

Better Buildings Webinar Series

We'll be starting in just a few minutes....

Tell us...

What topics are you interested in for future webinars?

Please go to **slido.com** and use event code **#DOE** to submit your responses.



Planning for Resilience in Multifamily Housing: A Portfolio-wide Approach

November 17, 2020

3:00 – 4:15 pm EST



U.S. DEPARTMENT OF
ENERGY

Please go to www.slido.com

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Enter Event Code

#DOE

Better Buildings Challenge – Multifamily

91 partners:

- 7 of the 10 largest Public Housing Agencies
- 13 Stewards of Affordable Housing Partners (SAHF)
- 9 nationwide partners

Partners:

- Commit to improve the energy efficiency of their portfolios by 20 percent over 10 years
- Receive utility benchmarking technical assistance
- Share energy performance data annually

<https://www.hudexchange.info/programs/better-buildings-challenge/>





Michael Freedberg

Senior Advisor / HUD's Office of Environment and Energy

Agenda

1

Overview of Resilience in Multifamily Housing

2

3 presentations, each followed by Q & A

3

Group Discussion

4

Wrap up

Actual – Port Arthur TX



For Resources see Community Resilience Page on HUD Exchange:
<https://www.hudexchange.info/programs/community-resilience/>



Baked Alaska: It's beach time as a heat wave hits cities across the state

RICHARD READ
REPORTING FROM ANCHORAGE
July 5 at 7:40 PM ET

Bears and moose are seeking relief in garden sprinklers. Stores are out of ice. Kids are lamenting the cancellation of Independence Day fireworks — not that pyrotechnics show up all that well anyway under the midnight sun.

Anchorage, and much of Alaska, is shattering temperature records amid a heat wave accompanied by

Michigan
Chicago
ell.
k Times



By Katie Mettler
May 30 at 10:52 AM ET



Missouri State Patrol did an aerial survey of the severe flooding along the Grand River near Brunswick on May 29. (Missouri State Highway Patrol Troop B via Storyful)

In Kendall Culp's corner of northwest Indiana, relentless rain began falling

'This is the new abnormal'

Air attack saves homes near Malibu Canyon, but winds pose a threat

BY SARAH PARVINI,
BENJAMIN ORESKES,
JAMES QUEALLY,
ALENE TCHEKMEDYIAN
AND JACK DOLAN

Los Angeles County fire engineer Scott Pishe stood guard outside several multimillion-dollar homes Sunday as air tankers and helicopters bombarded the fire-ravaged slopes of nearby Malibu Canyon with fire retardant and water.

Earlier in the day, flames threatened to make a run into a chute by the canyon, but the aggressive air attack kept the fire there at bay.

"If it had gotten into that chute, we would've been in trouble," Pishe said from the southeastern flank of the blaze, which had claimed two lives and forced

Forecast wind gusts

Officials warn that strong wind gusts are expected in some fire zones Monday afternoon.

Up to 30 mph 30-40 mph More than 40 mph



More bodies are found in Butte County; over 200 people still missing

BY LOUIS SAHAGUN, JOSEPH SERNA
AND HAILEY BRANSON-POTTS

PARADISE, Calif. — The death toll from the Camp fire raging in Butte County rose to 29 on Sunday as authorities continued their search for victims amid the ruins of the Sierra foothills town of Paradise.

Five additional victims were found in their homes, said Butte County Sheriff-Coroner Kory Honea. Another was found in a vehicle.

The number could continue to grow. On Sunday, authorities said, there were 228 people whose whereabouts were unknown. The search has been hampered by the active fire still burning in the area. Through much of the weekend, the ground remained too hot for cadaver

Potential? South Beach FL



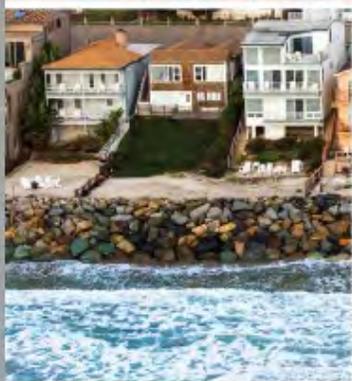
Resilience is the capacity for households, communities, and regions to adapt to changing conditions and to maintain and regain functionality in the face of stress or disturbance.

HUD Tools and Resources

- HUDEXchange
Community
Resilience web site
- Community
Resilience Toolkit
- Extreme
Temperature Index
- NOAA Climate
Explorer
- CDBG-MIT Clinics
- Coming Soon
 - Launch of
Community
Compass TA
Initiative in
Multifamily
Resilience Planning

For Resources see Community Resilience Page on
HUD Exchange:

<https://www.hudexchange.info/programs/community-resilience/>



Community Resilience Toolkit

U.S. Department of Housing and Urban Development
Community Resilience

Learn how current and future natural hazards affect your community, and actions you can take to

Table of Contents

	INTRODUCTION
	COMMUNITY HAZARDS GRAPHIC
	INCREASING TEMPERATURES AND EXTREME HEAT
	SEA LEVEL RISE AND COASTAL STORMS
	INLAND FLOODING
	WILDFIRE
	DROUGHT
	EROSION AND LANDSLIDES
	FUNDING RESILIENCE ACTIONS
	WHAT DOES A RESILIENT COMMUNITY LOOK LIKE?

- **Planning** - actions that can be taken at the policy or planning level.
- **Buildings and infrastructure** - actions aimed at buildings (such as homes and critical facilities) and infrastructure (including roads and utilities).
- **Environment** - actions that can help improve the natural environment to increase community resilience, and
- **People** - actions aimed directly at supporting individuals in the community.

How can natural hazard risks affect your community?

Climate-related natural hazards can impact all communities. To the right is a list of common impacts that might result from any of these hazards. Below, each hazard bullet hazard-specific impacts and interactions between the hazards. To learn more about each hazard and possible impacts to your community, click on the hyperlinks to go to the corresponding hazard fact sheet.

Common Impacts

Many of these hazards can:

- cause injury, illness, and death
- displace residents
- interrupt public services (e.g., electric power, water supplies), and
- damage buildings and infrastructure

Sea Level Rise

- increases coastal flooding
- damages natural flood barriers, and
- exacerbates erosion

Erosion

- increases soil loss and loss of land area
- reduces soil and water quality, and
- can be caused by heavy rainfall, sea level rise, and wildfire

Extreme Heat

- is more intense in urban areas
- strains building materials
- exacerbates chance of drought and wildfire

Landslides

- disrupt critical ecosystems
- increase soil loss and loss of land area
- reduce soil and water quality, and
- can be caused by heavy rainfall, coastal storms, and wildfire

Drought

- reduces the quantity and quality of water supplies
- increases the chance of wildfire, and
- is more likely during heat waves

Wildfire

- reduces air quality
- increases risk of future erosion, and
- is more likely during heat waves

Inland Flooding

- affects the quantity and quality of water supplies, and
 - can cause erosion





Funding Resilience Actions

NON-HUD FUNDING STREAMS

STATE AND LOCAL BOND MARKET

State and local governments frequently use the bond market to finance public projects and, as a result, new bond products have emerged to fund innovative green financing solutions.

- Green bonds
- Other bonds

STATE REVOLVING FUNDS AND PUBLICALLY REGULATED BANKS

Federal financing provides initial capital for states to create revolving funds and publically regulated banks.

- Water, clean energy, and transportation state revolving funds
- Infrastructure banks
- Green banks

LOCAL AND REGIONAL FEE PROGRAMS

Regional and local governments often use fee-based programs to cover administrative and operational costs for city or county services and projects.

- Bag fees
- Stormwater fees

PUBLIC-PRIVATE PARTNERSHIPS AND OTHER FINANCIAL STRATEGIES

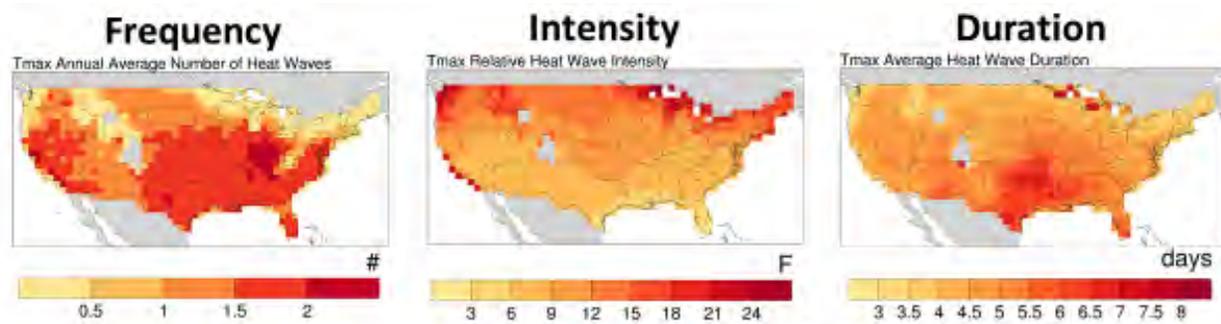
State and local governments can partner with the private sector to implement resilience projects.

GOVERNMENT ENTITIES AND PRIVATE FOUNDATION GRANTS

Government entities and private foundations offer financial and technical resources to advance local resilience actions.

HUD FUNDING STREAMS

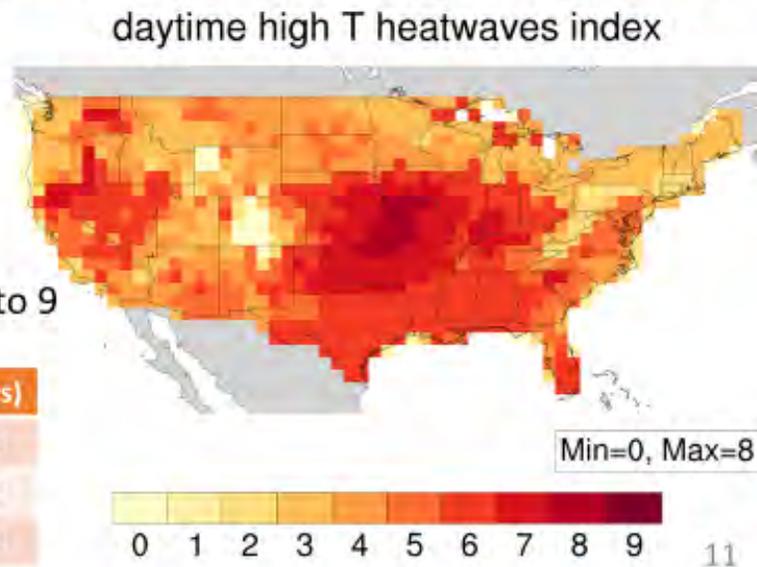
- Community Development Block Grants (CDBG)
- CDBG - Disaster Recovery
- HOME
- Section 108 loans
- Emergency Solutions Grants (ESG) and Continuum of Care (COC) Programs
- Other HUD funding opportunities



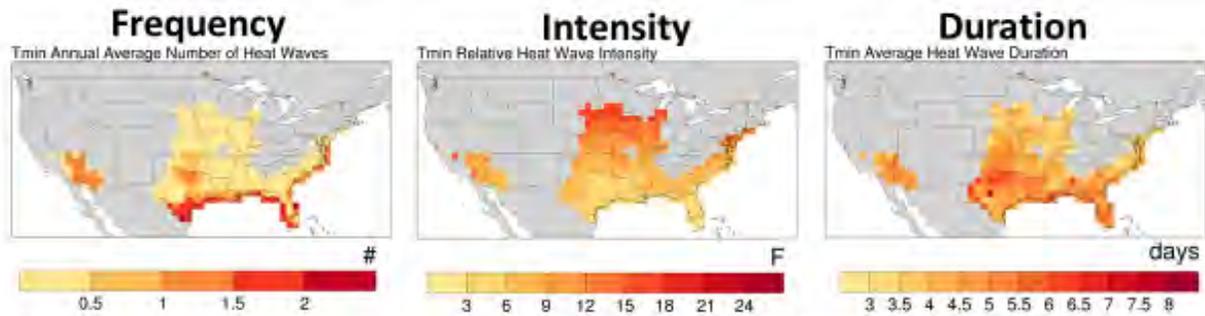
Creating an Index

- Assign 0-3 points each for F,I,D based on quartiles
- Sum F,I,D points
- Possible index range = 0 to 9

%ile	F (#/yr)	I, (°F)	D (days)
25 th	0.84	8.02	4.26
50 th	1.43	10.08	4.72
75 th	1.72	13.29	5.24



Extreme
Temperature
Index –
Daytime
Heat

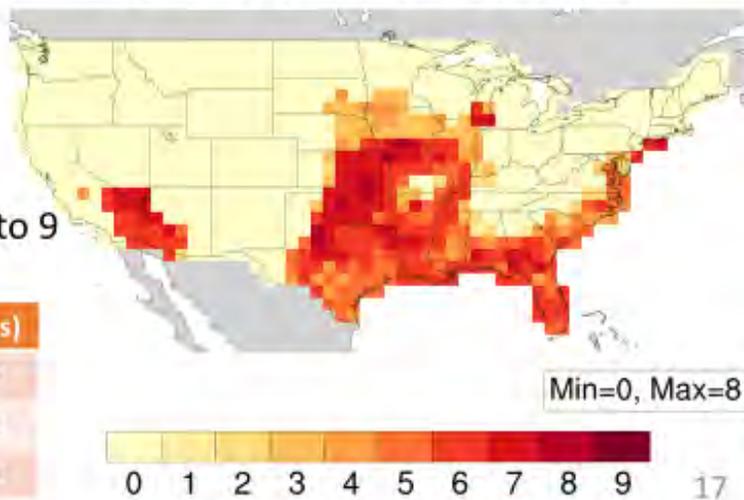


Creating an Index

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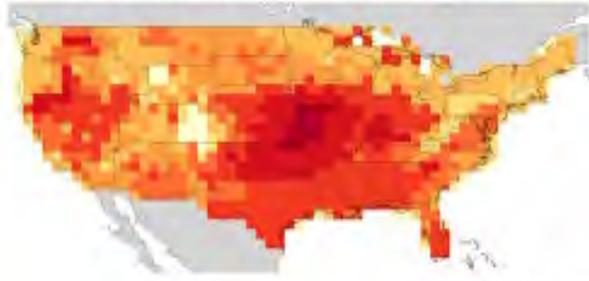
%ile	F (#/yr)	I, (°F)	D (days)
25 th	0.04	5.64	3.67
50 th	0.16	7.54	4.34
75 th	0.83	11.02	4.98

nighttime low T heatwaves index

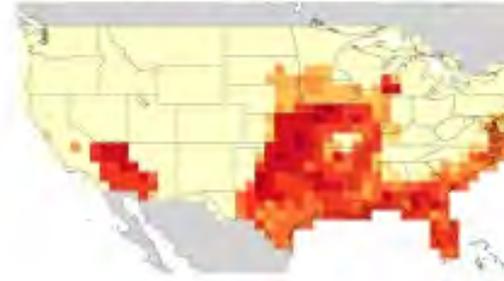


Extreme
Temperature
Index – Night
Time Heat

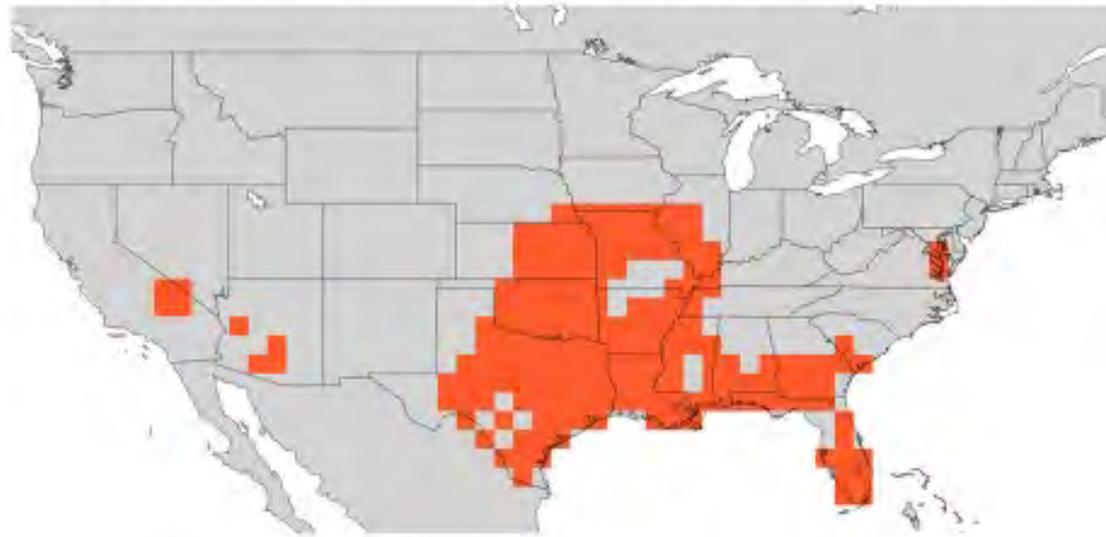
daytime high T heatwaves index



nighttime low T heatwaves index



both tmax and tmin heatwaves index > 5



Extreme
Temperature
Index -
Combined
Day and
Night Heat

What areas in the US are currently most exposed to extreme temperature events?

