto Rico. Train mental health care providers in the use of relevant evidence-based practices and monitor how those practices are being applied.

**Potential benefits:** Increases the standards of care and access to quality care for those with mental and behavioral problems. Identifies people who are in need of, but not receiving, mental health care.

**Potential upfront costs:** \$2.5 million–\$5.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.5 million–\$5.5 million in total estimated costs

**Potential funder(s):** DHHS, Medicaid, nongovernment sources

**Potential implementer(s):** Mental health care providers

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## **HSS 16** **Address Food Insecurity by Ensuring Flexible Nutrition Assistance Programs**

Transition Puerto Rico back to the Supplemental Nutritional Assistance Program (SNAP) to allow greater flexibility after a disaster and to provide greater benefit to participants.

**Potential benefits:** Allows for a more efficient disaster response. Makes food assistance more readily available and thus prevents hunger. Minimizes the dangerous effects of hunger on people with chronic diseases, such as diabetes, Crohn's disease, and hypertension.

**Potential upfront costs:** \$3 million in estimated upfront costs

**Potential recurring costs:** \$200 million in estimated recurring costs

**Potential total costs:** \$200 million in total estimated costs

**Potential funder(s):** USDA, PRDF

**Potential implementer(s):** Congress

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## **HSS 17** **Ensure That There Are Nutrition Supports for Populations Disproportionately Affected by the Disaster**

Create long-term (e.g., 3 months or longer) waivers to NAP regulations, which would be triggered upon declaration of a disaster, to enable greater flexibility in how program participants access food during a disaster.

**Potential benefits:** Prevents unnecessary gaps in benefits and averts negative health outcomes that could result from inadequate nutrition.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** USDA

**Potential implementer(s):** USDA Food and Nutrition Service

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## HSS 18

### Improve Programs to Prevent and Address Abuse of Children and Seniors After a Disaster

Initiate public education campaigns to raise awareness of child and senior abuse and how to report it. Train local officials or other professionals with expertise in child- and elder-care issues to train others on how to detect abuse and serve as liaisons with centers and shelters. Include, in the short term, detection and reporting efforts in a disaster case management system.

**Potential benefits:** Prevents physical, mental, and emotional abuse. Increases the availability of services for victims of abuse.

**Potential upfront costs:** \$370,000–\$630,000 in estimated upfront costs

**Potential recurring costs:** \$6.9 million–\$15 million in estimated recurring costs

**Potential total costs:** \$7.3 million–\$16 million in total estimated costs

**Potential funder(s):** DHHS, OPPEA, PRDF

**Potential implementer(s):** OPPEA, PRDF

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## HSS 19

### Create Flex-Funding for Social Service Centers

Assess the social service center facility landscape and develop an inventory of critical facilities. Create a flexible funding mechanism to assist critical facilities, such as domestic violence and homeless shelters and child- and elder-care facilities, in bearing the costs of long periods of generator use post-disaster.

**Potential benefits:** Avoids facility closures due to loss of fuel. Allows for continuity of service provision to populations disproportionately affected by disaster. Reduces the need to relocate shelters.

**Potential upfront costs:** \$180,000–\$310,000 in estimated upfront costs

**Potential recurring costs:** \$11 million–\$980 million in estimated recurring costs

**Potential total costs:** \$11 million–\$980 million in total estimated costs

**Potential funder(s):** U.S. Department of Energy, PREMA, PREPA, DHHS, private sector

**Potential implementer(s):** PRDF, PREMA

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## HSS 20

### **Improve Supports for Seniors, Particularly Those Living Alone**

Provide pre-disaster support to seniors by investigating reimbursement policies for home care visits to allow greater independence and promote economic opportunities. Encourage communities to participate in local emergency planning through activities, such as community mapping, that would help identify who might be at increased risk in a disaster, such as seniors who live alone.

**Potential benefits:** Increases the resiliency of the older adult population, including their ability to access aid or other needed supplies. Avoids the worsening of chronic conditions due to insufficient medicines or nutrition and promotes overall well-being.

**Potential upfront costs:** \$5.2 million in estimated upfront costs

**Potential recurring costs:** \$57 million in estimated recurring costs

**Potential total costs:** \$62 million in total estimated costs

**Potential funder(s):** DHHS, OPPEA, PRDF, CDBG-DR

**Potential implementer(s):** OPPEA, PREMA, PRDF

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## HSS 21

### **Improve Public Awareness of Proper Storage of Insulin Post-Disaster**

Increase public knowledge of guidelines for the storage of insulin by (1) training disaster shelter managers and health care providers to provide relevant information, (2) conducting mass media and social media campaigns, and (3) sending text messages to patients.

**Potential benefits:** Decreases medication gaps and negative health impacts for insulin-dependent individuals. Decreases medication waste and strain on insulin supply.

**Potential upfront costs:** \$640,000 in estimated upfront costs

**Potential recurring costs:** \$1.9 million in estimated recurring costs

**Potential total costs:** \$2.6 million in total estimated costs

**Potential funder(s):** DHHS, PRDOH, private sector, nongovernment sources

**Potential implementer(s):** Health care providers, PRDOH, private sector

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## HSS 22

### **Move to a More Regionally Integrated Approach to Emergency Planning, Exercising, Response, and Recovery**

Create a disaster preparedness, response, and recovery network that will prepare hospitals and health care facilities to assist each other to surge during disasters. Hire 2 people in each of the 7 health regions to facilitate the regional planning and preparedness approach. Review and improve plans for ensuring power, water, oxygen, and other critical supplies post-incident.

**Potential benefits:** Protects patients and communities from poor outcomes. Reduces morbidity and mortality. Ensures more efficient use of resources. Reduces costs.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$10 million in estimated recurring costs

**Potential total costs:** \$10 million in total estimated costs

**Potential funder(s):** CDBG-DR, DHHS, ASES, PRDOH, nongovernment sources

**Potential implementer(s):** PRDOH, hospital system, other health care organizations

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## HSS 23

### **Review and Improve Systems and Processes for Managing Volunteers and Donated Supplies**

Track volunteers through a system such as the Emergency System for Advance Registration of Volunteer Health Professionals. Institute volunteer credentialing to ensure that training and other competencies are up to date. Provide supports for volunteer capacity development and communication skills. Rent warehouse space for receiving and managing donated supplies. Contract specialized storage for receiving, managing, and dispatching donated medications. Strengthen registries for inventorying donations.

**Potential benefits:** Facilitates quicker deployment of assets. Minimizes confusion and duplication of services. Helps match assets to areas of greatest needs.

**Potential upfront costs:** \$210,000 in estimated upfront costs

**Potential recurring costs:** \$3.9 million in estimated recurring costs

**Potential total costs:** \$4.1 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** PRDOH

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## HSS 24 Increase the Child Welfare Investigative Workforce

Increase funding to the Puerto Rico Department of the Family (PRDF) to hire additional child welfare investigators to manage existing backlog of child maltreatment cases.

**Potential benefits:** Decreases the backlog of child maltreatment cases. Promotes the long-term safety of children.

**Potential upfront costs:** \$19 million in estimated upfront costs

**Potential recurring costs:** \$49 million in estimated recurring costs

**Potential total costs:** \$68 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, PRDF

**Potential implementer(s):** PRDF

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## HSS 25 Establish a Collaborative Agreement between PRDF and WIC for Infant Formula Storage and Distribution

Arrange for appropriate climate-controlled storage, handling, and distribution of milk formulas for WIC participants who are also NAP beneficiaries. Make sure that supplies are properly stored and strategically located around the Island to ensure adequate availability for all communities.

**Potential benefits:** Provides a key support for infants, a population that is particularly vulnerable during a disaster.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** PRDF, USDA WIC

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## HSS 26 Review and Improve Systems for Stockpiling and Distributing Supplies and Pharmaceuticals Post-Disaster

Designate approximately 10 key health care facilities as Health Care Disaster Resource Centers that will be equipped with extra supplies needed during a disaster.

**Potential benefits:** Avoids increased morbidity and mortality among electricity-dependent individuals. Makes emergency response supplies more readily available. Improves interagency coordination during and after a disaster.

**Potential upfront costs:** \$20 million in estimated upfront costs

**Potential recurring costs:** \$2.8 million in estimated recurring costs

**Potential total costs:** \$23 million in total estimated costs

**Potential funder(s):** DHHS, PREMA, PRDOH

**Potential implementer(s):** PRDOH, PREMA

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## HSS 27

### **Improve Current Epidemiological Surveillance to Better Respond to Natural and Man-Made Disasters**

Develop a comprehensive epidemiological surveillance system with the following components: infectious diseases, chronic diseases, maternal and child health, environmental health, injury, occupational health, and behavioral health. Increase workforce access to technological advancements to support surveillance activities.

**Potential benefits:** Improves Puerto Rico's response capacity for monitoring short- and long-term adverse health hazards and health effects as a result of any disaster. Lessens disease burden and health-related costs after a disaster.

**Potential upfront costs:** \$9 million in estimated upfront costs

**Potential recurring costs:** \$90 million in estimated recurring costs

**Potential total costs:** \$100 million in total estimated costs

**Potential funder(s):** DHHS, nongovernment sources

**Potential implementer(s):** PRDOH, FEMA, EPA, USDA, DoD, DHHS

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## HSS 28

### **Support the Development of a Suicide Prevention Campaign**

Initiate a 6-part suicide prevention campaign that includes (1) promoting wellness and self-care through a public awareness campaign, (2) identifying people who are at risk of suicide, (3) identifying and addressing barriers to appropriate care for suicidality, (4) providing appropriate care procedures for responding to suicide (both acutely on the suicide hotline and in emergency rooms and long-term care), and (5) addressing environmental factors associated with suicide.

**Potential benefits:** Prevents an increasing suicide epidemic in Puerto Rico.

**Potential upfront costs:** \$250,000 in estimated upfront costs

**Potential recurring costs:** \$73 million in estimated recurring costs

**Potential total costs:** \$73 million in total estimated costs

**Potential funder(s):** DHHS, Medicaid, nongovernment sources

**Potential implementer(s):** PRDOH, Puerto Rico's Commission for the Implementation of Public Policy in the Prevention of Suicide

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## HSS 29

### Revise Regulations on Food Stockpiling at Child- and Elder-Care Facilities

Require a minimum 14-day, healthy, shelf-stable food supply at all licensed facilities and provide guidance to facilities on stockpiling.

**Potential benefits:** Increases the availability of more nutritious foods post-disaster. Decreases the availability of salty and sugary foods.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** USDA, PRDF

**Potential implementer(s):** PRDF, child- and elder-care facilities

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## HSS 30

### Review and Improve Plans, Systems, and Processes for Tracking and Responding to Physical and Mental Health Needs of First Responders

Deploy counselors and volunteers to provide monthly support services to first responders. Conduct a periodic (every 4 months for year 1; annually after) survey—Emergency Responder Health Monitoring and Surveillance—to assess responder health needs and management of health symptoms.

**Potential benefits:** Lessens negative health impacts of the highly stressful circumstances of disaster response and recovery. Improves responder well-being and keeps responders prepared to attend to the needs of others.

**Potential upfront costs:** \$140,000 in estimated upfront costs

**Potential recurring costs:** \$18 million in estimated recurring costs

**Potential total costs:** \$18 million in total estimated costs

**Potential funder(s):** CDBG-DR, DHHS, Government of Puerto Rico, PRDOH, nongovernment sources

**Potential implementer(s):** PRDOH, FEMA

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### HSS 31

## Review and Improve Systems for Administration and Finance of Response-Related Activities

Implement temporary waivers for a range of emergency health service needs, including, but not limited to, authorization, payment deadlines, prescription coverage, enrollment, and mortuary services.

**Potential benefits:** Ensures uninterrupted access to care post-disaster. Prevents potential delays in time-sensitive care.

**Potential upfront costs:** \$250,000 in estimated upfront costs

**Potential recurring costs:** \$7.9 million in estimated recurring costs

**Potential total costs:** \$8.1 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** ASES, DHHS (CMS)

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### CIT 3

## Upgrade and Enhance 911 Service

Upgrade the current 911 network to an Emergency Services IP Network, implement Next Gen 911, consolidate dispatch at the PSAP, and coordinate with GPR agencies in the housing sector for the adoption of E911 address conversion of rural route addresses.

**Potential benefits:** Improves the effectiveness of 911 service through new features (such as text, photo, video, and GPS location sharing), improves 911 response times, and improves system resilience.

**Potential upfront costs:** \$2 million–\$6 million in estimated upfront costs

**Potential recurring costs:** \$1 million in estimated recurring costs

**Potential total costs:** \$3 million–\$7 million in total estimated costs

**Potential funder(s):** DOC

**Potential implementer(s):** Puerto Rico 911 Service Governing Board, NTIA NG911 Grant Program

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#### **CIT 4** **Rural Area Network Task Force**

Establish a task force to develop communication networks and information systems in rural or disconnected areas, particularly for seniors, individuals with mobility disabilities, and caregivers, for use in emergencies.

**Potential benefits:** Initiates the establishment of information systems that will avoid loss of life and improve the health of people in areas with limited communications infrastructure.

**Potential upfront costs:** \$400,000–\$800,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$400,000–\$800,000 in total estimated costs

**Potential funder(s):** Government of Puerto Rico, private sector

**Potential implementer(s):** PRTRB, PREMA

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#### **CIT 14** **Consolidated Government Information Systems**

Implement an open, modular, standards-based platform for information systems and consolidate Government of Puerto Rico and municipal government systems to improve continuity of government and quality of government services in the context of a disaster.

**Potential benefits:** Eliminates current mix of legacy government systems, reduces operating costs, and improves reliability of government functions, including response and recovery coordination.

**Potential upfront costs:** \$152 million in estimated upfront costs

**Potential recurring costs:** \$330 million in estimated recurring costs

**Potential total costs:** \$482 million in total estimated costs

**Potential funder(s):** CDBG–DR, Government of Puerto Rico

**Potential implementer(s):** CIO, GPR agencies

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### CIT 16

## Government Digital Reform Planning and Capacity Building

Create a roadmap for digital transformation and determine priorities, assess needs, costs, and feasibility for a government-wide digital transformation strategy.

**Potential benefits:** Helps Puerto Rico benefit from best practices and avoid common pitfalls to digital transformation, ensures stakeholder buy-in, and provides a comprehensive strategy and set of metrics.

**Potential upfront costs:** \$14 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$14 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA

**Potential implementer(s):** CINO, CIO

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### CIT 17

## Puerto Rico Data Center

Establish a robust, disaster-proof, scalable, and cloud-enabled data center for governmental information systems that expands the capacity to perform essential governmental functions and deliver essential services.

**Potential benefits:** Enables highly reliable governmental IT services for tracking, supporting, and coordinating response and recovery needs within Puerto Rico and externally while preserving the integrity of all essential information systems.

**Potential upfront costs:** \$7 million–\$20 million in estimated upfront costs

**Potential recurring costs:** \$61 million–\$170 million in estimated recurring costs

**Potential total costs:** \$68 million–\$190 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, lease of excess capacity, nongovernment sources

**Potential implementer(s):** CIO, GPR agencies

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### CIT 18

## Data Store and Data Exchange Standards for Critical Infrastructure

Create online data store and data exchange standards for up-to-date, cross-sector data on critical infrastructure (government and private sector), using an open, modular, and standards-based approach to information exchange, interoperability, and storage.

**Potential benefits:** Improves visibility of critical infrastructure status, provides accurate data to inform emergency response, and increases private-sector awareness of government work affecting infrastructure availability.

**Potential upfront costs:** \$1.8 million–\$2.5 million in estimated upfront costs

**Potential recurring costs:** \$6.3 million–\$13 million in estimated recurring costs

**Potential total costs:** \$8.1 million–\$15 million in total estimated costs

**Potential funder(s):** Private sector, Government of Puerto Rico

**Potential implementer(s):** CIO, GPR agencies

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## CIT 19

### Municipal Hotspots

Provide government-sponsored wi-fi in town centers and public buildings to address the digital disparity and provide a priority connection point after a disaster for reaching a large number of residents in one place. Maximize public access to government-sponsored wi-fi from the main centers of public life, including municipal buildings, parks, and town squares across Puerto Rico.

**Potential benefits:** Reduces the “digital divide” and provides a priority post-disaster connection point for reaching a large number of residents in one place.

**Potential upfront costs:** \$1.6 million in estimated upfront costs

**Potential recurring costs:** \$17 million in estimated recurring costs

**Potential total costs:** \$18 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, FCC

**Potential implementer(s):** CINO, PRTRB, GPR agencies, municipal governments

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## CIT 22

### Use Federal Programs to Spur Deployment of Broadband Internet Island-Wide

Work with the FCC, HUD, other federal agencies, and GPR agencies to streamline and expedite applications and approvals for schools, libraries and clinics to receive funding for broadband services through the FCC’s E-rate program, supplemented by other federal programs. Work with the FCC, federal agencies, and GPR agencies to leverage these programs.

**Potential benefits:** Facilitates the deployment of internet services to schools, libraries and clinics as precursor to improving the provision of education, health and other services.

**Potential upfront costs:** \$1.25 million in estimated upfront costs

**Potential recurring costs:** \$37.8 million–\$66.4 million in estimated recurring costs

**Potential total costs:** \$39.0 million–67.6 million in total estimated costs

**Potential funder(s):** FCC, USDA, HUD, DOC EDA, NTIA

**Potential implementer(s):** PRTRB, FCC, PRDE

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### CIT 23

## Data Collection and Standardization for Disaster Preparedness and Emergency Response

Support expansion and ongoing development of status.pr website with data-sharing protocol in partnership with private sector to enable ongoing situational awareness.

**Potential benefits:** Creates a platform to publicly share data in a standardized, user-friendly format; provides valuable information for policymakers, the media, and emergency responders; and makes data available in formats that can be used by software developers.

**Potential upfront costs:** \$100,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$100,000 in total estimated costs

**Potential funder(s):** CDBG-DR

**Potential implementer(s):** CINO, PREMA, GPR agencies

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### CIT 25

## Evaluate and Implement Alternative Methods to Deploy Broadband Internet Service Throughout Puerto Rico

Create a comprehensive plan for deploying broadband internet throughout Puerto Rico by leveraging existing fiber rings and assessing the availability of existing federal programs, particularly those of the FCC.

**Potential benefits:** Serves as an important step toward providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

**Potential upfront costs:** \$900,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$900,000 in total estimated costs

**Potential funder(s):** CDBG-DR, FCC

**Potential implementer(s):** PRTRB, FCC, private telecommunication companies

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### CIT 29

## Health Care Connectivity to Strengthen Resilience and Disaster Preparedness

Provide robust, resilient, multimodal connectivity to the 86 community clinics across Puerto Rico using satellite, low-power radio, and line-of-site technologies to complement fiber and cell systems and allow clinics to share bandwidth to support other recovery activities.

**Potential benefits:** Improves health care, emergency response, and medical innovation; provides real-time access to electronic health records, clinical data, and services; and bolsters situational awareness after a disaster.

**Potential upfront costs:** \$5.6 million–\$12 million in estimated upfront costs

**Potential recurring costs:** \$140 million–\$260 million in estimated recurring costs

**Potential total costs:** \$140 million–\$280 million in total estimated costs

**Potential funder(s):** CDBG-DR, FCC, DHHS, VA, DoD, Government of Puerto Rico

**Potential implementer(s):** CINO, PREMA, PRTRB, PRDOH

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### CIT 30

## Resiliency Innovation Network Leading to Development of a Resiliency Industry

Create a Resiliency Innovation Network to build on existing PRSTRT and university facilities to develop, teach, test, and refine resiliency products and services.

**Potential benefits:** Stimulates new commercial ventures and jobs, empowers communities and individuals, and increases resilience to disasters.

**Potential upfront costs:** \$2.2 million in estimated upfront costs

**Potential recurring costs:** \$26 million in estimated recurring costs

**Potential total costs:** \$29 million in total estimated costs

**Potential funder(s):** DOC EDA, NSF, PRSTRT, PRIDCO, private sector

**Potential implementer(s):** COR3, CINO, universities, PRSTRT, Resilient Puerto Rico Advisory Commission, DEDC, PRIDCO

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### CIT 32

## Digital Citizen Services

Expand the scope of PRITS to include a focus on citizen-centered services and prioritizing a “one-stop-shop” experience for accessing government services and information in an easy-to-use fashion.

**Potential benefits:** Increases public trust, transparency, and accountability; increases adoption of digital services; and streamlines government processes.

**Potential upfront costs:** \$400,000 in estimated upfront costs

**Potential recurring costs:** \$33 million in estimated recurring costs

**Potential total costs:** \$33 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, Government of Puerto Rico

**Potential implementer(s):** CINO, GPR agencies

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### CIT 33

## Government Digital Process Reform

Establish people-centered digital design and data science teams within the Government of Puerto Rico to tackle cross-cutting policy and operational challenges and coordinate government agencies.

**Potential benefits:** Establishes a “whole-of-government,” people-centered digital design and data-driven approach to continuously improve services, spend resources effectively, improve service delivery, better serve the public, and make better policy.

**Potential upfront costs:** \$300,000 in estimated upfront costs

**Potential recurring costs:** \$70 million in estimated recurring costs

**Potential total costs:** \$70 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, Government of Puerto Rico

**Potential implementer(s):** CINO, GPR agencies

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### CPCB 2

## Capacity Building for Community-Level Preparedness and Response

Develop and implement community-level response and recovery preparedness activities for priority communities that face particularly high risk during disasters. Recruit, train, and equip Community Emergency Response Teams so that these communities can better sustain themselves during the disaster response period, when emergency responders and access to communities will be limited. Work with community leaders and community-based organizations to establish community-specific approaches for checking on people with access and functional needs.

**Potential benefits:** Puts into place fundamental preparedness and response capabilities at the state and municipal levels.

**Potential upfront costs:** \$3 million in estimated upfront costs

**Potential recurring costs:** \$34 million in estimated recurring costs

**Potential total costs:** \$37 million in total estimated costs

**Potential funder(s):** CDBG-DR, PREMA

**Potential implementer(s):** FEMA, PREMA, municipal governments

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### CPCB 3 **Capacity Building to Incorporate Hazard Risk Reduction into Planning and Design**

Strengthen hazard mitigation assessment, monitoring, and evaluation capabilities within the PRPB so that the board can promote the incorporation of risk reduction in all planning and design decisions. This action includes (1) enhancing GIS capabilities to generate hazard maps for each municipality to inform zoning decisions and improve municipal hazard mitigation planning capacity, and (2) hiring a risk officer for each of the 27 state-level agencies.

**Potential benefits:** Enables a standardized and systematic approach to hazard mitigation. Encourages a more data-driven implementation of Puerto Rico's hazard mitigation plan.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$84 million in estimated recurring costs

**Potential total costs:** \$84 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR

**Potential implementer(s):** PRPB, infrastructure sectors

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### CPCB 4 **Resilience Building in Collaboration with High-Risk Communities**

Develop and implement disaster resilience plans in collaboration with 50–100 selected communities. This action includes (1) investments into programs—e.g., workforce development, microfinance, education—that address long-term stressors, as well as the improvement of essential services; and (2) resilience building events for community residents and local businesses, including fostering connections among governmental agencies, community groups, and NGOs.

**Potential benefits:** Builds community and individual resilience for both disaster response and long-term recovery.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$83 million in estimated recurring costs

**Potential total costs:** \$83 million in total estimated costs

**Potential funder(s):** CDBG-DR, HMGP, DOC EDA

**Potential implementer(s):** Government of Puerto Rico, municipal governments, local NGOs

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## CPCB 6

### Public Information and Communication Capability for Coordinated Recovery

Build a Public Information and Communication capability to maintain engagement with communities that are recovering and to support local engagement with recovery planning. Establish and maintain methods of two-way communication with residents about recovery planning and implementation. Establish effective communication with Puerto Rican communities on the mainland to better understand whether and when people decide to return to Puerto Rico for recovery planning purposes.

**Potential benefits:** Allows the Government of Puerto Rico to communicate more clearly with the public, thus increasing transparency and improving public trust.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$8.8 million in estimated recurring costs

**Potential total costs:** \$8.8 million in total estimated costs

**Potential funder(s):** CDBG-DR, PREMA

**Potential implementer(s):** Government of Puerto Rico

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## CPCB 7

### Capacity Building for Emergency Shelter Planning

Conduct an assessment and develop a shelter plan that includes a comprehensive and strategic approach to sheltering Island-wide. Hire planners in each municipality and at the state level to build a robust emergency shelter system. Develop parameters, standards, and design guidelines for shelters to support residents over the longer term. Establish a protocol in coordination with the National Guard to support local and state-level agencies' efforts for management of response commodities for shelters.

**Potential benefits:** Improves access to local, safe, and resourced shelters that can accommodate community needs, such as disabilities and medical conditions.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$57 million in estimated recurring costs

**Potential total costs:** \$57 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico, municipal governments

**Potential implementer(s):** FEMA, PREMA, public buildings sector

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**CPCB 10**  
**Incentivize Resilient,  
Creative Design Solutions for  
Addressing Hazards**

Fund a design competition that fosters innovative solutions for risk reduction—specifically aimed at mitigating hazards and including, but not limited to, hurricanes and flooding—while also offering added social or economic benefits to the community.

**Potential benefits:** Elicits original ideas, out-of-the-box solutions, and transdisciplinary approaches to mitigating disaster risks. Provides a valuable community-level perspective on existing problems and areas in need of improvement.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, PREMA

**Potential implementer(s):** PRPB, COR3, FEMA, PREMA, general public of Puerto Rico

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**CPCB 15**  
**Strengthen Local Nonprofit  
and NGO Involvement in  
Disaster Recovery**

Establish a unit within Puerto Rico's Office for the Socioeconomic and Community Development (ODSEC) to strengthen the engagement of local nonprofits and NGOs with government agencies and maximize their contributions as partners in the recovery process.

**Potential benefits:** Strengthens partnerships and drives more successful cross-sector collaboration. Improves coordination and communication among government agencies and NGOs, and enhances resource allocation. Builds community resilience. Increases nonprofit and NGO capacity while helping them develop more long-term, sustainable funding.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$9 million in estimated recurring costs

**Potential total costs:** \$9 million in total estimated costs

**Potential funder(s):** CDBG-DR, nongovernment sources

**Potential implementer(s):** ODSEC, NGOs, local nonprofits

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## EDU 1

### Create New—and Enhance Existing—After-School and Summer Learning Opportunities

Expand existing and implement new summer and after-school learning programs—including academic, vocational education, health, nutrition, and mental health services—to address potential learning loss due to long school closures post-hurricane, ensure access to the full range of educational opportunities, and provide consistency to meal programs.

**Potential benefits:** Promotes faster recovery in student achievement from post-hurricane learning loss; a stronger sense of stability; and better understanding of students' education, health, and mental health needs. Creates employment for teachers and other Puerto Ricans as program instructors.

**Potential upfront costs:** \$1 million in estimated upfront costs

**Potential recurring costs:** \$3.9 billion in estimated recurring costs

**Potential total costs:** \$3.9 billion in total estimated costs

**Potential funder(s):** U.S. Department of Education, USDA, nongovernment sources

**Potential implementer(s):** PRDE, U.S. Department of Education, USDA Summer Food Program, Echar Pa'lante alliance

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## EDU 3

### Landscape Analysis of Early Childhood Interventions and Care Opportunities

Determine the demographics of children 0–5 years of age (and their families), the current supply of interventions and care settings, and the cost of—and possible funding streams for—providing high-quality care to all children in Puerto Rico.

**Potential benefits:** Promotes children's school readiness and provides an important foundation for children's later academic and social success, as well as their health and well-being.

**Potential upfront costs:** \$1 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico, municipal governments, nongovernment sources

**Potential implementer(s):** Puerto Rico's Administration for the Care and Integral Development of Children, PRDE

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## EDU 7

### Augment Tele-Education/ Online Education

Provide "emergency instruction" in the event of a school closure of more than 2 weeks. This action includes building an online repository of free, open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K-12), and technology platforms.

**Potential benefits:** Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE's initiative to integrate technology into the classroom.

**Potential upfront costs:** \$3.7 million in estimated upfront costs

**Potential recurring costs:** \$18 million in estimated recurring costs

**Potential total costs:** \$22 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources, private sector

**Potential implementer(s):** PRDE, Echar Pa'lante alliance, professional development partners

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## HOU 5

### Collect, Integrate, and Map Housing Sector Data

Conduct research, data analysis, planning, and integrated mapping of housing data through the creation of an integrated database.

**Potential benefits:** Supports planning, relocation, and mitigation efforts needed to make these communities safer and more resilient. Aids civic planning for efficient location of emergency and other public services, such as fire stations, hospitals, and schools. Improves overall GPR and municipal efforts to increase property tax revenues.

**Potential upfront costs:** \$30 million–\$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$30 million–\$50 million in total estimated costs

**Potential funder(s):** CDBG–DR

**Potential implementer(s):** PRPB, PRDH, PRDOJ, OGPe, CRIM, private sector firms (banks, insurance)

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### **MUN 3** **Provide Technical Assistance to Repopulate Urban Centers**

Provide technical assistance to establish incentives for individuals and families living in outlying communities to relocate to urban centers, and identify and coordinate funding that can be used for this purpose.

**Potential benefits:** Helps improve community and municipal resilience by concentrating residents in easily accessible urban areas with more resilient infrastructure and services. Reduces the costs of providing these services and improves access for these populations after emergencies. Eases the repurposing of abandoned properties in urban centers and reduces blight while spurring economic development in all sectors.

**Potential upfront costs:** \$1.9 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.9 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico

**Potential implementer(s):** Governor, municipal governments

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### **NCR 1** **Historic and Cultural Properties and Collections Preservation**

Develop and implement an Island-wide Cultural Resources Management Plan and stabilization program to restore and protect resources, establish incentive programs and local historic districts to encourage private property preservation, and develop emergency plans for cultural institutions.

**Potential benefits:** Preserves historic buildings and collections; stabilizes property values; improves preparedness, shortens future recovery time, and prevents future losses from disasters; cost-effectively extends the lifespan of existing buildings; and ensures that cultural heritage will be accessible to communities.

**Potential upfront costs:** \$460 million–\$720 million in estimated upfront costs

**Potential recurring costs:** \$4.5 million–\$9 million in estimated recurring costs

**Potential total costs:** \$460 million–\$730 million in total estimated costs

**Potential funder(s):** HMGP, DOI, IMLS, NEA, NEH, NARA, Government of Puerto Rico, private insurance

**Potential implementer(s):** SHPO, ICP, individual property owners, HENTF, Cultural Resources Advisory Committee members, DOI, UPR, Caribbean University

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## **NCR 2** **Arts Recovery**

Implement an integrated strategy to help artists and arts organizations recover while supporting Puerto Rico's economic and emotional recovery. Options include recovery grants, workspaces, global arts exchange programs, preparedness and recovery training, an arts tourism service sector, and arts outreach to facilitate community recovery.

**Potential benefits:** Helps artists and arts organizations resume practice and livelihoods, reduces future recovery costs and time, and promotes sustainability and resiliency of the arts.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$6 million in estimated recurring costs

**Potential total costs:** \$10 million in total estimated costs

**Potential funder(s):** DOC EDA, IMLS, NEH, NEA, NARA, private sector, nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, ICP, HENTF, private foundations

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## **NCR 5** **Forest Recovery in Rural Protected Areas, Private Forests, Critical Watersheds, and Urban Areas**

Develop and implement strategic forest recovery and conservation strategies throughout Puerto Rico through public and private collaborations. Strategies should be developed with a focus on rural protected forests, ecological corridors, private forested lands, agroforestry, and urban forests. Restore tree nurseries and seed banks to aid in the recovery process.

**Potential benefits:** Restores ecological functions of forests and the provision of ecosystem services, boosts economic viability of forest conservation, provides employment opportunities, improves public safety, and reduces the risk of pest and disease damage.

