Promoting Climate Resilient Public Housing

Lessons Learned from New York State Public Housing Climate Resilience Pilot, a National Disaster Resilience Competition Project

State of New York Office of Resilient Homes and Communities,
U.S. Department of Housing and Urban Development and Enterprise Community Partners

NEW YORK STATE
Homes and Community Renewal
Office of Resilient Homes and Communities

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Version Number	Date Revised	Description of Revisions
1.0	June 30, 2023	Document creation

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Executive Summary

With the increasing intensity and number of storms the country is experiencing coupled with the vulnerability of residents living in public housing it is ever more important for PHAs to implement resiliency efforts across their housing units. There are over 1.7 million residents living in over 915,000 public housing units nationwide that provide affordable and stable housing for a portion of the population that is not adequately resourced to prepare for and recover from natural hazard events.

This report discusses the how four PHAs in the New York communities of Binghamton, Freeport, Long Beach, and Hempstead proactively responded to the challenges presented by Superstorm Sandy and took action through the State of New York Office of Resilient Homes and Communities Public Housing Resiliency Pilot Project (PHRPP) to fortify their properties in the face of a changing climate enabled through HUD's National Disaster Resilience Competition (NDRC).

There are 8 specific steps detailed in this report that each PHA went through to strategically identify resilient retrofits and engage residents during the PHRPP program. The steps included a physical assessment of the properties, climate mitigation strategy identification, identification of training, determining a course of action for the properties, engaging residents, developing emergency and business continuity plans, designing and building units or retrofits, and operating and maintaining those units and retrofits. In addition, this report highlights a workforce development initiative implemented during the program which leveraged the construction jobs needed to implement the resiliency measures.

During the course of the program there were several lessons learned that can be applied to other PHAs and affordable housing projects across the nation to make their units safer and more resilient to natural hazards, preserving the limited affordable housing stock in the State of New York and nationally.

> ***"RHC's public housing relief and resiliency programs are examples of our mission to build climate resilient communities while also prioritizing environmental justice. New York is working to combat these inequities through our public housing relief and resiliency programs that engage residents directly to plan projects that reduce their exposure to future emergencies and has helped us inform the direction of our Agency's mission going forward."***
>
> - Katie Brennan
> Office of Resilient Homes
> and Communities Executive Director

> ***"Those who are most impacted by disasters are also oftentimes those who can least afford it. This report will help housing operators across the nation, protect buildings from the impacts of climate change as well as adapt to its effects. We look forward to continuing our partnership with the public and affordable housing community."***
>
> - Paul Lozito
> Chief Strategy and Program Officer
> at the Office of Resilient Homes and Communities

> ***"Climate change poses a unique risk to multifamily affordable housing. Already in woefully short supply, the number of homes with affordable rents is threatened to erode even further by the proliferation of superstorms, hurricanes, wildfires and other natural disasters. The net result on the people who live there has been, and will be, catastrophic. If they lose their home, there are few alternatives. This report offers practical guidance for affordable housing owners both to reduce a building's vulnerability to extreme weather along with strategies to adapt to changing climate conditions."***
>
> - Laurie Schoeman
> Director Climate and Sustainability
> at Enterprise Community Investment

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- Long Beach Housing Authority
- Town of Hempstead Housing Authority
- Freeport Housing Authority

Workforce Development (Adult Learning Center)

Introduction

In 2012, Superstorm Sandy pummeled the mid-Atlantic and New York State, barreling through communities and uprooting lives throughout the region. Among the most profoundly affected were low-income renters, who typically are among the first hit and the last to recover after a natural disaster strikes.[1]

From beginning to end, Hurricane Sandy's nine-day progression caused catastrophic flooding, erosion, and destructive winds, from the Caribbean to the U.S. East Coast. In the nine days that Sandy raged, it killed 70 people in the Caribbean, almost 150 people in the U.S., and led to $70 billion dollars in damages, making it one of the costliest storms in the Nation's history. Over 8 million people lost power during the storm, with outages lasting for days in major cities and weeks in outlying areas. Six hundred thousand housing units were destroyed in New York and New Jersey. Thirty-seven thousand primary residences and approximately 9,300 rental units received major damage. Impacts to the region were significant - loss of operations at refineries and petroleum terminals delayed gas to the New York City region, and hundreds of stores and services were closed, preventing critical supplies like medicine and food from reaching many households. Homes owned and managed by the New York State's public housing authorities, or PHAs, were particularly vulnerable.

PHAs, which control the nation's public housing stock, are faced with the difficult task of ensuring that their properties and residents are protected against the challenges brought by a changing climate while maintaining affordable, safe, and healthy housing. That tension means that budgets are often tight, with few resources to ensure that PHA-owned properties are resilient. Current and future climate risks present profound design, construction, and operational challenges to PHAs in maintaining the quality and availability of affordable housing, retrofitting before a climate event, and in recovering afterward. In New York State and nationwide, PHAs are ill-prepared for the increasing pace and intensity of climate-fueled disasters. Owners and operators of multifamily housing need practical guidance on how to navigate this new normal.