Considering the combination of frequency, intensity, duration:

Extreme Heat

- US heartland and deep south

Extreme Cold

- US heartland, upper Midwest, and northern high plains

What areas have experienced trends in extreme temperature events over the past century?

Extreme Heat

- Southwest, Florida → more extreme (increasing F, I, and/or D)
- Great Lakes, Midwest → less extreme (decreasing F, I, and/or D)
- Large trend in D, as compared to F and I

Extreme Cold

- West, northern high plains, Great Lakes → less extreme (decreasing F, I, and/or D)

NOAA Climate Explorer

Search Assets by Community

20

A story map

Are HUD properties exposed to climate hazards?

HUD grantees own and manage around 4 million affordable housing units across the country. Depending on their regional settings, these properties may be exposed to climate hazards such as flooding, wildfire, or sea level rise.

To view HUD properties in your own community:

- Click the magnifying glass on the left side of the map.
- Enter your city/town name, and then select the one you want from the list.
- Zoom and pan on the map to view your location of interest.
- Click any dot to view addresses and other information that HUD has gathered about the properties.

SCROLL DOWN to check if properties of interest may be exposed to various hazards.

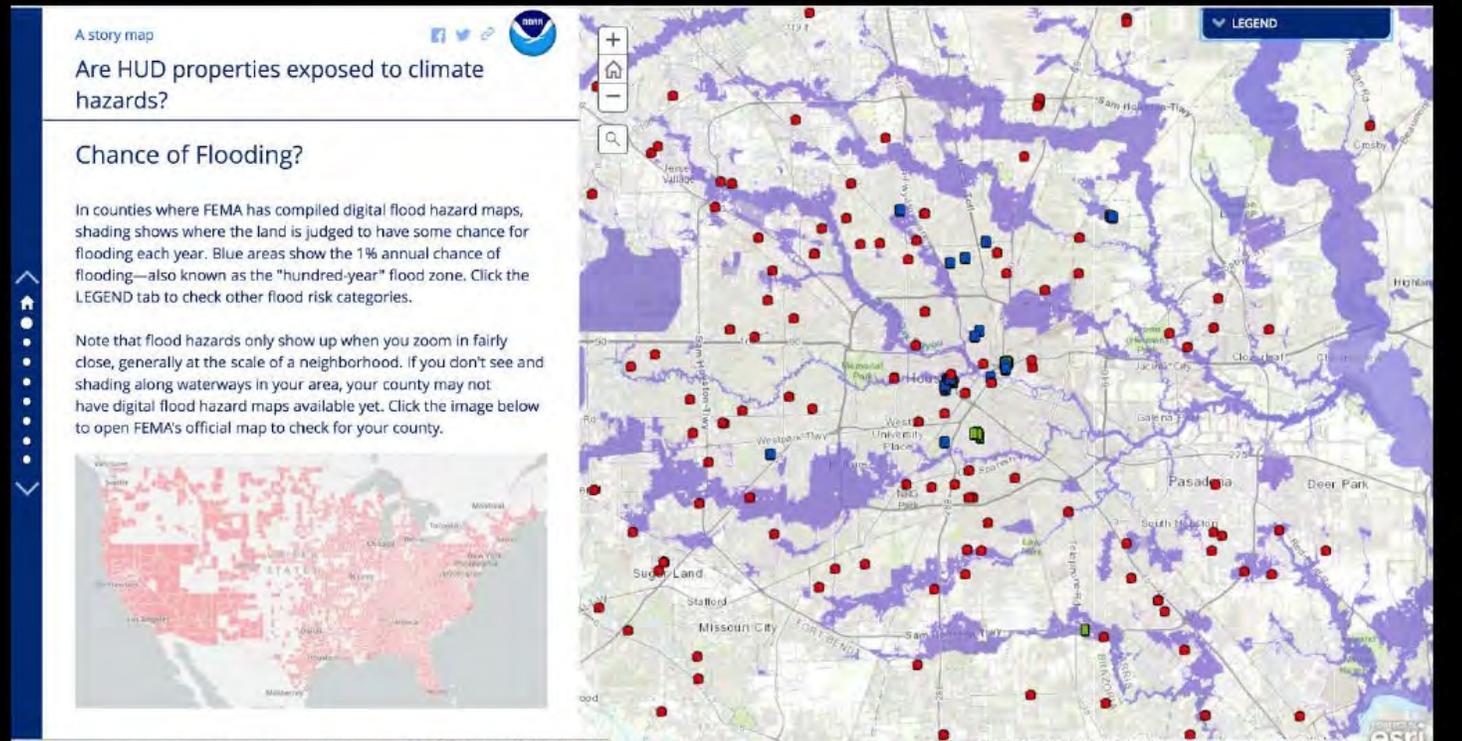
Chance of Flooding

City of Houston, Texas Parks & Wildlife, Esri, HERE, Garmin, USGS...

NOAA Climate Explorer Mapping Assets in Flood Zones

Explore where assets and potential hazards intersect

21



Today's Presenters



Laurie Schoeman

Enterprise Community Partners



Tom Chase

New Ecology, Inc.



Nathalie Beauvais

Kleinfelder



Lauren Zullo

Jonathan Rose Companies



Laurie Schoeman
Enterprise Community Partners





Preserving and Fortifying Multifamily Housing Across the Nation

Preserving Affordable Multifamily Housing Across the Nation



Prevent

Mitigate Risk

Understand risk, fortify your home/property, build capacity, and update operational guidelines.



Prepare

Get Ready for Impact

Update readiness plans, pack a "Go Bag", ensure back up systems are in place and align communications.



Respond

Disaster Strikes

Execute readiness plans, understand & apply for relief, and check on safety of staff and buildings' condition.



Rebuild

Build Better

Ensure equitable recovery, utilize building practices, and draw from the inherent strength in communities.

Preserving Affordable Housing From Climate Risk

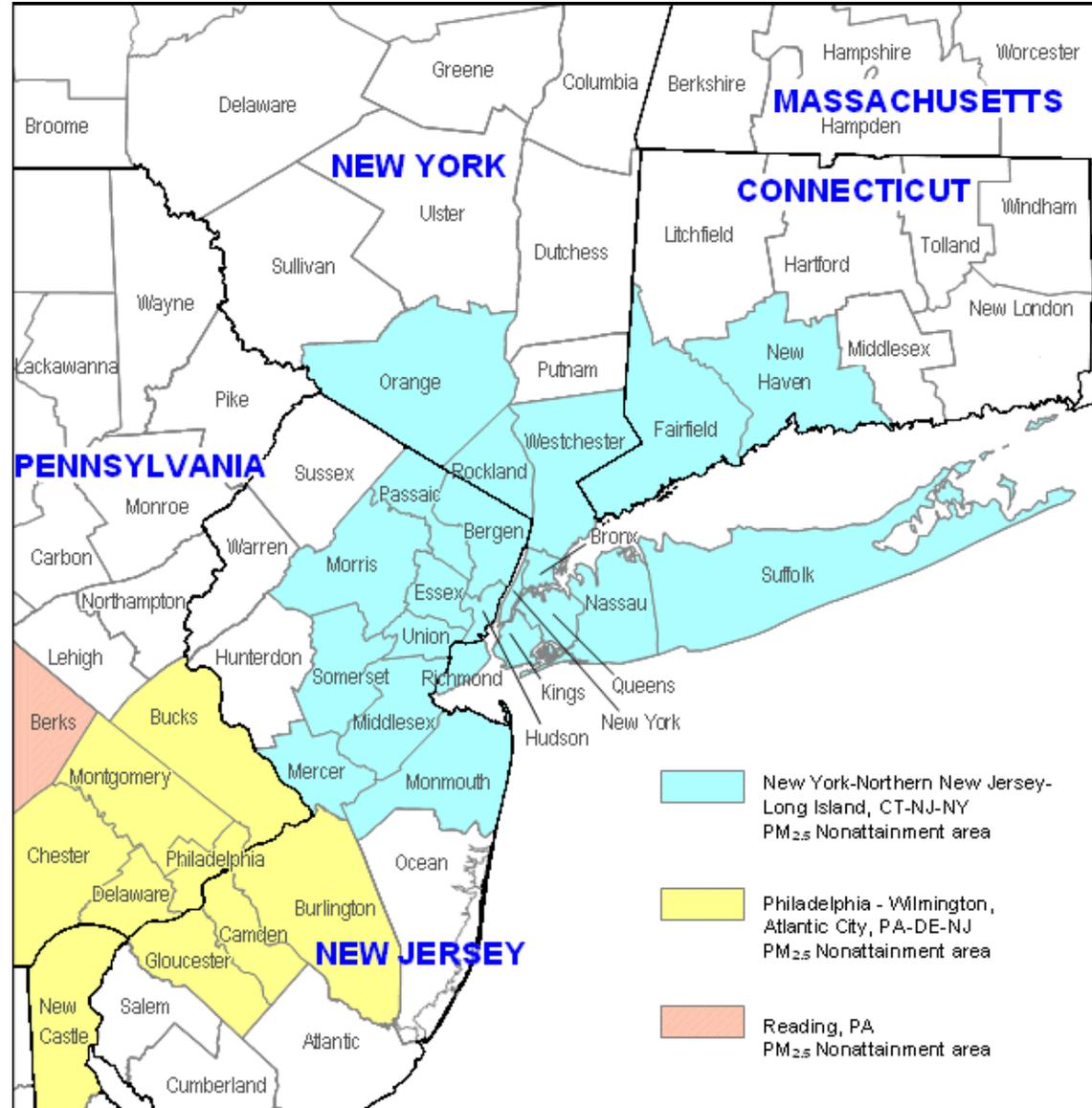




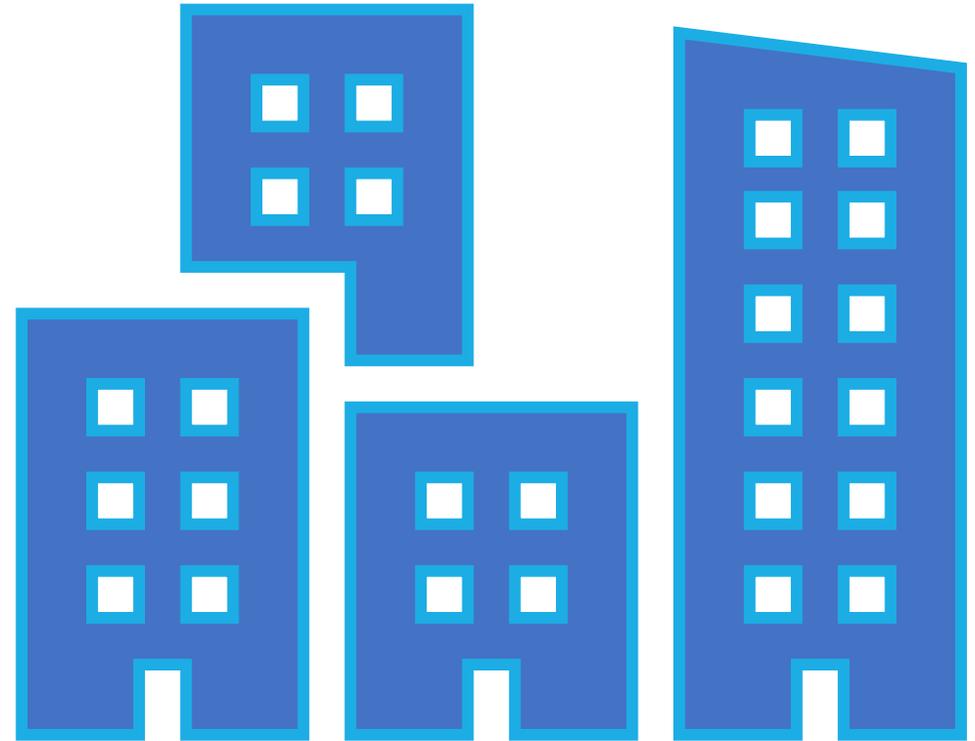
Superstorm Sandy



IT STARTED WITH A SIMPLE QUESTION?



**WHAT IS A
RESILIENT
MULTIFAMILY
RESIDENTIAL
BUILDING?**





Components of Resiliency

Physical Needs Assessment

- Tier Low to High Cost (including labor and complexity)
- Basement, Site, and Roof
- Consider Past, Present and Future
- Need to Engage Building Operations Staff
- Need to Train about Core Concepts
- Need To Connect to \$
- Energy, Water, Structure, MEP



150 Buildings Later

Elevation Not Feasible

Need to Capture Savings

Residents Need to Stay in Place

Funding Limited

VULNERABILITY ASSESSMENT, RESILIENCE AUDIT AND SOLAR TOOL FOR AFFORDABLE HOUSING

OVERVIEW



The DC Multi-Family Resilience & Solar Assessment Tool

Resilience Opportunity Assessment
 DC DOEE Resilience Audits/Solar for Affordable Housing
Solar for All

Category	Question	Assessment	A
	13. Is bicycle storage onsite, covered, and at ground level?		
	14. Are grab bars present in stairways, hallways, and bathrooms?		
Resilience - Mitigation and Adaptation	15. Is the building located in a FEMA or Climate Ready DC flood zone?	Yes	
	16. Is there an elevation certificate (FEMA document describing building's elevation relative to flood zones) for the building (if yes, please provide)?	Yes	
	17. Are there stormwater catch basins located around or on the site?	No	
	18. Are stormwater and sanitary sewer systems separated at this location?	No	
	19. If known, is the size of stormwater sewer piping adequate?	No	
	20. Is more than 50% of the site, not including building footprint, impervious surface or compacted soil?	No	
	21. Does the building share a party wall(s) with neighboring buildings?	Yes	
	22. Is the exterior siding material flood damage resistant?	Yes	
	23. Is there visible evidence of rot at the exterior walls, especially near the ground?	Yes	
	24. Is there structural wood in direct contact with soil?	No	
	25. Are there ground-level apartments located below the base flood elevation (BFE; the elevation to which water is expected to rise in a 1% annual chance or 100-year flood)?	No	
	26. Are there basements or crawlspaces below the BFE?	No	
	27. Are there exterior walls below the BFE made of a permeable type such as brick, stone, or rubble masonry?	Yes	
	28. Are there utility rooms located below the BFE?		
	29. Are there mechanical, electrical, telecom, or plumbing rooms located below the BFE?		
	30. Are there structural steel beams located below the BFE?		
	31. Are there utility lines (gas, water, sewer, or stormwater) located below the BFE?		
	32. Do any utility lines have backflow preventers?		
	33. Do any utility lines have backflow preventers located below the BFE?		
	34. Do any utility lines have backflow preventers located below the BFE?		
	35. Do any utility lines have backflow preventers located below the BFE?		
	36. Do any utility lines have backflow preventers located below the BFE?		
	37. Do any utility lines have backflow preventers located below the BFE?		
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	46. Do any utility lines have backflow preventers located below the BFE?		
	47. Do any utility lines have backflow preventers located below the BFE?		
	48. Do any utility lines have backflow preventers located below the BFE?		
	49. Do any utility lines have backflow preventers located below the BFE?		
	50. Do any utility lines have backflow preventers located below the BFE?		