**Potential upfront costs:** \$70 million–\$120 million in estimated upfront costs

**Potential recurring costs:** \$4.5 million in estimated recurring costs

**Potential total costs:** \$75 million–\$120 million in total estimated costs

**Potential funder(s):** DOI, USDA, public-private partnership, Government of Puerto Rico, DNER, municipal governments, nongovernment sources

**Potential implementer(s):** DNER, USFS, municipal governments

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## NCR 7

### Develop Partner Networks for Recovering Plant and Animal Species

Develop a comprehensive network of partners to work together to help fund actions for plant and animal species preservation, develop human capital and capacity in species management, educate the public, and cultivate experiential/tourism opportunities.

**Potential benefits:** Improves management of plant and animal species, helps prevent species from becoming extinct, and expands and enhances educational, tourism, and other economically beneficial opportunities.

**Potential upfront costs:** \$120,000–\$360,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$120,000–\$360,000 in total estimated costs

**Potential funder(s):** DOI, USDA, Government of Puerto Rico, DNER, municipal governments, private sector, nongovernment sources

**Potential implementer(s):** DNER, federal agencies, UPR, NGOs

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## NCR 10

### Clean Up and Eliminate Use of Unpermitted, Unregistered Dumps

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 unpermitted, unregistered dumps throughout Puerto Rico and identify steps to prevent future use of such dumps.

**Potential benefits:** Removes environmental and public health threats associated with unpermitted, unregistered dumps and helps ensure the overall success of a sustainable solid waste management plan.

**Potential upfront costs:** \$104 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$104 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, EPA

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## NCR 16

### Wetlands Restoration

Restore the capacity, resiliency, and ecological function of 10 priority coastal wetlands through site-specific actions. Coordinate with other land use activities such as stormwater management and port construction.

**Potential benefits:** Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

**Potential upfront costs:** \$24.8 million–\$31.4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$24.8 million–\$31.4 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

**Potential implementer(s):** DNER, EQB, USACE

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## NCR 17

### Reduce Coastal Erosion and Provide Disaster Protection Through Beaches and Dunes

Restore, monitor, and maintain beaches and sand dunes to make them stable and resilient to both seasonal- and disaster-related coastal flooding, as well as long-term sea level rise.

**Potential benefits:** Increases coastal resilience and protects coastal infrastructure, human health and safety, wildlife habitats, and commerce from erosion and flood hazards.

**Potential upfront costs:** \$80 million–\$82 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$80 million–\$82 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOI, USACE, NOAA

**Potential implementer(s):** DNER, municipal governments, USACE

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## NCR 18

### Establish the San Juan Barrier Reef System as a Marine Protected Area

Declare the San Juan Barrier Reef a Commonwealth of Puerto Rico Marine Protected Area, restrict fishing to support sustainable commercial and recreational fisheries, and invest in the reef's restoration and long-term health.

**Potential benefits:** Provides long-term protection of infrastructure, tourism sites, and housing in San Juan; reduces flood risk to community; provides eco-tourism opportunities; and protects beaches.

**Potential upfront costs:** \$500,000–\$1 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$500,000–\$1 million in total estimated costs

**Potential funder(s):** NOAA, DOI, Government of Puerto Rico, public-private partnership, nongovernment sources

**Potential implementer(s):** DNER, NOAA

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## NCR 20

### Redesign, Reorganize, and Rebuild Puerto Rican Parks

Conduct assessments to help the Puerto Rican parks system improve governance/operations efficiency, align park amenities to community needs, and reengineer parks to serve as stormwater infrastructure. Rebuild parks in compliance with building codes for hurricane-prone areas to be consistent with assessment findings.

**Potential benefits:** Promotes active recreation and reduces health care costs; improves flood control capability and mitigates future damage to community; promotes alternative transportation modes and reduces traffic congestion; and boosts economy through area attractiveness to tourists, businesses, and consumers.

**Potential upfront costs:** \$335 million–\$651 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$335 million–\$651 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG–DR, DOI, EPA, DOT, public–private partnership, private insurance, nongovernment sources

**Potential implementer(s):** DRD, DNER

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## NCR 26

### Resource Management Capacity Building

Apply an updated framework for resource management and future disaster response that includes training support, data sharing, and educational outreach to enhance resilience in future disasters.

**Potential benefits:** Provides stronger decisionmaking support to natural and cultural resource stakeholders, promotes exchange of ideas, and encourages community involvement in resource management.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$16 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** PRTC, NGOs, communities

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## **NCR 29**

### **Enhance Public Participation and Education Through Museum Exhibits**

Design and install in-depth, participatory exhibits at museums, such as the Parque de las Ciencias, that describe how different aspects of the natural and cultural resource recovery plans work and their benefits and drawbacks.

**Potential benefits:** Helps facilitate common understanding of the purpose of recovery efforts and promotes commitment to recovery and disaster preparedness.

**Potential upfront costs:** \$1.7 million–\$3.3 million in estimated upfront costs

**Potential recurring costs:** \$7.9 million–\$17 million in estimated recurring costs

**Potential total costs:** \$9.6 million–\$20 million in total estimated costs

**Potential funder(s):** Private sector, nongovernment sources

**Potential implementer(s):** DNER, ICP, universities, host museums

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## **PBD 7**

### **Refurbish Community Centers and Community Technology Centers**

Rebuild or refurbish 300 community centers in low-income communities and 172 community technology centers, including providing them with generators for backup power and building them to withstand hurricanes and earthquakes.

**Potential benefits:** Improves access to community services, including training, medical support, emergency shelter, and technology.

**Potential upfront costs:** \$20 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$20 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR

**Potential implementer(s):** PRPB

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### TXN 1

## Refine and Enforce Design Standards for Roads and Bridges

Collect and refine guidance on road design (e.g., "Complete Streets" policies that address needs of all road users, including pedestrians and bicyclists), develop a set of engineering standards that promote innovative and resilient features, and ensure that roads meet these standards.

**Potential benefits:** Improves road safety through better roadway markings, signs, and lighting. Reduces maintenance costs, increases roadway life, and prevents damage from future disasters through improved roadway drainage systems and bridge design. Encourages people to walk and bicycle instead of driving by promoting sidewalks and bicycle lanes, which provides public health benefits and reduces traffic congestion.

**Potential upfront costs:** \$2 million–\$100 million in estimated upfront costs

**Potential recurring costs:** \$3 million–\$4 million in estimated recurring costs

**Potential total costs:** \$6 million–\$100 million in total estimated costs

**Potential funder(s):** DOT

**Potential implementer(s):** PRHTA

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### TXN 8

## Improve Bus Service

Improve existing bus service by giving priority to buses at intersections, providing real-time arrival information, upgrading bus stops, updating the payment system to use smart cards, adding dedicated bus lanes to some roads, and expanding the bus fleet.

**Potential benefits:** Increases the reliability and comfort of bus travel and expands transportation options for people who do not drive.

**Potential upfront costs:** \$200,000–\$79 million in estimated upfront costs

**Potential recurring costs:** \$7.9 million–\$650 million in estimated recurring costs

**Potential total costs:** \$8 million–\$730 million in total estimated costs

**Potential funder(s):** DOT, users, public-private partnership

**Potential implementer(s):** Puerto Rico Metropolitan Bus Authority

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### WTR 23

## Evaluate, Repair, and Improve Flood Control Infrastructure

Evaluate, repair, and improve the performance and resilience of flood control infrastructure, including dams, levees, channels, and water control structures, to safely manage 100-year floods events.

**Potential benefits:** Reduces flood risk for communities and infrastructure assets.

**Potential upfront costs:** \$4.639 billion in estimated upfront costs

**Potential recurring costs:** \$27.7 million in estimated recurring costs

**Potential total costs:** \$4.667 billion in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, EPA, USDA, USACE, private insurance

**Potential implementer(s):** DNER, PRPB, PREMA, municipal governments, USACE, EPA, USGS

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# Rebuild, Repair, and Right-Size the Public Buildings Inventory

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## **PBD 1** **Compile a Public Buildings Inventory**

Create a comprehensive, centralized database of buildings and undeveloped properties owned by the Government of Puerto Rico that includes building characteristics, which will allow analysis of emergency response needs and general operational decisionmaking.

**Potential benefits:** Provides clear visibility of building inventories to facilitate system-wide infrastructure-related decisionmaking and support hazard mitigation programs, damage assessment, and recovery from natural disasters.

**Potential upfront costs:** \$2 million in estimated upfront costs

**Potential recurring costs:** \$1 million in estimated recurring costs

**Potential total costs:** \$4 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR, PRPB

**Potential implementer(s):** PRPB, PRIFA

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## **PBD 2** **Right-Size Public Buildings**

Analyze demand for government services to estimate the appropriate building capacity, program requirements, and proposed improvements for government operations. Repurpose, reallocate, and refurbish buildings. Sell or demolish unneeded vacant buildings.

**Potential benefits:** Provides income (from the sale of buildings), reduces operations and maintenance costs, improves the effectiveness of government operations and service delivery, and removes the blight of long-abandoned, vandalized buildings.

**Potential upfront costs:** \$200 million–\$500 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$200 million–\$500 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR, Government of Puerto Rico

**Potential implementer(s):** PRPB

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**PBD 3**  
**Establish Integrated Service Centers**

Continue supporting the Government of Puerto Rico's ongoing project to cluster public services in a single location to improve efficiency and accessibility to the public. A center is already operating in San Juan, where residents can access a variety of social services in a single location.

**Potential benefits:** Simplifies access to services for the population and streamlines maintenance processes.

**Potential upfront costs:** \$5 million–\$10 million in estimated upfront costs

**Potential recurring costs:** \$6 million–\$7 million in estimated recurring costs

**Potential total costs:** \$10 million–\$20 million in total estimated costs

**Potential funder(s):** PA, CDBG–DR, Government of Puerto Rico, USDA

**Potential implementer(s):** Puerto Rico Department of State, PRPBA

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**PBD 4**  
**Realign Public Building Ownership**

Transfer ownership of buildings so that buildings of the same type (e.g., schools or government centers) are all owned by the same agency.

**Potential benefits:** Resolves complications from buildings of the same type owned by different agencies, improving government efficiency, accessibility, and communication.

**Potential upfront costs:** \$60,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$60,000 in total estimated costs

**Potential funder(s):** PRPB

**Potential implementer(s):** Office of the Governor, Legislative Assembly

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**PBD 5**  
**Move Public Services to Public Buildings**

House government agencies in public buildings rather than privately owned buildings.

**Potential benefits:** Ensures public funds are used more efficiently by avoiding paying building rental costs to the private sector when acceptable alternative publicly-owned buildings are available.

**Potential upfront costs:** –

**Potential recurring costs:** –

**Potential total costs:** –

**Potential funder(s):** –

**Potential implementer(s):** Office of the Governor, Legislative Assembly

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**PBD 6**  
**Study Whether Externalizing PRIDCO Would Improve Its Ability to Support Economic Development**

Commission an independent analysis by a third party of whether converting PRIDCO into a nongovernmental entity would improve or reduce its ability to support economic development through the private-sector real estate market.

**Potential benefits:** Identifies whether there are potential significant economic gains in converting PRIDCO into a nongovernmental entity.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$500,000 in total estimated costs

**Potential funder(s):** Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** Independent research partner

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### **PBD 7**

## **Refurbish Community Centers and Community Technology Centers**

Rebuild or refurbish 300 community centers in low-income communities and 172 community technology centers, including providing them with generators for backup power and building them to withstand hurricanes and earthquakes.

**Potential benefits:** Improves access to community services, including training, medical support, emergency shelter, and technology.

**Potential upfront costs:** \$20 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$20 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR

**Potential implementer(s):** PRPB

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### **PBD 8**

## **Mitigate Flood Risk for Critical Government Functions**

Relocate critical public functions to buildings outside of flood hazard zones or elevate the building in which the critical function is housed to prevent service disruptions and reduce damages due to flooding.

**Potential benefits:** Ensures continuity of critical public services due to flooding and reduces costs of maintaining buildings in flood zones.

**Potential upfront costs:** \$2 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2 billion in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, U.S. Department of Education

**Potential implementer(s):** PRPB

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### **PBD 9**

## **Repair All Essential Public Buildings Damaged by Hurricanes Irma and Maria**

Complete repairs to essential public buildings that sustained hurricane damage, ensuring that repairs meet current building safety codes for wind, flood, and seismic events.

**Potential benefits:** Fixes damaged buildings and ensures that public buildings are more resilient to future hurricanes and other disasters.

**Potential upfront costs:** \$1 billion in estimated upfront costs

**Potential recurring costs:** \$700 million in estimated recurring costs

**Potential total costs:** \$2 billion in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, private insurance

**Potential implementer(s):** PRIFA

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### **PBD 10**

## **Incentivize State-of-the-Art Building Design, Practices, and Technologies**

Modify or develop policies and programs that establish clear standards for energy and water efficiency in public buildings and provide incentives for energy and water efficiency, renewable energy systems, increased resilience to natural hazards, and innovative redesign or reconfiguration of spaces to better support delivery of critical public services.

**Potential benefits:** Reduces resource use and building operational costs, meets Government of Puerto Rico energy goals, reduces potential future damages, increases reliability of critical public services, and potentially creates jobs.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$7 million in estimated recurring costs

**Potential total costs:** \$7 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, U.S. Department of Energy

**Potential implementer(s):** GPR agencies, municipal governments

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## **PBD 11** **Bring Public Buildings up to Code**

Assess building safety code compliance for wind, flood, and seismic risks across the public building inventory and retrofit buildings with the appropriate structural hardening, making other code upgrades where needed.

**Potential benefits:** Increases ability of public buildings to withstand extreme weather events and natural hazards, improves energy and water efficiency, and reduces building operational costs.

**Potential upfront costs:** \$900 million–\$2 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$900 million–\$2 billion in total estimated costs

**Potential funder(s):** PA, HMGP, Government of Puerto Rico, U.S. Department of Education

**Potential implementer(s):** GPR agencies, municipal governments

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## **PBD 12** **Develop Secondary Power Guidelines**

Develop guidelines for the design of secondary power systems for public buildings, possibly using existing standards for emergency and standby power systems as a resource.

**Potential benefits:** Facilitates the design of appropriate backup power systems to provide a redundant energy supply for essential public services.

**Potential upfront costs:** \$400,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$400,000 in total estimated costs

**Potential funder(s):** PREC, PREPA, HMGP, CDBG-DR

**Potential implementer(s):** SOEP, OGPs

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## EDU 11

### Rebuilding of Public (PRDE and Municipal) PreK–12 School Infrastructure

Rebuild PRDE and municipal schools according to an “Education Is Resilient” approach. Build school facilities that promote 21st-century approaches to learning by creating learning environments that promote student-directed learning and provide collaborative workspaces where students and teachers share creative, innovative, and developmentally appropriate teaching and learning experiences.

**Potential benefits:** Rebuilds schools. Creates learning environments that promote student-directed learning and reflects efforts to make the education system more focused on 21st-century approaches to learning.

**Potential upfront costs:** \$3.5 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$3.5 billion in total estimated costs

**Potential funder(s):** PA, private sector, nongovernment sources, private insurance

**Potential implementer(s):** PRDE

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## HOU 6

### Enforce Land Use Plans and Improve Compliance with Building Permitting

Provide funding to update current municipal plans and align them with the State Land Use Plan to align zoning and regulations for permitted land use and construction. Provide funding for municipalities to develop municipal plans when lacking. Increase capacity to enforce both land use and building codes through permitting and inspections.

**Potential benefits:** Avoids construction in high-risk areas. Provides access to local jobs, services, and economic and transportation hubs. Reduces burden of providing services in new construction areas and remote areas.

**Potential upfront costs:** \$25 million–\$64 million in estimated upfront costs

**Potential recurring costs:** \$77 million–\$250 million in estimated recurring costs

**Potential total costs:** \$100 million–\$320 million in total estimated costs

**Potential funder(s):** CDBG–DR, HMGP, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** PRPB, OGPe, municipal governments

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## **MUN 5**

### **Reduce Barriers to Transferring Property to Municipal Governments and Provide Technical Assistance**

Reduce administrative barriers to transferring property (such as closed schools and other public buildings) to municipalities and provide technical assistance to help municipalities navigate the process.

**Potential benefits:** Enables municipalities to more efficiently repurpose buildings to enhance the delivery of services to the public or stimulate economic development through public-private partnerships or municipal corporations. Reduces costs to the Government of Puerto Rico, municipalities, and communities. Returns previous public investments to active use.

**Potential upfront costs:** \$2.7 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.7 million in total estimated costs

**Potential funder(s):** CDBG-DR

**Potential implementer(s):** Government of Puerto Rico, municipal governments

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## **MUN 6**

### **Create and Maintain Central Repository of Municipal Assets and Associated Conditions**

Collect or update data on municipal assets. Create and maintain a central database of this information, including documentation of property condition.

**Potential benefits:** Helps municipalities and the Government of Puerto Rico identify, manage, and maintain assets. Helps with filing claims with the federal government for damage repair. Enables more efficient budgeting and disaster mitigation. Facilitates leveraging resources and utilization of assets.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$13 million in estimated recurring costs

**Potential total costs:** \$13 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, municipal mayors

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### NCR 1

## Historic and Cultural Properties and Collections Preservation

Develop and implement an Island-wide Cultural Resources Management Plan and stabilization program to restore and protect resources, establish incentive programs and local historic districts to encourage private property preservation, and develop emergency plans for cultural institutions.

**Potential benefits:** Preserves historic buildings and collections; stabilizes property values; improves preparedness, shortens future recovery time, and prevents future losses from disasters; cost-effectively extends the lifespan of existing buildings; and ensures that cultural heritage will be accessible to communities.

**Potential upfront costs:** \$460 million–\$720 million in estimated upfront costs

**Potential recurring costs:** \$4.5 million–\$9 million in estimated recurring costs

**Potential total costs:** \$460 million–\$730 million in total estimated costs

**Potential funder(s):** HMGP, DOI, IMLS, NEA, NEH, NARA, Government of Puerto Rico, private insurance

**Potential implementer(s):** SHPO, ICP, individual property owners, HENTF, Cultural Resources Advisory Committee members, DOI, UPR, Caribbean University

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### NCR 3

## General Archives Mitigation and Modernization

Protect essential government records and other collections in the Archivo General de Puerto Rico through architecture/engineering planning and design.

**Potential benefits:** Preserves historical records and collections, reinvests in existing buildings and infrastructure, and protects historic character of San Juan, with benefits to community and tourism.

**Potential upfront costs:** \$11.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$11.5 million in total estimated costs

**Potential funder(s):** National Archives, NEA, NEH, IMLS, Government of Puerto Rico, private sector, nongovernment sources

**Potential implementer(s):** ICP, NARA

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#### **NCR 4**

### **Caribbean Cultural Collections Preservation, Research, and Safe Storage Center**

Expand and fulfill SHPO and ICP plan to identify criteria for and build a new conservation center that provides preservation planning and conservation services for museum/library/archives, private client collections, and historic properties.

**Potential benefits:** Provides a local source of professional preservation advice and conservation treatment, boosts employment opportunities for professionals in preservation and curation, establishes Puerto Rico as a regional leader in preservation and conservation, and houses several ICP institutions and agencies.

**Potential upfront costs:** \$130 million–\$200 million in estimated upfront costs

**Potential recurring costs:** \$18 million in estimated recurring costs

**Potential total costs:** \$140 million–\$210 million in total estimated costs

**Potential funder(s):** CDBG–DR, NARA, NEH, NEA, IMLS, NSF, public-private partnership, nongovernment sources

**Potential implementer(s):** ICP, SHPO, NEH, HENTF, Regional Alliance for Preservation, various foundations and donors

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# Restore, Plan for, and Develop the Natural Environment

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## NCR 5

### Forest Recovery in Rural Protected Areas, Private Forests, Critical Watersheds, and Urban Areas

Develop and implement strategic forest recovery and conservation strategies throughout Puerto Rico through public and private collaborations. Strategies should be developed with a focus on rural protected forests, ecological corridors, private forested lands, agroforestry, and urban forests. Restore tree nurseries and seed banks to aid in the recovery process.

**Potential benefits:** Restores ecological functions of forests and the provision of ecosystem services, boosts economic viability of forest conservation, provides employment opportunities, improves public safety, and reduces the risk of pest and disease damage.

**Potential upfront costs:** \$70 million–\$120 million in estimated upfront costs

**Potential recurring costs:** \$4.5 million in estimated recurring costs

**Potential total costs:** \$75 million–\$120 million in total estimated costs

**Potential funder(s):** DOI, USDA, public-private partnership, Government of Puerto Rico, DNER, municipal governments, nongovernment sources

**Potential implementer(s):** DNER, USFS, municipal governments

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## NCR 6

### Implement Individual At-Risk Species Recovery Activities

Develop and implement recovery actions for a set of the 10–15 identified at-risk species that were known to be significantly affected by Hurricane Maria. Plans include species-appropriate habitat restoration, increasing wild populations, and addressing invasive species competition or predation.

**Potential benefits:** Improves resilience of habitats, especially for species that are at risk of extinction; assists species recovery; improves biodiversity and ecological health; and contributes to agricultural production and tourism.

**Potential upfront costs:** \$5.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$5.5 million in total estimated costs

**Potential funder(s):** DOI, USDA, Government of Puerto Rico, DNER, municipal governments, private sector, nongovernment sources

**Potential implementer(s):** DNER, FWS, other federal agencies, NGOs, universities

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## NCR 8

### Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to allow new capacity and inspect existing landfills.

**Potential benefits:** Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

**Potential upfront costs:** \$176 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$176 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, municipal governments

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## NCR 9

### Landfill Repair and Closure

Explore options for repairing landfills that sustained hurricane damage, and close unlined registered dumps.

**Potential benefits:** Reduces or eliminates the impact of damaged landfills and unlined dumps on natural resources (including soil, air, and water quality) and helps bring lined landfills back into compliance. Reduces the risk to public health and the environment.

**Potential upfront costs:** \$160 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$160 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, municipal governments, Solid Waste Authority

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## NCR 10

### Clean Up and Eliminate Use of Unpermitted, Unregistered Dumps

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 unpermitted, unregistered dumps throughout Puerto Rico and identify steps to prevent future use of such dumps.

**Potential benefits:** Removes environmental and public health threats associated with unpermitted, unregistered dumps and helps ensure the overall success of a sustainable solid waste management plan.

**Potential upfront costs:** \$104 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$104 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, EPA

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### NCR 11

## Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

**Potential benefits:** Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to landfills, provides economic opportunities, improves soil for agriculture, and provides opportunities for public engagement, including helping to ensure that information about the waste management process is communicated to users.

**Potential upfront costs:** \$101 million in estimated upfront costs

**Potential recurring costs:** \$263 million in estimated recurring costs

**Potential total costs:** \$363 million in total estimated costs

**Potential funder(s):** CDBG-DR, HUD, USDA, public-private partnership

**Potential implementer(s):** DNER, EQB, EPA, USDA

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### NCR 13

## Reduce Sediment Pollution and Risk from Landslides

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides during Hurricane Maria or are at high risk of future landslides, through vegetative, bioengineering, and structural approaches.

**Potential benefits:** Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

**Potential upfront costs:** \$1.05 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.05 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, USDA, USACE, DOT

**Potential implementer(s):** DNER, federal agencies

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## **NCR 14** **Water Quality Improvements at the Watershed Scale**

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

**Potential benefits:** Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves inland and coastal water quality, and restores coastal areas.

**Potential upfront costs:** \$142 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$142 million in total estimated costs

**Potential funder(s):** HMGP, USDA, EPA, DOI, NOAA, EQB

**Potential implementer(s):** DNER, federal agencies

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## **NCR 15<sup>1</sup>** **Coral Reef and Seagrass Protection and Restoration**

Restore damaged coral reef and seagrass sites in priority areas to protect coastal communities, human health and safety, biodiversity, ecological function, and economic activity.

**Potential benefits:** Provides a cost-effective way to increase protection from disasters, creates jobs, increases biodiversity of coastal areas, and enhances fishing, tourism, and recreation economies.

**Potential upfront costs:** \$13.5 million–\$14.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$13.5 million–\$14.5 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, NOAA, EPA, USCG, USACE, DOI, nongovernment sources

**Potential implementer(s):** DNER, NOAA

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<sup>1</sup>Cost estimate for NCR 15 requires labor from NCR 25.



**NCR 16**  
**Wetlands Restoration**

Restore the capacity, resiliency, and ecological function of 10 priority coastal wetlands through site-specific actions. Coordinate with other land use activities such as stormwater management and port construction.

**Potential benefits:** Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

**Potential upfront costs:** \$24.8 million–\$31.4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$24.8 million–\$31.4 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

**Potential implementer(s):** DNER, EQB, USACE

**NCR 17**  
**Reduce Coastal Erosion and Provide Disaster Protection Through Beaches and Dunes**

Restore, monitor, and maintain beaches and sand dunes to make them stable and resilient to both seasonal- and disaster-related coastal flooding, as well as long-term sea level rise.

**Potential benefits:** Increases coastal resilience and protects coastal infrastructure, human health and safety, wildlife habitats, and commerce from erosion and flood hazards.

**Potential upfront costs:** \$80 million–\$82 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$80 million–\$82 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOI, USACE, NOAA

**Potential implementer(s):** DNER, municipal governments, USACE

**NCR 25**  
**Blue Shore Workforce Development**

Create a locally sourced, skilled labor force to support recovery efforts in the short and long terms.

**Potential benefits:** Creates jobs, facilitates skill development, provides labor for recovery and restoration, and promotes more effective and efficient investment.

**Potential upfront costs:** \$35 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$35 million in total estimated costs

**Potential funder(s):** EPA, USDA, DOC EDA, DOL, DEDC

**Potential implementer(s):** Puerto Rico Department of Labor and Human Resources, DOC EDA

# Strategic Initiatives

FOCUS ON THE  
FUTURE

The order of these actions first highlights actions from the sector most relevant to that objective, listed numerically. Numerical assignment is random and does not indicate a specific prioritization. They are then followed by actions from other sectors that are also important to achieving the capital investment objective, which are listed in alphabetical order by code and number. As the actions in the Energy, Communications/IT, Water, Transportation, and Housing sectors support the capital investments in infrastructure that are prerequisites for achieving the strategic initiatives, we do not duplicate them in this section. (Those capital investments can be found on pages 218–307.)



# Ocean Economy

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## ECN 3

### Assist the Sport Fishing Industry

Restore and enhance sport fishery facilities and resources that were affected by the hurricanes.

**Potential benefits:** Helps spur economic growth in the areas surrounding the sport fishing facilities and encourages development of tourism and other industries.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$4 million in total estimated costs

**Potential funder(s):** CDBG-DR, private insurance

**Potential implementer(s):** DEDC, DNER

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## ECN 5

### Improve Retention of Educated Workforce Through Policy Change

Decrease the proportion of college students and educated workers who are leaving Puerto Rico by adopting policies that create incentives to stay.

**Potential benefits:** Increases retention of those who would otherwise migrate after completing their studies and increases production of goods and services through enhanced labor quality.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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## ECN 7

### Create Research Centers and Partnerships

Create research centers and partnerships across a variety of disciplines—for example, agricultural partnerships with universities or specialized research centers in technology, biotechnology, and marine economics—and a center devoted to developing and using blockchain technology. Focus on the knowledge economy.

**Potential benefits:** Leverages the intellectual capital of Puerto Rico to stimulate technological development that will potentially increase productivity across diverse sectors of the economy.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$110 million in estimated recurring costs

**Potential total costs:** \$110 million in total estimated costs

**Potential funder(s):** Multiple federal agencies

**Potential implementer(s):** Universities, private industry

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## **ECN 8** **Define and Develop Economic Development Zones**

Define geographically distinct economic development zones (starting with the Port of Ponce) and establish policies (which might include a waiver of the Jones Act) to provide benefits, such as tax advantages.

**Potential benefits:** Incentivizes particular types of economic activity in specific areas, which, in turn, increases the level of economic activity and employment.

**Potential upfront costs:** \$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$50 million in total estimated costs

**Potential funder(s):** DOC EDA

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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## **ECN 9** **Invest in Agricultural Recovery Assistance**

Provide a direct investment in recovery assistance to farming efforts. This action targets poultry; dairy milking; livestock breeding; specialty animals; and horticulture, including vegetables and tubers, grain production, orchards (fruit and nut trees), melons, and coffee facilities.

**Potential benefits:** Allows farmers and other agricultural workers to reestablish operations. Stimulates the development of innovative and efficient farming practices and use of next-generation agricultural technology, improving the profitability of agriculture and increasing exports.

**Potential upfront costs:** \$1.8 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.8 billion in total estimated costs

**Potential funder(s):** USDA, CDBG-DR, private insurance

**Potential implementer(s):** PRDA

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**ECN 10**  
**BLUETide INITIATIVE**

Develop a whole-Island approach to coastal resource management for disaster mitigation and resilience, workforce development, and advanced manufacturing. Start a marine business innovation and research center and an incubator network to develop ocean-related technologies. Leverage waterborne infrastructure to support sports anglers, tourism, biocompound extraction, aquaculture, policy, and enforcement.

**Potential benefits:** Increases tourism, international competitiveness, economic growth, and food security while diversifying economic drivers and preventing future hurricane damage.

**Potential upfront costs:** \$200 million–\$300 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$200 million–\$300 million in total estimated costs

**Potential funder(s):** CDBG–DR, FEMA, DOC EDA, NOAA, DOI, EPA, USDA, nongovernment sources

**Potential implementer(s):** FEMA, DOC EDA, NOAA, DOI, EPA, USDA, HUD, DEDC, DNER, PRSTRT, municipal governments, NGOs

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**ECN 12**  
**Provide Innovation and Entrepreneurial Training**

Reinvigorate innovation and research in Puerto Rico by implementing entrepreneurial initiatives. The model consists of three strategies: Bring talented workers into startup and research teams, screen the teams to identify those with strong potential, and scale up high-potential startup teams.

**Potential benefits:** Generates trained entrepreneurs who can start businesses that will produce goods and services for export, promotes public-private partnerships, and creates job opportunities.

**Potential upfront costs:** \$26 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$26 million in total estimated costs

**Potential funder(s):** DOC EDA, NSF, DOL, USDA

**Potential implementer(s):** Puerto Rican and other universities, PRDE, PRSTRT, Grupo Guayacán, DEDC, PRiMEX, Small Business Technology Development Center, Echar Pa'lante, PRITS

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**ECN 13**  
**Develop PRIDCO's Abandoned Buildings for Business Incubators**

Find tenants to occupy abandoned PRIDCO-owned buildings, ideally entrepreneurs seeking to develop business incubators who will benefit from reduced operating costs and the capacity building that can result from networking with other startup entrepreneurs.

**Potential benefits:** Avoids neighborhood blight, improves ease of doing business, and provides opportunities for communities as well as for startups. Creates community anchor points for business development.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** PA, CDBG-DR, PRIDCO

**Potential implementer(s):** PRIDCO, SBA

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**ECN 14**  
**Direct Small Business Investment**

Provide small grants and low-interest loans to small businesses, startups, and entrepreneurs affected by the hurricanes to ensure that they can continue to grow. Grants would cover working capital assistance, inventory losses, equipment and fixture replacement costs, hurricane repairs, and mitigation projects.

**Potential benefits:** Allows businesses to reestablish operations, rebuild, recover, and grow, as well as become more resilient to disasters and able to plan for continued growth with more confidence.

**Potential upfront costs:** \$2.7 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.7 billion in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, DOL, SBA, private insurance

**Potential implementer(s):** Individual applicants

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**ECN 15****Redevelop Former Roosevelt Roads Naval Station**

Redevelop the former Roosevelt Roads naval station to include housing, mixed-use retail establishments, industrial parks, and maritime and air transportation. Redevelopment will require a spectrum of investment partners to help with the required infrastructure developments.

