



# LINKING DISASTER MITIGATION AND RECOVERY WITH CLIMATE RESILIENCY

### Florida Section A&WMA 55th Annual Conference & Exhibition

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### **Presenters**



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## **Before, During, and After the Storm**

**Resilience and Adaptation** 















### Understand, Quantify, and Assess Risks



Global Climate Change



Rainfall (changes in intensity and distribution)



Storm Surge and Waves



Growth in coastal population



Hurricanes and Tropical Storms



Sea-Level Rise

### **Risk - Storms**





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# **Risk - Storms**





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N/A

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# **Risk - Storms**





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Rain events



Warmer temperatures result in the ability of the atmosphere to hold more moisture



Possibly higher intensity storms or changing distribution

Increase in Heaviest Precipitation Events



After Harvey NOAA revising Houston's 100-year 24-hour rainfall from 12-14 inches to 15-18 inches (in the range of old 500-year estimates).

# **Risk - Flooding**





FIRMs do not account for future effects of sea level rise and longterm erosion. All mapped flood hazard zones (V, A, and X) in areas subject to sea level rise and/or longterm erosion likely underestimate the extent and magnitude of actual flood hazards that a coastal building will experience over its lifetime.





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### Over a 30 year period



The 25-year flood zone gives you a 71 percent chance of being flooded

The 50-year flood zone gives you a 45 percent chance of being flooded

The 100-year flood zone gives you a 26 percent chance of being flooded

The 500-year flood zone gives you a six percent chance of being flooded

**Risk – Rising Seas** 







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- Science of sea level rise is continuously evolving
- Many forecasts available
- Future projections are highly variable
- Based upon models, assumptions, vigorous debate
- **<u>BUT</u>** no doubt sea level is rising

### **Risk – Rising Seas**















### **Sea Level Rise**

Sea Level Rise is the base on which other coastal hazards will be magnified





### **Sea Level Rise**

Sea Level Rise is the base on which other coastal hazards will be magnified







### What are the effects of sea level rise?

- Storm water/municipal drainage no longer works during high tide
- Increasing frequency of flood events
- Inundated roads (nuisance flooding)
- Salt-water intrusion
  - Rivers and lenses of fresh groundwater becoming more saline
  - Re-location of municipal drinking wells
- Coastal flooding and erosion
- Plant, tree, and habitat mortality (mangrove retreat, coral reef degradation, etc.)







### **Risk - Growing Coastal Populations**



- Coastal populations continue to rise
  - Florida's coastal counties >260% between 1960-2008
- People continue to be drawn to the coast to live, work, and vacation
- About 40% of the world's population live within 65 miles of a coastline
- Coastal areas contain key infrastructure vital to the economy





Infrastructure

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### **Assess Vulnerability of Key Infrastructure / Prioritize**









### Funding Resilience: Programs, Policy, and Case Studies





# **Learning Objectives**

- What is Resilience and Why Do We Care?
- Overview of Potential Funding Sources
  - National and Florida Specific Case Studies
- Important Policy and Program Updates
  - The Disaster Recovery Reform Act of 2018, Building Resilient Infrastructure and Communities Program (BRIC)
  - Community Development Block Grant Mitigation (CDBG-MIT)



### What is Resilience and Why Do We Care?

"Resilience is the capacity of communities to survive, adapt and grow no matter what kinds of **chronic stresses and acute shocks** they experience"

100 Resilient Cities, Rockefeller Foundation

#### Stresses and shocks are increasing!

- Within the next 25 years, 70 percent of the world's population will live in urban centers
- Resources are becoming more scare
- Increasing natural disasters have created a new normal for communities







**A Changing Risk Context** 



Billion-Dollar Disasters: Number and Cost of U.S. Weather-Related Disasters, 1980-2018. Source: National Centers for Environmental Information.





### **Pressure for Additional Resources**



Assessment of a utility's ability to cover the full cost of providing service currently and in the future. Source: American Water Works Association

Public spending on Capital and O&M investments, 1956-2016. Source: Bluefield Research using US Congressional Budget Office data.