Tab 1:
Project
Information

Tab 2:
Resilience
Assessment

Tab 3:
Strategies

Tab 4:
Energy &
Water

Tabs 5a&b:
Solar PV Feasibility
& Cash Flow

1 - Project Information
2 - Resilience Assessment
3 - Strategies
4 - Energy and Water
5a - Solar



The DC Multi-Family Resilience & Solar Assessment Tool

Resilience Opportunity Assessment

DC DOEE Resilience Audits/Solar for Affordable Housing

Solar for All

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	25. Are there ground-level apartments located below the base flood elevation (BFE) for the site (e.g., in a basement or crawlspace below the BFE)?	No	

Read instructions & input building info.

Answer Y/N/NA during walk through.

Review, select and describe property's resilience strategies.

Enter building utility rates and consumption info.

Complete solar PV Layout and capacity; and review projected Estimates.

1 - Project Information

2 - Resilience Assessment

3 - Strategies

4 - Energy and Water

5a - Solar

STRATEGIES FOR MULTIFAMILY HOUSING RESILIENCE

Community

Strategies that encourage behavior which enhances resilience.



Adaptation

Strategies that improve a facility's ability to adapt to changing climate conditions.



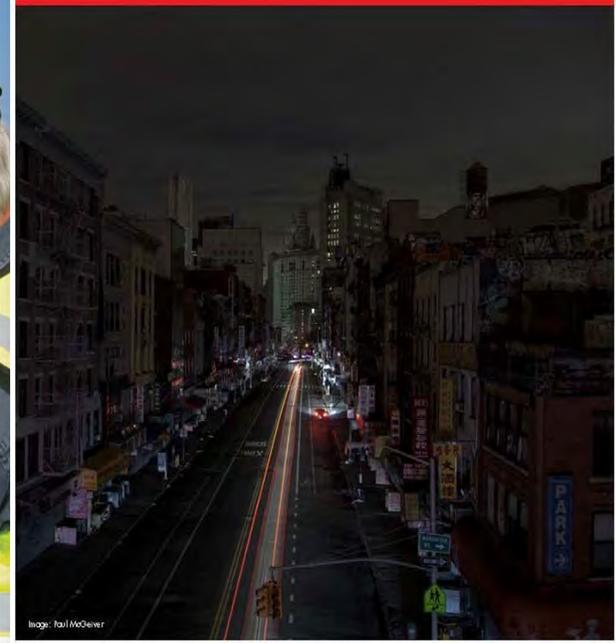
Protection

Strategies to reduce a building's vulnerability to extreme weather.



Backup

Strategies that provide critical needs when a facility loses power or other services.



THE PROCESS



WHATS AT RISK

Risks to Residents	Risks to Buildings	Risks to Business Continuity	Risks to the Community
 <ul style="list-style-type: none">» Injury or loss of life.» Psychological trauma.» Loss of property.» Economic hardship and loss of jobs.» Exposure to pathogens and toxins.» Security risk.» Housing displacement.» Loss of community services.	 <p>Damage to:</p> <ul style="list-style-type: none">» Envelope.» Building systems.» Communications infrastructure.» Roof.» Foundation.» Loss of housing units.» Loss of commercial and institutional tenants.	 <ul style="list-style-type: none">» Cost of repairs.» Displacement of tenants and loss of rental income.» Rising insurance rates.» Reduction in property value.» Regulatory fines.	 <ul style="list-style-type: none">» Destruction of public infrastructure.» Downturn in community business and economy.» Evacuation and Migration.» Disruption in transportation.» Loss of faith in public institutions.» Water supply contamination.

Elevation Terminology

Guidance on flood mitigation can be highly technical. Being familiar with these terms will help you better understand the recommendations in the following strategies.

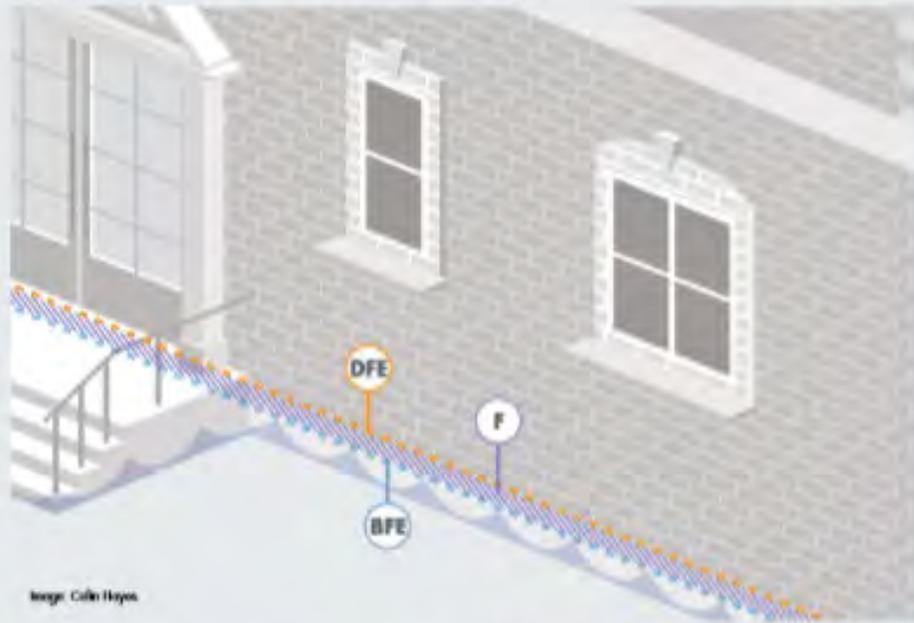


Image: Colin Hayes

BFE Base Flood Elevation (BFE) is measured from the crest of expected wave height. It does not take into account future sea-level rise from climate change.

DFE Design Flood Elevation (DFE) is BFE plus an additional amount of safety buffer or "freeboard". Although guidance varies by local codes, this is generally 1-2 ft. above the BFE. All design and elevation recommendations in this manual will refer to DFE.

F Freeboard is an additional safety buffer above the Base Flood Elevation. It can be thought of as the difference between the Base Flood Elevation and Design Flood Elevation.

Elevation Certificate lets a homeowner determine where their building lies in relation to the BFE. This document is required when purchasing flood insurance.

Building Types*

	Units	Floors	Year built	Typical building construction	Elevate
 Low to mid-rise walk-ups	8-50	3-6	pre-1929	Masonry structural walls, brick envelope, masonry or brick foundation, wood roof and wood joist floors.	Yes / No
 Low-rise contemporary	4-8	2-3	1920-present	Wood Frame, concrete block foundation and shingled roof.	No
 Mid-rise contemporary	10-250	4-12	1920-present	Masonry bearing wall with wood joists or concrete, concrete foundation, brick or wood framed envelope and tar roof membrane or shingled roof.	Yes
 High-rise contemporary	50-400	12-40	1950-present	Concrete masonry structure, CMU or slab on grade foundation, brick envelope and tar roof membrane.	Yes



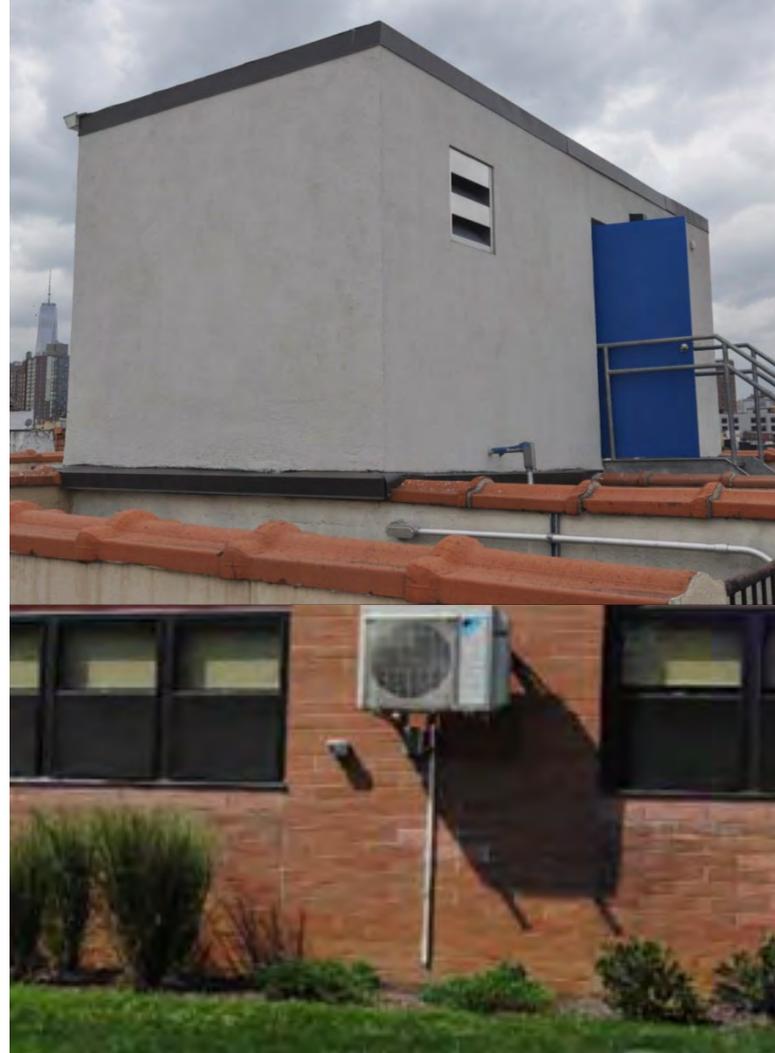
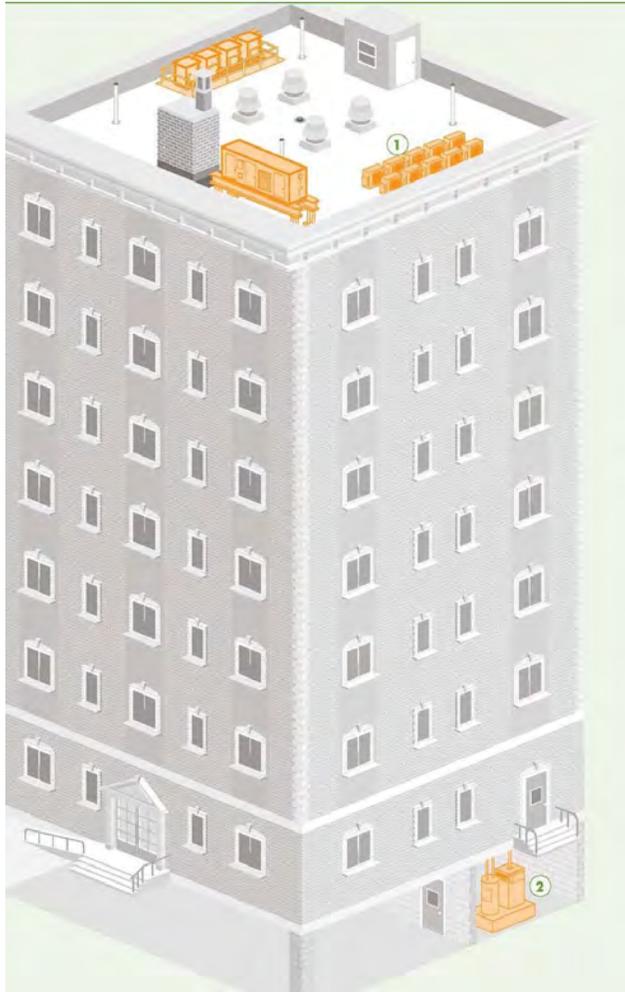
on — Low Cost
Cracks



Flood Prevention — Low Cost Sealing Cracks

Flood Prevention – Mid-High Cost

Elevated Equipment



Case Study: Services for the Underserved

Backup Generator for a 71-unit building -- \$380K

*****Load sized to
Common Spaces NOT
UNITS



Moxby Rigby, Freeport NY
\$5 million CDBG-DR funding via National Disaster Resilience Competition



Are Affordable Multifamily Housing Organizations Adequately Prepared for a Disaster?

- **46 percent reported that they were not fully prepared to maintain operations and services following a disaster.** The lowest level of preparedness related to Business Continuity was not having identified locations where administrative functions could relocate.
- **75 percent of respondents reported they were not fully prepared in terms of having adequate disaster plans and clearly assigned staff roles.**
- **65 percent of respondents reported they were not fully prepared in terms of planning, communication, and engagement with residents.**
- **48 percent reported that they were not fully prepared in terms of building preparation, emergency operation, and recovery.**

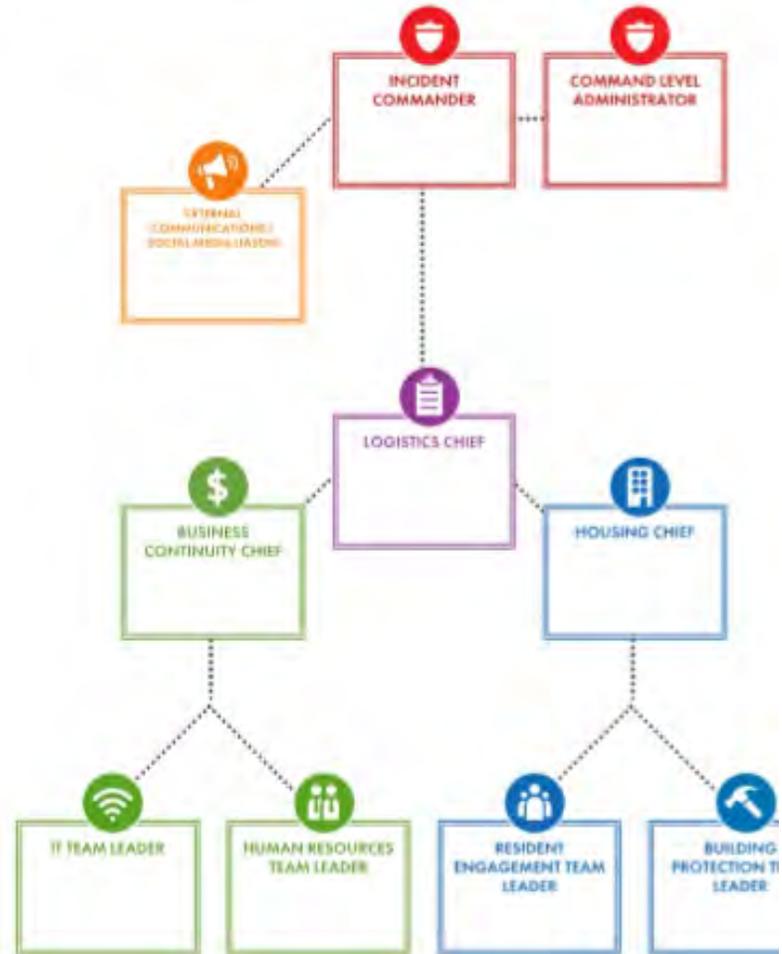
ARE YOU
READY TO RESPOND?



Fannie Mae

Staffing Chart

This Staffing Chart shows the recommended Disaster Response Roles to be filled by staff in your org. Staffing Chart is based on a chain of command led by the Incident Commander.



READY TO RESPOND DISASTER STAFFING TOOLKIT Building Readiness Report

This report organizes key information about your building.