**Potential benefits:** Results in economic growth, stabilization, and expansion in the surrounding communities.

**Potential upfront costs:** \$500 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$500 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR, PRIDCO

**Potential implementer(s):** DEDC, private developers

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**ECN 17****Construct the Puerto Rico Science, Technology, and Research Trust's Research and Development Center at Science City**

Construct the Forward Center—the research, development, and prototyping facility for the proposed Puerto Rico Science, Technology, and Research Trust—at Science City. This effort represents one of Puerto Rico's Comprehensive Economic Development Strategy approaches.

**Potential benefits:** Provides science and technology companies, such as Boston Scientific, space to expand their research and development efforts while helping to move Puerto Rico to the forefront of innovation. Establishes new co-working space for other high-tech ventures that have arisen from Parallel18 Ventures.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** DOC EDA, Opportunity Zone Funds, New Markets Tax Credits

**Potential implementer(s):** DEDC

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### **ECN 18**

## **Compensate Farmers for Crop Losses**

Compensate farmers directly for crop losses due to the hurricanes.

**Potential benefits:** Replaces lost income for farmers so they can maintain spending across all sectors of the economy.

**Potential upfront costs:** \$250 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$250 million in total estimated costs

**Potential funder(s):** USDA, private insurance

**Potential implementer(s):** USDA, PRDA

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### **ECN 19**

## **Recover and Restore Fishing Facilities and Equipment**

Construct and restore fishermen's wharves, docks, fishing centers, and equipment and supplies that were damaged in the hurricanes.

**Potential benefits:** Restores, recovers, or replaces equipment and working spaces that are essential to the fishing industry to support the industry across the Island.

**Potential upfront costs:** \$60 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$60 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, private insurance

**Potential implementer(s):** DEDC, NOAA

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### **ECN 23**

## **Implement Job Creation Initiative**

Create jobs that are responsive to the labor market, demand-driven, and within or near communities hardest hit by job loss and structural damage due to Hurricanes Irma and Maria. Target job creation efforts toward women and young adults, focusing on social and physical reconstruction projects.

**Potential benefits:** Helps rebuild communities, restore jobs, decrease the rate of unemployment, strengthen the local economy, and build resilience.

**Potential upfront costs:** \$80 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$80 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR, DOL, USDA

**Potential implementer(s):** Local public agency and individual program applicants

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## ECN 24

### Revitalize the PR-127 Petrochemical Corridor in Guyanilla-Peñuelas

Undertake cleanup and revitalization of contaminated former petrochemical zone.

**Potential benefits:** Allows development of new industries that focus on production of next-generation renewable energy resources and products and that support microalgae-based pharmaceutical manufacturing and responsible recycling industries.

**Potential upfront costs:** \$30 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$30 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR

**Potential implementer(s):** DEDC

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## ECN 25

### Assist Dislocated Workers Through the Use of Existing Grants

Provide funding through Disaster Dislocated Worker Grants to create temporary employment opportunities to help with cleanup and recovery efforts. This funding is provided to areas declared eligible for public assistance by FEMA or other federal agencies.

**Potential benefits:** Creates temporary jobs that will provide income to workers who lost their sources of income due to the hurricanes, promotes economic activity, and supplies workers who can assist in the cleanup and rebuilding efforts.

**Potential upfront costs:** \$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$50 million in total estimated costs

**Potential funder(s):** DOL

**Potential implementer(s):** Local public agency and individual program applicants

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## ECN 27

### Rehabilitate Esperanza Boardwalk and Waterfront

Revitalize the boardwalk that runs along the waterfront in the town of Esperanza on the island of Vieques (a popular tourist destination). The waterfront experienced significant damage from Hurricanes Irma and Maria and is currently closed to visitors, along with most local businesses.

**Potential benefits:** Revitalizes the boardwalk to allow tourist business to resume. Provides assistance to local businesses to reopen, to become more resilient, and to be better protected from future disasters.

**Potential upfront costs:** \$10 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$10 million in total estimated costs

**Potential funder(s):** DOC EDA, private insurance

**Potential implementer(s):** DEDC, private companies

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## ECN 28

### Implement Initiative to Promote Entrepreneurship

Establish a Business and Entrepreneurial Intelligence System to provide statistics, information, and data to simplify preparation of business plans, strategies, and market studies. The system will be established by the Government of Puerto Rico but managed by an organization outside the government, focused on general entrepreneurship.

**Potential benefits:** Allows potential business owners to view the investment and business climate and opportunities in Puerto Rico more clearly, encouraging them to start operations.

**Potential upfront costs:** \$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$50 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR, DOL

**Potential implementer(s):** DEDC

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## ECN 29

### Design Puerto Rico “Open for Business” Campaign

Design and launch a marketing strategy to inform the world that Puerto Rico is ready to resume receiving tourists and inviting visitors to see that the natural resources have been preserved and that the tourism industry is ready to serve them.

**Potential benefits:** Fills information gaps and promotes tourism to Puerto Rico, which will lead to enhanced exports and economic development. May complement private initiatives.

**Potential upfront costs:** \$67 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$67 million in total estimated costs

**Potential funder(s):** DOC EDA

**Potential implementer(s):** PRTC, DEDC, ICP

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## ECN 30

### Help Revitalize Eco and Beach Adventure and Fleet Boat Assistance

Identify key businesses on the island of Culebra that were damaged by the hurricanes, as well as other services that the island could develop. Provide economic assistance to existing businesses and resources to repair the beach and create new business opportunities.

**Potential benefits:** Creates jobs and increases economic activity by creating or stimulating a viable, sustainable tourism industry. Results in better services and experiences for visitors.

**Potential upfront costs:** \$2.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.5 million in total estimated costs

**Potential funder(s):** CDBG-DR, private insurance

**Potential implementer(s):** DEDC, private companies

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### **ECN 31**

## **Change Social Welfare and Benefits Policy**

Modify the distribution of social welfare benefits and income by altering policies pertaining to eligibility for social welfare benefits, such as Medicaid and the Nutrition Assistance Program. Examples include establishing work requirements, using income tax credits to eliminate thresholds for eligibility, and lowering individual income tax rates to stimulate consumption.

**Potential benefits:** Removes disincentives to work that have been created by the current system of benefit provision. Stimulates the economy by encouraging consumption. Improves fiscal spending by reducing benefit payments.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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### **ECN 32**

## **Create Business Resiliency Hubs**

Create business resiliency hubs (BRHs) in areas not prone to flooding to provide space for business operations after a disaster. Obtain satellite communications, if feasible, to enhance resiliency of communication systems. These BRHs would be community facilities, possibly closed schools, built to code, with sufficient backup generating capacity and fuel supply for the response phase of a disaster.

**Potential benefits:** Helps businesses survive and recover from disasters by assisting with continuity of operations, enabling them to communicate with employees, customers, and vendors.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$4 million in total estimated costs

**Potential funder(s):** DOC EDA

**Potential implementer(s):** Local public agency and individual program applicants

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**ECN 33**  
**Establish Business and Industrial Development Corporations (BIDCOs)**

Establish BIDCOs, i.e., state-chartered private lending institutions designed to help businesses that conventional lenders consider too high-risk and that lack the high growth potential to attract venture capitalists. BIDCOs will obtain their funding by selling the guaranteed portions of their government loans on the secondary market and subsequently re-lending their earnings to other businesses. This action will require a license provided by the SBA.

**Potential benefits:** Provides financing to businesses in the communities served by BIDCO that could not otherwise obtain financing, thereby saving and/or creating jobs.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$3 million in estimated recurring costs

**Potential total costs:** \$8 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, private sector

**Potential implementer(s):** Government of Puerto Rico, private sector

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**ECN 35**  
**Center of Excellence for Agricultural Technologies Training**

Establish a fully operational agricultural training center to catalyze applied technology-driven agro-innovation to integrate veterans, youth, and marginalized populations into agricultural business opportunities.

**Potential benefits:** Contributes to human capital development, hurricane mitigation, and food security by helping to increase the number of farmers in Puerto Rico.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** NOAA, DOI, EPA, USDA, HUD, DOL

**Potential implementer(s):** Government of Puerto Rico, PRDA

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### **ECN 36**

## **Agricultural Financial Support for Access to Capital**

Establish an Agricultural Enterprise program in the Economic Development Bank (EDB) exclusively for agricultural innovation enterprises supported by federal programs that provide revolving loan funds to expand farmers' access to capital and encourage innovation and agricultural modernization.

**Potential benefits:** Helps increase the number and productivity of farmers in Puerto Rico while contributing to hurricane mitigation and food security by encouraging innovation.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$5 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, DOC EDA

**Potential implementer(s):** EDB

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### **ECN 37**

## **PRIDCO Agriculture Parks**

Convert undeveloped PRIDCO parks to host state-of-the-art controlled-environment agriculture infrastructure, including hydroponics and aquaculture, for private lease using the same current landlord model.

**Potential benefits:** Helps attract entrepreneurs to the agriculture industry to help achieve critical mass, especially when combined with the technical expertise of the Center of Excellence and Operational Capital provided by the EDB. Controlled-environment agriculture can reduce climate vulnerability, overcome land constraints, and increase food security and exports.

**Potential upfront costs:** \$100 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$100 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, DOC EDA

**Potential implementer(s):** PRIDCO

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## ECN 38

### Agriculture Industry Support

Change the current model of the PRDA Agrological Laboratory to a public-private partnership with greater resources to enable it to communicate effectively and in a timely manner with farmers and serve as a support resource to enable optimal farm-level decisionmaking.

**Potential benefits:** Contributes to human capital development, hurricane mitigation, and food security by advising on better agricultural practices. May also increase and optimize the technical resources needed to improve the productivity of agriculture.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$22 in estimated recurring costs

**Potential total costs:** \$27 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, DOC EDA

**Potential implementer(s):** PRDA, private sector

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## EDU 5

### Implement a Student-Based Budget System

Review current budget practices to assess how funds are allocated to schools and identify unmet funding needs and inequities based on geographic location or school characteristics. Determine whether and how a new student-based budget formula would allow funding to be distributed more equitably, effectively, and transparently across both public and new charter schools.

**Potential benefits:** Helps increase equity, allocate more dollars to higher-need schools, and ensure consistency across all regions in access to resources.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$1.1 million in estimated recurring costs

**Potential total costs:** \$1.6 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources

**Potential implementer(s):** PRDE (Office of Public School Improvement)

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## **EDU 6** **Expanding and Updating K–12 Vocational Programs**

Implement a one-year pilot program and subsequent full-scale program to expand and update K–12 vocational programs to include entrepreneurship training and accommodate growth in economic sectors, such as manufacturing, finance, renewable energy, construction, hospitality, and health care.

**Potential benefits:** Helps build a skilled labor force for sectors that are key to recovery. Helps address the needs of those disproportionately affected by disasters. Helps create and/or strengthen private–public consortiums to support long-term recovery. Creates closer ties between K–12 schools and universities.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$3 billion in estimated recurring costs

**Potential total costs:** \$3 billion in total estimated costs

**Potential funder(s):** U.S. Department of Education, NSF, DoD, DHHS, DOL, public–private partnership, DEDC, Puerto Rico Department of Labor and Human Resources, nongovernment sources

**Potential implementer(s):** PRDE, PRITS, Echar Pa'lante alliance, schools, private industry

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## **EDU 7** **Augment Tele-Education/ Online Education**

Provide “emergency instruction” in the event of a school closure of more than 2 weeks. This action includes building an online repository of free, open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K–12), and technology platforms.

**Potential benefits:** Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE’s initiative to integrate technology into the classroom.

**Potential upfront costs:** \$3.7 million in estimated upfront costs

**Potential recurring costs:** \$18 million in estimated recurring costs

**Potential total costs:** \$22 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources, private sector

**Potential implementer(s):** PRDE, Echar Pa'lante alliance, professional development partners

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### HSS 3

## Implement Integrated Waste Management Program and Expand Programs to Increase Recycling Rates

Establish an integrated materials recovery and waste management program and increase the proportion of waste that is diverted from landfills. This action includes a comprehensive cost analysis, enforceable recycling and composting mandates, and public education.

**Potential benefits:** Creates a waste management program that would decrease negative health impacts across Puerto Rico.

**Potential upfront costs:** \$220,000 in estimated upfront costs

**Potential recurring costs:** \$6.2 million in estimated recurring costs

**Potential total costs:** \$6.4 million in total estimated costs

**Potential funder(s):** EPA, nongovernment sources

**Potential implementer(s):** EPA, DNER, EQB, PR Recycling Partnership, universities

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### HSS 6

## Reduce Opportunities for Vector-Borne Diseases

Support ongoing monitoring and engagement for mosquito control and provide support to establish additional innovative practices for mosquito control, including but not limited to using drones to detect breeding grounds and apply larvicide at abandoned properties.

**Potential benefits:** Improves mosquito control in areas that have been difficult to reach.

**Potential upfront costs:** \$370,000–\$3.4 million in estimated upfront costs

**Potential recurring costs:** \$170,000–\$350,000 in estimated recurring costs

**Potential total costs:** \$530,000–\$3.8 million in total estimated costs

**Potential funder(s):** DHHS

**Potential implementer(s):** PRVCU, PRDOH, municipal governments

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## **HSS 9**

### **Increase Access to Tele-Health Options as Telecommunication Supports Become More Robust**

Expand the use of tele-health across Puerto Rico and train the health care workforce in its use, including mental health. This action includes using social media to screen and enroll more geographically isolated populations in services and using phone and online applications to target those with trauma-related mental illness.

**Potential benefits:** Provides greater access to specialty care for nonurban populations and quicker networking and best-practice sharing among health care professionals in an emergency.

**Potential upfront costs:** \$1.8 million in estimated upfront costs

**Potential recurring costs:** \$19 million in estimated recurring costs

**Potential total costs:** \$21 million in total estimated costs

**Potential funder(s):** DHHS

**Potential implementer(s):** Health care providers, mental health care providers, private industry

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## **HSS 10**

### **Expand Care for Trauma and Chronic Stress**

Expand the networks to provide relief for trauma, stress, and anxiety-related behavioral health issues by training nontraditional providers and providing care in nontraditional medical settings. Empower faith-based organizations, schools, and NGOs to better understand and support their constituents in managing post-disaster stressors in a culturally compatible way.

**Potential benefits:** Improves quality of care outcomes for traumatic stress and addresses the mental health care provider shortage and distribution issues.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$3 million in estimated recurring costs

**Potential total costs:** \$3 million in total estimated costs

**Potential funder(s):** DHHS, nongovernment sources

**Potential implementer(s):** Mental health providers

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## HSS 11

### **Add Incentives and Other Supports to Increase and Retain Supply of Health Care Providers and Public Health Practitioners**

Use incentives and loan repayment programs to ensure that Puerto Rico has a robust and stable health care provider and public health practitioner workforce, including primary care providers, specialists, and mental health practitioners, for both disaster-related health issues and for the long term.

**Potential benefits:** Helps retain high-quality talent in health care, and creates communities of practitioners that can better serve their populations due to increased work satisfaction.

**Potential upfront costs:** \$39 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$39 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** Puerto Rican universities, associated hospitals and health care facilities

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## HSS 14

### **Develop a More Robust and Resilient Data System of Health Costs and Links to Health Outcomes**

Create supports for measuring health care costs systematically, including (1) merging claims data, hospital and other health center discharge data, and disease and health outcome information; (2) solidifying the robustness of data systems for health outcomes information and inclusive or related social and human service data; and (3) ensuring greater data digitization to facilitate analysis.

**Potential benefits:** Ensures that systematic data are collected, through robust and resilient data systems, and that there is a mechanism to integrate and report on findings for overall health quality improvement.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$3.3 million in estimated recurring costs

**Potential total costs:** \$3.3 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico

**Potential implementer(s):** Institute for Statistics, health care payers, health care providers, PRDOH

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## **HSS 21** **Improve Public Awareness of Proper Storage of Insulin Post-Disaster**

Increase public knowledge of guidelines for the storage of insulin by (1) training disaster shelter managers and health care providers to provide relevant information, (2) conducting mass media and social media campaigns, and (3) sending text messages to patients.

**Potential benefits:** Decreases medication gaps and negative health impacts for insulin-dependent individuals. Decreases medication waste and strain on insulin supply.

**Potential upfront costs:** \$640,000 in estimated upfront costs

**Potential recurring costs:** \$1.9 million in estimated recurring costs

**Potential total costs:** \$2.6 million in total estimated costs

**Potential funder(s):** DHHS, PRDOH, private sector, nongovernment sources

**Potential implementer(s):** Health care providers, PRDOH, private sector

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## **HSS 26** **Review and Improve Systems for Stockpiling and Distributing Supplies and Pharmaceuticals Post-Disaster**

Designate approximately 10 key health care facilities as Health Care Disaster Resource Centers that will be equipped with extra supplies needed during a disaster.

**Potential benefits:** Avoids increased morbidity and mortality among electricity-dependent individuals. Makes emergency response supplies more readily available. Improves interagency coordination during and after a disaster.

**Potential upfront costs:** \$20 million in estimated upfront costs

**Potential recurring costs:** \$2.8 million in estimated recurring costs

**Potential total costs:** \$23 million in total estimated costs

**Potential funder(s):** DHHS, PREMA, PRDOH

**Potential implementer(s):** PRDOH, PREMA

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**MUN 8**  
**Provide Municipalities with Technical Assistance and Support for Best Practices in Public Management and Operations**

Provide municipal governments with technical assistance and other forms of support to implement best practices in public management including human resources and fiscal issues. Improve municipal workforces by standardizing salary rates, position descriptions, and qualification requirements and by providing professional development and training.

**Potential benefits:** Improves public management at the municipal level by promoting best practices in core operations. Improves ability of municipal governments to provide an array of services maintaining fiscal well-being. Leads to a more highly skilled, professional workforce.

**Potential upfront costs:** \$3.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$3.5 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOL

**Potential implementer(s):** Government of Puerto Rico, municipal governments

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**NCR 7**  
**Develop Partner Networks for Recovering Plant and Animal Species**

Develop a comprehensive network of partners to work together to help fund actions for plant and animal species preservation, develop human capital and capacity in species management, educate the public, and cultivate experiential/tourism opportunities.

**Potential benefits:** Improves management of plant and animal species, helps prevent species from becoming extinct, and expands and enhances educational, tourism, and other economically beneficial opportunities.

**Potential upfront costs:** \$120,000–\$360,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$120,000–\$360,000 in total estimated costs

**Potential funder(s):** DOI, USDA, Government of Puerto Rico, DNER, municipal governments, private sector, nongovernment sources

**Potential implementer(s):** DNER, federal agencies, UPR, NGOs

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## NCR 8

### Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to allow new capacity and inspect existing landfills.

**Potential benefits:** Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

**Potential upfront costs:** \$176 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$176 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, municipal governments

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## NCR 9

### Landfill Repair and Closure

Explore options for repairing landfills that sustained hurricane damage, and close unlined registered dumps.

**Potential benefits:** Reduces or eliminates the impact of damaged landfills and unlined dumps on natural resources (including soil, air, and water quality) and helps bring lined landfills back into compliance. Reduces the risk to public health and the environment.

**Potential upfront costs:** \$160 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$160 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, municipal governments, Solid Waste Authority

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## NCR 10

### Clean Up and Eliminate Use of Unpermitted, Unregistered Dumps

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 unpermitted, unregistered dumps throughout Puerto Rico and identify steps to prevent future use of such dumps.

**Potential benefits:** Removes environmental and public health threats associated with unpermitted, unregistered dumps and helps ensure the overall success of a sustainable solid waste management plan.

**Potential upfront costs:** \$104 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$104 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, EPA

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## NCR 11

### **Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program**

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

**Potential benefits:** Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to landfills, provides economic opportunities, improves soil for agriculture, and provides opportunities for public engagement, including helping to ensure that information about the waste management process is communicated to users.

**Potential upfront costs:** \$101 million in estimated upfront costs

**Potential recurring costs:** \$263 million in estimated recurring costs

**Potential total costs:** \$363 million in total estimated costs

**Potential funder(s):** CDBG-DR, HUD, USDA, public-private partnership

**Potential implementer(s):** DNER, EQB, EPA, USDA

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## NCR 13

### **Reduce Sediment Pollution and Risk from Landslides**

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides during Hurricane Maria or are at high risk of future landslides, through vegetative, bioengineering, and structural approaches.

**Potential benefits:** Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

**Potential upfront costs:** \$1.05 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.05 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, USDA, USACE, DOT

**Potential implementer(s):** DNER, federal agencies

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## **NCR 14** **Water Quality Improvements at the Watershed Scale**

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

**Potential benefits:** Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves inland and coastal water quality, and restores coastal areas.

**Potential upfront costs:** \$142 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$142 million in total estimated costs

**Potential funder(s):** HMGP, USDA, EPA, DOI, NOAA, EQB

**Potential implementer(s):** DNER, federal agencies

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## **NCR 15<sup>2</sup>** **Coral Reef and Seagrass Protection and Restoration**

Restore damaged coral reef and seagrass sites in priority areas to protect coastal communities, human health and safety, biodiversity, ecological function, and economic activity.

**Potential benefits:** Provides a cost-effective way to increase protection from disasters, creates jobs, increases biodiversity of coastal areas, and enhances fishing, tourism, and recreation economies.

**Potential upfront costs:** \$13.5 million–\$14.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$13.5 million–\$14.5 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, NOAA, EPA, USCG, USACE, DOI, nongovernment sources

**Potential implementer(s):** DNER, NOAA

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<sup>2</sup> Cost estimate for NCR 15 requires labor from NCR 25.



## NCR 16

### Wetlands Restoration

Restore the capacity, resiliency, and ecological function of 10 priority coastal wetlands through site-specific actions. Coordinate with other land use activities such as stormwater management and port construction.

**Potential benefits:** Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

**Potential upfront costs:** \$24.8 million–\$31.4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$24.8 million–\$31.4 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

**Potential implementer(s):** DNER, EQB, USACE

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## NCR 17

### Reduce Coastal Erosion and Provide Disaster Protection Through Beaches and Dunes

Restore, monitor, and maintain beaches and sand dunes to make them stable and resilient to both seasonal- and disaster-related coastal flooding, as well as long-term sea level rise.

**Potential benefits:** Increases coastal resilience and protects coastal infrastructure, human health and safety, wildlife habitats, and commerce from erosion and flood hazards.

**Potential upfront costs:** \$80 million–\$82 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$80 million–\$82 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOI, USACE, NOAA

**Potential implementer(s):** DNER, municipal governments, USACE

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## **NCR 18** **Establish the San Juan Barrier Reef System as a Marine Protected Area**

Declare the San Juan Barrier Reef a Commonwealth of Puerto Rico Marine Protected Area, restrict fishing to support sustainable commercial and recreational fisheries, and invest in the reef's restoration and long-term health.

**Potential benefits:** Provides long-term protection of infrastructure, tourism sites, and housing in San Juan; reduces flood risk to community; provides eco-tourism opportunities; and protects beaches.

**Potential upfront costs:** \$500,000–\$1 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$500,000–\$1 million in total estimated costs

**Potential funder(s):** NOAA, DOI, Government of Puerto Rico, public-private partnership, nongovernment sources

**Potential implementer(s):** DNER, NOAA

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## **NCR 21** **Strategic Watershed, Landscape, and Conservation Corridor Approaches**

Implement strategic approaches at the watershed and landscape scale. This action includes creating land and river conservation corridors (potentially starting with the central mountain area) and employing adaptive management for restoring natural habitats.

**Potential benefits:** Protects natural areas and improves agricultural production, tourism, access to fresh drinking water, recreational opportunities, watershed and ecosystem health, and ecological functions. Supports positive human health, infrastructure, and economic outcomes.

**Potential upfront costs:** \$20 million–\$75 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$20 million–\$75 million in total estimated costs

**Potential funder(s):** NOAA, DOI, USDA, EPA, Government of Puerto Rico, DNER, nongovernment sources

**Potential implementer(s):** DNER, federal agencies, land trusts, NGOs

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## **NCR 22** **Promote Alternative Tourism for Economic Development**

Catalyze experience-based tourism in key hub areas and enhance efforts to preserve unique natural, cultural, and historical assets.

**Potential benefits:** Supports economic growth; improves services and access; protects historical, cultural, and natural assets; incubates local entrepreneurship; and improves quality of life in underserved communities.

**Potential upfront costs:** \$140 million–\$233.4 million in estimated upfront costs

**Potential recurring costs:** \$3.457 million in estimated recurring costs

**Potential total costs:** \$143.5 million–\$236.9 million in total estimated costs

**Potential funder(s):** DOC EDA, USDA, DOI, NOAA, NEH, NARA, IMLS, NEA, DOL

**Potential implementer(s):** ICP, PRTC, DOC EDA, SBA, DNER

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## **NCR 25** **Blue Shore Workforce Development**

Create a locally sourced, skilled labor force to support recovery efforts in the short and long terms.

**Potential benefits:** Creates jobs, facilitates skill development, provides labor for recovery and restoration, and promotes more effective and efficient investment.

**Potential upfront costs:** \$35 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$35 million in total estimated costs

**Potential funder(s):** EPA, USDA, DOC EDA, DOL, DEDC

**Potential implementer(s):** Puerto Rico Department of Labor and Human Resources, DOC EDA

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## **NCR 26** **Resource Management Capacity Building**

Apply an updated framework for resource management and future disaster response that includes training support, data sharing, and educational outreach to enhance resilience in future disasters.

**Potential benefits:** Provides stronger decisionmaking support to natural and cultural resource stakeholders, promotes exchange of ideas, and encourages community involvement in resource management.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$16 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** PRTC, NGOs, communities

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## NCR 27

### Expand Disaster Recovery Sister Cities Connections

Establish plans for twinning Puerto Rican cities with other disaster-affected cities around the world to promote professional exchange about disaster recovery and preparedness, as well as general cultural and economic exchange.

**Potential benefits:** Promotes sharing of lessons learned elsewhere, helps ensure continued success of Puerto Rico's recovery effort, and provides economic benefits, as well as professional development, educational, and tourism opportunities.

**Potential upfront costs:** \$2.4 million in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$13 million in total estimated costs

**Potential funder(s):** Nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, NGOs, communities

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## NCR 28

### Identify Funding for Natural and Cultural Resources Research

Establish a public-private fund for innovative scientific research that supports recovery goals and enhances understanding of the effects of the hurricanes.

**Potential benefits:** Encourages innovative and multidisciplinary research, expands opportunities for Puerto Rico's research community, and provides timely information to inform decisions about recovery projects, future plans, and actions.

**Potential upfront costs:** \$7.5 million–\$15 million in estimated upfront costs

**Potential recurring costs:** \$1.1 million in estimated recurring costs

**Potential total costs:** \$8.6 million–\$16 million in total estimated costs

**Potential funder(s):** Private sector, nongovernment sources

**Potential implementer(s):** PRTC, ICP

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## NCR 29

### Enhance Public Participation and Education Through Museum Exhibits

Design and install in-depth, participatory exhibits at museums, such as the Parque de las Ciencias, that describe how different aspects of the natural and cultural resource recovery plans work and their benefits and drawbacks.

**Potential benefits:** Helps facilitate common understanding of the purpose of recovery efforts and promotes commitment to recovery and disaster preparedness.

**Potential upfront costs:** \$1.7 million–\$3.3 million in estimated upfront costs

**Potential recurring costs:** \$7.9 million–\$17 million in estimated recurring costs

**Potential total costs:** \$9.6 million–\$20 million in total estimated costs

**Potential funder(s):** Private sector, nongovernment sources

**Potential implementer(s):** DNER, ICP, universities, host museums

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## NCR 30

### Create an Accessible Data Repository of Natural and Cultural Resources

Create a complete and accessible geo-referenced data repository of Puerto Rico's natural and cultural resources using reliable data standards and systems (such as cloud-based computing) to facilitate response and recovery and inform investment decisions.

**Potential benefits:** Provides data to inform damage assessments and strengthens support for decisions about natural and cultural resource recovery options. Benefits infrastructure, community capacity building, economics, and education.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$12 million in estimated recurring costs

**Potential total costs:** \$12 million in total estimated costs

**Potential funder(s):** DOI, USGS, NOAA, Government of Puerto Rico, DNER, SHPO

**Potential implementer(s):** GPR agencies (DNER, SHPO, ICP), NGOs (PRSTRT), PRTC

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#### **PBD 4**

### **Realign Public Building Ownership**

Transfer ownership of buildings so that buildings of the same type (e.g., schools or government centers) are all owned by the same agency.

**Potential benefits:** Resolves complications from buildings of the same type owned by different agencies, improving government efficiency, accessibility, and communication.

**Potential upfront costs:** \$60,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$60,000 in total estimated costs

**Potential funder(s):** PRPB

**Potential implementer(s):** Office of the Governor, Legislative Assembly

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#### **PBD 8**

### **Mitigate Flood Risk for Critical Government Functions**

Relocate critical public functions to buildings outside of flood hazard zones or elevate the building in which the critical function is housed to prevent service disruptions and reduce damages due to flooding.

**Potential benefits:** Ensures continuity of critical public services due to flooding and reduces costs of maintaining buildings in flood zones.

**Potential upfront costs:** \$2 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2 billion in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, U.S. Department of Education

**Potential implementer(s):** PRPB

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# Visitor Economy

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## ECN 3

### Assist the Sport Fishing Industry

Restore and enhance sport fishery facilities and resources that were affected by the hurricanes.

**Potential benefits:** Helps spur economic growth in the areas surrounding the sport fishing facilities and encourages development of tourism and other industries.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$4 million in total estimated costs

**Potential funder(s):** CDBG-DR, private insurance

**Potential implementer(s):** DEDC, DNER

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## ECN 5

### Improve Retention of Educated Workforce Through Policy Change

Decrease the proportion of college students and educated workers who are leaving Puerto Rico by adopting policies that create incentives to stay.

**Potential benefits:** Increases retention of those who would otherwise migrate after completing their studies and increases production of goods and services through enhanced labor quality.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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## ECN 7

### Create Research Centers and Partnerships

Create research centers and partnerships across a variety of disciplines—for example, agricultural partnerships with universities or specialized research centers in technology, biotechnology, and marine economics—and a center devoted to developing and using blockchain technology. Focus on the knowledge economy.

**Potential benefits:** Leverages the intellectual capital of Puerto Rico to stimulate technological development that will potentially increase productivity across diverse sectors of the economy.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$110 million in estimated recurring costs

**Potential total costs:** \$110 million in total estimated costs

**Potential funder(s):** Multiple federal agencies

**Potential implementer(s):** Universities, private industry

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## **ECN 8** **Define and Develop Economic Development Zones**

Define geographically distinct economic development zones (starting with the Port of Ponce) and establish policies (which might include a waiver of the Jones Act) to provide benefits, such as tax advantages.

**Potential benefits:** Incentivizes particular types of economic activity in specific areas, which, in turn, increases the level of economic activity and employment.

**Potential upfront costs:** \$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$50 million in total estimated costs

**Potential funder(s):** DOC EDA

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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## **ECN 9** **Invest in Agricultural Recovery Assistance**

Provide a direct investment in recovery assistance to farming efforts. This action targets poultry; dairy milking; livestock breeding; specialty animals; and horticulture, including vegetables and tubers, grain production, orchards (fruit and nut trees), melons, and coffee facilities.

**Potential benefits:** Allows farmers and other agricultural workers to reestablish operations. Stimulates the development of innovative and efficient farming practices and use of next-generation agricultural technology, improving the profitability of agriculture and increasing exports.

**Potential upfront costs:** \$1.8 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.8 billion in total estimated costs

**Potential funder(s):** USDA, CDBG-DR, private insurance

**Potential implementer(s):** PRDA

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## ECN 10 BLUETide INITIATIVE

Develop a whole-Island approach to coastal resource management for disaster mitigation and resilience, workforce development, and advanced manufacturing. Start a marine business innovation and research center and an incubator network to develop ocean-related technologies. Leverage waterborne infrastructure to support sports anglers, tourism, biocompound extraction, aquaculture, policy, and enforcement.