# **Future Revenue / Affordability**



#### Consumer rates' year-to-year climb

- <u>Example:</u> Water rates have risen nearly 30 percent from 2012 to 2018
- Rate increases more than triple the median household income growth since 2013
- Affordability impacts result in unpaid bills, and significant cuts on other expenses

Water and Wastewater Monthly Bills for Largest U.S. Cities by Population Served, 2012-2019. Source: Bluefield Research.





### **The Importance of External Funding Sources**







## What is Hazard Mitigation?

- One of the fundamentals of emergency management, along with preparedness, response and recovery.
- Any action taken to reduce or eliminate the loss of life, property, and infrastructure from natural and man-made hazards.
- Lessens the financial burden of hazards for government, utilities, businesses and individuals.







### **Value of Hazard Mitigation**



Source: FEMA/NIBS, 2017





### **Project Identification**

Hazard Mitigation	
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Proiects	

#### High Priority Assets

- Water Infrastructure
- Wastewater
  Infrastructure
- Stormwater
  Infrastructure

- Historical Impacts
  - Flood Events
  - Wind Events
  - Power Outages
  - Winter Storms
  - Earthquake

- Expected Impacts
  - Flood Recurrence
    Intervals
  - Wind Speed
    Probability

#### Known Project Needs

- Emergency Power Generation
- Floodproofing
- SCADA Installation
- Planning / Project Scoping



Addison Evans Water Treatment Plant, Chesterfield County, Virginia Floodwall and Stream Restoration Project [PDM FY18 // \$8.7M Fed Share]



Well 18, City of Tallahassee Utilities Emergency Power Generation Project [Hurricane Hermine DR-4280 // \$168K Fed Share]



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# **FEMA Pre-Disaster Mitigation (PDM) Program**



Annually appropriated by Congress



- FY2017 **\$90M**
- FY2018 **\$230M**
- FY2019 **\$250M**



Who?

When?

Local Governments, State Governments, Public Utilities, Tribal Entities



What?

Any Hazard Planning, Infrastructure Protection, Drainage Projects, Building Retrofits

- 75% • \$4N
- Projects, Building Retrofits75% Federal cost share
  - \$4M Federal share for standard projects
  - \$150K for planning projects
  - In FY18, "Resilient Infrastructure" with a maximum Federal share of \$10M



**Open Application Cycle!** 

Florida Division of Emergency Management (FDEM) requests applications by November 12, 2019





# **PDM Case Study: DC Water and Sewer Authority**

- 700,000 water customers
- 2.2 million wastewater customers DC, MD, and VA jurisdictions
- Combined system (stormwater and sewage)
- The Blue Plains Advanced Wastewater Treatment Plant averages 370 MGD with a peak design capacity of 1 billion gallons per day.
- Largest advanced wastewater treatment plant in the world.







### PDM Case Study: Blue Plains AWTP Floodwall









### PDM Case Study: Blue Plains AWTP Floodwall



- Vulnerable flood elevation 11.58 ft., DC Datum
- Interconnected underground galleries across the site which contain vulnerable mechanical and electrical equipment
- Vulnerable flood elevation inundation would result in months of treatment disruption







### PDM Case Study: Blue Plains AWTP Floodwall



#### D.C.'s Water Treatment Plant Makes Strides When It Comes to Preparing for Climate Change

Experts say DC Water, which operates Blue Plains, has become a forwardthinking leader in both adaptation and mitigation.

BY DIANA MICHELE YAP - SEP 19, 2019 5 AM





#### **Project:**

- In FY16 we applied for PDM funding, was awarded \$3.2M total, \$2.4M federal share
- 600 linear foot floodwall with removable flood gates / barriers
- 17.2 ft., DC Datum (500-year + 3 ft.)
- Effective protection 12.0 ft., DC Datum (100-year +2ft)







# Hang On

- Execute response plan
- Attitude
- Take care of team







### **Multiple Layers to Better Resist**



~ FIGURE: North Atlantic Coast Comprehensive Study (USACE, 2015)

#### Inner Layer (Local)

- Smaller-scale solutions
- Protect critical infrastructure
- Integrating water management and urban planning

#### Middle Layer (Regional)

- "Transition" zone
- Floodwalls, marshes, levees
- (multifunctional), beaches

#### <u>Outer Layer (Large Area)</u>

- Larger, engineered solutions
- Storm surge barriers, sea gates, Offshore structures, pump and levee systems

### **Operate system**

Close gates, deploy temporary measures,  $\bullet$ advance drawdown and active pumping, etc.