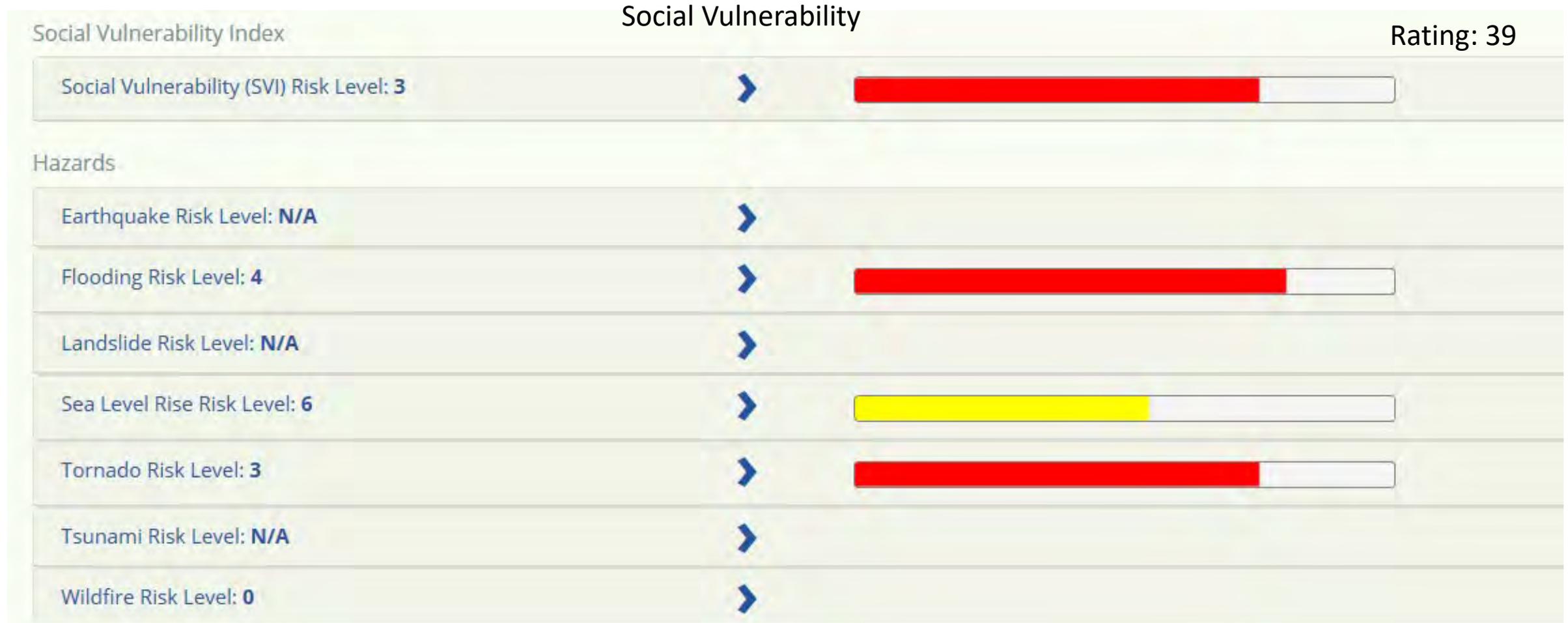
Building Information			
Building name			
Address		Evacuation zone	
Building Protection Team Leader			
Name			
Phone		Email	
Permission to use payment card	<input type="checkbox"/> Yes <input type="checkbox"/> No	Payment card limit	\$
Facility Superintendent or Property Manager			
Name			
Phone		Email	
Residential / Commercial Use			
Number of floors		Residential units	
		Vacant units	
Number of residents		Commercial units	
Primary contact for commercial space (Agency)			
Building Critical Systems			
Number of Elevators		On-site generators available	<input type="checkbox"/> Yes <input type="checkbox"/> No
Boiler hookup available	<input type="checkbox"/> Yes <input type="checkbox"/> No	Generator hookup available	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sufficient fuel stored for 3 days	<input type="checkbox"/> Yes <input type="checkbox"/> No	Sump pumps on site	<input type="checkbox"/> Yes <input type="checkbox"/> No
Post Event			
Emergency Kit available and in place	<input type="checkbox"/> Yes <input type="checkbox"/> No		
Damage assessment			
Notes			



Portfolio Protect-Rating Housing Climate Exposure

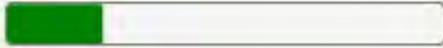
PORTFOLIO PROTECT

Rating your Portfolio Climate Vulnerability



do St, New Orleans, LA 70112, USA

Score: **21**



calculated your risk score by multiplying your Social Vulnerability by all your hazards.

ore range for USA is 0 - 96



rability Index

nerability (SVI) Risk Level: **3**



Prioritizing Your Portfolio Risk Investment

<input type="checkbox"/>	Action	Address	Risk Score	
<input type="checkbox"/>	VIEW RESULTS	1300 Perdido St, New Orleans, LA 70112, USA	21	<div><div style="width: 21%;"></div></div>
	VIEW RESULTS	658 Esters Blvd, Biloxi, MS 39530, USA	28	<div><div style="width: 28%;"></div></div>
<input type="checkbox"/>	VIEW RESULTS	S Howard Creek Dr, Biloxi, MS 39532, USA	21	<div><div style="width: 21%;"></div></div>
<input type="checkbox"/>	VIEW RESULTS	823 Rosenberg St, Galveston, TX 77550, USA	24	<div><div style="width: 24%;"></div></div>
<input type="checkbox"/>	VIEW RESULTS	202 W C St, San Diego, CA 92101, USA	12	<div><div style="width: 12%;"></div></div>

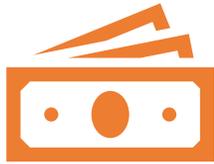


KEEP SAFE MIAMI

Opens February
2021!

- 50 Multifamily Housing Owners
- \$500K Funding from City of Miami
- Support: Facility, Operations, Resident Preparedness

Sounds Good. Now how do I fund this?



Grants



Loans



Direct Program Support

Weatherization

HGMP

CDBG

**KEEP
SAFE
AMERICA**

November 18th UVI,
NeighborWorks,
Enterprise Keep
Safe USVI

December 2nd
FEMA, Enterprise
Equity and
Mitigation

December 10th
Fannie Mae,
Enterprise Business
Continuity

February City of
Miami, Enterprise
Keep Safe Miami



CONTACT LAURIE SCHOEMAN
LSCHOEMAN@ENTERPRISECOMMUNITY.ORG

Q & A



Laurie Schoeman

Email: lschoeman@enterprisecommunity.org

Submit Questions

www.slido.com event code **#DOE**



U.S. DEPARTMENT OF
ENERGY



Tom Chase
New Ecology, Inc.



Nathalie Beauvais
Kleinfelder



November 17, 2020

Portfolio-Wide Climate Preparedness for Multifamily Housing

Overview

- **Intro** - Managing Climate Change Risk for Multi-family Housing Portfolios
- **Portfolio Prioritization** - Using Climate Change Risk and Vulnerability Assessment
- **Resilience Toolkit** – Building and Site Design Guidance and Requirements
- **Conclusion** - Lessons Learned

Goals of study -- Risk & Vulnerability Across the Public Housing Portfolio

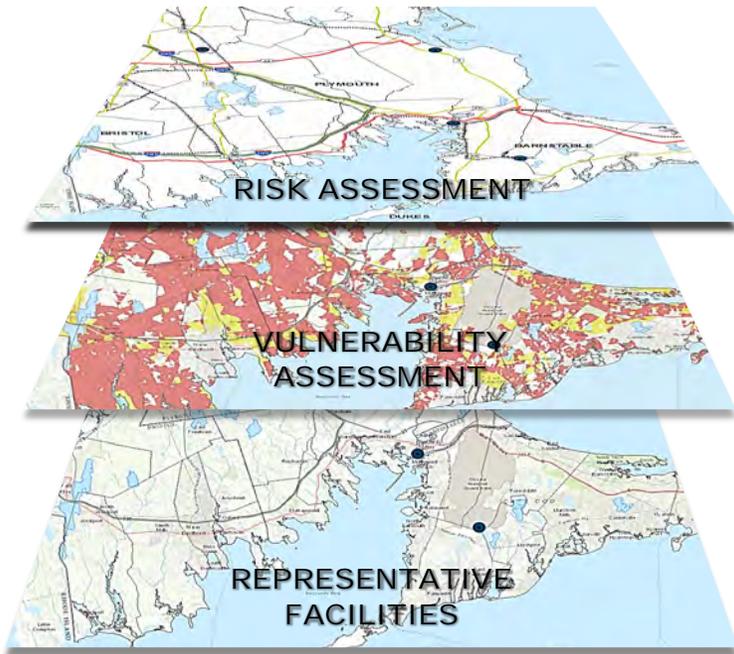
Address all State-Funded Public Housing Developments in MA (80,000 people in 1,430 developments/45,300 apartments)

- Assess risk & vulnerability score for every development
- Prioritize the most vulnerable developments
- Recommend resilience strategies integrated to capital planning improvements, for third-party owned and managed developments
- Provide limited, targeted funding assistance



Risk & Vulnerability Analysis

3 Steps Risk & Vulnerability Assessment



Step 3: Prioritization

Prioritization

Step 2: Per Climate Scenarios



Step 1: Criticality

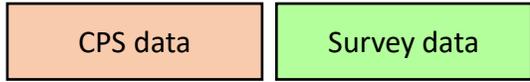


Vulnerability	High	May be priority planning areas	Should be priority planning areas
	Low	Are unlikely to be priority planning areas	May be priority planning areas
		Low	High
		Risk	

Guidelines
Action Plan
Implementation

Step 1: Criticality of DHCD Portfolio

- Each category score normalized on 10-point scale by multiplying by 10 and dividing by the number of inputs. The formula below assumes development has all possible 16 inputs (survey and CPS data).



$$\text{Total Criticality Score} = \frac{10 * \text{Scope Score}}{5} + \frac{10 * \text{Time Score}}{3} + \frac{10 * \text{Severity Score}}{8}$$

Scope		Time (to shelter in place)			Severity								Survey complete	Criticality Score				
Number of buildings in development	Estimated number of residents in development	Development has vulnerable populations (family, elderly, disabled)	Score	Development FCI (Expired Value/Replacement Value) 2015	Development has up-to-date emergency standby generator on-site	Development acts as a shelter for the community during emergencies	Score	Duration of longest historic stormwater or coastal flooding event at development	Development has up-to-date wastewater treatment infrastructure on site	Number of times residents or staff have experienced weather-related challenges getting to and from work in the past 5 years	Development relies on other community facilities for shelter during emergencies	Development's emergency plan is referenced by the local municipality			Number of local hazards within 5 miles of development	Development has oil or propane storage tank	Number of times development has been evacuated in the past 5 years	Score
1 = 0 >1 = 1	<50 = 0 50-99 = 1 >100 = 2	Chapter 200, 705 = 0 Chapter 667 = 1 Chapter 167, 689 = 2	Sum: Max w/ all=5 Max w/o survey=5 Max w/o cps=5 Min = 0	>= 15% = 0 <15% = 1	No = 0 Yes = 1	No = 0 Yes = 1	Sum: Max w/ all=3 Max w/o survey=2 Max w/o cps=2 Min = 0	< 6 hours = 0 >= 6 hours = 1	No = 0 Yes (any of the 4 components) = 1	0 = 0 >=1 = 1	No = 0 Yes = 1	Yes = 0 No = 1	0 = 0 >=1 = 1	No = 0 Yes = 1	0 = 0 >=1 = 1	Sum: Max w/ all=8 Max w/o survey=2 Max w/o cps=6 Min = 0	Yes/No	Normalized
Sum				Sum				Sum										

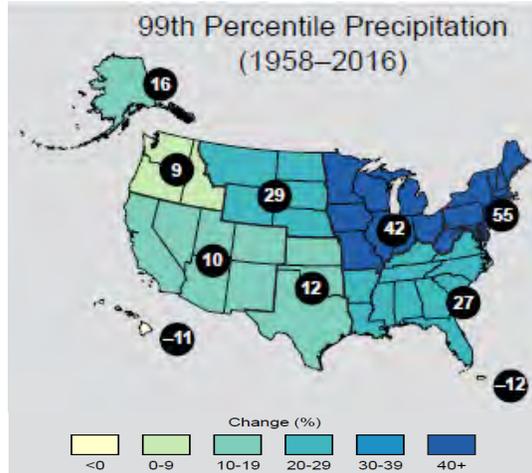
Step 2: Climate Scenarios

Temperature



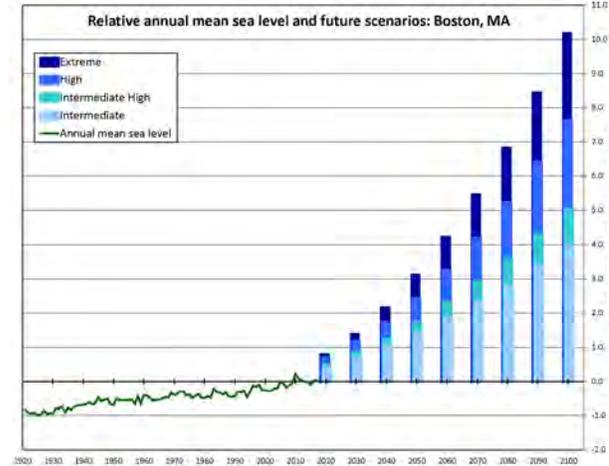
Source: USACE, 2013

Precipitation

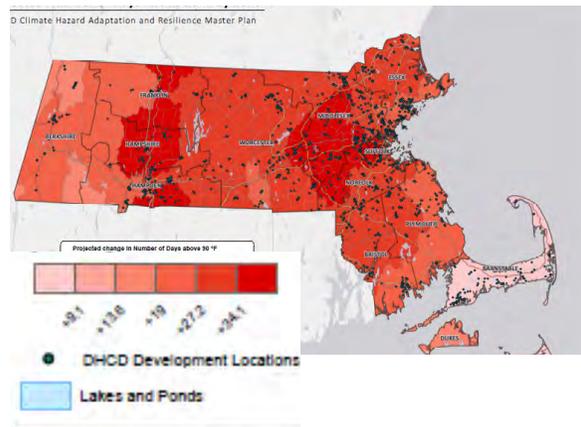


Northeast saw a 55% increase in heavy precipitation (top 1% of all non-zero precipitation days) from 1958-2016. (Source: NOAA NCEI 2017)

Sea Level Rise (SLR)

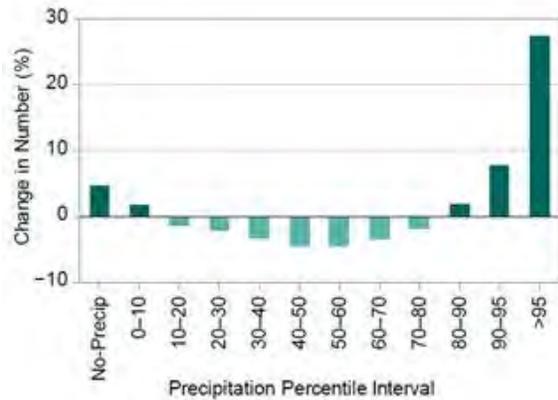


More extreme events

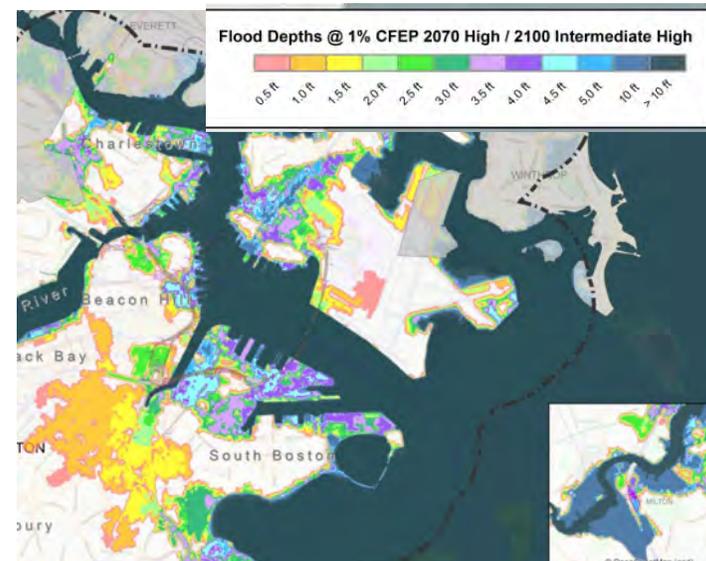


Projected Days above 90 F by 2070

Source: ResilientMA



Northeast expected to see >25% increase in heavy precipitation (top 5% of all non-zero precipitation days). (Source: ResilientMA 2019)