**Potential benefits:** Increases tourism, international competitiveness, economic growth, and food security while diversifying economic drivers and preventing future hurricane damage.

**Potential upfront costs:** \$200 million–\$300 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$200 million–\$300 million in total estimated costs

**Potential funder(s):** CDBG–DR, FEMA, DOC EDA, NOAA, DOI, EPA, USDA, nongovernment sources

**Potential implementer(s):** FEMA, DOC EDA, NOAA, DOI, EPA, USDA, HUD, DEDC, DNER, PRSTRT, municipal governments, NGOs

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## ECN 11 Medical Tourism Initiative

Establish and fund a not-for-profit Medical Tourism Corporation (MTC) to be run by the Destination Management Organization. Continue to fund the MTC until it becomes self-sustaining. Consider including an initiative to retain local health care workers.

**Potential benefits:** Stimulates economic activity from tourist spending and may reverse the departure of medical professionals from Puerto Rico.

**Potential upfront costs:** \$8 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$8 million in total estimated costs

**Potential funder(s):** CDBG–DR, private sector, nongovernment sources

**Potential implementer(s):** PRTC, DEDC

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## **ECN 12** **Provide Innovation and Entrepreneurial Training**

Reinvigorate innovation and research in Puerto Rico by implementing entrepreneurial initiatives. The model consists of three strategies: Bring talented workers into startup and research teams, screen the teams to identify those with strong potential, and scale up high-potential startup teams.

**Potential benefits:** Generates trained entrepreneurs who can start businesses that will produce goods and services for export, promotes public-private partnerships, and creates job opportunities.

**Potential upfront costs:** \$26 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$26 million in total estimated costs

**Potential funder(s):** DOC EDA, NSF, DOL, USDA

**Potential implementer(s):** Puerto Rican and other universities, PRDE, PRSTRT, Grupo Guayacán, DEDC, PRIMEX, Small Business Technology Development Center, Echar Pa'lante, PRITS

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## **ECN 13** **Develop PRIDCO's Abandoned Buildings for Business Incubators**

Find tenants to occupy abandoned PRIDCO-owned buildings, ideally entrepreneurs seeking to develop business incubators who will benefit from reduced operating costs and the capacity building that can result from networking with other startup entrepreneurs.

**Potential benefits:** Avoids neighborhood blight, improves ease of doing business, and provides opportunities for communities as well as for startups. Creates community anchor points for business development.

**Potential upfront costs:** –

**Potential recurring costs:** –

**Potential total costs:** –

**Potential funder(s):** PA, CDBG-DR, PRIDCO

**Potential implementer(s):** PRIDCO, SBA

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#### **ECN 14**

### **Direct Small Business Investment**

Provide small grants and low-interest loans to small businesses, startups, and entrepreneurs affected by the hurricanes to ensure that they can continue to grow. Grants would cover working capital assistance, inventory losses, equipment and fixture replacement costs, hurricane repairs, and mitigation projects.

**Potential benefits:** Allows businesses to reestablish operations, rebuild, recover, and grow, as well as become more resilient to disasters and able to plan for continued growth with more confidence.

**Potential upfront costs:** \$2.7 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.7 billion in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, DOL, SBA, private insurance

**Potential implementer(s):** Individual applicants

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#### **ECN 15**

### **Redevelop Former Roosevelt Roads Naval Station**

Redevelop the former Roosevelt Roads naval station to include housing, mixed-use retail establishments, industrial parks, and maritime and air transportation. Redevelopment will require a spectrum of investment partners to help with the required infrastructure developments.

**Potential benefits:** Results in economic growth, stabilization, and expansion in the surrounding communities.

**Potential upfront costs:** \$500 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$500 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR, PRIDCO

**Potential implementer(s):** DEDC, private developers

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#### ECN 16

### Revitalize the Santurce Neighborhood of San Juan Through Business Development Activities

Establish Santurce as a center of business innovation that can serve as a replicable model for urban revitalization. This effort will be spearheaded by the Nuestro Barrio Creative Industries Acceleration and Commercialization Program at the Universidad del Sagrado Corazón.

**Potential benefits:** Increases retention and encourages expansion of business activity in a neighborhood that is transforming economically. Retains, diversifies, and commercializes creative industries. Develops affordable housing, bridging the university and the neighborhood.

**Potential upfront costs:** \$3 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$3 million in total estimated costs

**Potential funder(s):** DOC EDA

**Potential implementer(s):** Private developer, GPR agencies

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#### ECN 17

### Construct the Puerto Rico Science, Technology, and Research Trust's Research and Development Center at Science City

Construct the Forward Center—the research, development, and prototyping facility for the proposed Puerto Rico Science, Technology, and Research Trust—at Science City. This effort represents one of Puerto Rico's Comprehensive Economic Development Strategy approaches.

**Potential benefits:** Provides science and technology companies, such as Boston Scientific, space to expand their research and development efforts while helping to move Puerto Rico to the forefront of innovation. Establishes new co-working space for other high-tech ventures that have arisen from Parallel18 Ventures.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** DOC EDA, Opportunity Zone Funds, New Markets Tax Credits

**Potential implementer(s):** DEDC

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## ECN 19 Recover and Restore Fishing Facilities and Equipment

Construct and restore fishermen's wharves, docks, fishing centers, and equipment and supplies that were damaged in the hurricanes.

**Potential benefits:** Restores, recovers, or replaces equipment and working spaces that are essential to the fishing industry to support the industry across the Island.

**Potential upfront costs:** \$60 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$60 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, private insurance

**Potential implementer(s):** DEDC, NOAA

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## ECN 20 Rehabilitate Plaza Dársenas

Fix concrete walkways, relocate benches, install new lighting, and plant new trees in Plaza Dársenas, a San Juan landmark and tourist destination where local artisans show their work. Damage was sustained during Hurricane Maria.

**Potential benefits:** Improves Puerto Rico's image as a tourist destination, particularly for cruise ships, which, in turn, helps strengthen the economy.

**Potential upfront costs:** \$10 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$10 million in total estimated costs

**Potential funder(s):** DOC EDA, private insurance

**Potential implementer(s):** DEDC, PRTC

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## ECN 21 Study Hurricane Impacts on the Local Economy

Conduct an analysis of the main effects of Hurricane Maria on the local economy of Puerto Rico, as suggested in the Build Back Better plan. Prepare and evaluate economic estimates of the damages to the overall economy, as well as by sector. Track recent demographic changes in the local economy, including movement of persons.

**Potential benefits:** Enables local businesses to plan better for the future and make strategic, efficient investments to stimulate growth. Helps provide a basis for the government to use in estimating revenues and in fiscal planning, including infrastructure planning.

**Potential upfront costs:** \$300,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$300,000 in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA

**Potential implementer(s):** Private-sector firm or university

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## **ECN 22** **Rehabilitate Paseo de la Princesa and Princesa Building**

Revitalize the Paseo de la Princesa walkway and the Princesa Building, a historical site and popular tourist attraction in San Juan that experienced extensive damage from Hurricanes Irma and Maria. The renovation and mitigation project is based on the Build Back Better plan.

**Potential benefits:** Restores an area that draws many tourists from cruise ships and helps revitalize the tourism industry, which, in turn, helps local businesses, including restaurants, cafes, gift shops, the local artisans who display their work on the Paseo, and tour operators.

**Potential upfront costs:** \$4.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$4.5 million in total estimated costs

**Potential funder(s):** DOC EDA, Opportunity Zone Funds, New Markets Tax Credits

**Potential implementer(s):** PRIDCO, DEDC, PRTC

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## **ECN 23** **Implement Job Creation Initiative**

Create jobs that are responsive to the labor market, demand-driven, and within or near communities hardest hit by job loss and structural damage due to Hurricanes Irma and Maria. Target job creation efforts toward women and young adults, focusing on social and physical reconstruction projects.

**Potential benefits:** Helps rebuild communities, restore jobs, decrease the rate of unemployment, strengthen the local economy, and build resilience.

**Potential upfront costs:** \$80 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$80 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR, DOL, USDA

**Potential implementer(s):** Local public agency and individual program applicants

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## ECN 27

### Rehabilitate Esperanza Boardwalk and Waterfront

Revitalize the boardwalk that runs along the waterfront in the town of Esperanza on the island of Vieques (a popular tourist destination). The waterfront experienced significant damage from Hurricanes Irma and Maria and is currently closed to visitors, along with most local businesses.

**Potential benefits:** Revitalizes the boardwalk to allow tourist business to resume. Provides assistance to local businesses to reopen, to become more resilient, and to be better protected from future disasters.

**Potential upfront costs:** \$10 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$10 million in total estimated costs

**Potential funder(s):** DOC EDA, private insurance

**Potential implementer(s):** DEDC, private companies

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## ECN 29

### Design Puerto Rico “Open for Business” Campaign

Design and launch a marketing strategy to inform the world that Puerto Rico is ready to resume receiving tourists and inviting visitors to see that the natural resources have been preserved and that the tourism industry is ready to serve them.

**Potential benefits:** Fills information gaps and promotes tourism to Puerto Rico, which will lead to enhanced exports and economic development. May complement private initiatives.

**Potential upfront costs:** \$67 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$67 million in total estimated costs

**Potential funder(s):** DOC EDA

**Potential implementer(s):** PRTC, DEDC, ICP

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### **ECN 30**

## **Help Revitalize Eco and Beach Adventure and Fleet Boat Assistance**

Identify key businesses on the island of Culebra that were damaged by the hurricanes, as well as other services that the island could develop. Provide economic assistance to existing businesses and resources to repair the beach and create new business opportunities.

**Potential benefits:** Creates jobs and increases economic activity by creating or stimulating a viable, sustainable tourism industry. Results in better services and experiences for visitors.

**Potential upfront costs:** \$2.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.5 million in total estimated costs

**Potential funder(s):** CDBG-DR, private insurance

**Potential implementer(s):** DEDC, private companies

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### **ECN 31**

## **Change Social Welfare and Benefits Policy**

Modify the distribution of social welfare benefits and income by altering policies pertaining to eligibility for social welfare benefits, such as Medicaid and the Nutrition Assistance Program. Examples include establishing work requirements, using income tax credits to eliminate thresholds for eligibility, and lowering individual income tax rates to stimulate consumption.

**Potential benefits:** Removes disincentives to work that have been created by the current system of benefit provision. Stimulates the economy by encouraging consumption. Improves fiscal spending by reducing benefit payments.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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## ECN 32 Create Business Resiliency Hubs

Create business resiliency hubs (BRHs) in areas not prone to flooding to provide space for business operations after a disaster. Obtain satellite communications, if feasible, to enhance resiliency of communication systems. These BRHs would be community facilities, possibly closed schools, built to code, with sufficient backup generating capacity and fuel supply for the response phase of a disaster.

**Potential benefits:** Helps businesses survive and recover from disasters by assisting with continuity of operations, enabling them to communicate with employees, customers, and vendors.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$4 million in total estimated costs

**Potential funder(s):** DOC EDA

**Potential implementer(s):** Local public agency and individual program applicants

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## ECN 35 Center of Excellence for Agricultural Technologies Training

Establish a fully operational agricultural training center to catalyze applied technology-driven agro-innovation to integrate veterans, youth, and marginalized populations into agricultural business opportunities.

**Potential benefits:** Contributes to human capital development, hurricane mitigation, and food security by helping to increase the number of farmers in Puerto Rico.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** NOAA, DOI, EPA, USDA, HUD, DOL

**Potential implementer(s):** Government of Puerto Rico, PRDA

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### ECN 36

## Agricultural Financial Support for Access to Capital

Establish an Agricultural Enterprise program in the Economic Development Bank (EDB) exclusively for agricultural innovation enterprises supported by federal programs that provide revolving loan funds to expand farmers' access to capital and encourage innovation and agricultural modernization.

**Potential benefits:** Helps increase the number and productivity of farmers in Puerto Rico while contributing to hurricane mitigation and food security by encouraging innovation.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$5 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, DOC EDA

**Potential implementer(s):** EDB

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### ECN 37

## PRIDCO Agriculture Parks

Convert undeveloped PRIDCO parks to host state-of-the-art controlled-environment agriculture infrastructure, including hydroponics and aquaculture, for private lease using the same current landlord model.

**Potential benefits:** Helps attract entrepreneurs to the agriculture industry to help achieve critical mass, especially when combined with the technical expertise of the Center of Excellence and Operational Capital provided by the EDB. Controlled-environment agriculture can reduce climate vulnerability, overcome land constraints, and increase food security and exports.

**Potential upfront costs:** \$100 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$100 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, DOC EDA

**Potential implementer(s):** PRIDCO

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## **CPCB 1**

### **Disaster Preparedness Data Analysis and Decision Support Capability**

Enhance disaster-related data analysis and decision support capability within PREMA and in partnership with the Puerto Rico Planning Board (PRPB) to support disaster preparedness and hazard mitigation activities. Collect and analyze data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc., by geography and disseminate this information to planners in PREMA, other state-level agencies, and municipalities.

**Potential benefits:** Allows the Government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$21 million in estimated recurring costs

**Potential total costs:** \$21 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, PREMA

**Potential implementer(s):** Government of Puerto Rico, municipal governments, PRPB

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## **CPCB 2**

### **Capacity Building for Community-Level Preparedness and Response**

Develop and implement community-level response and recovery preparedness activities for priority communities that face particularly high risk during disasters. Recruit, train, and equip Community Emergency Response Teams so that these communities can better sustain themselves during the disaster response period, when emergency responders and access to communities will be limited. Work with community leaders and community-based organizations to establish community-specific approaches for checking on people with access and functional needs.

**Potential benefits:** Puts into place fundamental preparedness and response capabilities at the state and municipal levels.

**Potential upfront costs:** \$3 million in estimated upfront costs

**Potential recurring costs:** \$34 million in estimated recurring costs

**Potential total costs:** \$37 million in total estimated costs

**Potential funder(s):** CDBG-DR, PREMA

**Potential implementer(s):** FEMA, PREMA, municipal governments

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## **CPCB 7** **Capacity Building for Emergency Shelter Planning**

Conduct an assessment and develop a shelter plan that includes a comprehensive and strategic approach to sheltering Island-wide. Hire planners in each municipality and at the state level to build a robust emergency shelter system. Develop parameters, standards, and design guidelines for shelters to support residents over the longer term. Establish a protocol in coordination with the National Guard to support local and state-level agencies' efforts for management of response commodities for shelters.

**Potential benefits:** Improves access to local, safe, and resourced shelters that can accommodate community needs, such as disabilities and medical conditions.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$57 million in estimated recurring costs

**Potential total costs:** \$57 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico, municipal governments

**Potential implementer(s):** FEMA, PREMA, public buildings sector

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## **CPCB 8** **Strengthening Emergency Management Capacity at Municipalities**

Establish Municipal Emergency Management Offices in municipalities where they do not yet exist. FEMA to work with PREMA Zone Managers and local Emergency Managers to identify gaps in emergency management capability, including personnel needs, training gaps, equipment, etc. Develop a strategy for addressing capability gaps. Develop a training curriculum that more directly establishes a clear understanding of the diverse roles of different entities during a disaster and how they connect.

**Potential benefits:** Strengthens municipalities' emergency management and response capacity.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$165 million in estimated recurring costs

**Potential total costs:** \$165 million in total estimated costs

**Potential funder(s):** FEMA EMPG, HMGP, CDBG-DR, PREMA

**Potential implementer(s):** FEMA, PREMA, Municipal Emergency Management Offices, DHHS

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## **EDU 6** **Expanding and Updating K–12 Vocational Programs**

Implement a one-year pilot program and subsequent full-scale program to expand and update K–12 vocational programs to include entrepreneurship training and accommodate growth in economic sectors, such as manufacturing, finance, renewable energy, construction, hospitality, and health care.

**Potential benefits:** Helps build a skilled labor force for sectors that are key to recovery. Helps address the needs of those disproportionately affected by disasters. Helps create and/or strengthen private–public consortiums to support long-term recovery. Creates closer ties between K–12 schools and universities.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$3 billion in estimated recurring costs

**Potential total costs:** \$3 billion in total estimated costs

**Potential funder(s):** U.S. Department of Education, NSF, DoD, DHHS, DOL, public–private partnership, DEDC, Puerto Rico Department of Labor and Human Resources, nongovernment sources

**Potential implementer(s):** PRDE, PRITS, Echar Pa'lante alliance, schools, private industry

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## **EDU 7** **Augment Tele-Education/ Online Education**

Provide “emergency instruction” in the event of a school closure of more than 2 weeks. This action includes building an online repository of free, open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K–12), and technology platforms.

**Potential benefits:** Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE’s initiative to integrate technology into the classroom.

**Potential upfront costs:** \$3.7 million in estimated upfront costs

**Potential recurring costs:** \$18 million in estimated recurring costs

**Potential total costs:** \$22 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources, private sector

**Potential implementer(s):** PRDE, Echar Pa'lante alliance, professional development partners

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## EDU 9

### Develop and Implement Teacher Pipeline Program

Improve teacher preparation programs and instructional practice by (1) creating a residency model for training, (2) reviewing certification requirements, (3) aligning personnel decisionmaking processes with teacher assessments, (4) strengthening supports and career pathways, and (5) rewarding high-quality teachers working in demanding environments.

**Potential benefits:** Helps ensure a good match between teacher skills and student needs. Sustains a pipeline of teachers who can engage in and support high-quality instruction. Reduces teacher turnover and promotes a closer relationship between PreK–12 schools and UPR.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$350 million in estimated recurring costs

**Potential total costs:** \$350 million in total estimated costs

**Potential funder(s):** U.S. Department of Education

**Potential implementer(s):** PRDE, UPR, professional development partners, schools

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## HSS 3

### Implement Integrated Waste Management Program and Expand Programs to Increase Recycling Rates

Establish an integrated materials recovery and waste management program and increase the proportion of waste that is diverted from landfills. This action includes a comprehensive cost analysis, enforceable recycling and composting mandates, and public education.

**Potential benefits:** Creates a waste management program that would decrease negative health impacts across Puerto Rico.

**Potential upfront costs:** \$220,000 in estimated upfront costs

**Potential recurring costs:** \$6.2 million in estimated recurring costs

**Potential total costs:** \$6.4 million in total estimated costs

**Potential funder(s):** EPA, nongovernment sources

**Potential implementer(s):** EPA, DNER, EQB, PR Recycling Partnership, universities

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#### **HSS 4**

### **Improve Surveillance of Waterborne Disease**

Increase the robustness of the surveillance system for waterborne disease by (1) ensuring that equipment is operational through QA/QC, (2) developing communication tools, and (3) establishing interagency partnerships.

**Potential benefits:** Reduces the transmission of infectious pathogens and harmful chemicals and toxins in the water system.

**Potential upfront costs:** \$90,000 in estimated upfront costs

**Potential recurring costs:** \$2.8 million in estimated recurring costs

**Potential total costs:** \$2.9 million in total estimated costs

**Potential funder(s):** EPA

**Potential implementer(s):** PRDOH, PRASA, CDC

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#### **HSS 6**

### **Reduce Opportunities for Vector-Borne Diseases**

Support ongoing monitoring and engagement for mosquito control and provide support to establish additional innovative practices for mosquito control, including but not limited to using drones to detect breeding grounds and apply larvicide at abandoned properties.

**Potential benefits:** Improves mosquito control in areas that have been difficult to reach.

**Potential upfront costs:** \$370,000–\$3.4 million in estimated upfront costs

**Potential recurring costs:** \$170,000–\$350,000 in estimated recurring costs

**Potential total costs:** \$530,000–\$3.8 million in total estimated costs

**Potential funder(s):** DHHS

**Potential implementer(s):** PRVCU, PRDOH, municipal governments

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#### **HSS 9**

### **Increase Access to Tele-Health Options as Telecommunication Supports Become More Robust**

Expand the use of tele-health across Puerto Rico and train the health care workforce in its use, including mental health. This action includes using social media to screen and enroll more geographically isolated populations in services and using phone and online applications to target those with trauma-related mental illness.

**Potential benefits:** Provides greater access to specialty care for nonurban populations and quicker networking and best-practice sharing among health care professionals in an emergency.

**Potential upfront costs:** \$1.8 million in estimated upfront costs

**Potential recurring costs:** \$19 million in estimated recurring costs

**Potential total costs:** \$21 million in total estimated costs

**Potential funder(s):** DHHS

**Potential implementer(s):** Health care providers, mental health care providers, private industry

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## **HSS 11** **Add Incentives and Other Supports to Increase and Retain Supply of Health Care Providers and Public Health Practitioners**

Use incentives and loan repayment programs to ensure that Puerto Rico has a robust and stable health care provider and public health practitioner workforce, including primary care providers, specialists, and mental health practitioners, for both disaster-related health issues and for the long term.

**Potential benefits:** Helps retain high-quality talent in health care, and creates communities of practitioners that can better serve their populations due to increased work satisfaction.

**Potential upfront costs:** \$39 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$39 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** Puerto Rican universities, associated hospitals and health care facilities

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## **HSS 13** **Expand Practice Laws for Health Care Providers**

Increase the supply and practice capacity of licensed health care providers and public health practitioners in Puerto Rico. This action includes (1) allowing nurse practitioners and physician assistants from other states to provide care in Puerto Rico, (2) providing incentives to attract licensed nurse practitioners and physician assistants from other locations, and (3) establishing and expanding nurse practitioner and physician assistant degree programs in Puerto Rico.

**Potential benefits:** Increases access to quality care. Helps identify and control diseases or outbreaks in a timely manner.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$8 million in estimated recurring costs

**Potential total costs:** \$8 million in total estimated costs

**Potential funder(s):** Medicaid/Mi Salud reimbursement

**Potential implementer(s):** Independent health care licensure body, PRDOH

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#### HSS 14

### Develop a More Robust and Resilient Data System of Health Costs and Links to Health Outcomes

Create supports for measuring health care costs systematically, including (1) merging claims data, hospital and other health center discharge data, and disease and health outcome information; (2) solidifying the robustness of data systems for health outcomes information and inclusive or related social and human service data; and (3) ensuring greater data digitization to facilitate analysis.

**Potential benefits:** Ensures that systematic data are collected, through robust and resilient data systems, and that there is a mechanism to integrate and report on findings for overall health quality improvement.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$3.3 million in estimated recurring costs

**Potential total costs:** \$3.3 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico

**Potential implementer(s):** Institute for Statistics, health care payers, health care providers, PRDOH

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#### HSS 22

### Move to a More Regionally Integrated Approach to Emergency Planning, Exercising, Response, and Recovery

Create a disaster preparedness, response, and recovery network that will prepare hospitals and health care facilities to assist each other to surge during disasters. Hire 2 people in each of the 7 health regions to facilitate the regional planning and preparedness approach. Review and improve plans for ensuring power, water, oxygen, and other critical supplies post-incident.

**Potential benefits:** Protects patients and communities from poor outcomes. Reduces morbidity and mortality. Ensures more efficient use of resources. Reduces costs.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$10 million in estimated recurring costs

**Potential total costs:** \$10 million in total estimated costs

**Potential funder(s):** CDBG-DR, DHHS, ASES, PRDOH, nongovernment sources

**Potential implementer(s):** PRDOH, hospital system, other health care organizations

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## HSS 26 Review and Improve Systems for Stockpiling and Distributing Supplies and Pharmaceuticals Post-Disaster

Designate approximately 10 key health care facilities as Health Care Disaster Resource Centers that will be equipped with extra supplies needed during a disaster.

**Potential benefits:** Avoids increased morbidity and mortality among electricity-dependent individuals. Makes emergency response supplies more readily available. Improves interagency coordination during and after a disaster.

**Potential upfront costs:** \$20 million in estimated upfront costs

**Potential recurring costs:** \$2.8 million in estimated recurring costs

**Potential total costs:** \$23 million in total estimated costs

**Potential funder(s):** DHHS, PREMA, PRDOH

**Potential implementer(s):** PRDOH, PREMA

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## HSS 31 Review and Improve Systems for Administration and Finance of Response-Related Activities

Implement temporary waivers for a range of emergency health service needs, including, but not limited to, authorization, payment deadlines, prescription coverage, enrollment, and mortuary services.

**Potential benefits:** Ensures uninterrupted access to care post-disaster. Prevents potential delays in time-sensitive care.

**Potential upfront costs:** \$250,000 in estimated upfront costs

**Potential recurring costs:** \$7.9 million in estimated recurring costs

**Potential total costs:** \$8.1 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** ASES, DHHS (CMS)

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### **MUN 3** **Provide Technical Assistance to Repopulate Urban Centers**

Provide technical assistance to establish incentives for individuals and families living in outlying communities to relocate to urban centers, and identify and coordinate funding that can be used for this purpose.

**Potential benefits:** Helps improve community and municipal resilience by concentrating residents in easily accessible urban areas with more resilient infrastructure and services. Reduces the costs of providing these services and improves access for these populations after emergencies. Eases the repurposing of abandoned properties in urban centers and reduces blight while spurring economic development in all sectors.

**Potential upfront costs:** \$1.9 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.9 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico

**Potential implementer(s):** Governor, municipal governments

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### **NCR 1** **Historic and Cultural Properties and Collections Preservation**

Develop and implement an Island-wide Cultural Resources Management Plan and stabilization program to restore and protect resources, establish incentive programs and local historic districts to encourage private property preservation, and develop emergency plans for cultural institutions.

**Potential benefits:** Preserves historic buildings and collections; stabilizes property values; improves preparedness, shortens future recovery time, and prevents future losses from disasters; cost-effectively extends the lifespan of existing buildings; and ensures that cultural heritage will be accessible to communities.

**Potential upfront costs:** \$460 million–\$720 million in estimated upfront costs

**Potential recurring costs:** \$4.5 million–\$9 million in estimated recurring costs

**Potential total costs:** \$460 million–\$730 million in total estimated costs

**Potential funder(s):** HMGP, DOI, IMLS, NEA, NEH, NARA, Government of Puerto Rico, private insurance

**Potential implementer(s):** SHPO, ICP, individual property owners, HENTF, Cultural Resources Advisory Committee members, DOI, UPR, Caribbean University

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## NCR 2 Arts Recovery

Implement an integrated strategy to help artists and arts organizations recover while supporting Puerto Rico's economic and emotional recovery. Options include recovery grants, workspaces, global arts exchange programs, preparedness and recovery training, an arts tourism service sector, and arts outreach to facilitate community recovery.

**Potential benefits:** Helps artists and arts organizations resume practice and livelihoods, reduces future recovery costs and time, and promotes sustainability and resiliency of the arts.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$6 million in estimated recurring costs

**Potential total costs:** \$10 million in total estimated costs

**Potential funder(s):** DOC EDA, IMLS, NEH, NEA, NARA, private sector, nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, ICP, HENTF, private foundations

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## NCR 3 General Archives Mitigation and Modernization

Protect essential government records and other collections in the Archivo General de Puerto Rico through architecture/engineering planning and design.

**Potential benefits:** Preserves historical records and collections, reinvests in existing buildings and infrastructure, and protects historic character of San Juan, with benefits to community and tourism.

**Potential upfront costs:** \$11.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$11.5 million in total estimated costs

**Potential funder(s):** National Archives, NEA, NEH, IMLS, Government of Puerto Rico, private sector, nongovernment sources

**Potential implementer(s):** ICP, NARA

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#### **NCR 4**

### **Caribbean Cultural Collections Preservation, Research, and Safe Storage Center**

Expand and fulfill SHPO and ICP plan to identify criteria for and build a new conservation center that provides preservation planning and conservation services for museum/library/archives, private client collections, and historic properties.

**Potential benefits:** Provides a local source of professional preservation advice and conservation treatment, boosts employment opportunities for professionals in preservation and curation, establishes Puerto Rico as a regional leader in preservation and conservation, and houses several ICP institutions and agencies.

**Potential upfront costs:** \$130 million–\$200 million in estimated upfront costs

**Potential recurring costs:** \$18 million in estimated recurring costs

**Potential total costs:** \$140 million–\$210 million in total estimated costs

**Potential funder(s):** CDBG–DR, NARA, NEH, NEA, IMLS, NSF, public–private partnership, nongovernment sources

**Potential implementer(s):** ICP, SHPO, NEH, HENTF, Regional Alliance for Preservation, various foundations and donors

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#### **NCR 5**

### **Forest Recovery in Rural Protected Areas, Private Forests, Critical Watersheds, and Urban Areas**

Develop and implement strategic forest recovery and conservation strategies throughout Puerto Rico through public and private collaborations. Strategies should be developed with a focus on rural protected forests, ecological corridors, private forested lands, agroforestry, and urban forests. Restore tree nurseries and seed banks to aid in the recovery process.

**Potential benefits:** Restores ecological functions of forests and the provision of ecosystem services, boosts economic viability of forest conservation, provides employment opportunities, improves public safety, and reduces the risk of pest and disease damage.

**Potential upfront costs:** \$70 million–\$120 million in estimated upfront costs

**Potential recurring costs:** \$4.5 million in estimated recurring costs

**Potential total costs:** \$75 million–\$120 million in total estimated costs

**Potential funder(s):** DOI, USDA, public–private partnership, Government of Puerto Rico, DNER, municipal governments, nongovernment sources

**Potential implementer(s):** DNER, USFS, municipal governments

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## NCR 7

### Develop Partner Networks for Recovering Plant and Animal Species

Develop a comprehensive network of partners to work together to help fund actions for plant and animal species preservation, develop human capital and capacity in species management, educate the public, and cultivate experiential/tourism opportunities.

**Potential benefits:** Improves management of plant and animal species, helps prevent species from becoming extinct, and expands and enhances educational, tourism, and other economically beneficial opportunities.

**Potential upfront costs:** \$120,000–\$360,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$120,000–\$360,000 in total estimated costs

**Potential funder(s):** DOI, USDA, Government of Puerto Rico, DNER, municipal governments, private sector, nongovernment sources

**Potential implementer(s):** DNER, federal agencies, UPR, NGOs

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## NCR 8

### Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to allow new capacity and inspect existing landfills.

**Potential benefits:** Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

**Potential upfront costs:** \$176 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$176 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, municipal governments

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## **NCR 9**

### **Landfill Repair and Closure**

Explore options for repairing landfills that sustained hurricane damage, and close unlined registered dumps.

**Potential benefits:** Reduces or eliminates the impact of damaged landfills and unlined dumps on natural resources (including soil, air, and water quality) and helps bring lined landfills back into compliance. Reduces the risk to public health and the environment.

**Potential upfront costs:** \$160 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$160 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, municipal governments, Solid Waste Authority

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## **NCR 10**

### **Clean Up and Eliminate Use of Unpermitted, Unregistered Dumps**

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 unpermitted, unregistered dumps throughout Puerto Rico and identify steps to prevent future use of such dumps.

**Potential benefits:** Removes environmental and public health threats associated with unpermitted, unregistered dumps and helps ensure the overall success of a sustainable solid waste management plan.

**Potential upfront costs:** \$104 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$104 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, EPA

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## NCR 11

### **Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program**

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

**Potential benefits:** Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to landfills, provides economic opportunities, improves soil for agriculture, and provides opportunities for public engagement, including helping to ensure that information about the waste management process is communicated to users.

**Potential upfront costs:** \$101 million in estimated upfront costs

**Potential recurring costs:** \$263 million in estimated recurring costs

**Potential total costs:** \$363 million in total estimated costs

**Potential funder(s):** CDBG-DR, HUD, USDA, public-private partnership

**Potential implementer(s):** DNER, EQB, EPA, USDA

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## NCR 12

### **Develop Forest Products Industry**

Build on a pilot USFS project to (1) manage valuable wood gathered in the post-hurricane vegetation waste removal process and (2) revive local markets for hardwoods.