This report examines how four PHAs in the New York communities of Binghamton, Freeport, Long Beach, and Hempstead proactively responded to the challenges presented by Superstorm Sandy and took action through the **RHC Public Housing Resiliency Pilot Project (PHRPP)** to fortify their properties in the face of a changing climate. This report explains how those PHAs ensured habitable and resilient homes for the hundreds of families that depend on them and provides a template for other PHAs across the nation to follow as we face an ever more perilous climate future.

[1] https://preservationdatabase.org/wp-content/uploads/2021/06/Taking-Stock.pdf

NDRC Program Creation and Award Background

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NDRC Program Creation and Award Background

After Superstorm Sandy, the President declared major disasters in ten states, as well as the District of Columbia.[2] In response to the event, Congress passed a supplemental appropriations bill that provided more than $49 billion in assistance for victims of the damage caused by Sandy.[3] The funding in the bill was used to offset the cost of repairs of damaged housing and community infrastructure and to provide funding for small business loans and recovery aid to businesses. Under the bill, HUD's Community Development Fund provided $16 billion for housing repair and replacement costs, repair needs of small businesses, and public infrastructure investments.

About the National Disaster Resilience Competition (NDRC)

Using $1 billion set aside from the Congressional Allocation, HUD held the **National Disaster Resilience Competition** (NDRC) in 2014 as a two-phase process, which awarded nearly $1 billion in HUD Disaster Recovery funds to 13 states and communities that had been impacted by natural disasters in recent years.[4] The competition promoted innovation in climate risk assessment, stakeholder engagement, and planning, and funded the implementation of innovative resilience projects to better prepare communities for storms and other extreme events. The competition sought to encourage communities to not only consider how they can recover from a past disaster, but also how to avoid future disaster losses. Applicants were asked to link or "tieback" their proposals to the disaster from which they were recovering, as well as demonstrate how they were reducing future risks and advancing broader community development goals within their target geographic area(s). HUD expected that the awards would not only help better protect residents from future threats in those affected areas, but also help lead the way for all U.S. communities to make better and more thoughtful investments in resilience.[5]

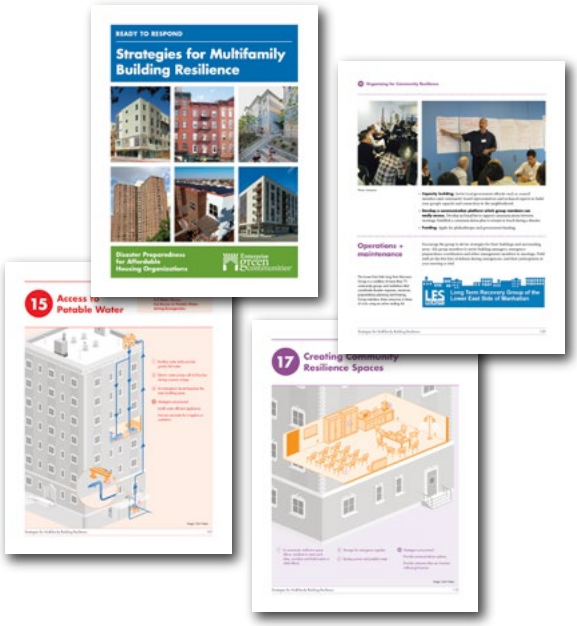
In early 2016, RHC was awarded $35.8 million via the NDRC to support a cohort of public housing resiliency pilot projects. Funding was committed to support four PHAs in implementing site-specific resiliency recommendations based on Enterprise's **Ready to Respond Toolkit**. The funding was also supplemented by RHC's Community Development Block Grant – Disaster Recovery (CDBG-DR) funding allocation, providing the PHAs with additional funding leverage to improve resiliency, such as energy efficiency.

RHC partnered with Enterprise Community Partners (Enterprise) on the PHRPP program development. Program design was informed by a pilot project that Enterprise led with the Jersey City Public Housing Authority the year prior, which had commissioned a design competition and conducted intensive resident engagement to help the PHA repair its largest housing site, the Booker T. Washington Housing Authority, a community of more than 300 residents. This process laid the groundwork for what would become a template for the New York Public Housing Resiliency Pilot Project.