Source: MassDOT, BH-FRM model

Exposure - Overview

Survey data

$$\text{Sensitivity Score} = \left(2 * \text{Exp}_{\text{primary,present}} + 1.5 * \text{Exp}_{\text{primary,2030}} + 1.25 * \text{Exp}_{\text{primary,2070}} + 1 * \text{Exp}_{\text{Related}} \right) * \frac{10}{25}$$

SLR/Storm Surge from BH-FRM or SLOSH					Precipitation						Temperature				Severe Winter Storms (SHMCA Report)		Landslide (SHMCA Report)		Drought - Consecutive Dry Days (ResilientMA)		Wildfire (SHMCA Report)		Extreme Wind (SHMCA Report)		Sensitivity Score	Sensitivity Score Weighted	Sensitivity Score (Normalized)
					Days per year with rain > 2-inches (ResilientMA)			Inland Flooding from FEMA			Days with Tmax > 90°F (ResilientMA)		Maximum Annual Temperature (ResilientMA)		Number of prior winter storm events that caused damage	Declared snow emergencies	Exposure level	2030	2070	Number of prior wildfire events experienced at development	Exposure level	Number of prior wind or tornado events that caused damage	Exposure level				
Present % Probability	2030 % Probability	2030 (SLOSH Cat 1)	2070 % Probability	2070 (SLOSH Cat 2)	Number of prior stormwater flooding events at development	2030s (2020-2049)	2070s (2060-2089)	Number of prior coastal or riverine flooding events at development	2030 (100-year)	2070 (500-year)	Number of prior extreme heat events where development has	2030s (2020-2049)	2070s (2060-2089)	2030s (2020-2049)	2070s (2060-2089)	Number of prior winter storm events that caused damage	Declared snow emergencies	Exposure level	2030	2070	Number of prior wildfire events experienced at development	Exposure level	Number of prior wind or tornado events that caused damage	Exposure level			
0% = 0 >0% = 1	0% = 0 >0% = 1	No = 0 Yes = 1	0% = 0 >0% = 1	No = 0 Yes = 1	0 = 0 >0 = 1	<0.32 day increase = 0 >= 0.32 day increase = 1	<0.32 day increase = 0 >= 0.32 day increase = 1	0 = 0 >0 = 1	No = 0 Yes = 1	No = 0 Yes = 1	0 = 0 >0 = 1	<27.2 day increase = 0 >= 27.2 day increase = 1	<27.2 days = 0 >= 27.2 days = 1	<6 degrees F increase = 0 >= 6 degrees F increase = 1	<6 degrees F increase = 0 >= 6 degrees F increase = 1	0 = 0 >0 = 1	<9 = 0 >= 9 = 1	stable = 0 low stability/moderately unstable/unstable = 1	<1 day increase = 0 >= 1 day increase = 1	<1 day increase = 0 >= 1 day increase = 1	0 = 0 >0 = 1	interface = 0 intermix = 1	0 = 0 >0 = 1	<90/90/100 mph = 0 110mph = 1	Sum: Max w/ all = 25 Max w/o survey = 19 Max w/o cps = N/A Min = 0	Weighted sum based on Tier 1 or Tier 2 categorization	Normalized
sum					sum						sum				sum												

Step 2: Identify Development Most at Risk

Vulnerability is defined by a person's or asset's exposure, sensitivity and capacity to adapt.

Risk is defined by the extent and probability of harm occurring.

Adaptive Capacity (informed by Survey)

People

Operations

Infrastructure

Vulnerable Population
(below 5, above 65, disability, mental health)

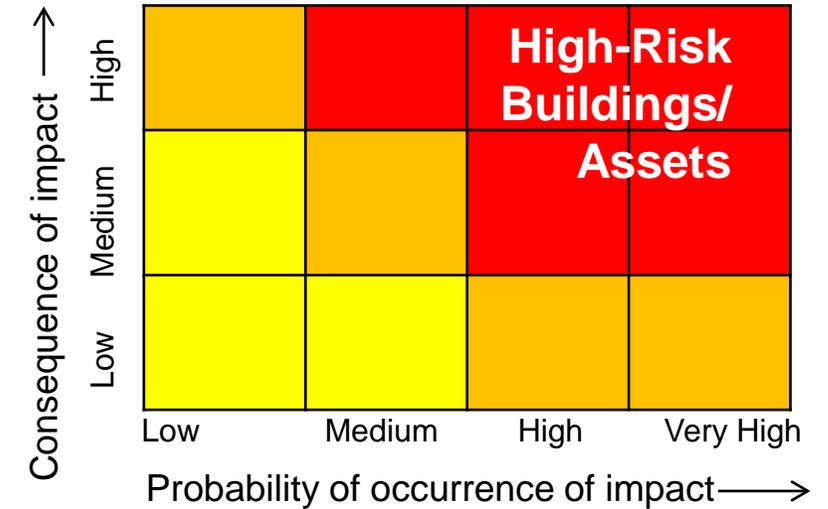
Emergency Preparedness Plan

Temporary Services

Backup

Potable Water

Generator
(type, runtime, location)



Risk Matrix

Step 3: Prioritization

Vulnerability (V)	High	229 Developments May be Priority (High V, Low R)	189 Developments High Priority (High V, High R)
	Low	869 Developments Unlikely to be Priority (Low V, Low R)	60 Developments May be Priority (Low V, High R)
		Low	High
		Risk (R)	

Figure 1 - Priority Ranking Table

- 189 developments were identified as high priority
- 289 developments a priority
- 869 developments were at low risk and low probability

(83 not assessed as noncritical support facilities)

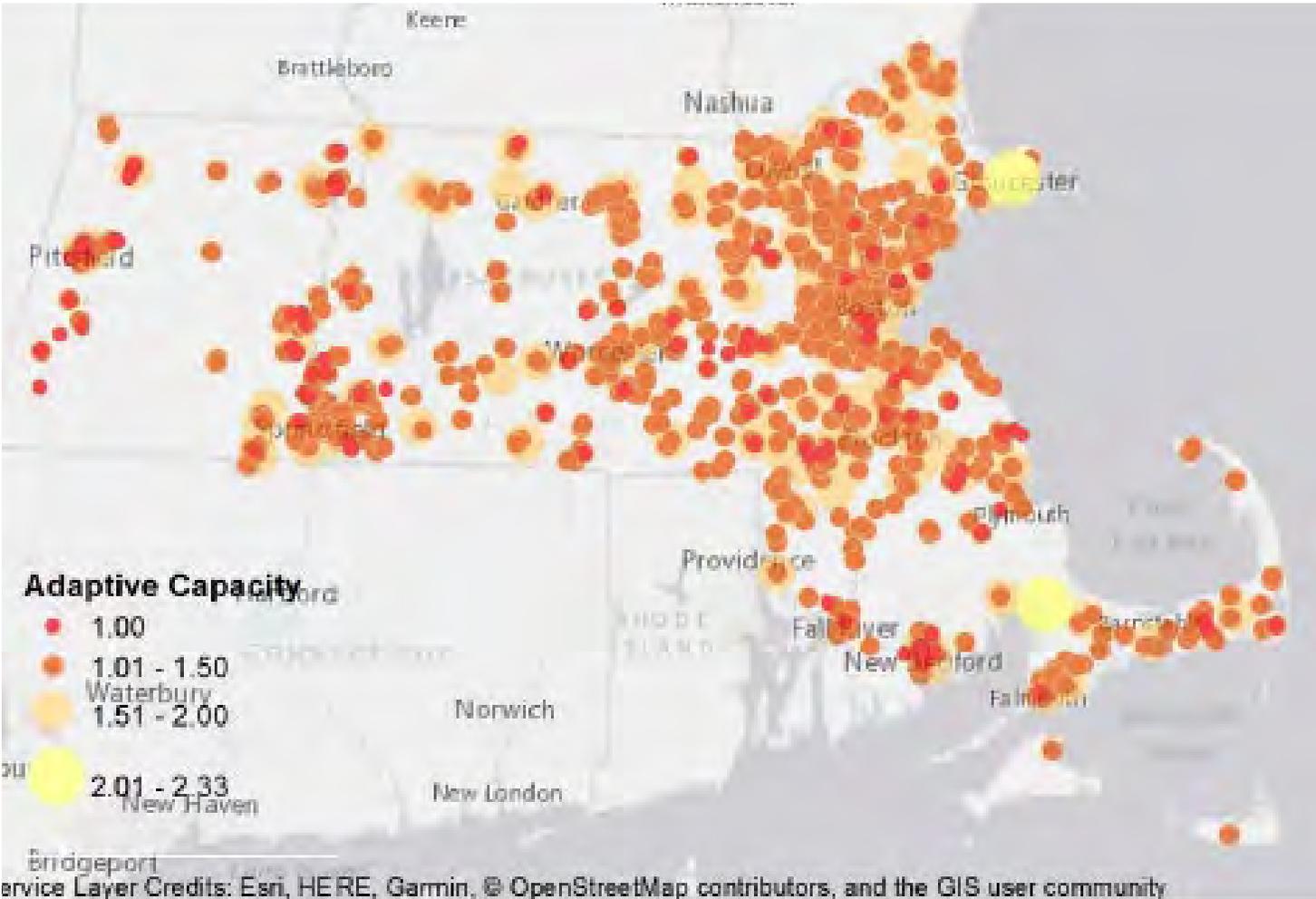


Figure 4 – Adaptive capacity score geographical distribution



Resilience in Capital Planning

Rapid RVA Tool

- 34 questions
- Can be completed in 20-30 minutes by experience property manager for each development
- Provides 0-100 “Resilience Score”
- Used for:
 - Individual capital planning projects by local housing authority staff
 - Educational tool
 - Check on recommended resilience measures and associated design guidance by architects and engineers
 - 5-year capital needs assessment as component of third-party assessment data forms

Rapid RVA Tool

Rapid Risk and Vulnerability Assessment | CHARM

Massachusetts Department of Housing and Community Development

INSTRUCTIONS

This tool is intended to educate and guide LHA users in planning more resilient developments. Please use the following questions to gather information about a given development by walking the site and in conversation with site managers and staff. For "NO" answers, see applicable resilience strategies to consider in the column to the right. Refer to the Resilience Strategies page to identify and explore potential strategies. Related hazards are identified as follows: "EP" = emergency preparedness, "P/SLRSS" = precipitation/sea level rise and storm surge, "H" = extreme heat, "W" = wind. Each "YES" answer receives a score of 3, each "NO" answer receives a score of 0. Total scores for all questions to derive development Resilience Score.

RESILIENCE SCORE
Scores are out of 100 points, with 100 being most resilient.
49

Property Name	Prattville Apartments, Chelsea, MA
Assessment Completed By	Tom Chase
Date	5/28/20

ASSESSMENT QUESTIONS

PROPERTY MANAGEMENT	YES / NO	HAZARD(s)	COMMENTS	APPLICABLE RESILIENCE STRATEGIES	SCORE
Does the development have an emergency management plan covering staff, residents, and business operations continuity?	NO	EP	Some evacuation planning in place	22	0
Is the emergency management plan referenced by the municipal emergency plan? Check with municipal officials to confirm.	NO	EP		22	0
Are staff familiar with the emergency preparedness plan and aware of their role in it, if identified?	NO	EP		22	0
Is there a nearby public facility where residents can go during power outages, storms or extreme heat or cold?	NO	EP		26	0
Are residents able to evacuate without mobility assistance?	YES	EP		22, 26, 27	3

Resilience Strategies Recommendations

Resilience Strategies | CHARM

Massachusetts Department of Housing and Community Development

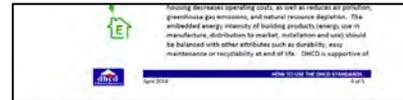
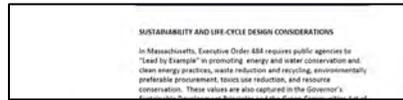
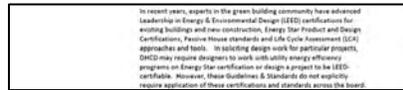
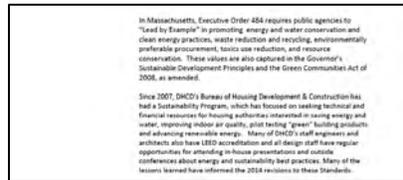
INSTRUCTIONS

Use the strategy ID number below to match applicable strategies as identified during the Rapid Risk and Vulnerability Assessment.

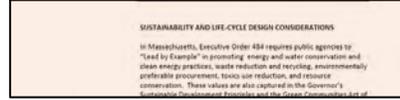
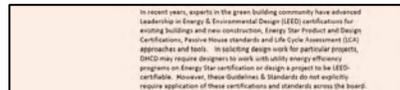
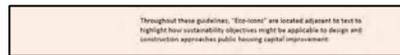
STRATEGY ID	STRATEGY NAME	HAZARD(S)	STRATEGY DETAILS	APPLICABLE DESIGN GUIDELINE SECTION
1	Wet Floodproofing	P/SLRSS	FEMA defines wet floodproofing as "Permanent or temporary measures applied to a structure or its contents that prevent or provide resistance to damage from flooding while allowing floodwater to enter the structure or area. Generally, this includes properly anchoring the structure, using flood resistant materials below the Base Flood Elevation (BFE), protection of mechanical and utility equipment, and use of openings or breakaway walls."	06 10 00 ROUGH CARPENTRY 06 20 00 FINISH CARPENTRY 08 10 00 DOORS AND FRAMES 09 20 00 GYPSUM 09 30 00 TILE 09 64 00 WOOD FLOORING 09 65 00 RESILIENT FLOORING 09 68 00 CARPET 09 90 00 PAINTING 14 20 00 ELEVATORS 22 00 00 PLUMBING 23 00 00 HVAC 26 00 00 ELECTRICAL 33 00 00 SITE UTILITIES
2	Dry Floodproofing (Building)	P/SLRSS	Dry floodproofing of a building is installing measures applied to a structure to prevent damage from flooding by preventing floodwater from entering the structure. There are two types of dry floodproofing: active and permanent. Active measures require removable elements to be put into place before an anticipated flood. Permanent measures are fixtures and systems integrated into the structure itself, which do not need to be manually deployed in the event of an emergency. Dry floodproofing is prone to a high risk of failing in lightweight wood-framed buildings, however, and is not recommended for wood-framed building exteriors or openings per FEMA guidance.	07 10 00 WATERPROOFING AND DAMPPROOFING 07 90 00 SEALANTS 08 10 00 DOORS AND FRAMES 32 30 00 SITE IMPROVEMENTS 33 00 00 SITE UTILITIES