**Potential benefits:** Builds long-term capacity to manage woody debris and provide economic, cultural, educational, ecological, and research benefits, including wood to rebuild historic structures, for art, and for businesses to develop new wood products. Stimulates the economy and reduces the amount of waste going into landfills.

**Potential upfront costs:** \$10 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$10 million in total estimated costs

**Potential funder(s):** DOI, Government of Puerto Rico, DNER, PRTC

**Potential implementer(s):** DNER, USFS, ICP

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### **NCR 13**

## **Reduce Sediment Pollution and Risk from Landslides**

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides during Hurricane Maria or are at high risk of future landslides, through vegetative, bioengineering, and structural approaches.

**Potential benefits:** Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

**Potential upfront costs:** \$1.05 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.05 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, USDA, USACE, DOT

**Potential implementer(s):** DNER, federal agencies

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### **NCR 14**

## **Water Quality Improvements at the Watershed Scale**

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

**Potential benefits:** Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves inland and coastal water quality, and restores coastal areas.

**Potential upfront costs:** \$142 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$142 million in total estimated costs

**Potential funder(s):** HMGP, USDA, EPA, DOI, NOAA, EQB

**Potential implementer(s):** DNER, federal agencies

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### NCR 15<sup>3</sup>

## Coral Reef and Seagrass Protection and Restoration

Restore damaged coral reef and seagrass sites in priority areas to protect coastal communities, human health and safety, biodiversity, ecological function, and economic activity.

**Potential benefits:** Provides a cost-effective way to increase protection from disasters, creates jobs, increases biodiversity of coastal areas, and enhances fishing, tourism, and recreation economies.

**Potential upfront costs:** \$13.5 million–\$14.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$13.5 million–\$14.5 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, NOAA, EPA, USCG, USACE, DOI, nongovernment sources

**Potential implementer(s):** DNER, NOAA

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### NCR 16

## Wetlands Restoration

Restore the capacity, resiliency, and ecological function of 10 priority coastal wetlands through site-specific actions. Coordinate with other land use activities such as stormwater management and port construction.

**Potential benefits:** Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

**Potential upfront costs:** \$24.8 million–\$31.4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$24.8 million–\$31.4 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

**Potential implementer(s):** DNER, EQB, USACE

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<sup>3</sup> Cost estimate for NCR 15 requires labor from NCR 25.



## NCR 17

### Reduce Coastal Erosion and Provide Disaster Protection Through Beaches and Dunes

Restore, monitor, and maintain beaches and sand dunes to make them stable and resilient to both seasonal- and disaster-related coastal flooding, as well as long-term sea level rise.

**Potential benefits:** Increases coastal resilience and protects coastal infrastructure, human health and safety, wildlife habitats, and commerce from erosion and flood hazards.

**Potential upfront costs:** \$80 million–\$82 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$80 million–\$82 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, DOI, USACE, NOAA

**Potential implementer(s):** DNER, municipal governments, USACE

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## NCR 18

### Establish the San Juan Barrier Reef System as a Marine Protected Area

Declare the San Juan Barrier Reef a Commonwealth of Puerto Rico Marine Protected Area, restrict fishing to support sustainable commercial and recreational fisheries, and invest in the reef's restoration and long-term health.

**Potential benefits:** Provides long-term protection of infrastructure, tourism sites, and housing in San Juan; reduces flood risk to community; provides eco-tourism opportunities; and protects beaches.

**Potential upfront costs:** \$500,000–\$1 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$500,000–\$1 million in total estimated costs

**Potential funder(s):** NOAA, DOI, Government of Puerto Rico, public-private partnership, nongovernment sources

**Potential implementer(s):** DNER, NOAA

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## **NCR 20** **Redesign, Reorganize, and Rebuild Puerto Rican Parks**

Conduct assessments to help the Puerto Rican parks system improve governance/operations efficiency, align park amenities to community needs, and reengineer parks to serve as stormwater infrastructure. Rebuild parks in compliance with building codes for hurricane-prone areas to be consistent with assessment findings.

**Potential benefits:** Promotes active recreation and reduces health care costs; improves flood control capability and mitigates future damage to community; promotes alternative transportation modes and reduces traffic congestion; and boosts economy through area attractiveness to tourists, businesses, and consumers.

**Potential upfront costs:** \$335 million–\$651 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$335 million–\$651 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG–DR, DOI, EPA, DOT, public–private partnership, private insurance, nongovernment sources

**Potential implementer(s):** DRD, DNER

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## **NCR 21** **Strategic Watershed, Landscape, and Conservation Corridor Approaches**

Implement strategic approaches at the watershed and landscape scale. This action includes creating land and river conservation corridors (potentially starting with the central mountain area) and employing adaptive management for restoring natural habitats.

**Potential benefits:** Protects natural areas and improves agricultural production, tourism, access to fresh drinking water, recreational opportunities, watershed and ecosystem health, and ecological functions. Supports positive human health, infrastructure, and economic outcomes.

**Potential upfront costs:** \$20 million–\$75 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$20 million–\$75 million in total estimated costs

**Potential funder(s):** NOAA, DOI, USDA, EPA, Government of Puerto Rico, DNER, nongovernment sources

**Potential implementer(s):** DNER, federal agencies, land trusts, NGOs

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## NCR 22

### Promote Alternative Tourism for Economic Development

Catalyze experience-based tourism in key hub areas and enhance efforts to preserve unique natural, cultural, and historical assets.

**Potential benefits:** Supports economic growth; improves services and access; protects historical, cultural, and natural assets; incubates local entrepreneurship; and improves quality of life in underserved communities.

**Potential upfront costs:** \$140 million–\$233.4 million in estimated upfront costs

**Potential recurring costs:** \$3.457 million in estimated recurring costs

**Potential total costs:** \$143.5 million–\$236.9 million in total estimated costs

**Potential funder(s):** DOC EDA, USDA, DOI, NOAA, NEH, NARA, IMLS, NEA, DOL

**Potential implementer(s):** ICP, PRTC, DOC EDA, SBA, DNER

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## NCR 23

### Protected Natural Area Land Management for Alternative Tourism

Create plans, policies, and actions to support, manage, and monitor the development of alternative tourism, such as nature tourism. Develops impact investment program for public-private tourism infrastructure.

**Potential benefits:** Protects natural and cultural resources over the long term, generates revenue from tourism on public land, and ensures legal protection while increasing accessibility of public lands for tourism.

**Potential upfront costs:** \$3 million–\$4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$3 million–\$4 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** DNER, ICP, Para La Naturaleza, other NGOs

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## **NCR 24** **Enterprise Development for Alternative Tourism**

Develop small, medium, and micro enterprises in communities that lack populations with basic entrepreneurial skills to build creative tourism market concepts and launch new enterprises.

**Potential benefits:** Supports communities beyond traditional training and business assistance programs; includes the creative process of launching enterprises. Empowers communities to plan their own future according to their local vision, and provides expertise for economic growth and social benefits. Derives economic benefits and greater resiliency from having a diversified set of sustainable tourism products.

**Potential upfront costs:** \$1.2 million–\$2.4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.2 million–\$2.4 million in total estimated costs

**Potential funder(s):** DOC EDA, nongovernment sources, private insurance

**Potential implementer(s):** Destination Marketing Organization, ICP, PRTC, municipal governments, NGOs

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## **NCR 25** **Blue Shore Workforce Development**

Create a locally sourced, skilled labor force to support recovery efforts in the short and long terms.

**Potential benefits:** Creates jobs, facilitates skill development, provides labor for recovery and restoration, and promotes more effective and efficient investment.

**Potential upfront costs:** \$35 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$35 million in total estimated costs

**Potential funder(s):** EPA, USDA, DOC EDA, DOL, DEDC

**Potential implementer(s):** Puerto Rico Department of Labor and Human Resources, DOC EDA

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## **NCR 26**

### **Resource Management Capacity Building**

Apply an updated framework for resource management and future disaster response that includes training support, data sharing, and educational outreach to enhance resilience in future disasters.

**Potential benefits:** Provides stronger decisionmaking support to natural and cultural resource stakeholders, promotes exchange of ideas, and encourages community involvement in resource management.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$16 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** PRTC, NGOs, communities

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## **NCR 27**

### **Expand Disaster Recovery Sister Cities Connections**

Establish plans for twinning Puerto Rican cities with other disaster-affected cities around the world to promote professional exchange about disaster recovery and preparedness, as well as general cultural and economic exchange.

**Potential benefits:** Promotes sharing of lessons learned elsewhere, helps ensure continued success of Puerto Rico's recovery effort, and provides economic benefits, as well as professional development, educational, and tourism opportunities.

**Potential upfront costs:** \$2.4 million in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$13 million in total estimated costs

**Potential funder(s):** Nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, NGOs, communities

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## **NCR 28** **Identify Funding for Natural and Cultural Resources Research**

Establish a public-private fund for innovative scientific research that supports recovery goals and enhances understanding of the effects of the hurricanes.

**Potential benefits:** Encourages innovative and multidisciplinary research, expands opportunities for Puerto Rico's research community, and provides timely information to inform decisions about recovery projects, future plans, and actions.

**Potential upfront costs:** \$7.5 million–\$15 million in estimated upfront costs

**Potential recurring costs:** \$1.1 million in estimated recurring costs

**Potential total costs:** \$8.6 million–\$16 million in total estimated costs

**Potential funder(s):** Private sector, nongovernment sources

**Potential implementer(s):** PRTC, ICP

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## **NCR 29** **Enhance Public Participation and Education Through Museum Exhibits**

Design and install in-depth, participatory exhibits at museums, such as the Parque de las Ciencias, that describe how different aspects of the natural and cultural resource recovery plans work and their benefits and drawbacks.

**Potential benefits:** Helps facilitate common understanding of the purpose of recovery efforts and promotes commitment to recovery and disaster preparedness.

**Potential upfront costs:** \$1.7 million–\$3.3 million in estimated upfront costs

**Potential recurring costs:** \$7.9 million–\$17 million in estimated recurring costs

**Potential total costs:** \$9.6 million–\$20 million in total estimated costs

**Potential funder(s):** Private sector, nongovernment sources

**Potential implementer(s):** DNER, ICP, universities, host museums

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### **NCR 30**

## **Create an Accessible Data Repository of Natural and Cultural Resources**

Create a complete and accessible geo-referenced data repository of Puerto Rico's natural and cultural resources using reliable data standards and systems (such as cloud-based computing) to facilitate response and recovery and inform investment decisions.

**Potential benefits:** Provides data to inform damage assessments and strengthens support for decisions about natural and cultural resource recovery options. Benefits infrastructure, community capacity building, economics, and education.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$12 million in estimated recurring costs

**Potential total costs:** \$12 million in total estimated costs

**Potential funder(s):** DOI, USGS, NOAA, Government of Puerto Rico, DNER, SHPO

**Potential implementer(s):** GPR agencies (DNER, SHPO, ICP), NGOs (PRSTRT), PRTC

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### **PBD 1**

## **Compile a Public Buildings Inventory**

Create a comprehensive, centralized database of buildings and undeveloped properties owned by the Government of Puerto Rico that includes building characteristics, which will allow analysis of emergency response needs and general operational decisionmaking.

**Potential benefits:** Provides clear visibility of building inventories to facilitate system-wide infrastructure-related decisionmaking and support hazard mitigation programs, damage assessment, and recovery from natural disasters.

**Potential upfront costs:** \$2 million in estimated upfront costs

**Potential recurring costs:** \$1 million in estimated recurring costs

**Potential total costs:** \$4 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR, PRPB

**Potential implementer(s):** PRPB, PRIFA

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### **PBD 3** **Establish Integrated Service Centers**

Continue supporting the Government of Puerto Rico's ongoing project to cluster public services in a single location to improve efficiency and accessibility to the public. A center is already operating in San Juan, where residents can access a variety of social services in a single location.

**Potential benefits:** Simplifies access to services for the population and streamlines maintenance processes.

**Potential upfront costs:** \$5 million–\$10 million in estimated upfront costs

**Potential recurring costs:** \$6 million–\$7 million in estimated recurring costs

**Potential total costs:** \$10 million–\$20 million in total estimated costs

**Potential funder(s):** PA, CDBG–DR, Government of Puerto Rico, USDA

**Potential implementer(s):** Puerto Rico Department of State, PRPBA

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### **PBD 7** **Refurbish Community Centers and Community Technology Centers**

Rebuild or refurbish 300 community centers in low-income communities and 172 community technology centers, including providing them with generators for backup power and building them to withstand hurricanes and earthquakes.

**Potential benefits:** Improves access to community services, including training, medical support, emergency shelter, and technology.

**Potential upfront costs:** \$20 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$20 million in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG–DR

**Potential implementer(s):** PRPB

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# Emergency Services Modernization and Integration

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## CPCB 1

### Disaster Preparedness Data Analysis and Decision Support Capability

Enhance disaster-related data analysis and decision support capability within PREMA and in partnership with the Puerto Rico Planning Board (PRPB) to support disaster preparedness and hazard mitigation activities. Collect and analyze data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc., by geography and disseminate this information to planners in PREMA, other state-level agencies, and municipalities.

**Potential benefits:** Allows the Government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$21 million in estimated recurring costs

**Potential total costs:** \$21 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, PREMA

**Potential implementer(s):** Government of Puerto Rico, municipal governments, PRPB

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## CPCB 2

### Capacity Building for Community-Level Preparedness and Response

Develop and implement community-level response and recovery preparedness activities for priority communities that face particularly high risk during disasters. Recruit, train, and equip Community Emergency Response Teams so that these communities can better sustain themselves during the disaster response period, when emergency responders and access to communities will be limited. Work with community leaders and community-based organizations to establish community-specific approaches for checking on people with access and functional needs.

**Potential benefits:** Puts into place fundamental preparedness and response capabilities at the state and municipal levels.

**Potential upfront costs:** \$3 million in estimated upfront costs

**Potential recurring costs:** \$34 million in estimated recurring costs

**Potential total costs:** \$37 million in total estimated costs

**Potential funder(s):** CDBG-DR, PREMA

**Potential implementer(s):** FEMA, PREMA, municipal governments

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### CPCB 3 **Capacity Building to Incorporate Hazard Risk Reduction into Planning and Design**

Strengthen hazard mitigation assessment, monitoring, and evaluation capabilities within the PRPB so that the board can promote the incorporation of risk reduction in all planning and design decisions. This action includes (1) enhancing GIS capabilities to generate hazard maps for each municipality to inform zoning decisions and improve municipal hazard mitigation planning capacity, and (2) hiring a risk officer for each of the 27 state-level agencies.

**Potential benefits:** Enables a standardized and systematic approach to hazard mitigation. Encourages a more data-driven implementation of Puerto Rico's hazard mitigation plan.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$84 million in estimated recurring costs

**Potential total costs:** \$84 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR

**Potential implementer(s):** PRPB, infrastructure sectors

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### CPCB 4 **Resilience Building in Collaboration with High-Risk Communities**

Develop and implement disaster resilience plans in collaboration with 50–100 selected communities. This action includes (1) investments into programs—e.g., workforce development, microfinance, education—that address long-term stressors, as well as the improvement of essential services; and (2) resilience building events for community residents and local businesses, including fostering connections among governmental agencies, community groups, and NGOs.

**Potential benefits:** Builds community and individual resilience for both disaster response and long-term recovery.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$83 million in estimated recurring costs

**Potential total costs:** \$83 million in total estimated costs

**Potential funder(s):** CDBG-DR, HMGP, DOC EDA

**Potential implementer(s):** Government of Puerto Rico, municipal governments, local NGOs

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### **CPCB 5**

## **Establishing a University-Based Center of Excellence for Disaster Preparedness and Recovery**

Establish a Center of Excellence for Disaster Preparedness and Recovery at a university in Puerto Rico to (1) foster local, multidisciplinary research on disaster preparedness, response, and recovery; (2) develop innovative solutions to preparedness, resilience, hazard mitigation, and recovery problems; and (3) build preparedness, response, and recovery capacity in Puerto Rico through curriculum development and training.

**Potential benefits:** Translates knowledge of disaster preparedness and recovery to innovative and usable solutions. Increases university resources for research and teaching, and fosters multidisciplinary and multiagency collaboration.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$22 million–\$55 million in estimated recurring costs

**Potential total costs:** \$22 million–\$55 million in total estimated costs

**Potential funder(s):** CDBG-DR, DHS S&T, private sector, nongovernment sources

**Potential implementer(s):** Universities, DHS S&T

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### **CPCB 6**

## **Public Information and Communication Capability for Coordinated Recovery**

Build a Public Information and Communication capability to maintain engagement with communities that are recovering and to support local engagement with recovery planning. Establish and maintain methods of two-way communication with residents about recovery planning and implementation. Establish effective communication with Puerto Rican communities on the mainland to better understand whether and when people decide to return to Puerto Rico for recovery planning purposes.

**Potential benefits:** Allows the Government of Puerto Rico to communicate more clearly with the public, thus increasing transparency and improving public trust.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$8.8 million in estimated recurring costs

**Potential total costs:** \$8.8 million in total estimated costs

**Potential funder(s):** CDBG-DR, PREMA

**Potential implementer(s):** Government of Puerto Rico

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### **CPCB 7**

## **Capacity Building for Emergency Shelter Planning**

Conduct an assessment and develop a shelter plan that includes a comprehensive and strategic approach to sheltering Island-wide. Hire planners in each municipality and at the state level to build a robust emergency shelter system. Develop parameters, standards, and design guidelines for shelters to support residents over the longer term. Establish a protocol in coordination with the National Guard to support local and state-level agencies' efforts for management of response commodities for shelters.

**Potential benefits:** Improves access to local, safe, and resourced shelters that can accommodate community needs, such as disabilities and medical conditions.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$57 million in estimated recurring costs

**Potential total costs:** \$57 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico, municipal governments

**Potential implementer(s):** FEMA, PREMA, public buildings sector

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### **CPCB 8**

## **Strengthening Emergency Management Capacity at Municipalities**

Establish Municipal Emergency Management Offices in municipalities where they do not yet exist. FEMA to work with PREMA Zone Managers and local Emergency Managers to identify gaps in emergency management capability, including personnel needs, training gaps, equipment, etc. Develop a strategy for addressing capability gaps. Develop a training curriculum that more directly establishes a clear understanding of the diverse roles of different entities during a disaster and how they connect.

**Potential benefits:** Strengthens municipalities' emergency management and response capacity.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$165 million in estimated recurring costs

**Potential total costs:** \$165 million in total estimated costs

**Potential funder(s):** FEMA EMPG, HMGP, CDBG-DR, PREMA

**Potential implementer(s):** FEMA, PREMA, Municipal Emergency Management Offices, DHHS

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### **CPCB 10** **Incentivize Resilient, Creative Design Solutions for Addressing Hazards**

Fund a design competition that fosters innovative solutions for risk reduction—specifically aimed at mitigating hazards and including, but not limited to, hurricanes and flooding—while also offering added social or economic benefits to the community.

**Potential benefits:** Elicits original ideas, out-of-the-box solutions, and transdisciplinary approaches to mitigating disaster risks. Provides a valuable community-level perspective on existing problems and areas in need of improvement.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, PREMA

**Potential implementer(s):** PRPB, COR3, FEMA, PREMA, general public of Puerto Rico

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### **CPCB 14** **Building Grant Writing Capacity**

Establish a set of 100 scholarships each year, for 5 years, for municipal government and local NGO staff to receive training in grant writing over a one-year period from university-based certification programs (at UPR or other academic centers on the mainland). This action builds on existing policy set by the Governor's Executive Order that all executive branch agencies must contract with UPR for capacity building.

**Potential benefits:** Provides professional development for municipal government staff to prepare competitive grant proposals to fund state-financed projects, including disaster recovery. Empowers citizens to seek solutions for their communities.

**Potential upfront costs:** \$3.2 million in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$14 million in total estimated costs

**Potential funder(s):** CDBG-DR, nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, COR3, municipal governments

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**CPCB 15**  
**Strengthen Local Nonprofit and NGO Involvement in Disaster Recovery**

Establish a unit within Puerto Rico's Office for the Socioeconomic and Community Development (ODSEC) to strengthen the engagement of local nonprofits and NGOs with government agencies and maximize their contributions as partners in the recovery process.

**Potential benefits:** Strengthens partnerships and drives more successful cross-sector collaboration. Improves coordination and communication among government agencies and NGOs, and enhances resource allocation. Builds community resilience. Increases nonprofit and NGO capacity while helping them develop more long-term, sustainable funding.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$9 million in estimated recurring costs

**Potential total costs:** \$9 million in total estimated costs

**Potential funder(s):** CDBG-DR, nongovernment sources

**Potential implementer(s):** ODSEC, NGOs, local nonprofits

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**ECN 5**  
**Improve Retention of Educated Workforce Through Policy Change**

Decrease the proportion of college students and educated workers who are leaving Puerto Rico by adopting policies that create incentives to stay.

**Potential benefits:** Increases retention of those who would otherwise migrate after completing their studies and increases production of goods and services through enhanced labor quality.

**Potential upfront costs:** –

**Potential recurring costs:** –

**Potential total costs:** –

**Potential funder(s):** –

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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## ECN 25

### Assist Dislocated Workers Through the Use of Existing Grants

Provide funding through Disaster Dislocated Worker Grants to create temporary employment opportunities to help with cleanup and recovery efforts. This funding is provided to areas declared eligible for public assistance by FEMA or other federal agencies.

**Potential benefits:** Creates temporary jobs that will provide income to workers who lost their sources of income due to the hurricanes, promotes economic activity, and supplies workers who can assist in the cleanup and rebuilding efforts.

**Potential upfront costs:** \$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$50 million in total estimated costs

**Potential funder(s):** DOL

**Potential implementer(s):** Local public agency and individual program applicants

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## ECN 31

### Change Social Welfare and Benefits Policy

Modify the distribution of social welfare benefits and income by altering policies pertaining to eligibility for social welfare benefits, such as Medicaid and the Nutrition Assistance Program. Examples include establishing work requirements, using income tax credits to eliminate thresholds for eligibility, and lowering individual income tax rates to stimulate consumption.

**Potential benefits:** Removes disincentives to work that have been created by the current system of benefit provision. Stimulates the economy by encouraging consumption. Improves fiscal spending by reducing benefit payments.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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## HSS 20

### **Improve Supports for Seniors, Particularly Those Living Alone**

Provide pre-disaster support to seniors by investigating reimbursement policies for home care visits to allow greater independence and promote economic opportunities. Encourage communities to participate in local emergency planning through activities, such as community mapping, that would help identify who might be at increased risk in a disaster, such as seniors who live alone.

**Potential benefits:** Increases the resiliency of the older adult population, including their ability to access aid or other needed supplies. Avoids the worsening of chronic conditions due to insufficient medicines or nutrition and promotes overall well-being.

**Potential upfront costs:** \$5.2 million in estimated upfront costs

**Potential recurring costs:** \$57 million in estimated recurring costs

**Potential total costs:** \$62 million in total estimated costs

**Potential funder(s):** DHHS, OPPEA, PRDF, CDBG-DR

**Potential implementer(s):** OPPEA, PREMA, PRDF

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## HSS 22

### **Move to a More Regionally Integrated Approach to Emergency Planning, Exercising, Response, and Recovery**

Create a disaster preparedness, response, and recovery network that will prepare hospitals and health care facilities to assist each other to surge during disasters. Hire 2 people in each of the 7 health regions to facilitate the regional planning and preparedness approach. Review and improve plans for ensuring power, water, oxygen, and other critical supplies post-incident.

**Potential benefits:** Protects patients and communities from poor outcomes. Reduces morbidity and mortality. Ensures more efficient use of resources. Reduces costs.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$10 million in estimated recurring costs

**Potential total costs:** \$10 million in total estimated costs

**Potential funder(s):** CDBG-DR, DHHS, ASES, PRDOH, nongovernment sources

**Potential implementer(s):** PRDOH, hospital system, other health care organizations

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### HSS 23

## Review and Improve Systems and Processes for Managing Volunteers and Donated Supplies

Track volunteers through a system such as the Emergency System for Advance Registration of Volunteer Health Professionals. Institute volunteer credentialing to ensure that training and other competencies are up to date. Provide supports for volunteer capacity development and communication skills. Rent warehouse space for receiving and managing donated supplies. Contract specialized storage for receiving, managing, and dispatching donated medications. Strengthen registries for inventorying donations.

**Potential benefits:** Facilitates quicker deployment of assets. Minimizes confusion and duplication of services. Helps match assets to areas of greatest needs.

**Potential upfront costs:** \$210,000 in estimated upfront costs

**Potential recurring costs:** \$3.9 million in estimated recurring costs

**Potential total costs:** \$4.1 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** PRDOH

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### HSS 26

## Review and Improve Systems for Stockpiling and Distributing Supplies and Pharmaceuticals Post-Disaster

Designate approximately 10 key health care facilities as Health Care Disaster Resource Centers that will be equipped with extra supplies needed during a disaster.

**Potential benefits:** Avoids increased morbidity and mortality among electricity-dependent individuals. Makes emergency response supplies more readily available. Improves interagency coordination during and after a disaster.

**Potential upfront costs:** \$20 million in estimated upfront costs

**Potential recurring costs:** \$2.8 million in estimated recurring costs

**Potential total costs:** \$23 million in total estimated costs

**Potential funder(s):** DHHS, PREMA, PRDOH

**Potential implementer(s):** PRDOH, PREMA

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### HSS 29

## Revise Regulations on Food Stockpiling at Child- and Elder-Care Facilities

Require a minimum 14-day, healthy, shelf-stable food supply at all licensed facilities and provide guidance to facilities on stockpiling.

**Potential benefits:** Increases the availability of more nutritious foods post-disaster. Decreases the availability of salty and sugary foods.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** USDA, PRDF

**Potential implementer(s):** PRDF, child- and elder-care facilities

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### HSS 30

## Review and Improve Plans, Systems, and Processes for Tracking and Responding to Physical and Mental Health Needs of First Responders

Deploy counselors and volunteers to provide monthly support services to first responders. Conduct a periodic (every 4 months for year 1; annually after) survey—Emergency Responder Health Monitoring and Surveillance—to assess responder health needs and management of health symptoms.

**Potential benefits:** Lessens negative health impacts of the highly stressful circumstances of disaster response and recovery. Improves responder well-being and keeps responders prepared to attend to the needs of others.

**Potential upfront costs:** \$140,000 in estimated upfront costs

**Potential recurring costs:** \$18 million in estimated recurring costs

**Potential total costs:** \$18 million in total estimated costs

**Potential funder(s):** CDBG-DR, DHHS, Government of Puerto Rico, PRDOH, nongovernment sources

**Potential implementer(s):** PRDOH, FEMA

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### MUN 5

## Reduce Barriers to Transferring Property to Municipal Governments and Provide Technical Assistance

Reduce administrative barriers to transferring property (such as closed schools and other public buildings) to municipalities and provide technical assistance to help municipalities navigate the process.

**Potential benefits:** Enables municipalities to more efficiently repurpose buildings to enhance the delivery of services to the public or stimulate economic development through public-private partnerships or municipal corporations. Reduces costs to the Government of Puerto Rico, municipalities, and communities. Returns previous public investments to active use.

**Potential upfront costs:** \$2.7 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.7 million in total estimated costs

**Potential funder(s):** CDBG-DR

**Potential implementer(s):** Government of Puerto Rico, municipal governments

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## MUN 6

### Create and Maintain Central Repository of Municipal Assets and Associated Conditions

Collect or update data on municipal assets. Create and maintain a central database of this information, including documentation of property condition.

**Potential benefits:** Helps municipalities and the Government of Puerto Rico identify, manage, and maintain assets. Helps with filing claims with the federal government for damage repair. Enables more efficient budgeting and disaster mitigation. Facilitates leveraging resources and utilization of assets.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$13 million in estimated recurring costs

**Potential total costs:** \$13 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, municipal mayors

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## NCR 1

### Historic and Cultural Properties and Collections Preservation

Develop and implement an Island-wide Cultural Resources Management Plan and stabilization program to restore and protect resources, establish incentive programs and local historic districts to encourage private property preservation, and develop emergency plans for cultural institutions.

**Potential benefits:** Preserves historic buildings and collections; stabilizes property values; improves preparedness, shortens future recovery time, and prevents future losses from disasters; cost-effectively extends the lifespan of existing buildings; and ensures that cultural heritage will be accessible to communities.

**Potential upfront costs:** \$460 million–\$720 million in estimated upfront costs

**Potential recurring costs:** \$4.5 million–\$9 million in estimated recurring costs

**Potential total costs:** \$460 million–\$730 million in total estimated costs

**Potential funder(s):** HMGP, DOI, IMLS, NEA, NEH, NARA, Government of Puerto Rico, private insurance

**Potential implementer(s):** SHPO, ICP, individual property owners, HENTF, Cultural Resources Advisory Committee members, DOI, UPR, Caribbean University

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## NCR 8

### Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to allow new capacity and inspect existing landfills.

**Potential benefits:** Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

**Potential upfront costs:** \$176 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$176 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, municipal governments

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## NCR 9

### Landfill Repair and Closure

Explore options for repairing landfills that sustained hurricane damage, and close unlined registered dumps.

**Potential benefits:** Reduces or eliminates the impact of damaged landfills and unlined dumps on natural resources (including soil, air, and water quality) and helps bring lined landfills back into compliance. Reduces the risk to public health and the environment.

**Potential upfront costs:** \$160 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$160 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, municipal governments, Solid Waste Authority

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## NCR 10

### Clean Up and Eliminate Use of Unpermitted, Unregistered Dumps

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 unpermitted, unregistered dumps throughout Puerto Rico and identify steps to prevent future use of such dumps.

**Potential benefits:** Removes environmental and public health threats associated with unpermitted, unregistered dumps and helps ensure the overall success of a sustainable solid waste management plan.

**Potential upfront costs:** \$104 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$104 million in total estimated costs

**Potential funder(s):** EPA, USDA, HUD

**Potential implementer(s):** DNER, EQB, EPA

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### **NCR 13**

## **Reduce Sediment Pollution and Risk from Landslides**

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides during Hurricane Maria or are at high risk of future landslides, through vegetative, bioengineering, and structural approaches.

**Potential benefits:** Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

**Potential upfront costs:** \$1.05 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.05 billion in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, USDA, USACE, DOT

**Potential implementer(s):** DNER, federal agencies

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### **NCR 27**

## **Expand Disaster Recovery Sister Cities Connections**

Establish plans for twinning Puerto Rican cities with other disaster-affected cities around the world to promote professional exchange about disaster recovery and preparedness, as well as general cultural and economic exchange.

**Potential benefits:** Promotes sharing of lessons learned elsewhere, helps ensure continued success of Puerto Rico's recovery effort, and provides economic benefits, as well as professional development, educational, and tourism opportunities.

**Potential upfront costs:** \$2.4 million in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$13 million in total estimated costs

**Potential funder(s):** Nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, NGOs, communities

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**PBD 8**  
**Mitigate Flood Risk for Critical Government Functions**

Relocate critical public functions to buildings outside of flood hazard zones or elevate the building in which the critical function is housed to prevent service disruptions and reduce damages due to flooding.

**Potential benefits:** Ensures continuity of critical public services due to flooding and reduces costs of maintaining buildings in flood zones.

**Potential upfront costs:** \$2 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2 billion in total estimated costs

**Potential funder(s):** PA, HMGP, CDBG-DR, U.S. Department of Education

**Potential implementer(s):** PRPB

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**PBD 11**  
**Bring Public Buildings up to Code**

Assess building safety code compliance for wind, flood, and seismic risks across the public building inventory and retrofit buildings with the appropriate structural hardening, making other code upgrades where needed.

**Potential benefits:** Increases ability of public buildings to withstand extreme weather events and natural hazards, improves energy and water efficiency, and reduces building operational costs.