Performance Monitoring/Assessment

Collect key data 



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web-based dashboard

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**NWS** forecast

outlet or pump







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# AFTER

- Assess damage, gather data
- Bounce back regaining normalcy
- Prepare a post-disaster report
- Don't just rebuild... rethink
- Learn from it adapt plan/design for future







### LESSONS LEARNED: HURRICANE KATRINA



AFTER

Hurricane Katrina changed the way many people think of storms. >\$65B in damages

#### RESISTANT SYSTEM CAN HAVE CATASTROPHIC FAILURE





# AFTER

### **LESSONS LEARNED: HURRICANE HARVEY**



LESSER CATEGORY HURRICANES AND TROPICAL STORMS CAN CAUSE LARGE SCALE DISASTERS

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# AFTER

### LESSONS LEARNED: SUPERSTORM SANDY



BUILDING RESILIENCY AT DIFFERENT LEVELS INTO URBAN INFRASTRUCTURE Superstorm Sandy exposed vulnerability of large urban centers and infrastructure

### REBUILD BY DESIGN

### LESSONS LEARNED: SUPERSTORM SANDY



design + ecology + engineering + people

IDEAS BORN FROM DISASTER

The Big U











### LESSONS LEARNED: SUPERSTORM SANDY

### **Active Floodproofing**



- Improve the resiliency of critical building components before, during, and after a storm
- Real time monitoring of pipe water levels, weather forecast and other parameters
- Controls valves automatically when conditions are indicative of a flood risk
- Protect a building from the backflow from utility systems and storm water, when deployed at the building network level

"NEW, INNOVATIVE, AND COST-EFFECTIVE" SOLUTIONS TO "ENABLE BUILDINGS AND INFRASTRUCTURE NETWORKS TO BETTER RESIST, ADAPT TO, AND/OR BOUNCE BACK FROM FUTURE STORMS."

# AFTER

### • Better design

- Community scale
- Not a one asset solution

### IS THIS RESILIENCY?

### LESSONS LEARNED: HURRICANE MICHAEL

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After a Presidentially Declared Major Disaster Declaration

Local Governments, State Governments, Private Non-Profits, Public Utilities, Tribal Entities

Any Hazard Infrastructure Protection, Drainage Projects, Building Retrofits



When?

Who?

What?

75% Federal cost share20% set aside of all Federal disasterspending on event



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Administered by FDEM

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- Three-tiered funding system
- Must apply through County Local Mitigation Strategy Working Groups

Open Application Cycle! DR-4399 Hurricane Michael

FDEM requests applications by March 10, 2020



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### HMGP Case Study: Miami-Dade Water and Sewer Department

- Provides water and wastewater service to over 2.3 million residents and thousands of visitors
- WASD operates and maintains two critical assets- Pump Station 1 and Pump Station 2 which serve over 800k residents combined
- Risk to facilities consists of wind, surge, stormwater, power loss, and subsurface intrusion into the wastewater collection system



Source: Miami-Dade Water and Sewer Department







### HMGP Case Study: Pump Station 1 & 2 Hardening







### **HMGP Case Study: Pump Station 1**







### **HMGP Case Study: Pump Station 2**







### HMGP Case Study: Pump Station 1 and 2 Mitigation

<b>FEMA</b>	FEMA Awards Miami-Dade County Over \$1.7 Million for a Wastewater Transmission System, Utility Protective
Navigation	Mitigation Project
Search	Release date: June 14, 2019
Languages	Release Number: R4 DR-4337-FL NR 287
ews Releases Fact Sheets	Orlando, Fla. – FEMA is awarding Miami-Dade County a \$1,780,624.50 Hazard Mitigation grant to fund the initial phase 1 of design and engineering a project to harden Pump Station 1 and Pump Station 2 located at 390 NW North River Drive, Miami, FL 33128 and 1075 Biscayne Boulevard, Miami, FL 33132, respectively.
News Desk Contacts	These stations provide wastewater conveyance services to a direct service population of approximately 811,722 people.