DHCD Design Guidelines Revisions

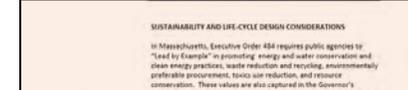
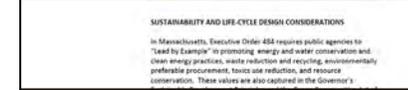
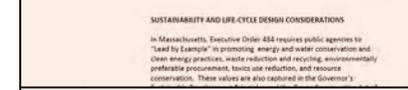
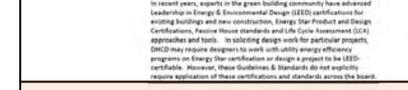
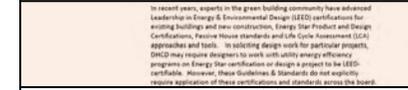
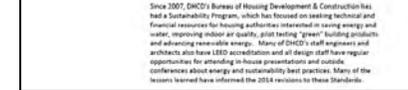
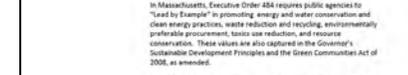
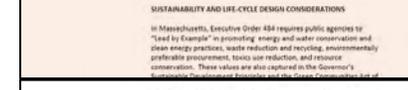
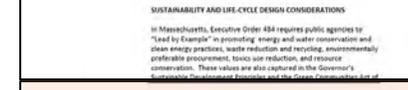
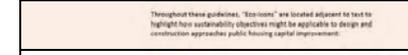
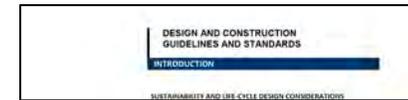
Existing DHCD Design Guidelines by CSI Section



New Resilience Design Guidelines by CSI Section



Revised DHCD Design Guidelines by CSI Section



DHCD Design Guidelines Example

DESIGN AND CONSTRUCTION GUIDELINES AND STANDARDS DIVISION 32 • EXTERIOR IMPROVEMENTS

32 12 00 • ASPHALT PAVING

SECTION INCLUDES

Bituminous Concrete Paving of Roads and Walkways

RELATED GUIDELINE SECTIONS

02 41 00	Demolition
03 30 00	Concrete
22 00 00	Plumbing
26 00 00	Electrical
31 00 00	Earthwork
32 30 00	Site Improvements
32 80 00	Site Irrigation
32 90 00	Landscape
33 00 00	Site Utilities

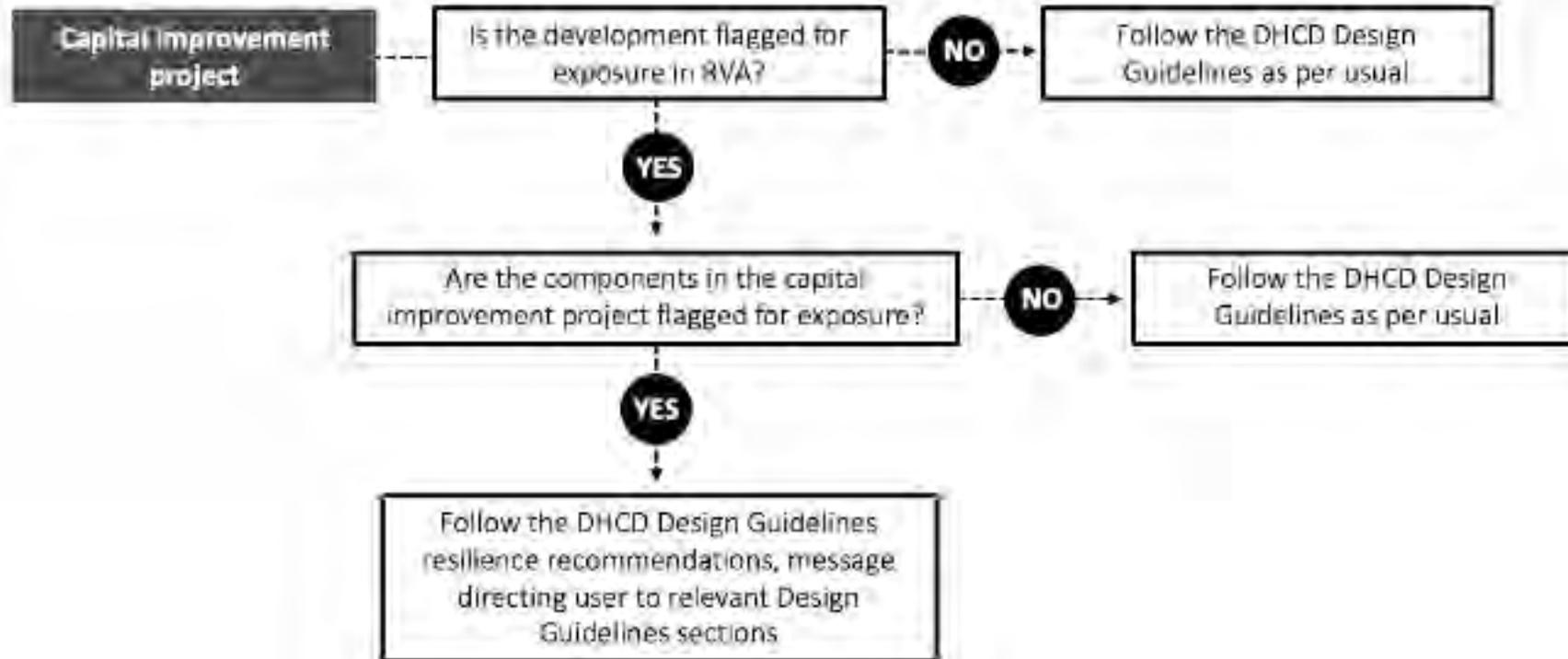
Climate Resilience Design Considerations

Pavement presents an opportunity to address heat island effects and manage stormwater. Some pavement types can help mitigate both concerns. Light colored pavement (high albedo) and open grid pavement help reduce heat impacts. Open grid and permeable pavements help absorb stormwater. Some materials will require modified maintenance practices.



DHCD Systems Guidance

CPS Development Exposure and Component Flagging:

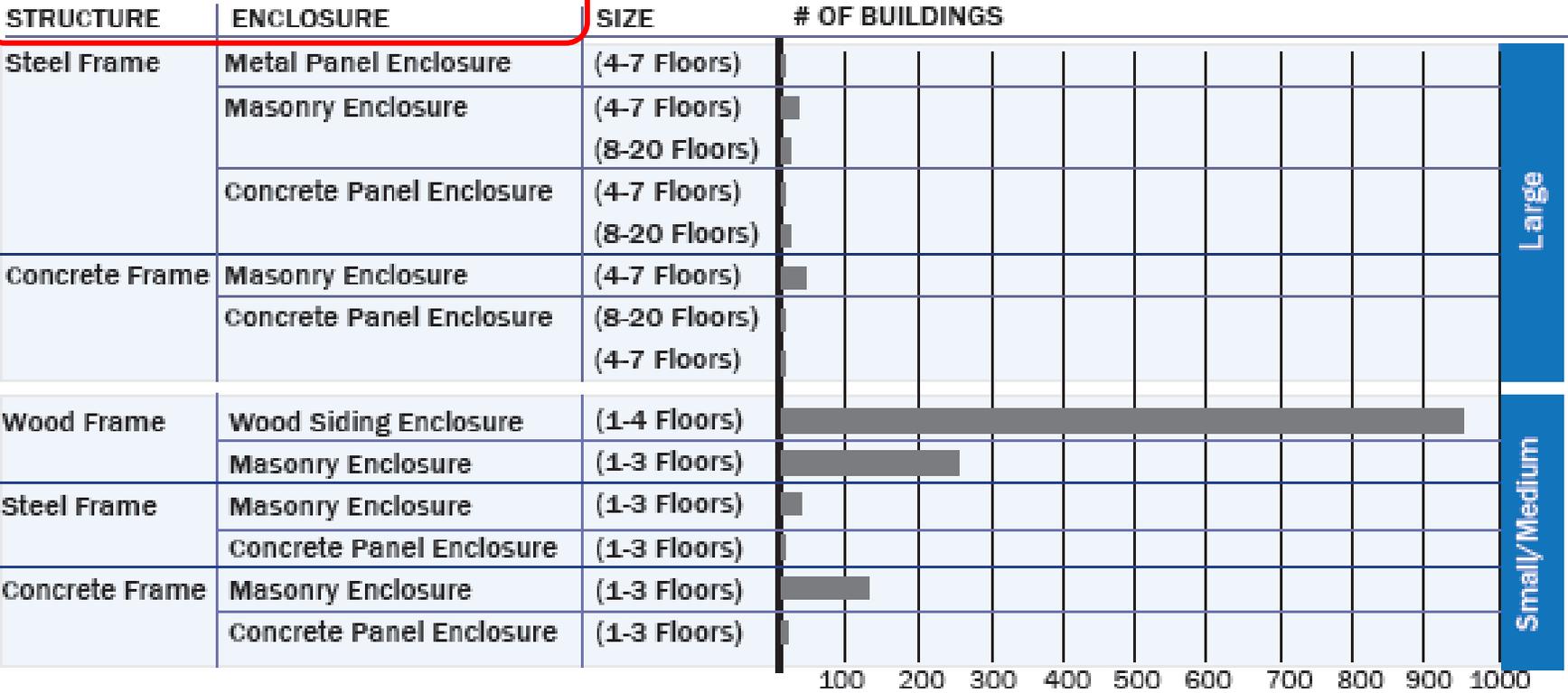




Building and Site Guidelines

LHA Buildings by Construction Type

LHA BUILDINGS BY CONSTRUCTION TYPE



LARGE BUILDINGS

The most common construction type for large buildings are steel or concrete masonry structure with masonry enclosure. Large building developments are likely to have elevators and centralized mechanical and electrical equipment.



Example: McCarthy Building - Melrose Housing Authority is characterized as Large by masonry frame, masonry enclosure, seven stories.

SMALL/MEDIUM BUILDINGS

The most common construction type for small/medium building is wood frame, wood or masonry enclosure. Small building developments are likely to have multiple small buildings with individual mechanical and electrical equipment.



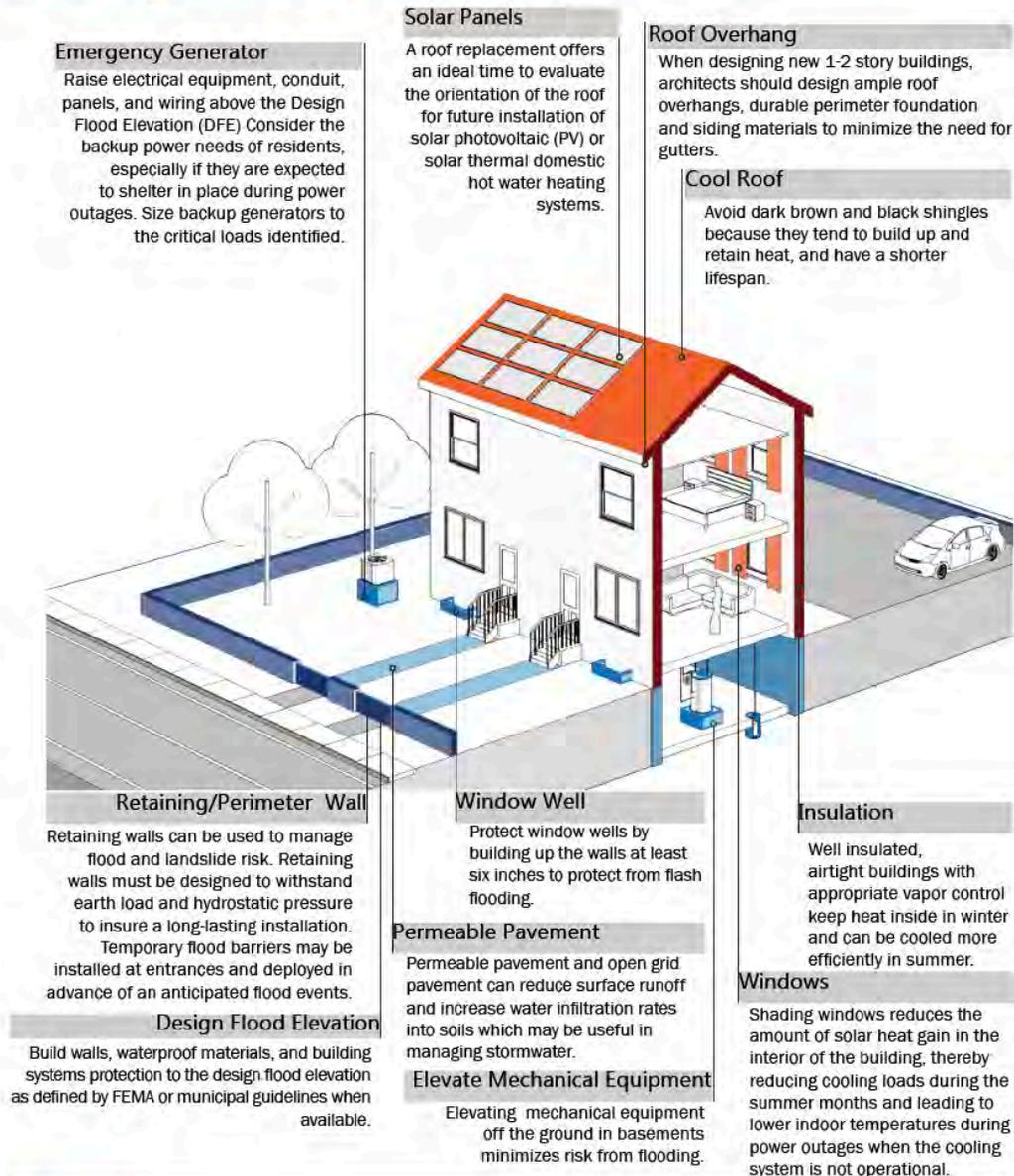
Example: Lee Fort Terrace - Salem Housing Authority is characterized as Small/Medium by wood frame, masonry enclosure, single story.