**Potential upfront costs:** \$900 million–\$2 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$900 million–\$2 billion in total estimated costs

**Potential funder(s):** PA, HMGP, Government of Puerto Rico, U.S. Department of Education

**Potential implementer(s):** GPR agencies, municipal governments

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# Agricultural Modernization and Processing

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## ECN 9

### Invest in Agricultural Recovery Assistance

Provide a direct investment in recovery assistance to farming efforts. This action targets poultry; dairy milking; livestock breeding; specialty animals; and horticulture, including vegetables and tubers, grain production, orchards (fruit and nut trees), melons, and coffee facilities.

**Potential benefits:** Allows farmers and other agricultural workers to reestablish operations. Stimulates the development of innovative and efficient farming practices and use of next-generation agricultural technology, improving the profitability of agriculture and increasing exports.

**Potential upfront costs:** \$1.8 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.8 billion in total estimated costs

**Potential funder(s):** USDA, CDBG-DR, private insurance

**Potential implementer(s):** PRDA

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## ECN 18

### Compensate Farmers for Crop Losses

Compensate farmers directly for crop losses due to the hurricanes.

**Potential benefits:** Replaces lost income for farmers so they can maintain spending across all sectors of the economy.

**Potential upfront costs:** \$250 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$250 million in total estimated costs

**Potential funder(s):** USDA, private insurance

**Potential implementer(s):** USDA, PRDA

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### ECN 35

## Center of Excellence for Agricultural Technologies Training

Establish a fully operational agricultural training center to catalyze applied technology-driven agro-innovation to integrate veterans, youth, and marginalized populations into agricultural business opportunities.

**Potential benefits:** Contributes to human capital development, hurricane mitigation, and food security by helping to increase the number of farmers in Puerto Rico.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** NOAA, DOI, EPA, USDA, HUD, DOL

**Potential implementer(s):** Government of Puerto Rico, PRDA

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### ECN 36

## Agricultural Financial Support for Access to Capital

Establish an Agricultural Enterprise program in the Economic Development Bank (EDB) exclusively for agricultural innovation enterprises supported by federal programs that provide revolving loan funds to expand farmers' access to capital and encourage innovation and agricultural modernization.

**Potential benefits:** Helps increase the number and productivity of farmers in Puerto Rico while contributing to hurricane mitigation and food security by encouraging innovation.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$5 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, DOC EDA

**Potential implementer(s):** EDB

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### ECN 37

#### PRIDCO Agriculture Parks

Convert undeveloped PRIDCO parks to host state-of-the-art controlled-environment agriculture infrastructure, including hydroponics and aquaculture, for private lease using the same current landlord model.

**Potential benefits:** Helps attract entrepreneurs to the agriculture industry to help achieve critical mass, especially when combined with the technical expertise of the Center of Excellence and Operational Capital provided by the EDB. Controlled-environment agriculture can reduce climate vulnerability, overcome land constraints, and increase food security and exports.

**Potential upfront costs:** \$100 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$100 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, DOC EDA

**Potential implementer(s):** PRIDCO

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### ECN 38

#### Agriculture Industry Support

Change the current model of the PRDA Agrological Laboratory to a public-private partnership with greater resources to enable it to communicate effectively and in a timely manner with farmers and serve as a support resource to enable optimal farm-level decisionmaking.

**Potential benefits:** Contributes to human capital development, hurricane mitigation, and food security by advising on better agricultural practices. May also increase and optimize the technical resources needed to improve the productivity of agriculture.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$22 in estimated recurring costs

**Potential total costs:** \$27 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, DOC EDA

**Potential implementer(s):** PRDA, private sector

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# Digital Transformation

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As the actions within the communications/IT, energy, and other infrastructure capital investment priorities are necessary pre-requisites for Digital Transformation, they are not duplicated here.

## **CPCB 1 Disaster Preparedness Data Analysis and Decision Support Capability**

Enhance disaster-related data analysis and decision support capability within PREMA and in partnership with the Puerto Rico Planning Board (PRPB) to support disaster preparedness and hazard mitigation activities. Collect and analyze data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc., by geography and disseminate this information to planners in PREMA, other state-level agencies, and municipalities.

**Potential benefits:** Allows the Government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$21 million in estimated recurring costs

**Potential total costs:** \$21 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, PREMA

**Potential implementer(s):** Government of Puerto Rico, municipal governments, PRPB

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## **CPCB 6 Public Information and Communication Capability for Coordinated Recovery**

Build a Public Information and Communication capability to maintain engagement with communities that are recovering and to support local engagement with recovery planning. Establish and maintain methods of two-way communication with residents about recovery planning and implementation. Establish effective communication with Puerto Rican communities on the mainland to better understand whether and when people decide to return to Puerto Rico for recovery planning purposes.

**Potential benefits:** Allows the Government of Puerto Rico to communicate more clearly with the public, thus increasing transparency and improving public trust.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$8.8 million in estimated recurring costs

**Potential total costs:** \$8.8 million in total estimated costs

**Potential funder(s):** CDBG-DR, PREMA

**Potential implementer(s):** Government of Puerto Rico

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### ECN 33

## Establish Business and Industrial Development Corporations (BIDCOs)

Establish BIDCOs, i.e., state-chartered private lending institutions designed to help businesses that conventional lenders consider too high-risk and that lack the high growth potential to attract venture capitalists. BIDCOs will obtain their funding by selling the guaranteed portions of their government loans on the secondary market and subsequently re-lending their earnings to other businesses. This action will require a license provided by the SBA.

**Potential benefits:** Provides financing to businesses in the communities served by BIDCO that could not otherwise obtain financing, thereby saving and/or creating jobs.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$3 million in estimated recurring costs

**Potential total costs:** \$8 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, private sector

**Potential implementer(s):** Government of Puerto Rico, private sector

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### EDU 2

## Improve Longitudinal Data System to Support Evidence-Based Policy

Complete prior work to develop a longitudinal data system. Provide training on how to integrate data into operations and decisionmaking. Link K-12 data to postsecondary outcomes and workforce data to better manage school-to-work transitions.

**Potential benefits:** Supports decisions by teachers and administrators in everyday practice and helps inform students and their parents. Supports timely, data-driven decisions about school closures, reallocation of teachers and students to consolidated schools, resource allocation, and targeted professional development.

**Potential upfront costs:** \$2.2 million in estimated upfront costs

**Potential recurring costs:** \$5.5 million in estimated recurring costs

**Potential total costs:** \$7.7 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources

**Potential implementer(s):** PRDE

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## EDU 7

### Augment Tele-Education/ Online Education

Provide "emergency instruction" in the event of a school closure of more than 2 weeks. This action includes building an online repository of free, open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K–12), and technology platforms.

**Potential benefits:** Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE's initiative to integrate technology into the classroom.

**Potential upfront costs:** \$3.7 million in estimated upfront costs

**Potential recurring costs:** \$18 million in estimated recurring costs

**Potential total costs:** \$22 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources, private sector

**Potential implementer(s):** PRDE, Echar Pa'lante alliance, professional development partners

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## HSS 4

### Improve Surveillance of Waterborne Disease

Increase the robustness of the surveillance system for waterborne disease by (1) ensuring that equipment is operational through QA/QC, (2) developing communication tools, and (3) establishing interagency partnerships.

**Potential benefits:** Reduces the transmission of infectious pathogens and harmful chemicals and toxins in the water system.

**Potential upfront costs:** \$90,000 in estimated upfront costs

**Potential recurring costs:** \$2.8 million in estimated recurring costs

**Potential total costs:** \$2.9 million in total estimated costs

**Potential funder(s):** EPA

**Potential implementer(s):** PRDOH, PRASA, CDC

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## HSS 31

### Review and Improve Systems for Administration and Finance of Response-Related Activities

Implement temporary waivers for a range of emergency health service needs, including, but not limited to, authorization, payment deadlines, prescription coverage, enrollment, and mortuary services.

**Potential benefits:** Ensures uninterrupted access to care post-disaster. Prevents potential delays in time-sensitive care.

**Potential upfront costs:** \$250,000 in estimated upfront costs

**Potential recurring costs:** \$7.9 million in estimated recurring costs

**Potential total costs:** \$8.1 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** ASES, DHHS (CMS)

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## MUN 6

### Create and Maintain Central Repository of Municipal Assets and Associated Conditions

Collect or update data on municipal assets. Create and maintain a central database of this information, including documentation of property condition.

**Potential benefits:** Helps municipalities and the Government of Puerto Rico identify, manage, and maintain assets. Helps with filing claims with the federal government for damage repair. Enables more efficient budgeting and disaster mitigation. Facilitates leveraging resources and utilization of assets.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$13 million in estimated recurring costs

**Potential total costs:** \$13 million in total estimated costs

**Potential funder(s):** CDBG-DR, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, municipal mayors

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## MUN 8

### Provide Municipalities with Technical Assistance and Support for Best Practices in Public Management and Operations

Provide municipal governments with technical assistance and other forms of support to implement best practices in public management including human resources and fiscal issues. Improve municipal workforces by standardizing salary rates, position descriptions, and qualification requirements and by providing professional development and training.

**Potential benefits:** Improves public management at the municipal level by promoting best practices in core operations. Improves ability of municipal governments to provide an array of services maintaining fiscal well-being. Leads to a more highly skilled, professional workforce.

**Potential upfront costs:** \$3.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$3.5 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOL

**Potential implementer(s):** Government of Puerto Rico, municipal governments

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### **NCR 3**

## **General Archives Mitigation and Modernization**

Protect essential government records and other collections in the Archivo General de Puerto Rico through architecture/engineering planning and design.

**Potential benefits:** Preserves historical records and collections, reinvests in existing buildings and infrastructure, and protects historic character of San Juan, with benefits to community and tourism.

**Potential upfront costs:** \$11.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$11.5 million in total estimated costs

**Potential funder(s):** National Archives, NEA, NEH, IMLS, Government of Puerto Rico, private sector, nongovernment sources

**Potential implementer(s):** ICP, NARA

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# 21st-Century Workforce

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## **ECN 12** **Provide Innovation and Entrepreneurial Training**

Reinvigorate innovation and research in Puerto Rico by implementing entrepreneurial initiatives. The model consists of three strategies: Bring talented workers into startup and research teams, screen the teams to identify those with strong potential, and scale up high-potential startup teams.

**Potential benefits:** Generates trained entrepreneurs who can start businesses that will produce goods and services for export, promotes public-private partnerships, and creates job opportunities.

**Potential upfront costs:** \$26 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$26 million in total estimated costs

**Potential funder(s):** DOC EDA, NSF, DOL, USDA

**Potential implementer(s):** Puerto Rican and other universities, PRDE, PRSTRT, Grupo Guayacán, DEDC, PRiMEX, Small Business Technology Development Center, Echar Pa'lante, PRITS

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## **ECN 13** **Develop PRIDCO's Abandoned Buildings for Business Incubators**

Find tenants to occupy abandoned PRIDCO-owned buildings, ideally entrepreneurs seeking to develop business incubators who will benefit from reduced operating costs and the capacity building that can result from networking with other startup entrepreneurs.

**Potential benefits:** Avoids neighborhood blight, improves ease of doing business, and provides opportunities for communities as well as for startups. Creates community anchor points for business development.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** PA, CDBG-DR, PRIDCO

**Potential implementer(s):** PRIDCO, SBA

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## **ECN 21** **Study Hurricane Impacts on the Local Economy**

Conduct an analysis of the main effects of Hurricane Maria on the local economy of Puerto Rico, as suggested in the Build Back Better plan. Prepare and evaluate economic estimates of the damages to the overall economy, as well as by sector. Track recent demographic changes in the local economy, including movement of persons.

**Potential benefits:** Enables local businesses to plan better for the future and make strategic, efficient investments to stimulate growth. Helps provide a basis for the government to use in estimating revenues and in fiscal planning, including infrastructure planning.

**Potential upfront costs:** \$300,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$300,000 in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA

**Potential implementer(s):** Private-sector firm or university

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## **ECN 23** **Implement Job Creation Initiative**

Create jobs that are responsive to the labor market, demand-driven, and within or near communities hardest hit by job loss and structural damage due to Hurricanes Irma and Maria. Target job creation efforts toward women and young adults, focusing on social and physical reconstruction projects.

**Potential benefits:** Helps rebuild communities, restore jobs, decrease the rate of unemployment, strengthen the local economy, and build resilience.

**Potential upfront costs:** \$80 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$80 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR, DOL, USDA

**Potential implementer(s):** Local public agency and individual program applicants

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## ECN 25

### Assist Dislocated Workers Through the Use of Existing Grants

Provide funding through Disaster Dislocated Worker Grants to create temporary employment opportunities to help with cleanup and recovery efforts. This funding is provided to areas declared eligible for public assistance by FEMA or other federal agencies.

**Potential benefits:** Creates temporary jobs that will provide income to workers who lost their sources of income due to the hurricanes, promotes economic activity, and supplies workers who can assist in the cleanup and rebuilding efforts.

**Potential upfront costs:** \$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$50 million in total estimated costs

**Potential funder(s):** DOL

**Potential implementer(s):** Local public agency and individual program applicants

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## ECN 26

### Conduct Studies for Workforce Development and Rapid Response

Assess the available labor supply and demand for workers with various skills to determine the need for training and to better align available workers with the needs of local employers.

**Potential benefits:** Helps local businesses better understand the available labor supply. Helps government decisionmakers modify their workforce development efforts and develop strategies to better align the labor supply with labor demand.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$5 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOL

**Potential implementer(s):** Private-sector firm or university

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### **ECN 28**

## **Implement Initiative to Promote Entrepreneurship**

Establish a Business and Entrepreneurial Intelligence System to provide statistics, information, and data to simplify preparation of business plans, strategies, and market studies. The system will be established by the Government of Puerto Rico but managed by an organization outside the government, focused on general entrepreneurship.

**Potential benefits:** Allows potential business owners to view the investment and business climate and opportunities in Puerto Rico more clearly, encouraging them to start operations.

**Potential upfront costs:** \$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$50 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR, DOL

**Potential implementer(s):** DEDC

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### **ECN 33**

## **Establish Business and Industrial Development Corporations (BIDCOs)**

Establish BIDCOs, i.e., state-chartered private lending institutions designed to help businesses that conventional lenders consider too high-risk and that lack the high growth potential to attract venture capitalists. BIDCOs will obtain their funding by selling the guaranteed portions of their government loans on the secondary market and subsequently re-lending their earnings to other businesses. This action will require a license provided by the SBA.

**Potential benefits:** Provides financing to businesses in the communities served by BIDCO that could not otherwise obtain financing, thereby saving and/or creating jobs.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$3 million in estimated recurring costs

**Potential total costs:** \$8 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, private sector

**Potential implementer(s):** Government of Puerto Rico, private sector

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## EDU 1

### Create New—and Enhance Existing—After-School and Summer Learning Opportunities

Expand existing and implement new summer and after-school learning programs—including academic, vocational education, health, nutrition, and mental health services—to address potential learning loss due to long school closures post-hurricanes, ensure access to the full range of educational opportunities, and provide consistency to meal programs.

**Potential benefits:** Promotes faster recovery in student achievement from post-hurricane learning loss; a stronger sense of stability; and better understanding of students' education, health, and mental health needs. Creates employment for teachers and other Puerto Ricans as program instructors.

**Potential upfront costs:** \$1 million in estimated upfront costs

**Potential recurring costs:** \$3.9 billion in estimated recurring costs

**Potential total costs:** \$3.9 billion in total estimated costs

**Potential funder(s):** U.S. Department of Education, USDA, nongovernment sources

**Potential implementer(s):** PRDE, U.S. Department of Education, USDA Summer Food Program, Echar Pa'lante alliance

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## EDU 2

### Improve Longitudinal Data System to Support Evidence-Based Policy

Complete prior work to develop a longitudinal data system. Provide training on how to integrate data into operations and decisionmaking. Link K–12 data to postsecondary outcomes and workforce data to better manage school-to-work transitions.

**Potential benefits:** Supports decisions by teachers and administrators in everyday practice and helps inform students and their parents. Supports timely, data-driven decisions about school closures, reallocation of teachers and students to consolidated schools, resource allocation, and targeted professional development.

**Potential upfront costs:** \$2.2 million in estimated upfront costs

**Potential recurring costs:** \$5.5 million in estimated recurring costs

**Potential total costs:** \$7.7 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources

**Potential implementer(s):** PRDE

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## **EDU 6** **Expanding and Updating K–12 Vocational Programs**

Implement a one-year pilot program and subsequent full-scale program to expand and update K–12 vocational programs to include entrepreneurship training and accommodate growth in economic sectors, such as manufacturing, finance, renewable energy, construction, hospitality, and health care.

**Potential benefits:** Helps build a skilled labor force for sectors that are key to recovery. Helps address the needs of those disproportionately affected by disasters. Helps create and/or strengthen private–public consortiums to support long-term recovery. Creates closer ties between K–12 schools and universities.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$3 billion in estimated recurring costs

**Potential total costs:** \$3 billion in total estimated costs

**Potential funder(s):** U.S. Department of Education, NSF, DoD, DHHS, DOL, public–private partnership, DEDC, Puerto Rico Department of Labor and Human Resources, nongovernment sources

**Potential implementer(s):** PRDE, PRITS, Echar Pa'lante alliance, schools, private industry

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## **EDU 7** **Augment Tele-Education/ Online Education**

Provide “emergency instruction” in the event of a school closure of more than 2 weeks. This action includes building an online repository of free, open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K–12), and technology platforms.

**Potential benefits:** Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE’s initiative to integrate technology into the classroom.

**Potential upfront costs:** \$3.7 million in estimated upfront costs

**Potential recurring costs:** \$18 million in estimated recurring costs

**Potential total costs:** \$22 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources, private sector

**Potential implementer(s):** PRDE, Echar Pa'lante alliance, professional development partners

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## EDU 8 Strengthen School Leadership Pipeline

Strengthen the school director and district leader pipeline by improving recruitment, embedded training, support (e.g., mentoring, coaching, supporting entrepreneurship), and retention practices. Conduct analysis to understand future skill demands on education leaders.

**Potential benefits:** Contributes to student learning, reduction in teacher and leadership turnover, improved understanding of local education needs, and improved communication between schools and regional administrators. Increases the capacity to function within a newly decentralized system.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$290 million in estimated recurring costs

**Potential total costs:** \$290 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources

**Potential implementer(s):** PRDE, professional development partners

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## EDU 9 Develop and Implement Teacher Pipeline Program

Improve teacher preparation programs and instructional practice by (1) creating a residency model for training, (2) reviewing certification requirements, (3) aligning personnel decisionmaking processes with teacher assessments, (4) strengthening supports and career pathways, and (5) rewarding high-quality teachers working in demanding environments.

**Potential benefits:** Helps ensure a good match between teacher skills and student needs. Sustains a pipeline of teachers who can engage in and support high-quality instruction. Reduces teacher turnover and promotes a closer relationship between PreK–12 schools and UPR.

**Potential upfront costs:** \$500,000 in estimated upfront costs

**Potential recurring costs:** \$350 million in estimated recurring costs

**Potential total costs:** \$350 million in total estimated costs

**Potential funder(s):** U.S. Department of Education

**Potential implementer(s):** PRDE, UPR, professional development partners, schools

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# Entrepreneurship

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## ECN 5

### **Improve Retention of Educated Workforce Through Policy Change**

Decrease the proportion of college students and educated workers who are leaving Puerto Rico by adopting policies that create incentives to stay.

**Potential benefits:** Increases retention of those who would otherwise migrate after completing their studies and increases production of goods and services through enhanced labor quality.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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## ECN 7

### **Create Research Centers and Partnerships**

Create research centers and partnerships across a variety of disciplines—for example, agricultural partnerships with universities or specialized research centers in technology, biotechnology, and marine economics—and a center devoted to developing and using blockchain technology. Focus on the knowledge economy.

**Potential benefits:** Leverages the intellectual capital of Puerto Rico to stimulate technological development that will potentially increase productivity across diverse sectors of the economy.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$110 million in estimated recurring costs

**Potential total costs:** \$110 million in total estimated costs

**Potential funder(s):** Multiple federal agencies

**Potential implementer(s):** Universities, private industry

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### **ECN 11**

## **Medical Tourism Initiative**

Establish and fund a not-for-profit Medical Tourism Corporation (MTC) to be run by the Destination Management Organization. Continue to fund the MTC until it becomes self-sustaining. Consider including an initiative to retain local health care workers.

**Potential benefits:** Stimulates economic activity from tourist spending and may reverse the departure of medical professionals from Puerto Rico.

**Potential upfront costs:** \$8 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$8 million in total estimated costs

**Potential funder(s):** CDBG-DR, private sector, nongovernment sources

**Potential implementer(s):** PRTC, DEDC

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### **ECN 13**

## **Develop PRIDCO's Abandoned Buildings for Business Incubators**

Find tenants to occupy abandoned PRIDCO-owned buildings, ideally entrepreneurs seeking to develop business incubators who will benefit from reduced operating costs and the capacity building that can result from networking with other startup entrepreneurs.

**Potential benefits:** Avoids neighborhood blight, improves ease of doing business, and provides opportunities for communities as well as for startups. Creates community anchor points for business development.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** PA, CDBG-DR, PRIDCO

**Potential implementer(s):** PRIDCO, SBA

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### **ECN 14**

## **Direct Small Business Investment**

Provide small grants and low-interest loans to small businesses, startups, and entrepreneurs affected by the hurricanes to ensure that they can continue to grow. Grants would cover working capital assistance, inventory losses, equipment and fixture replacement costs, hurricane repairs, and mitigation projects.

**Potential benefits:** Allows businesses to reestablish operations, rebuild, recover, and grow, as well as become more resilient to disasters and able to plan for continued growth with more confidence.

**Potential upfront costs:** \$2.7 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.7 billion in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, DOL, SBA, private insurance

**Potential implementer(s):** Individual applicants

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## **ECN 28** **Implement Initiative to Promote Entrepreneurship**

Establish a Business and Entrepreneurial Intelligence System to provide statistics, information, and data to simplify preparation of business plans, strategies, and market studies. The system will be established by the Government of Puerto Rico but managed by an organization outside the government, focused on general entrepreneurship.

**Potential benefits:** Allows potential business owners to view the investment and business climate and opportunities in Puerto Rico more clearly, encouraging them to start operations.

**Potential upfront costs:** \$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$50 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR, DOL

**Potential implementer(s):** DEDC

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## **ECN 31** **Change Social Welfare and Benefits Policy**

Modify the distribution of social welfare benefits and income by altering policies pertaining to eligibility for social welfare benefits, such as Medicaid and the Nutrition Assistance Program. Examples include establishing work requirements, using income tax credits to eliminate thresholds for eligibility, and lowering individual income tax rates to stimulate consumption.

**Potential benefits:** Removes disincentives to work that have been created by the current system of benefit provision. Stimulates the economy by encouraging consumption. Improves fiscal spending by reducing benefit payments.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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### ECN 32

## Create Business Resiliency Hubs

Create business resiliency hubs (BRHs) in areas not prone to flooding to provide space for business operations after a disaster. Obtain satellite communications, if feasible, to enhance resiliency of communication systems. These BRHs would be community facilities, possibly closed schools, built to code, with sufficient backup generating capacity and fuel supply for the response phase of a disaster.

**Potential benefits:** Helps businesses survive and recover from disasters by assisting with continuity of operations, enabling them to communicate with employees, customers, and vendors.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$4 million in total estimated costs

**Potential funder(s):** DOC EDA

**Potential implementer(s):** Local public agency and individual program applicants

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### ECN 33

## Establish Business and Industrial Development Corporations (BIDCOs)

Establish BIDCOs, i.e., state-chartered private lending institutions designed to help businesses that conventional lenders consider too high-risk and that lack the high growth potential to attract venture capitalists. BIDCOs will obtain their funding by selling the guaranteed portions of their government loans on the secondary market and subsequently re-lending their earnings to other businesses. This action will require a license provided by the SBA.

**Potential benefits:** Provides financing to businesses in the communities served by BIDCO that could not otherwise obtain financing, thereby saving and/or creating jobs.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$3 million in estimated recurring costs

**Potential total costs:** \$8 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, private sector

**Potential implementer(s):** Government of Puerto Rico, private sector

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#### **CPCB 4**

### **Resilience Building in Collaboration with High-Risk Communities**

Develop and implement disaster resilience plans in collaboration with 50–100 selected communities. This action includes (1) investments into programs—e.g., workforce development, microfinance, education—that address long-term stressors, as well as the improvement of essential services; and (2) resilience building events for community residents and local businesses, including fostering connections among governmental agencies, community groups, and NGOs.

**Potential benefits:** Builds community and individual resilience for both disaster response and long-term recovery.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$83 million in estimated recurring costs

**Potential total costs:** \$83 million in total estimated costs

**Potential funder(s):** CDBG-DR, HMGP, DOC EDA

**Potential implementer(s):** Government of Puerto Rico, municipal governments, local NGOs

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#### **EDU 6**

### **Expanding and Updating K–12 Vocational Programs**

Implement a one-year pilot program and subsequent full-scale program to expand and update K–12 vocational programs to include entrepreneurship training and accommodate growth in economic sectors, such as manufacturing, finance, renewable energy, construction, hospitality, and health care.

**Potential benefits:** Helps build a skilled labor force for sectors that are key to recovery. Helps address the needs of those disproportionately affected by disasters. Helps create and/or strengthen private-public consortiums to support long-term recovery. Creates closer ties between K–12 schools and universities.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$3 billion in estimated recurring costs

**Potential total costs:** \$3 billion in total estimated costs

**Potential funder(s):** U.S. Department of Education, NSF, DoD, DHHS, DOL, public-private partnership, DEDC, Puerto Rico Department of Labor and Human Resources, nongovernment sources

**Potential implementer(s):** PRDE, PRITS, Echar Pa'lante alliance, schools, private industry

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## EDU 7

### Augment Tele-Education/ Online Education

Provide "emergency instruction" in the event of a school closure of more than 2 weeks. This action includes building an online repository of free, open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K-12), and technology platforms.

**Potential benefits:** Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE's initiative to integrate technology into the classroom.

**Potential upfront costs:** \$3.7 million in estimated upfront costs

**Potential recurring costs:** \$18 million in estimated recurring costs

**Potential total costs:** \$22 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, nongovernment sources, private sector

**Potential implementer(s):** PRDE, Echar Pa'lante alliance, professional development partners

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# Advanced Manufacturing

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## **ECN 5** **Improve Retention of Educated Workforce Through Policy Change**

Decrease the proportion of college students and educated workers who are leaving Puerto Rico by adopting policies that create incentives to stay.

**Potential benefits:** Increases retention of those who would otherwise migrate after completing their studies and increases production of goods and services through enhanced labor quality.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** —

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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## **ECN 8** **Define and Develop Economic Development Zones**

Define geographically distinct economic development zones (starting with the Port of Ponce) and establish policies (which might include a waiver of the Jones Act) to provide benefits, such as tax advantages.

**Potential benefits:** Incentivizes particular types of economic activity in specific areas, which, in turn, increases the level of economic activity and employment.

**Potential upfront costs:** \$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$50 million in total estimated costs

**Potential funder(s):** DOC EDA

**Potential implementer(s):** Puerto Rico Executive Branch, Puerto Rico Legislative Assembly

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## ECN 9 Invest in Agricultural Recovery Assistance

Provide a direct investment in recovery assistance to farming efforts. This action targets poultry; dairy milking; livestock breeding; specialty animals; and horticulture, including vegetables and tubers, grain production, orchards (fruit and nut trees), melons, and coffee facilities.

**Potential benefits:** Allows farmers and other agricultural workers to reestablish operations. Stimulates the development of innovative and efficient farming practices and use of next-generation agricultural technology, improving the profitability of agriculture and increasing exports.

**Potential upfront costs:** \$1.8 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$1.8 billion in total estimated costs

**Potential funder(s):** USDA, CDBG-DR, private insurance

**Potential implementer(s):** PRDA

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## ECN 10 BLUEtide INITIATIVE

Develop a whole-Island approach to coastal resource management for disaster mitigation and resilience, workforce development, and advanced manufacturing. Start a marine business innovation and research center and an incubator network to develop ocean-related technologies. Leverage waterborne infrastructure to support sports anglers, tourism, biocompound extraction, aquaculture, policy, and enforcement.

**Potential benefits:** Increases tourism, international competitiveness, economic growth, and food security while diversifying economic drivers and preventing future hurricane damage.

**Potential upfront costs:** \$200 million–\$300 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$200 million–\$300 million in total estimated costs

**Potential funder(s):** CDBG-DR, FEMA, DOC EDA, NOAA, DOI, EPA, USDA, nongovernment sources

**Potential implementer(s):** FEMA, DOC EDA, NOAA, DOI, EPA, USDA, HUD, DEDC, DNER, PRSTRT, municipal governments, NGOs

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## ECN 11

### Medical Tourism Initiative

Establish and fund a not-for-profit Medical Tourism Corporation (MTC) to be run by the Destination Management Organization. Continue to fund the MTC until it becomes self-sustaining. Consider including an initiative to retain local health care workers.

**Potential benefits:** Stimulates economic activity from tourist spending and may reverse the departure of medical professionals from Puerto Rico.

**Potential upfront costs:** \$8 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$8 million in total estimated costs

**Potential funder(s):** CDBG-DR, private sector, nongovernment sources

**Potential implementer(s):** PRTC, DEDC

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## ECN 12

### Provide Innovation and Entrepreneurial Training

Reinvigorate innovation and research in Puerto Rico by implementing entrepreneurial initiatives. The model consists of three strategies: Bring talented workers into startup and research teams, screen the teams to identify those with strong potential, and scale up high-potential startup teams.

**Potential benefits:** Generates trained entrepreneurs who can start businesses that will produce goods and services for export, promotes public-private partnerships, and creates job opportunities.

**Potential upfront costs:** \$26 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$26 million in total estimated costs

**Potential funder(s):** DOC EDA, NSF, DOL, USDA

**Potential implementer(s):** Puerto Rican and other universities, PRDE, PRSTRT, Grupo Guayacán, DEDC, PRiMEX, Small Business Technology Development Center, Echar Pa'lante, PRITS

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**ECN 13**  
**Develop PRIDCO's Abandoned Buildings for Business Incubators**

Find tenants to occupy abandoned PRIDCO-owned buildings, ideally entrepreneurs seeking to develop business incubators who will benefit from reduced operating costs and the capacity building that can result from networking with other startup entrepreneurs.

**Potential benefits:** Avoids neighborhood blight, improves ease of doing business, and provides opportunities for communities as well as for startups. Creates community anchor points for business development.

**Potential upfront costs:** —

**Potential recurring costs:** —

**Potential total costs:** —

**Potential funder(s):** PA, CDBG-DR, PRIDCO

**Potential implementer(s):** PRIDCO, SBA

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**ECN 14**  
**Direct Small Business Investment**

Provide small grants and low-interest loans to small businesses, startups, and entrepreneurs affected by the hurricanes to ensure that they can continue to grow. Grants would cover working capital assistance, inventory losses, equipment and fixture replacement costs, hurricane repairs, and mitigation projects.

**Potential benefits:** Allows businesses to reestablish operations, rebuild, recover, and grow, as well as become more resilient to disasters and able to plan for continued growth with more confidence.

**Potential upfront costs:** \$2.7 billion in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$2.7 billion in total estimated costs

**Potential funder(s):** CDBG-DR, DOC EDA, DOL, SBA, private insurance

**Potential implementer(s):** Individual applicants

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### ECN 15

## Redevelop Former Roosevelt Roads Naval Station

Redevelop the former Roosevelt Roads naval station to include housing, mixed-use retail establishments, industrial parks, and maritime and air transportation. Redevelopment will require a spectrum of investment partners to help with the required infrastructure developments.

**Potential benefits:** Results in economic growth, stabilization, and expansion in the surrounding communities.

**Potential upfront costs:** \$500 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$500 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR, PRIDCO

**Potential implementer(s):** DEDC, private developers

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### ECN 17

## Construct the Puerto Rico Science, Technology, and Research Trust's Research and Development Center at Science City

Construct the Forward Center—the research, development, and prototyping facility for the proposed Puerto Rico Science, Technology, and Research Trust—at Science City. This effort represents one of Puerto Rico's Comprehensive Economic Development Strategy approaches.