#### **Project:**

- Applied and awarded funding and awarded under the Hurricane Irma (DR-4377) HMGP Allocation
- Phase 1 (~\$ 1.7M) Hydrology and Hydraulic Study, Design Engineering, and Permitting
- Phase 2 (~\$18.4M) Construction

#### Scope:

- Flood protection to base flood elevation (BFE) + 3 Feet of Freeboard
- Wind retrofit (structural and opening protection) to mitigate wind speeds of 190MPH (minimum)
- Emergency power generation
- SCADA system improvements
- HVAC Improvements for ventilation and safety





# **Policy and Program Updates**



### **Disaster Recovery Reform Act of 2018**

- Passed and signed into law in October 2018
- Federal Government shift from being "reactive" to more "proactive"
- Major changes to FEMA Hazard Mitigation Assistance
- 6% set aside of all federal disaster spending will be appropriated to a new National Public Infrastructure Pre-Disaster fund.
  - Funds will be awarded under a new Building Resilient Infrastructure and Communities (BRIC) program

If the DDRA was in effect last year, the total amount of funding under the program would have been greater than \$1 Billion!





# FEMA Building Resilient Infrastructure and Communities (BRIC)

When?

What?

Official announcement expected in 2020

Who? Local Governments, StateWho? Governments, Public Utilities, Tribal Entities

Public infrastructure projects that increase a community's resilience

# What Should We Be Doing Now?

- FEMA is currently seeking input and developing guidance on the program
- Begin to identify potential BRIC eligible projects for FY20
- Plan for implementation develop "shelf-ready" applications for when the program is announced

•••

How 6% set aside of all disaster spendingmuch? in FY2019





### HUD Community Development Block Grant – Mitigation (CDBG-MIT)

- New mitigation program included in 2018 Supplemental Appropriation. Federal Register Notice Published on August 30, 2019.
- Funding is administered by the Florida Department of Economic Opportunity
- 51 counties are eligible for CDBG-MIT due to 2016 and 2017 Major Disaster Declarations (Hurricanes Hermine, Matthew, and Irma)
- 50% of funding must be spent on mitigation in HUD Most Impacted and Distressed (MID) areas. 50% minimum spending to benefit Low to Moderate Income (LMI) populations

HUD announced an allocation of \$6.78B for CDBG-MIT across 14 states!





## HUD Community Development Block Grant – Mitigation (CDBG-MIT)



When? 2020



Who?

What?

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Local Governments, State Governments, Tribal Entities

- Infrastructure, Economic
  Development, Housing, Public
  Services, Planning
- Encouraged to use as match for FEMA Hazard Mitigation Assistance



- Action Plan due to HUD February 2020
- DEO holding community workshops:
  - Duval 10/29
  - Brevard 10/30
  - Pinellas 10/31
  - Lee 11/4
  - Miami-Dade 11/5
  - Palm Beach 11/6
  - Monroe 11/7



How\$6.78 billion over 14 Statesmuch?\$633 million in Florida





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## **Preparation for External Funding**

- Proactive thinking and acting is necessary
- Have a funding strategy in place with prioritized projects, funding sources, and timeframes identified
- Understand the following for your infrastructure:
  - Hazard
  - Vulnerability
  - Criticality
  - Consequence
- Design your funding strategy to <u>implementation</u> and develop "shelf ready" grant applications



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# **Concluding Thoughts**

- Recovery begins long before the disaster Disaster Recovery begins TODAY
- Uncertainty and climate change impacts necessitate resilience and adaptive planning and design (add resilience to every infrastructure plan)
- Requires innovative thinking, multidisciplinary collaboration and public education
- Dollars spent in advance of disasters result in significant cost savings post-disaster and accelerated recovery times







### **Questions?**



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