Resilience Best Practices

Building Strategies				
Resilient Structure and Enclosure The most effective wall assemblies are well insulated, air and water tight to keep flooding out and maintain comfortable indoor temperature.	Climate Hazard			Guideline Section
	 PRECIPITATION	 STORM SURGE	 EXTREME HEAT	
Repairing or improving the thermal performance of masonry at all properties should always be done with attention to managing moisture and permeability as well as thermal performance.				04 20 00 Unit Masonry
Use wood building materials which are considered flood damage resistant, meaning they can withstand direct contact with water for at least 72 hours without being significantly damaged.				06 10 00 Rough Carpentry 06 20 00 Finish Carpentry
For some residential buildings, the Massachusetts Energy Code requires a continuous air barrier assembly for new construction buildings or additions at opaque exterior walls or soffits, including joints and junctions to abutting constructions to control air movement through the wall. The air barrier also serves as a liquid-water drainage plane when flashed to discharge water to the exterior.				07 10 00 Waterproofing and Dampproofing
The most effective wall assemblies have a primary water barrier (the exterior cladding: brick, clapboards, shingles, etc.) and a secondary, vapor-open, bulk water barrier (house wrap with all joints taped, peel-and-stick membrane, liquid-applied air and water barrier, or other product).				07 20 00 Building Insulation & Moisture Protection
Making improvements to roof drainage will help buildings address water penetration and structural failures. Improving roof insulation at the eaves of sloped roofs will reduce the freeze-thaw cycling of ice and snow on the roof that leads to ice dams.				07 30 00 Asphalt Roof Shingles

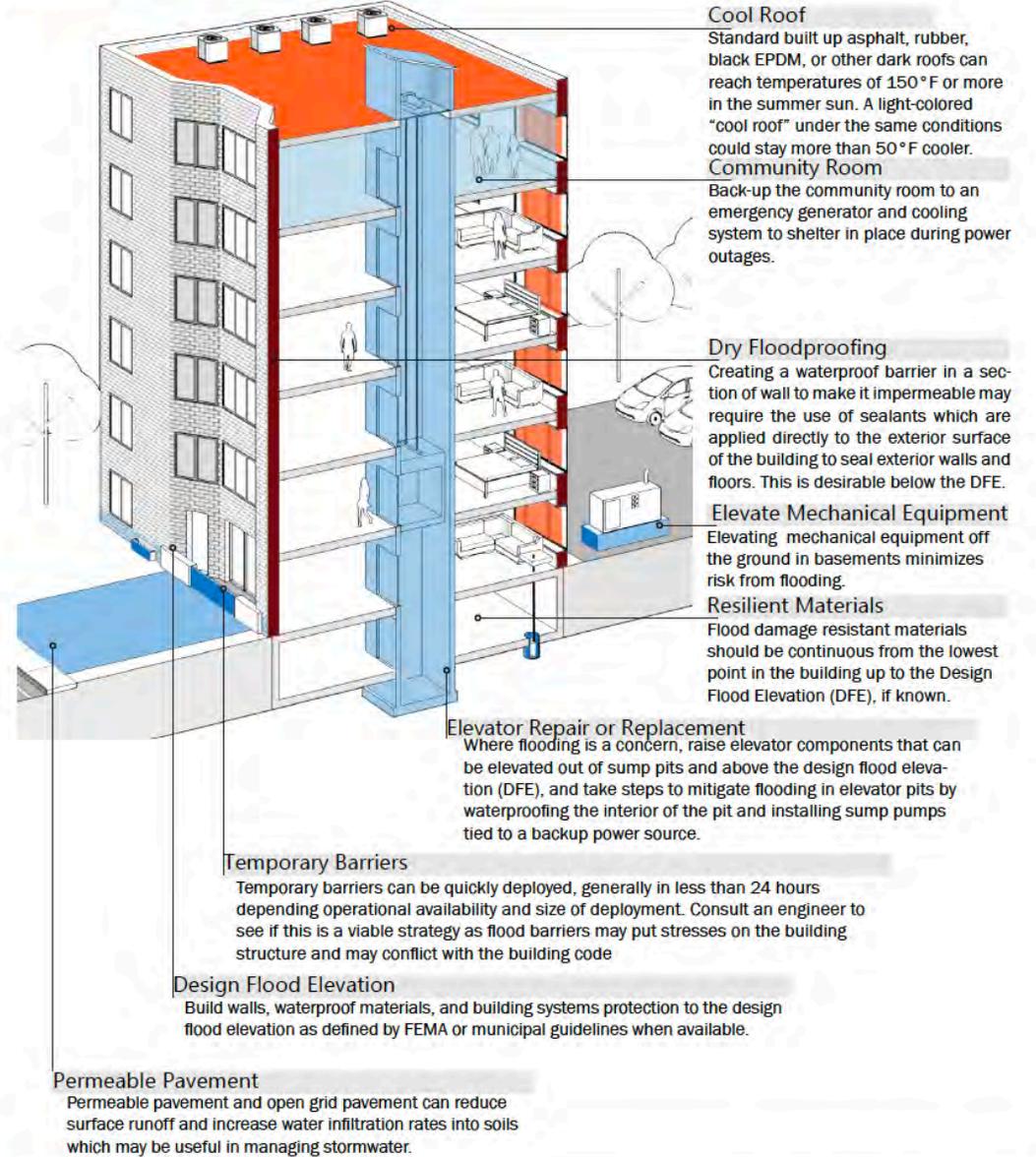
SMALL/MEDIUM DEVELOPMENT STRATEGIES

The graphic below demonstrates a suite of potential strategies for wood frame, wood enclosure and wood frame, masonry enclosure buildings, the most common small/medium construction types in the DHCD portfolio. For wood frame, wood enclosure buildings in flood zones, elevating the building may also be possible.



LARGE DEVELOPMENT STRATEGIES

The graphic below demonstrates a suite of potential strategies for a concrete frame, masonry enclosure building, the most common large construction type in the DHCD portfolio.



thank you

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Q & A



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Submit Questions
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U.S. DEPARTMENT OF
ENERGY



Lauren Zullo
Jonathan Rose Companies

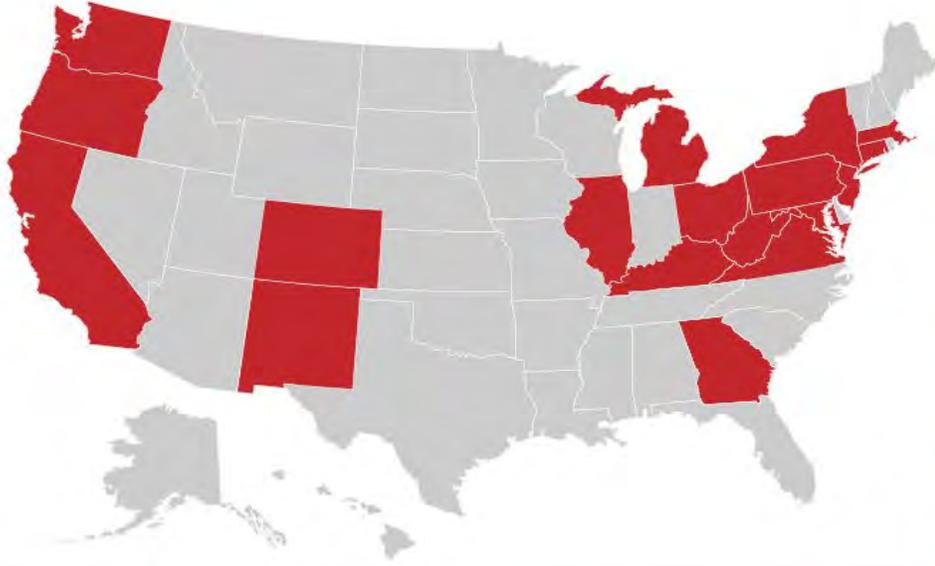


Strengthening Communities: A Portfolio Approach



Lauren Zullo, LEED AP
Director of Environmental Impact
Jonathan Rose Companies
Better Buildings Challenge
November 17, 2020

Company Overview



400+
Employees

11 million+
Square Feet

\$3.2 billion
Invested in Acquisitions
And Development

15,000+
Residential Units Across
18 States and D.C.

5 Offices
Across the U.S.A

13,000+
Affordable Units





Physical risk from increasing frequency and severity of natural disasters due to climate change



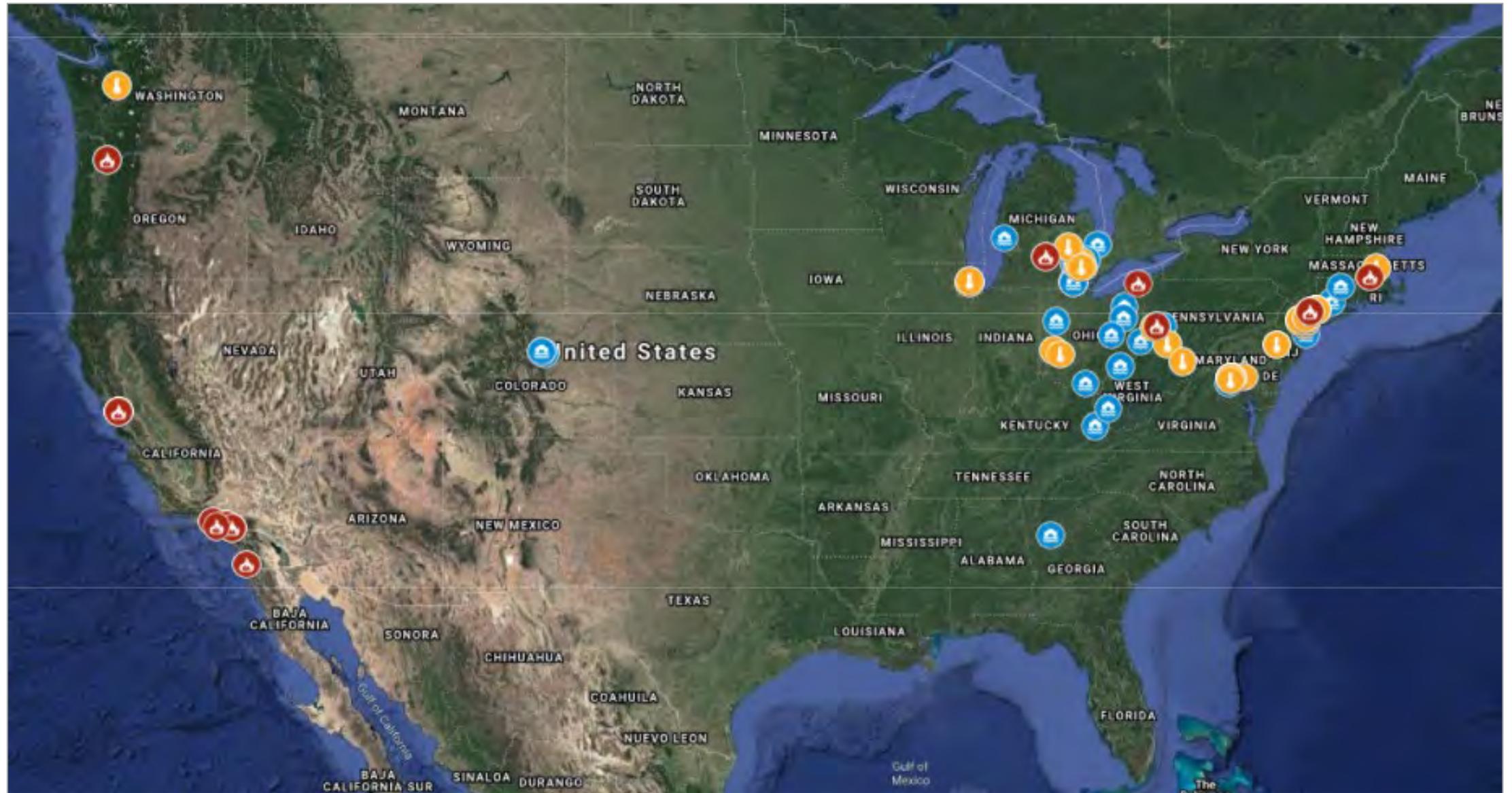
Transition risk from changes in markets, technologies, policy, and legal frameworks due to a transition to a low-carbon economy



Social risk and physical security from lack of social cohesion or opportunity under stressors



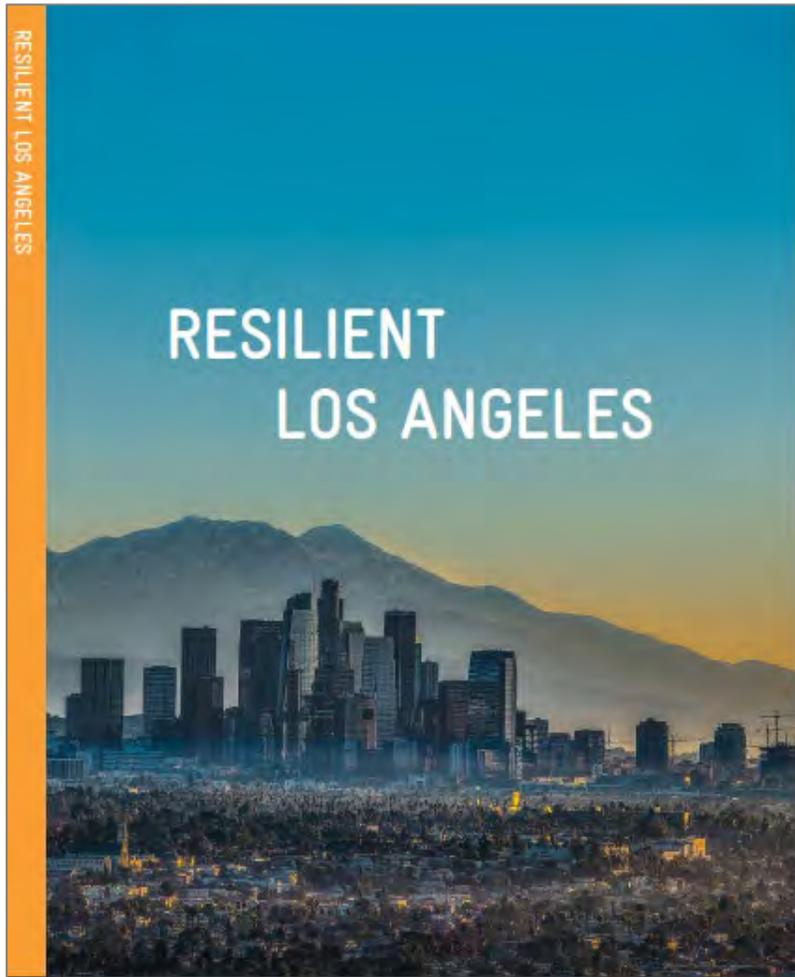
- **GRESB Resilience Module** is a supplement to the GRESB Real Estate and Infrastructure Assessments
- Alignment with **Task Force on Climate Related Financial Disclosures (TCFD)**
- In 2019, Jonathan Rose Companies ranked **1st Place** globally, for private entities in our peer group



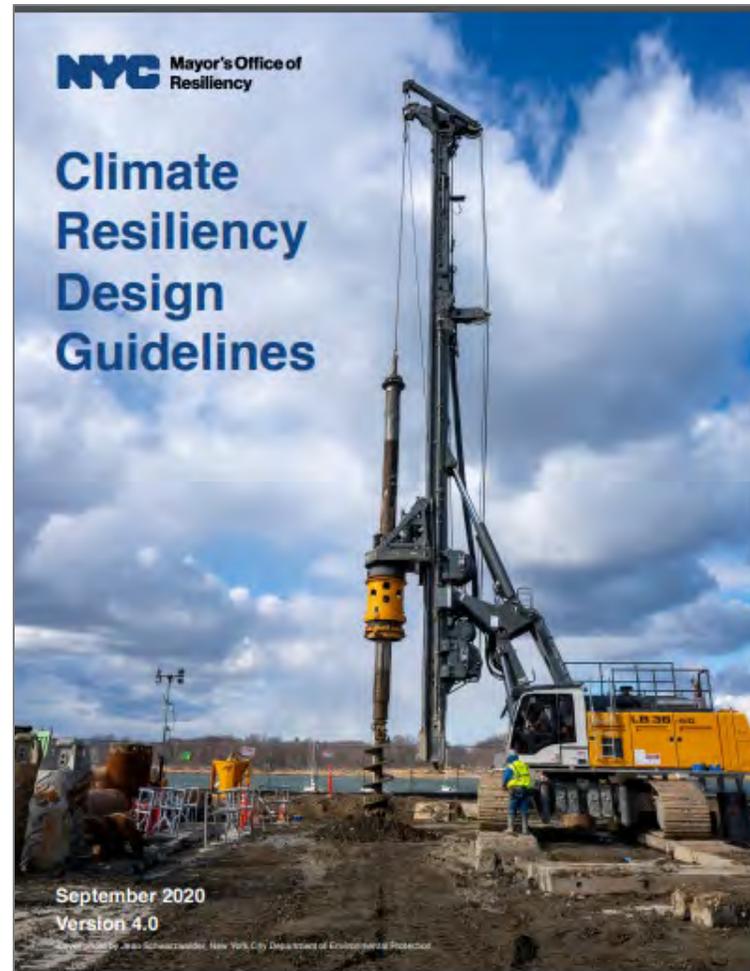
Top Risks: Flooding | Winter Storms | Extreme Heat | Tornadoes | Drought