**Potential benefits:** Provides science and technology companies, such as Boston Scientific, space to expand their research and development efforts while helping to move Puerto Rico to the forefront of innovation. Establishes new co-working space for other high-tech ventures that have arisen from Parallel18 Ventures.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** DOC EDA, Opportunity Zone Funds, New Markets Tax Credits

**Potential implementer(s):** DEDC

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**ECN 23**  
**Implement Job Creation Initiative**

Create jobs that are responsive to the labor market, demand-driven, and within or near communities hardest hit by job loss and structural damage due to Hurricanes Irma and Maria. Target job creation efforts toward women and young adults, focusing on social and physical reconstruction projects.

**Potential benefits:** Helps rebuild communities, restore jobs, decrease the rate of unemployment, strengthen the local economy, and build resilience.

**Potential upfront costs:** \$80 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$80 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR, DOL, USDA

**Potential implementer(s):** Local public agency and individual program applicants

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**ECN 24**  
**Revitalize the PR-127 Petrochemical Corridor in Guyanilla-Peñuelas**

Undertake cleanup and revitalization of contaminated former petrochemical zone.

**Potential benefits:** Allows development of new industries that focus on production of next-generation renewable energy resources and products and that support microalgae-based pharmaceutical manufacturing and responsible recycling industries.

**Potential upfront costs:** \$30 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$30 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR

**Potential implementer(s):** DEDC

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## **ECN 28** **Implement Initiative to Promote Entrepreneurship**

Establish a Business and Entrepreneurial Intelligence System to provide statistics, information, and data to simplify preparation of business plans, strategies, and market studies. The system will be established by the Government of Puerto Rico but managed by an organization outside the government, focused on general entrepreneurship.

**Potential benefits:** Allows potential business owners to view the investment and business climate and opportunities in Puerto Rico more clearly, encouraging them to start operations.

**Potential upfront costs:** \$50 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$50 million in total estimated costs

**Potential funder(s):** DOC EDA, CDBG-DR, DOL

**Potential implementer(s):** DEDC

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## **ECN 29** **Design Puerto Rico “Open for Business” Campaign**

Design and launch a marketing strategy to inform the world that Puerto Rico is ready to resume receiving tourists and inviting visitors to see that the natural resources have been preserved and that the tourism industry is ready to serve them.

**Potential benefits:** Fills information gaps and promotes tourism to Puerto Rico, which will lead to enhanced exports and economic development. May complement private initiatives.

**Potential upfront costs:** \$67 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$67 million in total estimated costs

**Potential funder(s):** DOC EDA

**Potential implementer(s):** PRTC, DEDC, ICP

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## ECN 32 Create Business Resiliency Hubs

Create business resiliency hubs (BRHs) in areas not prone to flooding to provide space for business operations after a disaster. Obtain satellite communications, if feasible, to enhance resiliency of communication systems. These BRHs would be community facilities, possibly closed schools, built to code, with sufficient backup generating capacity and fuel supply for the response phase of a disaster.

**Potential benefits:** Helps businesses survive and recover from disasters by assisting with continuity of operations, enabling them to communicate with employees, customers, and vendors.

**Potential upfront costs:** \$4 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$4 million in total estimated costs

**Potential funder(s):** DOC EDA

**Potential implementer(s):** Local public agency and individual program applicants

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## ECN 33 Establish Business and Industrial Development Corporations (BIDCOs)

Establish BIDCOs, i.e., state-chartered private lending institutions designed to help businesses that conventional lenders consider too high-risk and that lack the high growth potential to attract venture capitalists. BIDCOs will obtain their funding by selling the guaranteed portions of their government loans on the secondary market and subsequently re-lending their earnings to other businesses. This action will require a license provided by the SBA.

**Potential benefits:** Provides financing to businesses in the communities served by BIDCO that could not otherwise obtain financing, thereby saving and/or creating jobs.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$3 million in estimated recurring costs

**Potential total costs:** \$8 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, private sector

**Potential implementer(s):** Government of Puerto Rico, private sector

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**ECN 35**  
**Center of Excellence for  
Agricultural Technologies  
Training**

Establish a fully operational agricultural training center to catalyze applied technology-driven agro-innovation to integrate veterans, youth, and marginalized populations into agricultural business opportunities.

**Potential benefits:** Contributes to human capital development, hurricane mitigation, and food security by helping to increase the number of farmers in Puerto Rico.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** NOAA, DOI, EPA, USDA, HUD, DOL

**Potential implementer(s):** Government of Puerto Rico, PRDA

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**ECN 36**  
**Agricultural Financial Support  
for Access to Capital**

Establish an Agricultural Enterprise program in the Economic Development Bank (EDB) exclusively for agricultural innovation enterprises supported by federal programs that provide revolving loan funds to expand farmers' access to capital and encourage innovation and agricultural modernization.

**Potential benefits:** Helps increase the number and productivity of farmers in Puerto Rico while contributing to hurricane mitigation and food security by encouraging innovation.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$5 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, DOC EDA

**Potential implementer(s):** EDB

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### ECN 37 PRIDCO Agriculture Parks

Convert undeveloped PRIDCO parks to host state-of-the-art controlled-environment agriculture infrastructure, including hydroponics and aquaculture, for private lease using the same current landlord model.

**Potential benefits:** Helps attract entrepreneurs to the agriculture industry to help achieve critical mass, especially when combined with the technical expertise of the Center of Excellence and Operational Capital provided by the EDB. Controlled-environment agriculture can reduce climate vulnerability, overcome land constraints, and increase food security and exports.

**Potential upfront costs:** \$100 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$100 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, DOC EDA

**Potential implementer(s):** PRIDCO

---

### ECN 38 Agriculture Industry Support

Change the current model of the PRDA Agrological Laboratory to a public-private partnership with greater resources to enable it to communicate effectively and in a timely manner with farmers and serve as a support resource to enable optimal farm-level decisionmaking.

**Potential benefits:** Contributes to human capital development, hurricane mitigation, and food security by advising on better agricultural practices. May also increase and optimize the technical resources needed to improve the productivity of agriculture.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$22 in estimated recurring costs

**Potential total costs:** \$27 million in total estimated costs

**Potential funder(s):** CDBG-DR, USDA, DOC EDA

**Potential implementer(s):** PRDA, private sector

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### **CPCB 1**

## **Disaster Preparedness Data Analysis and Decision Support Capability**

Enhance disaster-related data analysis and decision support capability within PREMA and in partnership with the Puerto Rico Planning Board (PRPB) to support disaster preparedness and hazard mitigation activities. Collect and analyze data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc., by geography and disseminate this information to planners in PREMA, other state-level agencies, and municipalities.

**Potential benefits:** Allows the Government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$21 million in estimated recurring costs

**Potential total costs:** \$21 million in total estimated costs

**Potential funder(s):** HMGP, CDBG-DR, PREMA

**Potential implementer(s):** Government of Puerto Rico, municipal governments, PRPB

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### **CPCB 8**

## **Strengthening Emergency Management Capacity at Municipalities**

Establish Municipal Emergency Management Offices in municipalities where they do not yet exist. FEMA to work with PREMA Zone Managers and local Emergency Managers to identify gaps in emergency management capability, including personnel needs, training gaps, equipment, etc. Develop a strategy for addressing capability gaps. Develop a training curriculum that more directly establishes a clear understanding of the diverse roles of different entities during a disaster and how they connect.

**Potential benefits:** Strengthens municipalities' emergency management and response capacity.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$165 million in estimated recurring costs

**Potential total costs:** \$165 million in total estimated costs

**Potential funder(s):** FEMA EMPG, HMGP, CDBG-DR, PREMA

**Potential implementer(s):** FEMA, PREMA, Municipal Emergency Management Offices, DHHS

---



## EDU 10

### Develop and Implement a Parent Education Program on School Choice

Develop outreach and public education programs, with special emphasis on disadvantaged families, to ensure that all parents and guardians have the knowledge and tools they need to be effective consumers in a school-choice environment.

**Potential benefits:** Improves parents' knowledge about their school choices while also making parents and families happier and more invested in their chosen schools.

**Potential upfront costs:** \$200,000 in estimated upfront costs

**Potential recurring costs:** \$5.5 million in estimated recurring costs

**Potential total costs:** \$5.7 million in total estimated costs

**Potential funder(s):** U.S. Department of Education, PRDE, nongovernment sources

**Potential implementer(s):** PRDE (Family Engagement Office)

---

## HSS 3

### Implement Integrated Waste Management Program and Expand Programs to Increase Recycling Rates

Establish an integrated materials recovery and waste management program and increase the proportion of waste that is diverted from landfills. This action includes a comprehensive cost analysis, enforceable recycling and composting mandates, and public education.

**Potential benefits:** Creates a waste management program that would decrease negative health impacts across Puerto Rico.

**Potential upfront costs:** \$220,000 in estimated upfront costs

**Potential recurring costs:** \$6.2 million in estimated recurring costs

**Potential total costs:** \$6.4 million in total estimated costs

**Potential funder(s):** EPA, nongovernment sources

**Potential implementer(s):** EPA, DNER, EQB, PR Recycling Partnership, universities

---



## **HSS 9**

### **Increase Access to Tele-Health Options as Telecommunication Supports Become More Robust**

Expand the use of tele-health across Puerto Rico and train the health care workforce in its use, including mental health. This action includes using social media to screen and enroll more geographically isolated populations in services and using phone and online applications to target those with trauma-related mental illness.

**Potential benefits:** Provides greater access to specialty care for nonurban populations and quicker networking and best-practice sharing among health care professionals in an emergency.

**Potential upfront costs:** \$1.8 million in estimated upfront costs

**Potential recurring costs:** \$19 million in estimated recurring costs

**Potential total costs:** \$21 million in total estimated costs

**Potential funder(s):** DHHS

**Potential implementer(s):** Health care providers, mental health care providers, private industry

---

## **HSS 10**

### **Expand Care for Trauma and Chronic Stress**

Expand the networks to provide relief for trauma, stress, and anxiety-related behavioral health issues by training nontraditional providers and providing care in nontraditional medical settings. Empower faith-based organizations, schools, and NGOs to better understand and support their constituents in managing post-disaster stressors in a culturally compatible way.

**Potential benefits:** Improves quality of care outcomes for traumatic stress and addresses the mental health care provider shortage and distribution issues.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$3 million in estimated recurring costs

**Potential total costs:** \$3 million in total estimated costs

**Potential funder(s):** DHHS, nongovernment sources

**Potential implementer(s):** Mental health providers

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## HSS 11 Add Incentives and Other Supports to Increase and Retain Supply of Health Care Providers and Public Health Practitioners

Use incentives and loan repayment programs to ensure that Puerto Rico has a robust and stable health care provider and public health practitioner workforce, including primary care providers, specialists, and mental health practitioners, for both disaster-related health issues and for the long term.

**Potential benefits:** Helps retain high-quality talent in health care, and creates communities of practitioners that can better serve their populations due to increased work satisfaction.

**Potential upfront costs:** \$39 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$39 million in total estimated costs

**Potential funder(s):** DHHS, Government of Puerto Rico, nongovernment sources

**Potential implementer(s):** Puerto Rican universities, associated hospitals and health care facilities

---

## HSS 19 Create Flex-Funding for Social Service Centers

Assess the social service center facility landscape and develop an inventory of critical facilities. Create a flexible funding mechanism to assist critical facilities, such as domestic violence and homeless shelters and child- and elder-care facilities, in bearing the costs of long periods of generator use post-disaster.

**Potential benefits:** Avoids facility closures due to loss of fuel. Allows for continuity of service provision to populations disproportionately affected by disaster. Reduces the need to relocate shelters.

**Potential upfront costs:** \$180,000–\$310,000 in estimated upfront costs

**Potential recurring costs:** \$11 million–\$980 million in estimated recurring costs

**Potential total costs:** \$11 million–\$980 million in total estimated costs

**Potential funder(s):** U.S. Department of Energy, PREMA, PREPA, DHHS, private sector

**Potential implementer(s):** PRDF, PREMA

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**MUN 8**  
**Provide Municipalities with Technical Assistance and Support for Best Practices in Public Management and Operations**

Provide municipal governments with technical assistance and other forms of support to implement best practices in public management including human resources and fiscal issues. Improve municipal workforces by standardizing salary rates, position descriptions, and qualification requirements and by providing professional development and training.

**Potential benefits:** Improves public management at the municipal level by promoting best practices in core operations. Improves ability of municipal governments to provide an array of services maintaining fiscal well-being. Leads to a more highly skilled, professional workforce.

**Potential upfront costs:** \$3.5 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$3.5 million in total estimated costs

**Potential funder(s):** CDBG-DR, DOL

**Potential implementer(s):** Government of Puerto Rico, municipal governments

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**MUN 10**  
**Provide Technical Assistance to Improve Municipal Finances by Generating Additional Revenues, Reducing Costs, and Balancing Budgets**

Design and implement technical assistance programs to help municipalities find innovative ways to improve their finances by generating more revenue, cutting unnecessary costs, increasing productivity, and improving their ability to forecast revenue and spending.

**Potential benefits:** Helps municipalities balance their budgets. Improves their capacity to function and deliver services. Leads to an improved fiscal situation throughout Puerto Rico.

**Potential upfront costs:** \$6 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$6 million in total estimated costs

**Potential funder(s):** CDBG-DR

**Potential implementer(s):** Independent research partner, municipal governments

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## NCR 2 Arts Recovery

Implement an integrated strategy to help artists and arts organizations recover while supporting Puerto Rico's economic and emotional recovery. Options include recovery grants, workspaces, global arts exchange programs, preparedness and recovery training, an arts tourism service sector, and arts outreach to facilitate community recovery.

**Potential benefits:** Helps artists and arts organizations resume practice and livelihoods, reduces future recovery costs and time, and promotes sustainability and resiliency of the arts.

**Potential upfront costs:** \$5 million in estimated upfront costs

**Potential recurring costs:** \$6 million in estimated recurring costs

**Potential total costs:** \$10 million in total estimated costs

**Potential funder(s):** DOC EDA, IMLS, NEH, NEA, NARA, private sector, nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, ICP, HENTF, private foundations

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## NCR 7 Develop Partner Networks for Recovering Plant and Animal Species

Develop a comprehensive network of partners to work together to help fund actions for plant and animal species preservation, develop human capital and capacity in species management, educate the public, and cultivate experiential/tourism opportunities.

**Potential benefits:** Improves management of plant and animal species, helps prevent species from becoming extinct, and expands and enhances educational, tourism, and other economically beneficial opportunities.

**Potential upfront costs:** \$120,000–\$360,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$120,000–\$360,000 in total estimated costs

**Potential funder(s):** DOI, USDA, Government of Puerto Rico, DNER, municipal governments, private sector, nongovernment sources

**Potential implementer(s):** DNER, federal agencies, UPR, NGOs

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#### NCR 11

### Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

**Potential benefits:** Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to landfills, provides economic opportunities, improves soil for agriculture, and provides opportunities for public engagement, including helping to ensure that information about the waste management process is communicated to users.

**Potential upfront costs:** \$101 million in estimated upfront costs

**Potential recurring costs:** \$263 million in estimated recurring costs

**Potential total costs:** \$363 million in total estimated costs

**Potential funder(s):** CDBG-DR, HUD, USDA, public-private partnership

**Potential implementer(s):** DNER, EQB, EPA, USDA

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#### NCR 14

### Water Quality Improvements at the Watershed Scale

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

**Potential benefits:** Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves inland and coastal water quality, and restores coastal areas.

**Potential upfront costs:** \$142 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$142 million in total estimated costs

**Potential funder(s):** HMGP, USDA, EPA, DOI, NOAA, EQB

**Potential implementer(s):** DNER, federal agencies

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## NCR 27

### Expand Disaster Recovery Sister Cities Connections

Establish plans for twinning Puerto Rican cities with other disaster-affected cities around the world to promote professional exchange about disaster recovery and preparedness, as well as general cultural and economic exchange.

**Potential benefits:** Promotes sharing of lessons learned elsewhere, helps ensure continued success of Puerto Rico's recovery effort, and provides economic benefits, as well as professional development, educational, and tourism opportunities.

**Potential upfront costs:** \$2.4 million in estimated upfront costs

**Potential recurring costs:** \$11 million in estimated recurring costs

**Potential total costs:** \$13 million in total estimated costs

**Potential funder(s):** Nongovernment sources

**Potential implementer(s):** Government of Puerto Rico, NGOs, communities

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## NCR 28

### Identify Funding for Natural and Cultural Resources Research

Establish a public-private fund for innovative scientific research that supports recovery goals and enhances understanding of the effects of the hurricanes.

**Potential benefits:** Encourages innovative and multidisciplinary research, expands opportunities for Puerto Rico's research community, and provides timely information to inform decisions about recovery projects, future plans, and actions.

**Potential upfront costs:** \$7.5 million–\$15 million in estimated upfront costs

**Potential recurring costs:** \$1.1 million in estimated recurring costs

**Potential total costs:** \$8.6 million–\$16 million in total estimated costs

**Potential funder(s):** Private sector, nongovernment sources

**Potential implementer(s):** PRTC, ICP

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### **NCR 30**

## **Create an Accessible Data Repository of Natural and Cultural Resources**

Create a complete and accessible geo-referenced data repository of Puerto Rico's natural and cultural resources using reliable data standards and systems (such as cloud-based computing) to facilitate response and recovery and inform investment decisions.

**Potential benefits:** Provides data to inform damage assessments and strengthens support for decisions about natural and cultural resource recovery options. Benefits infrastructure, community capacity building, economics, and education.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$12 million in estimated recurring costs

**Potential total costs:** \$12 million in total estimated costs

**Potential funder(s):** DOI, USGS, NOAA, Government of Puerto Rico, DNER, SHPO

**Potential implementer(s):** GPR agencies (DNER, SHPO, ICP), NGOs (PRSTRT), PRTC

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### **PBD 1**

## **Compile a Public Buildings Inventory**

Create a comprehensive, centralized database of buildings and undeveloped properties owned by the Government of Puerto Rico that includes building characteristics, which will allow analysis of emergency response needs and general operational decisionmaking.

**Potential benefits:** Provides clear visibility of building inventories to facilitate system-wide infrastructure-related decisionmaking and support hazard mitigation programs, damage assessment, and recovery from natural disasters.

**Potential upfront costs:** \$2 million in estimated upfront costs

**Potential recurring costs:** \$1 million in estimated recurring costs

**Potential total costs:** \$4 million in total estimated costs

**Potential funder(s):** PA, CDBG-DR, PRPB

**Potential implementer(s):** PRPB, PRIFA

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## **PBD 2** **Right-Size Public Buildings**

Analyze demand for government services to estimate the appropriate building capacity, program requirements, and proposed improvements for government operations. Repurpose, reallocate, and refurbish buildings. Sell or demolish unneeded vacant buildings.

**Potential benefits:** Provides income (from the sale of buildings), reduces operations and maintenance costs, improves the effectiveness of government operations and service delivery, and removes the blight of long-abandoned, vandalized buildings.

**Potential upfront costs:** \$200 million–\$500 million in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$200 million–\$500 million in total estimated costs

**Potential funder(s):** PA, CDBG–DR, Government of Puerto Rico

**Potential implementer(s):** PRPB

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## **PBD 3** **Establish Integrated Service Centers**

Continue supporting the Government of Puerto Rico's ongoing project to cluster public services in a single location to improve efficiency and accessibility to the public. A center is already operating in San Juan, where residents can access a variety of social services in a single location.

**Potential benefits:** Simplifies access to services for the population and streamlines maintenance processes.

**Potential upfront costs:** \$5 million–\$10 million in estimated upfront costs

**Potential recurring costs:** \$6 million–\$7 million in estimated recurring costs

**Potential total costs:** \$10 million–\$20 million in total estimated costs

**Potential funder(s):** PA, CDBG–DR, Government of Puerto Rico, USDA

**Potential implementer(s):** Puerto Rico Department of State, PRPBA

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#### **PBD 4**

### **Realign Public Building Ownership**

Transfer ownership of buildings so that buildings of the same type (e.g., schools or government centers) are all owned by the same agency.

**Potential benefits:** Resolves complications from buildings of the same type owned by different agencies, improving government efficiency, accessibility, and communication.

**Potential upfront costs:** \$60,000 in estimated upfront costs

**Potential recurring costs:** \$0 in estimated recurring costs

**Potential total costs:** \$60,000 in total estimated costs

**Potential funder(s):** PRPB

**Potential implementer(s):** Office of the Governor, Legislative Assembly

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#### **PBD 10**

### **Incentivize State-of-the-Art Building Design, Practices, and Technologies**

Modify or develop policies and programs that establish clear standards for energy and water efficiency in public buildings and provide incentives for energy and water efficiency, renewable energy systems, increased resilience to natural hazards, and innovative redesign or reconfiguration of spaces to better support delivery of critical public services.

**Potential benefits:** Reduces resource use and building operational costs, meets Government of Puerto Rico energy goals, reduces potential future damages, increases reliability of critical public services, and potentially creates jobs.

**Potential upfront costs:** \$0 in estimated upfront costs

**Potential recurring costs:** \$7 million in estimated recurring costs

**Potential total costs:** \$7 million in total estimated costs

**Potential funder(s):** Government of Puerto Rico, U.S. Department of Energy

**Potential implementer(s):** GPR agencies, municipal governments

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# DETAILED LOOK AT HOW THE PLAN WAS DEVELOPED



In the development of this recovery plan, the Government of Puerto Rico—in particular, the [Central Office of Recovery, Reconstruction, and Resiliency \(COR3\)](#)—was supported by the Federal Emergency Management Agency (FEMA) and the Homeland Security Operational Analysis Center (HSOAC, a federally funded research and development center operated by the RAND Corporation under contract with the U.S. Department of Homeland Security). The effort involved extensive outreach to and collaboration with a broad group of federal agencies, state-level and municipal government agencies within Puerto Rico, private-sector and nonprofit entities, and the group most affected by Hurricanes Irma and Maria—the people of Puerto Rico.

The plan was developed over the course of three dynamic and—given the urgency—overlapping phases (see figure on the next page):

1. identifying damage, needs, and priorities for recovery
2. identifying potential courses of action (and their related costs)
3. aligning the priorities and courses of action with plan objectives and identifying funding sources.

## Phase 1: Identify damage, needs, and priorities

### Assess damage and needs

To ensure that the recovery plan is as robust as possible and responds to the requirements established by Congress, the team of experts supporting the Government of Puerto Rico in developing the plan assessed the damage from the hurricanes and the Island's remaining needs both within specific sectors and across sectors. The damage and needs assessment documents conditions before Irma and Maria, the damage caused by the hurricanes (both direct physical damage and the impact on Puerto Rico's population and economy), conditions six to nine months after the hurricanes, and remaining needs. This assessment provides a baseline to define and then compare and prioritize the courses of action considered for recovery planning.

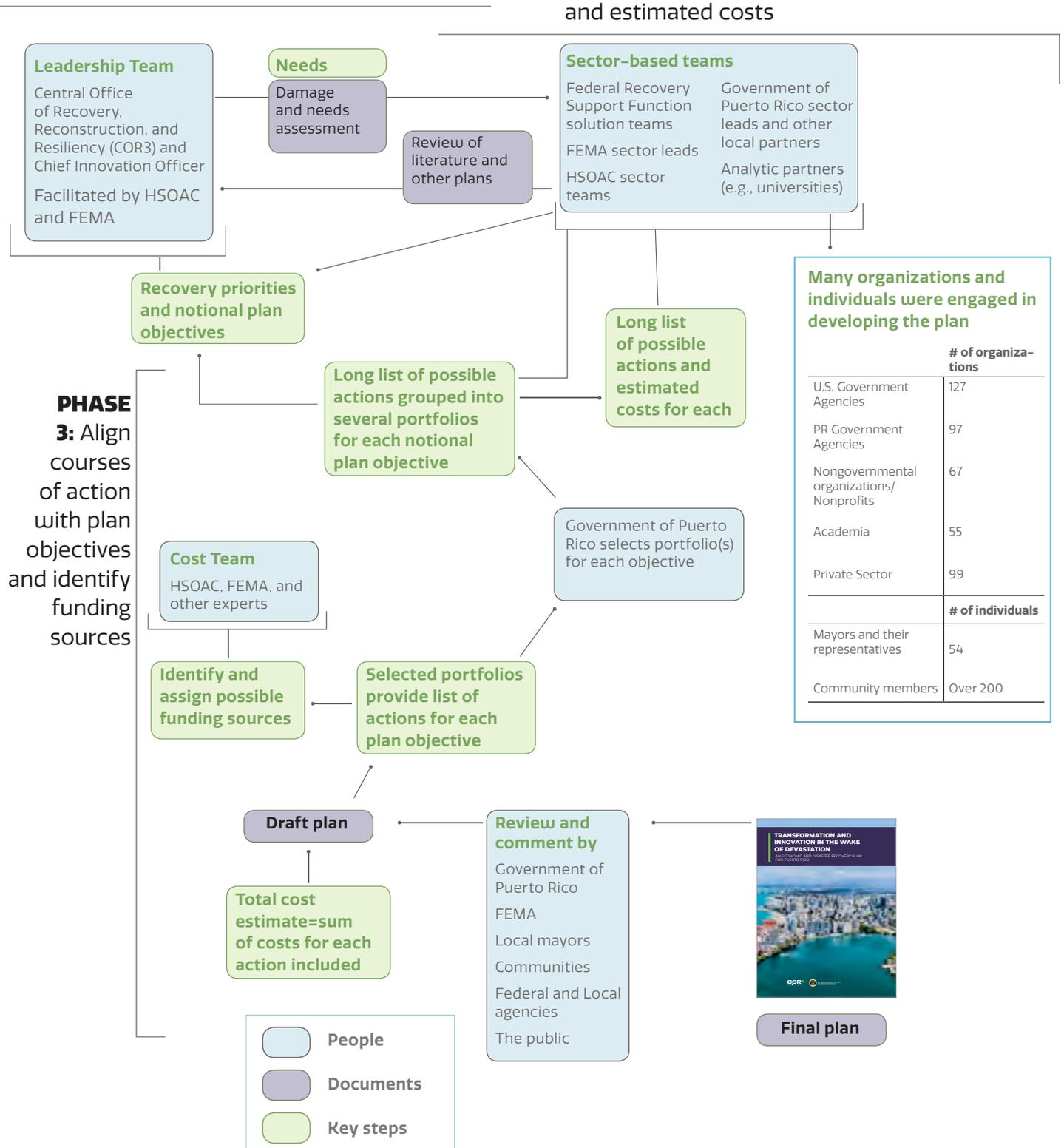
Communities are trying to prepare themselves for the next disaster, for example, by providing water filtration systems to supply drinking water until basic services can be restored.

Photo by HSOAC



## PHASE 1: Identify needs and priorities

## PHASE 2: Identify potential actions and estimated costs



More than 100 separate data sources and hundreds of individual data sets of varied types (qualitative, quantitative, secondary, primary) and time periods (historic, baseline, immediately post-hurricane, post-hurricane recovery) were used to develop the damage and needs assessment. FEMA, the Recovery Support Functions (RSFs), other federal partners, and the Government of Puerto Rico provided the majority of the data. Other sources of data and analysis included literature reviews, interviews with subject-matter experts and key stakeholders within and outside Puerto Rico, media reporting (to gather or cross-check data), and open-source data available through a variety of platforms, including federal government websites (e.g., U.S. Census Bureau), Government of Puerto Rico websites, foundations that have worked in Puerto Rico, OpenStreetMaps, and others. As with any assessment of damages and needs, it is important to note that although data collection efforts were extensive and intended to be comprehensive, gaps remain. HSOAC also conducted primary data collection via a survey of representatives from municipalities, roundtables with municipal staff, and focus groups with Puerto Rican residents living in vulnerable circumstances.

### Set priorities

While the damage and needs assessment was being conducted, the Government of Puerto Rico developed the vision, goals, and objectives for the recovery plan, which were then laid out for the team that FEMA convened to help develop the plan. Developing the vision, goals, and objectives was a highly iterative process and involved a series of coordination meetings and interactive workshops, along with a review of completed and forthcoming plans for Puerto Rico. The objectives were updated throughout the plan's development to account for insights gained through this iterative process and from the damage and needs assessment. This approach ensured the plan's responsiveness to the most current and complete picture of damage and needs, as well as long-term goals. The plan objectives (focused on precursors, capital investments, and strategic initiatives) detailed in Chapters 5-7 are the ultimate outcome of this iterative process.

### Incorporate information from existing plans

Many plans, critical guidance, and other documents relevant to the Island as a whole or directed at specific sectors were produced in parallel with the recovery plan. These plans were reviewed to identify relevant data, courses of action, and

The recovery plan calls for increasing the resilience of the Port of Mayaguez.

Photo by HSOAC



### MUNICIPALITY SURVEY

Teams of subject-matter experts and professional staff visited each of Puerto Rico's 78 municipalities in May and June 2018 to collect data for establishing a baseline for individual municipalities' operations, financial management, capacity and workforce, services and service delivery, hurricane impacts, and outstanding needs.

These interdisciplinary teams were led by professional city management staff affiliated with the International City/County Management Association (ICMA) or by University of Puerto Rico professors. To collect the baseline data, the teams surveyed municipal personnel, using a standardized data collection instrument developed by ICMA in consultation with HSOAC, FEMA, and the University of Puerto Rico. HSOAC staff also participated in many site visits to observe the process.

While ICMA's tool was created specifically for this assessment, it is based on similar data collection instruments that ICMA has validated and used successfully in its work with municipal governments throughout the world.



guidance about the Government of Puerto Rico’s transformative vision. The following documents in particular provided overarching guidance for the structure and vision of the recovery plan: *Build Back Better Puerto Rico*, the various new fiscal plans for Puerto Rico, the *Plan for Puerto Rico*, the National Disaster Recovery Framework, and the 2018 Community Development Block Grant–Disaster Recovery Action Plan.<sup>1</sup> Sector-specific plans detailing the goals and day-to-day operations of state-level and federal agencies offered essential context for priorities and actions before the hurricanes and how the agencies are modifying these priorities and actions in the new post-disaster reality. The variety of economic and disaster recovery plans, some produced before the hurricanes as solely economic recovery plans, illustrates the breadth of views about how Puerto Rico will move forward.

## Phase 2: Identify potential courses of action and their related costs

Phase 2 activities involved identifying potential courses of action that could contribute to recovery and then estimating the associated costs. These actions are a collection of potential activities, policies, and other actions that are intended to contribute to the Government of Puerto Rico’s vision and priority goals. Each action describes an approach to address an issue associated with hurricane damage, a preexisting condition that inhibits economic recovery, and/or a factor that contributes to economic and disaster recovery.

### Identify potential actions

Dedicated teams of experts—each focused on a specific sector, such as energy or economic activity—were formed to develop possible actions that respond to the needs identified in the first phase. Consisting of experts from HSOAC and other partners, these sector teams worked closely with the RSF solutions-based teams, FEMA sector-specific teams, representatives from the Government of Puerto Rico, and local partners and stakeholders to develop the courses of action.

<sup>1</sup> See Government of Puerto Rico, *Build Back Better Puerto Rico*, San Juan, November 2017; Financial Oversight and Management Board for Puerto Rico, *New Fiscal Plan for Puerto Rico: Restoring Growth and Prosperity*, April 2018; Government of Puerto Rico, *New Fiscal Plan for Puerto Rico*, San Juan, April 2018; Government of Puerto Rico, *Plan para Puerto Rico*, San Juan, 2016; Federal Emergency Management Agency, *National Disaster Recovery Framework*, 2nd ed., Washington, D.C.: U.S. Department of Homeland Security, June 2016; and Government of Puerto Rico, *Puerto Rico: Disaster Recovery Action Plan for the Use of CDBG-DR Funds in Response to 2017 Hurricanes Irma and Maria* [CDBG-DR Action Plan], San Juan, May 10, 2018.