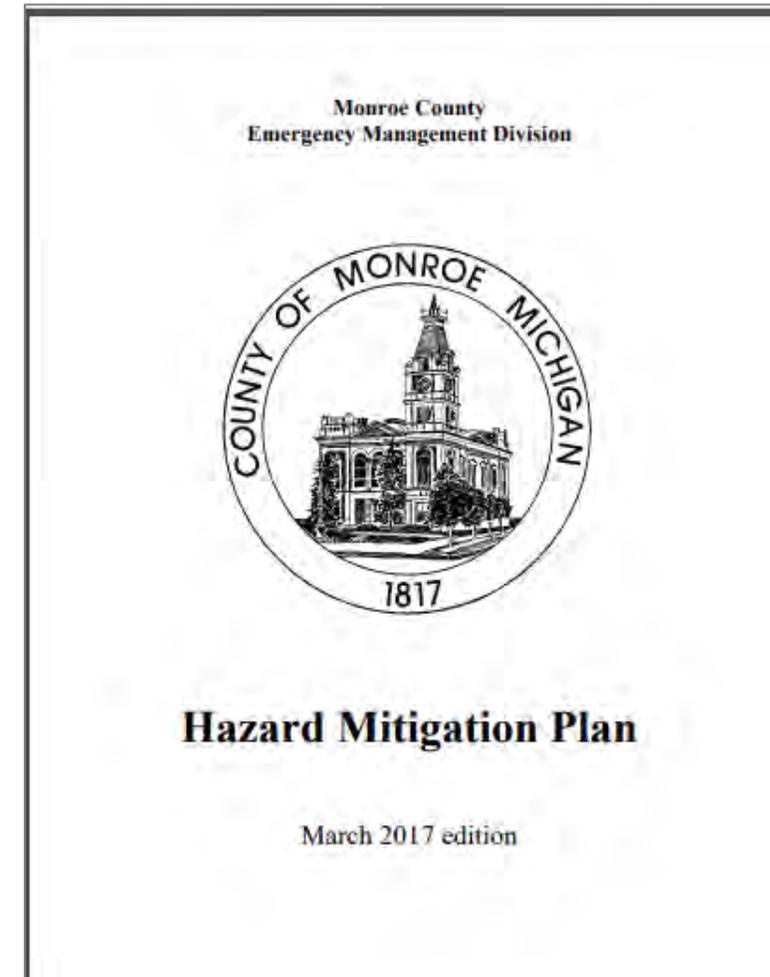
EXAMPLE DOCUMENT TYPES:



Climate Resilience Plan
Los Angeles, CA



Resiliency Design Guidelines
New York, NY



Hazard Mitigation Plan
Monroe, MI

READY TO RESPOND

Strategies for Multifamily Building Resilience



Disaster Preparedness
for Affordable
Housing Organizations

Enterprise
green
communities®

Evaluate impacts and interventions

- Building-level impacts caused by stressors
- Strategies to mitigate risk and approx. cost
- Availability of capital
- Pervasiveness of risk / intervention opportunity

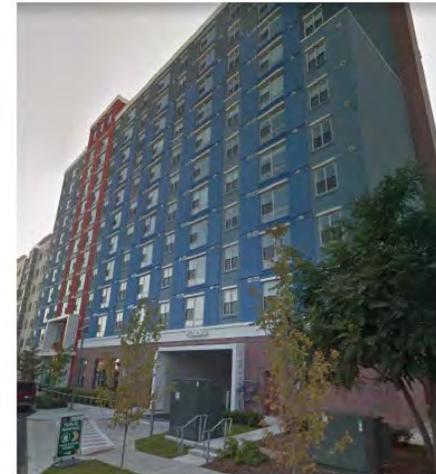
Site interviews

- Assess site-specific risk
- Obtain history of events
- Inventory existing resilience infrastructure
- Understand current processes & procedures



Resilience and Energy and Water Opportunity Assessment

Stamford Metro Green - Terrace
695 Atlantic St., Stamford, CT 06902
October 15, 2019



Submitted To:
Jonathan Rose Companies
551 Fifth Avenue, 23rd Floor
New York, NY 10176



Protection

- Flood protection
- Backflow prevention

Adaptation

- Envelope improvements
- LED lighting upgrades

Backup

- Solar feasibility
- Generator mapping
- Potable water storage

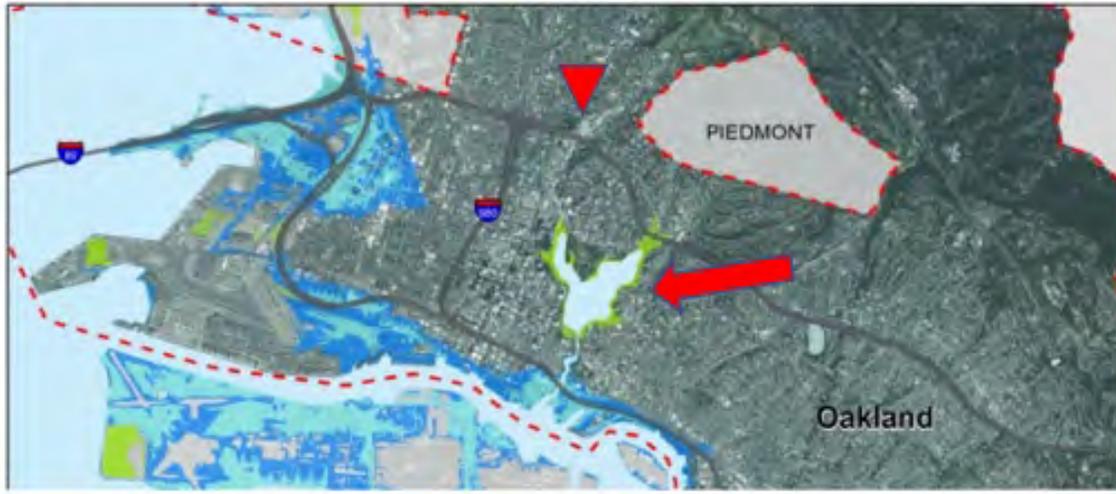
Community

- Update Emergency Manual





Figure 4: MHHW* + 48 Inches and 72 Inches of Sea Level Rise



Sea Level Rise Road Map | Oakland, CA

Heat Vulnerability Index (HVI) for New York City Community Districts

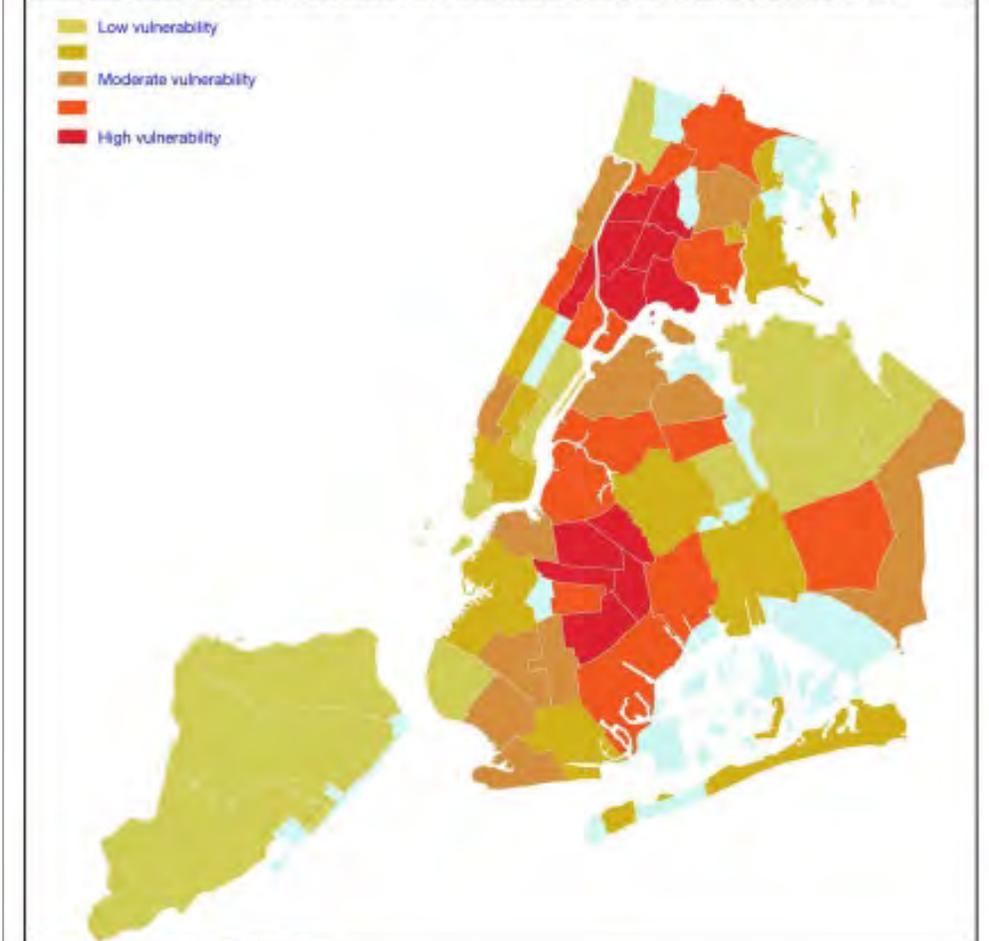
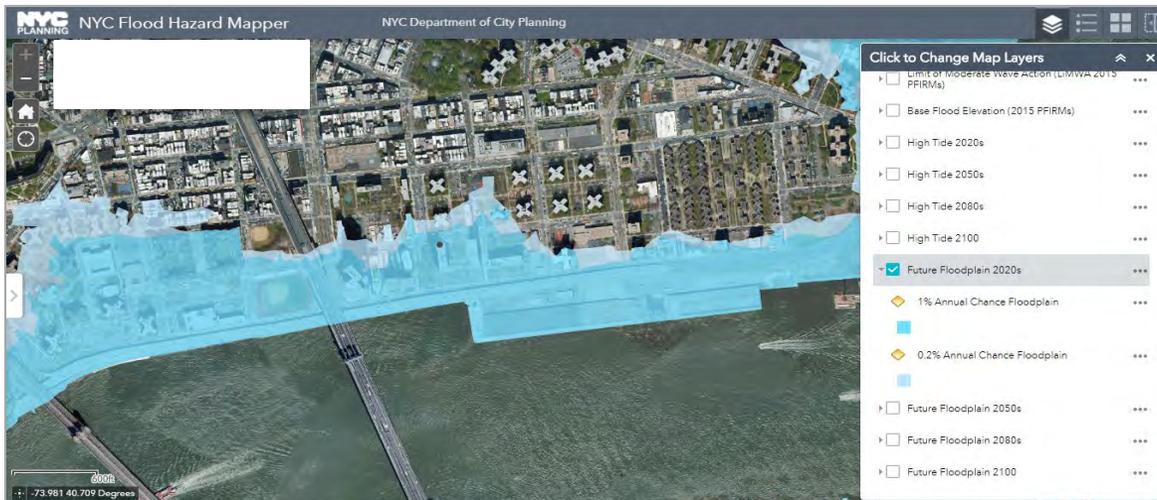


Figure 3: Source: DOHMH, 2015.

Cool Neighborhoods | New York, NY



Flood Hazard Mapper | New York, NY

Q & A



Jonathan Rose
Companies

Lauren Zullo

Email: lzullo@rosecompanies.com

Submit Questions

www.slido.com event code **#DOE**



U.S. DEPARTMENT OF
ENERGY

Additional Resources

- Ready to Respond: Strategies for Multifamily Building Resilience
 - <https://www.enterprisecommunity.org/resources/ready-respond-strategies-multifamily-building-resilience-13356>
- Department of Housing and Community Development (DHCD) Design Guidelines
 - <https://www.mass.gov/service-details/design-construction-guidelines-standards>
- GRESB Resilience Module
 - <https://gresb.com/resilience-module/>
- Resilience and Solar Assessment Tool User Manual
 - <https://www.enterprisecommunity.org/sites/default/files/media-library/solutions-and-innovation/recovery-rebuilding/DC%20DOEE%20Resilience%20Tool%20Manual-8.28.19.pdf>

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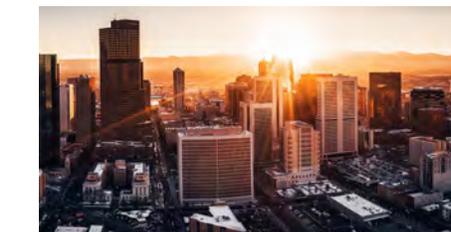
Tue, Nov 17, 2020 | 3:00 - 4:00 PM ET



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■ Indicates the session was a part of the 2020 Virtual Summit. To view a full list of the Summit Sessions, [click here](#).

BUILDING ENVELOPE

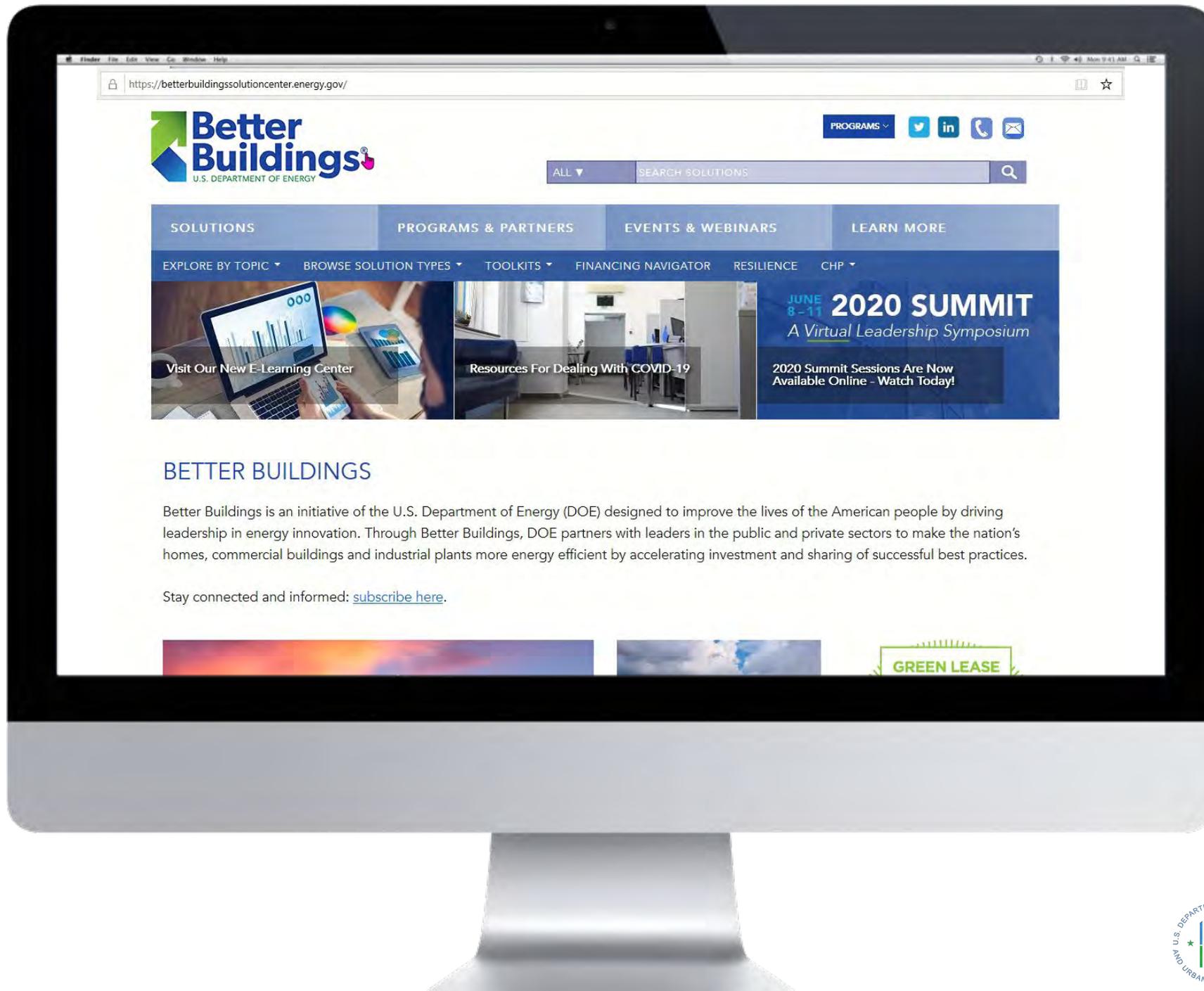
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