Many plans contributed  
data | vision | solutions  
to the **Recovery Plan**



### Most Influential Plans

- Build Back Better Puerto Rico (GPR) | ☒
- New Fiscal Plan for Puerto Rico (GPR, FOMB) | ☒
- Plan Para Puerto Rico (GPR) | ☒
- National Disaster Recovery Framework (FEMA) | ☒
- Community Development Block Grant Disaster Recovery (CDBG-DR) Action Plan (GPR) | 🏠

### Economic Recovery and Disaster Recovery Plans

From the Commonwealth (14 plans) | 🏠 📶 📱 📖 💡 🏥 🚚 🌱 🏢 📍 🗺️

INCLUDING:

- Comprehensive Economic Development Strategy (Planning Board) | ☒
- Integrated Economic Development Plan (PRIDCO) | ☒
- Puerto Rico Energy Working Group (PREWG) Build Back Better: Reimagining and Strengthening the Power Grid of Puerto Rico (GPR) | 💡

From private/nonprofits (2 plans) | ☒ 💡

INCLUDING:

- Reimagina Puerto Rico (100RC) | ☒

From the U.S. Government (5 plans) | 📶 🏠 📱 💡 🚚

INCLUDING:

- Congressional Task Force on Economic Growth in Puerto Rico: Report to the House and Senate (U.S. Congress)

### Standard Operations Plans (Pre- and Post-Hurricanes) (23 plans)

From Commonwealth, U.S. Government, and private/non-profit | 🏠 📶 📱 📖 💡 🏥 🚚 🌱 🏢 📍 🗺️

#### Sectors represented in the plans

- 📱 Economy
- 🏠 Community Planning and Capacity Building
- 🚚 Municipalities
- 🏠 Housing
- 💡 Energy
- 🌱 Natural and Cultural Resources
- 📍 Transportation
- 🏢 Public Buildings
- 📶 Communications/IT
- 🚚 Water
- 🏥 Health and Social Services
- 📖 Education
- ☒ Cross-sector

Building on the damage and needs assessment and information provided by partners and experts, the sector teams conducted background research; engaged with sector stakeholders and subject-matter experts in Puerto Rico and beyond; and reviewed existing plans, proposals, and the literature to identify strategies, best practices, and possible innovations to meet the short- and long-term needs identified in Phase 1. The sector teams consulted stakeholders and subject-matter experts from federal and state-level government agencies, the Government of Puerto Rico and municipal governments, nonprofits, nongovernmental organizations, academia, private industry, and professional associations.

### **TRACKING COURSES OF ACTION**

Each course of action presented in this plan has an identifier based on the sector in which it was developed and an arbitrary number used for tracking (e.g., EDU 1). All actions included in “Detailed Actions” Chapter 12, include their respective tracking identifiers for easy reference.

The sector teams partnered with RSF solutions-based teams and drew heavily from discussions held in larger sector-specific working groups and task forces to develop courses of action. The RSF solutions-based teams brought much-needed practical knowledge, experience with relevant programs, and a deep understanding of the federal system. Given that the stakeholders are striving to meet diverse goals, there is no single dimension of merit or performance along which to analyze courses of action. Although it was not possible to conduct formal cost-benefit and feasibility analyses for each course of action, the teams considered an action’s characteristics—such as its responsiveness to needs, level of innovation, and alignment with the evidence base (e.g., based on best or promising practices)—when developing courses of action. As part of this process, some actions were eliminated from consideration or adjusted in an effort to roughly align the costs and benefits. For example, an action proposing to turn some roads from paved to gravel was eliminated because the estimated costs of maintaining the gravel road over time exceeded the potential savings from the modification. Given the diversity of needs and priorities stemming from the overarching vision for the plan, the developed courses of action vary in terms of their granularity and operational level (e.g., strategic versus tactical).

### **Estimate related costs**

Where possible, for each proposed action, the relevant sector team made rough-order-of-magnitude cost estimates to support high-level planning and inform decisionmaking. Where available, costs are presented in 2018 dollars. Costs are for fiscal year 2018 through fiscal year 2028, which is the time horizon for the fiscal plans. These estimates include both upfront (initial) costs (e.g., construction investment) and recurring costs (e.g., operations and

maintenance) over the 11-year period.<sup>2</sup> Incremental operations and maintenance costs are included if they reflect increases over pre-hurricane levels (e.g., due to structural improvements or technological upgrades) and thus represent a new expense that would have to be covered. Similarly, full operations and maintenance costs are included for facilities that were not being maintained prior to the hurricanes. All presented estimates represent only the costs for which a specific payment is made by some source to carry out a specific action; they do not include all of the costs to society that may be associated with recovery actions (e.g., the costs that individuals and business owners may incur to comply with newly instituted or better enforced regulations).

The approach to estimating the cost of each course of action was based on the quality of available information. Some cost estimates are much more precise than others. Estimates are less precise for some actions because (1) they could be implemented at different levels or scales, which would affect their cost, and (2) decisionmakers could implement future policies that could affect the actions' implementation and costs. Cost information presented in this plan is preliminary and will be revisited as more is known about how the recovery options will be implemented and as damage assessments are further refined. Some actions, such as policy changes, do not have costs that require specific recovery funding, although these actions may require administrative time or other resources. Costs are not estimated for some other actions because not enough information is available to provide even rough-order-of-magnitude estimates.

The cost estimates in this plan do not necessarily align with estimates of the cost of the hurricane damage in Puerto Rico reported here and elsewhere. There are several important reasons for these differences. First, given the devastating and extended length of the disaster, estimates of damage remain incomplete, and the dollar estimates in this plan are based on preliminary and incomplete information. The true toll of hurricanes Irma and Maria—in terms of damage to buildings and infrastructure,

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<sup>2</sup> Recurring costs represent ongoing, annual costs for activities, such as operations and maintenance, meant to sustain initial investments. Some initial investments may take several years to complete. If recurring costs that are incurred when the initial investment is complete are R per year, and if it takes N years to complete the investment, we estimate that  $1/N \times R$  is incurred in the first year,  $2/N \times R$  is incurred in the second year (and so forth), and R is incurred in each year after the upfront cost has been fully incurred through the end of the time period, or 11 years. That is, the investment cost is spread equally over the years, and the recurring costs grow with the cumulative investment. There may be alternate patterns for both investment and operations and maintenance cost streams; we use this estimate for consistency across courses of action.

economic and business disruption, public health impacts, natural systems, and many others—will take years to fully assess. Relatedly, this disaster represents a particular challenge for damage cost estimation, given the unprecedented loss of lifeline infrastructure during the months-long hurricane response and slow transition to recovery.

Most importantly, the costs associated with different actions in this plan do not address hurricane damage alone. Instead, to “build back better,” the investments identified here seek to repair hurricane damage while also correcting critical pre-hurricane deficiencies and building future disaster resiliency for housing and lifeline infrastructure. As a result, even with perfect information about hurricane damage, the costs in this plan would likely exceed damage estimates.

One example of a cost estimation methodology is presented on the next page.

### **Phase 3: Align courses of action with plan objectives and identify funding sources**

#### **Align courses of action with plan objectives**

As the courses of action evolved, they were sorted into notional recovery plan objectives: precursors needed to start recovery with a strong foundation, nine objectives focused on capital investments (such as water and telecommunications), and eight objectives focused on strategic initiatives (such as enhancing the visitor economy).

To facilitate decisionmaking, between two and five portfolios (sets of actions) were developed for each objective. Portfolios build on courses of action to get one step closer to an actionable recovery plan that, in turn, meets the top-down vision and goals of this plan. The portfolios were based on themes that aligned with the objectives and, in most cases, varied in cost and comprehensiveness (e.g., more resilience or lower cost).

The HSOAC team developed draft portfolios in collaboration with partners and held numerous engagements with representatives from the Government of Puerto Rico to review and compare portfolios. When necessary, the HSOAC team developed new courses of action and modified portfolios to reflect these additions. At times, courses of action were also deleted to make the final portfolios more cohesive and parsimonious. During this iterative process, a set of actions emerged that were consistently

## THE COMPLEX PROCESS OF ESTIMATING COSTS

### EXAMPLE

#### INSTALL UNDERGROUND CONDUIT ALONG ROADWAYS TO BURY FIBER-OPTIC CABLE (CIT 21)

To prevent future damage to fiber-optic cable, one proposal is to install underground conduit along roadways so that telecommunications providers can run their fiber-optic cable underground instead of on poles. To estimate the costs of this initiative, there are precedents to draw on: The U.S. Federal Highway Administration white paper Rural Interstate Corridor Communications Study estimates the costs of installing 48-SMFO cable along Interstate 90 (through South Dakota, Minnesota, and Wisconsin) and Interstate 20 (through Louisiana, Mississippi, and Alabama). We also corroborated our unit cost estimates with an expert with local knowledge of Puerto Rico roadways and extensive experience laying fiber-optic cable for the U.S. military in different types of terrain.

#### Construction Costs

##### TRENCHING

Uses these directional boring costs as a proxy:

- \$8/foot** for rural areas,
- \$11/foot** for urban areas, and
- \$270/foot** for mountain road

##### BUILDINGS TO HOUSE SIGNAL REGENERATION EQUIPMENT

Assumes these costs:

- Each building will cost \$340,000**
- Buildings will be required:**
  - » Every 50 miles in flat terrain
  - » Every 35 miles in rocky terrain

##### LAYING CONDUIT

Assumes these costs:

- \$1/foot** for laying conduit
- \$1,600 per handhole** installed every 1,500 feet of roadway (\$750 in materials and equipment, and \$830 in installation costs)

##### CONSTRUCTION OVERHEAD

Assumes an **overhead rate of 48.5%** for design, engineering, mobilization, administration, traffic control, and contingencies



#### Amount of Conduit Needed

*How many miles of roads are there?*

**4,600 miles** of roadways are operated by Department of Transportation and Public Works (DTOP)

- » We used Geographic Information System (GIS) data to assess that the roadway network reached every municipality

*Are the roads in tough terrain?*

**Approximately 25 percent** of roadways are in mountainous regions

- » We arrived at this number using GIS data overlaying all DTOP roadways on a topographical map of Puerto Rico to estimate how many miles of roadway are in mountainous terrain.

*Is conduit needed along every roadway?*

**50 percent**—about **2,300 miles** of roads—will need cable

- » We arrived at this number because more than one road reaches most municipal centers, so laying cable along all of them is duplicative.

*What is the cost per mile?*

**Based on the unit costs above and accounting for the higher cost of construction in mountainous terrain, we estimate an average cost of \$580,000 per mile.**

**In comparison, the costs of laying broadband along rural U.S. interstates (in generally flat terrain) ranged from \$150,000 to \$210,000 per mile.**



TOTAL ESTIMATED COST

**\$1.3 billion**

listed as precursors to other actions and portfolios. The HSOAC team developed a dedicated precursor portfolio containing these critical actions that are foundational to recovery.

Ultimately, the Government of Puerto Rico selected the final portfolios for each recovery plan objective, and the combination of the chosen portfolios for the precursors and the other 17 objectives constitutes this recovery plan. The chosen portfolios contain approximately 270 actions, and the estimated total cost of this plan is the sum of the estimated cost associated with each action.

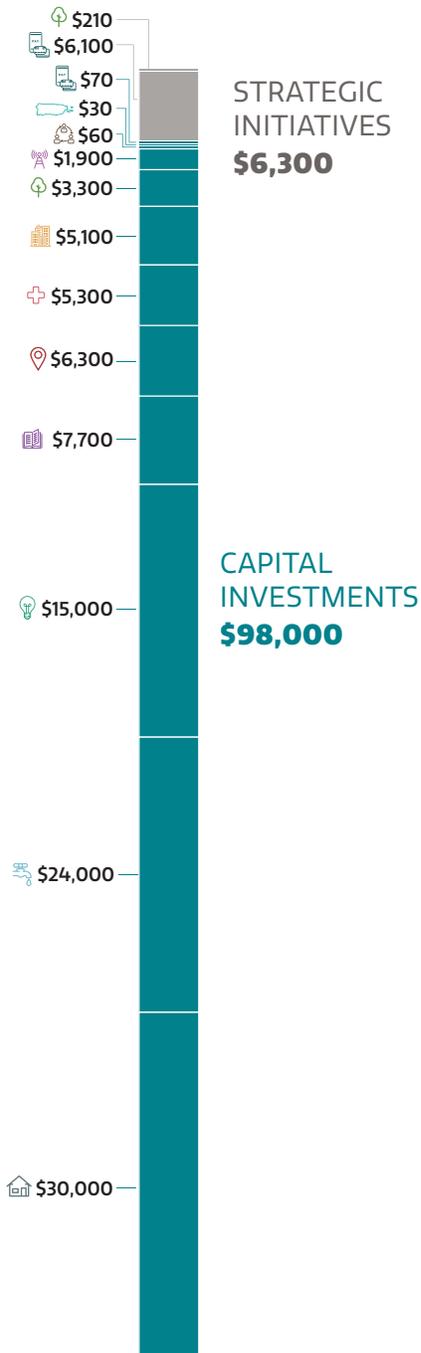
Most of these actions are focused on the capital investments needed for Puerto Rico to recover from Hurricanes Irma and Maria. Fully funding these roughly 270 actions will require approximately \$139 billion. The figure on the following page provides a breakdown by sector of costs, including upfront costs associated with the initial investment and annual costs (which are recurring operations and maintenance costs) summed up over 11 years. Costs are shown by sector because funding sources align most closely with sectors. Actions in the precursor portfolio are foundational to all capital investments, so the cost of this portfolio is reflected along with the cost of the actions for other capital investments.

A detailed list of the selected portfolios and the specific actions that constitute each portfolio is presented in “Detailed Actions,” Chapter 12 of this plan. There was no cost constraint put on the decisionmaking process, but estimated costs of actions were presented to the Government of Puerto Rico as part of the portfolio development process.

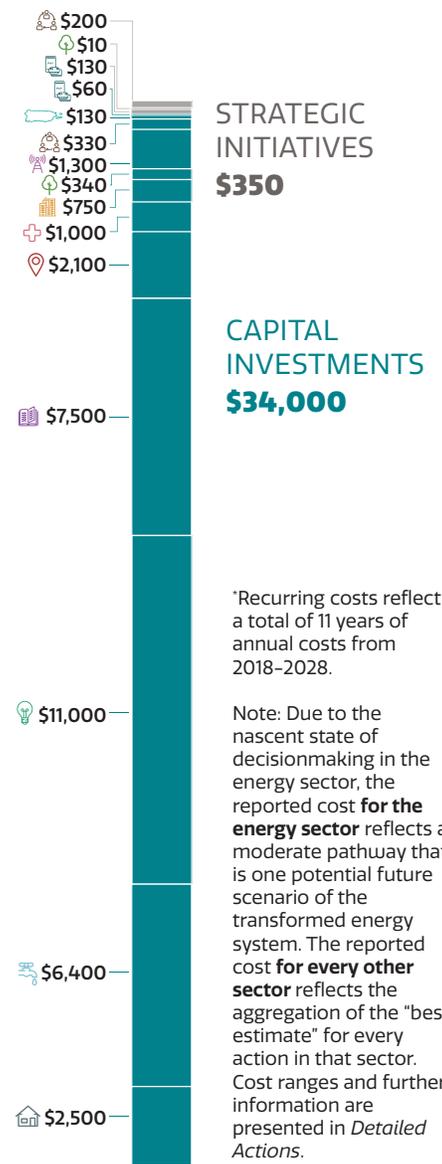
**Total costs  
(in millions)  
\$139,000**



**Upfront costs  
(in millions)  
\$105,000**



**Recurring costs\*  
(in millions)  
\$34,000**



\*Recurring costs reflect a total of 11 years of annual costs from 2018-2028.

Note: Due to the nascent state of decisionmaking in the energy sector, the reported cost **for the energy sector** reflects a moderate pathway that is one potential future scenario of the transformed energy system. The reported cost **for every other sector** reflects the aggregation of the "best estimate" for every action in that sector. Cost ranges and further information are presented in *Detailed Actions*.

The three bars are not in proportion to each other for legibility. Sector costs have been rounded and may not add up to the totals shown.

### **Identify funding sources**

Given the significant hurricane damage and the Government of Puerto Rico’s vision to “build back better,” the sector-based teams considered both U.S. government aid and nongovernmental funding sources as resources for the courses of action identified. The levels of funds that might be available from the Disaster Relief Fund, special appropriations for disaster relief and recovery, and steady-state federal programs funded via normal annual program budgets were estimated and reviewed with FEMA and other outside experts. Nongovernmental funders (charitable and corporate foundations, institutional investors, and venture capitalists) were also examined as potential sources of funding. For each course of action, HSOAC and FEMA sector teams worked to assign possible funding sources to the extent possible given available information. Eligibility requirements for many supplemental funding elements are still unspecified, so possible funding sources are notional at this time (for more information, see “Estimated Costs and Funding for Puerto Rico’s Recovery,” Chapter 8). Optimizing constrained funds across courses of action specifically and recovery efforts generally will require additional analysis.

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# ACKNOWLEDGMENTS



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100 Resilient Cities	California Health Medical Reserve Corps, on behalf of People-Centered Internet
Abre Puerto Rico	Centers for Disease Control and Prevention
Acción Social de Puerto Rico	Colmena66
Advantage Business Consulting	Constituido el Consejo Multisectorial del Sistema de Salud de Puerto Rico
Advisory Council on Historic Preservation	Deloitte & Touche
Arcadis US, Inc., on behalf of Arcadis Caribe, PSC	Dewberry Engineers, Inc.
Bender Consulting Services, Inc.	Edelman Miami Latin America Corporation, doing business as Edelman
Beta-Local	Enterprise Community Partners, Inc.
Boys and Girls Club	
Burns & McDonnell Engineering Company, Inc.	

EplerWood International  
 Federal Bureau of Prisons  
 Federal Communications Commission  
 Federal Communications Commission  
 Hurricane Recovery Task Force  
 Foundation for Puerto Rico  
 GeoAdaptive, LLC  
 Grupo Guayacán, Inc.  
 Heritage Emergency National Task Force  
 Institute of Puerto Rican Culture  
 Instituto de Desarrollo Juventud  
 Interamerican University  
 International City/County Management  
 Association  
 Junta Reglamentadora de Telecomunicaciones  
 de Puerto Rico  
 Massachusetts Institute of Technology Lincoln  
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 Mortgage Bankers Association of Puerto Rico  
 National Aeronautics and Space Administration  
 National Coalition for Arts' Preparedness and  
 Emergency Response  
 National Endowment for the Arts  
 National Endowment for the Humanities  
 National Renewable Energy Laboratory  
 National Security Council  
 National Telecommunications and Information  
 Administration  
 National Voluntary Organizations Active in  
 Disaster  
 National Weather Service  
 Natural Resources Defense Council, Inc.  
 New Orleans Recovery School District  
 New York Disaster Interfaith Services  
 New York Power Authority  
 New York Federal Reserve Bank  
 Novaces  
 Para la Naturaleza  
 Pharmaceutical Industry Association of Puerto  
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 Ponce Port Authority  
 PRiMEX  
 Puerto Rico Community Foundation  
 Puerto Rico Convention District Authority  
 Puerto Rico Department of Economic  
 Development and Commerce  
 Puerto Rico Department of Treasury (Hacienda)  
 Puerto Rico Department of Agriculture  
 Puerto Rico Department of Health  
 Puerto Rico Department of Housing  
 Puerto Rico Department of Natural and  
 Environmental Resources  
 Puerto Rico Department of Public Safety  
 Puerto Rico Department of Transportation and  
 Public Works  
 Puerto Rico Electric Power Authority  
 Puerto Rico Emergency Management Agency  
 Puerto Rico Environmental Quality Board  
 Puerto Rico Farmers Association  
 Puerto Rico Highway and Transportation  
 Authority  
 Puerto Rico Home Builders Association  
 Puerto Rico Housing Finance Authority  
 Puerto Rico Housing Recovery Task Force  
 Puerto Rico Industrial Development Company  
 Puerto Rico Infrastructure Financing Authority

Puerto Rico Innovation and Technology Service	U.S. Army Corps of Engineers, Engineer Research and Development Center Coastal and Hydraulics Laboratory
Puerto Rico Institute of Statistics	
Puerto Rico Maritime Transport Authority	U.S. Census Bureau
Puerto Rico Metropolitan Bus Authority	U.S. Coast Guard
Puerto Rico National Guard	U.S. Committee on the Marine Transportation Systems
Puerto Rico Office of the Chief Innovation Officer	U.S. Department of Agriculture
Puerto Rico Office of the Commissioner for Municipal Affairs	U.S. Department of Agriculture, Animal and Plant Health Inspection Service
Puerto Rico Office of the Commissioner of Insurance	U.S. Department of Agriculture, Farm Service Agency
Puerto Rico Planning Board	U.S. Department of Agriculture, Forest Service
Puerto Rico Ports Authority	U.S. Department of Agriculture, Natural Resources Conservation Service
Puerto Rico Public Buildings Authority	U.S. Department of Agriculture, Office of Rural Development
Puerto Rico Public Housing Administration	U.S. Department of Commerce
Puerto Rico Public Private Partnerships Authority	U.S. Department of Commerce, Bureau of Economic Analysis
Puerto Rico Science, Technology, and Research Trust	U.S. Department of Commerce, Economic Development Administration
Puerto Rico State Office of Energy Policy	U.S. Department of Commerce, Minority Business Development Agency
Puerto Rico Tourism Company	U.S. Department of Commerce, National Institute of Standards and Technology
ReImagine Puerto Rico	U.S. Department of Commerce, National Oceanic and Atmospheric Administration
Resuelve Comunitario	U.S. Department of Commerce, National Telecommunications and Information Administration
Rocky Mountain Institute	U.S. Department of Defense
Save the Children	U.S. Department of Education
Smart Electric Power Alliance	U.S. Department of Energy
State Historic Preservation Office	U.S. Department of Energy, National Labs Modeling Team
Smithsonian Institution	
U.S. Agency for International Development, Office of U.S. Foreign Disaster Assistance	
U.S. Army	
U.S. Army Corps of Engineers	
U.S. Army Corps of Engineers, Research and Development Center	

U.S. Department of Health and Human Services	U.S. Department of Transportation, Federal Aviation Administration
U.S. Department of Health and Human Services, Center for Medicare & Medicaid Services	U.S. Department of Transportation, Federal Highway Administration
U.S. Department of Homeland Security	U.S. Department of Transportation, Federal Transit Administration
U.S. Department of Homeland Security, National Protection and Programs Directorate	U.S. Department of Transportation, Maritime Administration
U.S. Department of Homeland Security, Office of Infrastructure Protection	U.S. Department of the Treasury
U.S. Department of Housing and Urban Development	U.S. Environmental Protection Agency
U.S. Department of the Interior	U.S. Environmental Protection Agency, Caribbean Environmental Protection Division
U.S. Department of the Interior, Bureau of Land Management	U.S. Federal Reserve System
U.S. Department of the Interior, Fish and Wildlife Service	U.S. Government Accountability Office
U.S. Department of the Interior, National Park Service	U.S. Geological Survey
U.S. Department of the Interior, Office of the Secretary	U.S. National Guard
U.S. Department of Justice	U.S. Small Business Administration
U.S. Department of Labor	University of Puerto Rico
U.S. Department of Labor, Bureau of Labor Statistics	Visual Ops
U.S. Department of Transportation	WSP USA Inc.
	Western Area Power Administration

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Finally, we sincerely thank the numerous citizens of Puerto Rico who contributed their time and energy to participate in the planning process and comment on earlier drafts of this plan. You have contributed to the transformation of Puerto Rico.



CASA ALCALDIA

The historic Casa Alcaldia houses the Ponce City Hall.

Bryan Mullennix/Getty Images

# ABBREVIATIONS



ABBREVIATION	EXPLANATION
<b>ASES</b>	Administración de Seguros de Salud de Puerto Rico [Puerto Rico Health Insurance Administration]
<b>ATM</b>	automated teller machine
<b>BIDCO</b>	business and industrial development corporation
<b>BRH</b>	business resiliency hub
<b>CDBG-DR</b>	Community Development Block Grant – Disaster Recovery [HUD program]
<b>CDC</b>	Centers for Disease Control and Prevention
<b>CHC</b>	community health center
<b>CINO</b>	Office of the Chief Innovation Officer
<b>CIO</b>	Office of the Chief Information Officer
<b>CMS</b>	Centers for Medicare & Medicaid Services
<b>COR3</b>	Central Office of Recovery, Reconstruction, and Resiliency
<b>CRIM</b>	Centro de Recaudación de Ingresos Municipales [Municipal Revenues Collection Center]
<b>CRRO</b>	Central Recovery and Reconstruction Office of Puerto Rico
<b>DHHS</b>	U.S. Department of Health and Human Services
<b>DHS</b>	U.S. Department of Homeland Security
<b>DNER</b>	Puerto Rico Department of Natural and Environmental Resources
<b>DOC</b>	U.S. Department of Commerce
<b>DoD</b>	U.S. Department of Defense
<b>DOI</b>	U.S. Department of the Interior
<b>DOL</b>	U.S. Department of Labor
<b>DOT</b>	U.S. Department of Transportation
<b>DPS</b>	Puerto Rico Department of Public Safety
<b>DRD</b>	Departamento de Recreación y Deportes [Department of Sports and Recreation]
<b>DRF</b>	Disaster Relief Fund
<b>DTOP</b>	Puerto Rico Department of Transportation and Public Works
<b>E911</b>	Enhanced 911
<b>EDA</b>	Economic Development Administration
<b>EDB</b>	Puerto Rico Economic Development Bank
<b>EMPG</b>	Emergency Management Performance Grant
<b>EOC</b>	emergency operations center

<b>ABBREVIATION</b>	<b>EXPLANATION</b>
<b>EPA</b>	U.S. Environmental Protection Agency
<b>EQB</b>	Puerto Rico Environmental Quality Board
<b>FCC</b>	Federal Communications Commission
<b>FEMA</b>	Federal Emergency Management Agency
<b>FirstNet</b>	First Responder Network Authority
<b>FOG</b>	fats, oil, and grease
<b>FOMB</b>	Financial Oversight Management Board
<b>FWS</b>	U.S. Fish and Wildlife Services
<b>FY</b>	fiscal year
<b>GIS</b>	geographic information system
<b>GNP</b>	gross national product
<b>GPR</b>	Government of Puerto Rico
<b>HENTF</b>	Heritage Emergency National Task Force
<b>HMGP</b>	Hazard Mitigation Grant Program [FEMA program]
<b>HSOAC</b>	Homeland Security Operational Analysis Center
<b>HUD</b>	U.S. Department of Housing and Urban Development
<b>IA</b>	Individual Assistance [FEMA program]
<b>ICMA</b>	International City/County Management Association
<b>ICP</b>	Instituto de Cultura Puertorriqueña [Institute of Puerto Rican Culture]
<b>IDDE</b>	illicit discharge detection and elimination
<b>IMLS</b>	Institute of Museum and Library Services
<b>IT</b>	information technology
<b>K-12</b>	kindergarten to 12th grade
<b>LMR</b>	land mobile radio
<b>MTC</b>	Medical Tourism Corporation
<b>NAP</b>	Nutrition Assistance Program
<b>NAPHSIS</b>	National Association for Public Health Statistics and Information Systems
<b>NARA</b>	National Archives and Records Administration
<b>NDRF</b>	National Disaster Recovery Framework
<b>NEA</b>	National Endowment for the Arts
<b>NEH</b>	National Endowment for the Humanities
<b>NFIP</b>	National Flood Insurance Program
<b>NG911</b>	Next Generation 911
<b>NGO</b>	nongovernmental organization
<b>NOAA</b>	National Oceanic and Atmospheric Administration
<b>NSF</b>	National Science Foundation
<b>NTIA</b>	National Telecommunications and Information Administration
<b>ODSEC</b>	Oficina para el Desarrollo Socioeconómico y Comunitario [Office for Socioeconomic and Community Development]
<b>OGPe</b>	Oficina de Gerencia de Permisos [Office of Permit Management]

<b>ABBREVIATION</b>	<b>EXPLANATION</b>
<b>OIGPe</b>	Oficina del Inspector General de Permisos [Office of Inspector General of Permits]
<b>OPPEA</b>	Oficina del Procurador de las Personas de Edad Avanzada [Office of the Ombudsman for the Elderly]
<b>P3 Authority</b>	Puerto Rico Public–Private Partnerships Authority
<b>PA</b>	Public Assistance [FEMA program]
<b>PAHO</b>	Pan American Health Organization
<b>PDM</b>	Pre–Disaster Mitigation Grant Program
<b>PNP</b>	private nonprofit
<b>PRASA</b>	Puerto Rico Aqueduct and Sewer Authority
<b>PRDA</b>	Puerto Rico Department of Agriculture
<b>PRDE</b>	Puerto Rico Department of Education
<b>PRDF</b>	Puerto Rico Department of the Family
<b>PRDH</b>	Puerto Rico Department of Housing
<b>PRDOH</b>	Puerto Rico Department of Health
<b>PRDOJ</b>	Puerto Rico Department of Justice
<b>PRDR</b>	Puerto Rico Demographic Registry
<b>PREC</b>	Puerto Rico Energy Commission
<b>PREMA</b>	Puerto Rico Emergency Management Agency
<b>PREPA</b>	Puerto Rico Electric Power Authority
<b>PRHTA</b>	Puerto Rico Highway and Transportation Authority
<b>PRIDCO</b>	Puerto Rico Industrial Development Company
<b>PRIFA</b>	Puerto Rico Infrastructure Financing Authority
<b>PRiMEX</b>	Puerto Rico Manufacturing Extension
<b>PRITS</b>	Puerto Rico Innovation and Technology Service
<b>PROMESA</b>	Puerto Rico Oversight, Management, and Economic Stability Act
<b>PRPA</b>	Puerto Rico Ports Authority
<b>PRPB</b>	Puerto Rico Planning Board
<b>PRPBA</b>	Puerto Rico Public Buildings Authority
<b>PRSTRT</b>	Puerto Rico Science, Technology, and Research Trust
<b>PRTC</b>	Puerto Rico Tourism Company
<b>PRTRB</b>	Puerto Rico Telecommunications Regulatory Board
<b>PRVCU</b>	Puerto Rico Vector Control Unit
<b>PSAP</b>	public safety answering point
<b>QA/QC</b>	quality assurance / quality control
<b>RD</b>	Rural Development
<b>RSF</b>	Recovery Support Function
<b>RUS</b>	Rural Utilities Service
<b>S&amp;T</b>	Science & Technology Directorate
<b>SBA</b>	Small Business Administration

<b>ABBREVIATION</b>	<b>EXPLANATION</b>
<b>SCADA</b>	supervisory control and data acquisition
<b>SHPO</b>	State Historic Preservation Office
<b>SNAP</b>	Supplemental Nutrition Assistance Program
<b>SOEP</b>	State Office of Energy Policy
<b>STEM</b>	science, technology, engineering, and mathematics
<b>UPR</b>	University of Puerto Rico
<b>USACE</b>	U.S. Army Corps of Engineers
<b>USCG</b>	U.S. Coast Guard
<b>USDA</b>	U.S. Department of Agriculture
<b>USFS</b>	U.S. Forest Service
<b>USGS</b>	U.S. Geological Survey
<b>USPS</b>	U.S. Postal Service
<b>VA</b>	U.S. Department of Veterans Affairs
<b>WIC</b>	Special Supplemental Nutrition Program for Women, Infants, and Children



Aerial view of a damaged home in the mountainous area of Barranquitas, Puerto Rico, October 9, 2017.

Photo by Andrea Booher/FEMA