[2] https://www.fema.gov/disaster/declarations?field_dv2_state_territory_tribal_value=All&field_year_value%5B2012%5D=2012&field_dv2_declaration_type_value=DR&field_dv2_incident_type_target_id_selective=49124&page=0
[3] https://www.fema.gov/about/openfema/data-sets/sandy-pmo-disaster-relief-appropriations-act-2013-sandy-supplemental-bill#:~:text=The%20Disaster%20Relief%20Appropriations%20Act%20of%202013%2C%20or%20Sandy%20Supplemental,2011%2C%202012%2C%20and%202013
[4] https://www.hud.gov/program_offices/economic_development/resilience/competition#:~:text=Launched%20in%202014%2C%20the%20National,and%20communities%20across%20the%20country
[5] NDRCFACTSHEETFINAL.PDF (hud.gov)

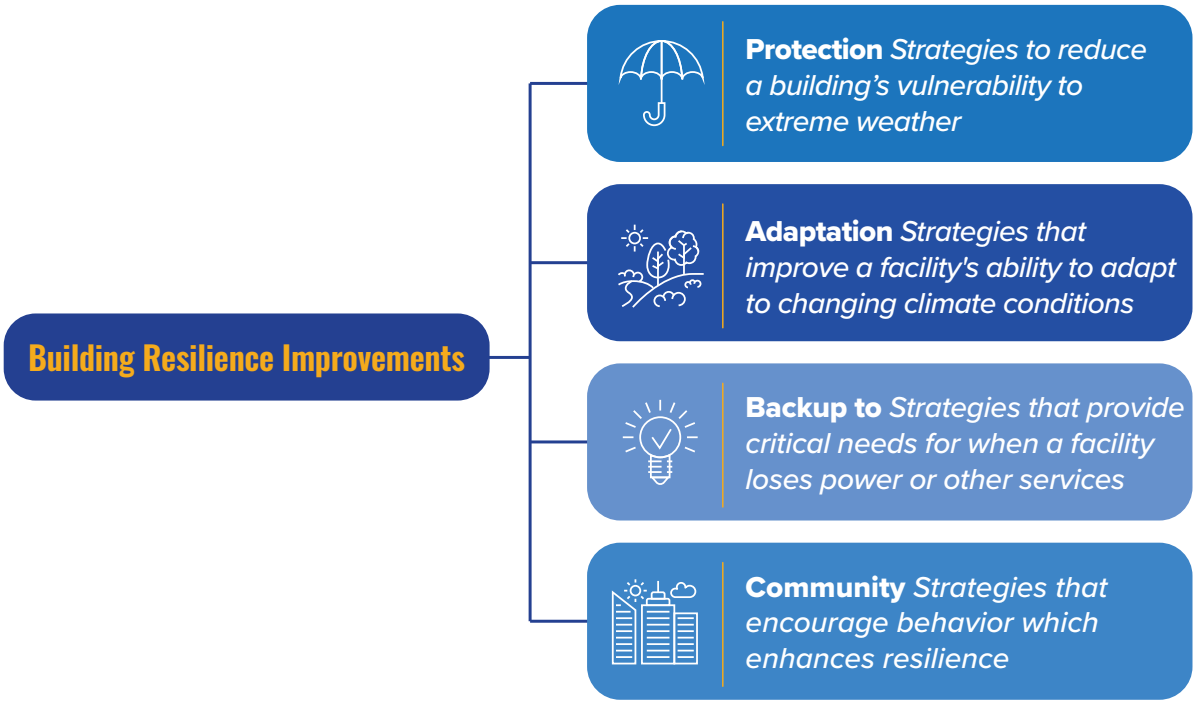
Pilot Program

The RHC Public Housing Resiliency Pilot Project (PHRPP),[6] referred to as the "National Disaster Resilience (NDR) Program," addressed the needs of highly vulnerable, low- and moderate-income public housing residents located in coastal and riverine communities. The program focused on protecting and enhancing the lives of residents of storm-impacted public housing developments, demonstrating a range of resiliency interventions and reducing exposure to future disasters. The project was intended to take a comprehensive and community-driven approach to disaster recovery with the goal of making vulnerable populations more resilient to acute shocks, including extreme coastal and riverine flooding events, as well as chronic stresses like climate change, economic instability, and environmental degradation. The State believes this is best achieved through an integrated approach rooted in addressing and leveraging the interconnectedness of systems and by investing in transformative, scalable interventions with multiple benefits. The projects and programs outlined in this report enhance the physical, economic, social, and environmental resilience of the Empire State's coastal and riverine communities.



www.climatesafehousing.org

Organizing principles of the work and retrofits were based on Enterprise's Strategies for Multifamily Resilience guide, which lays out the qualities of resilient housing strategies to promote mitigation, adaptation, redundancy, and community resilience for affordable multifamily housing properties.



[6] https://stormrecovery.ny.gov/ndr-public-housing-programs

Public Housing and the Impact of Climate Change

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Public Housing and the Impact of Climate Change

Due to the intersectional effects of poverty, determinants of health, and location of many public housing units, renters living in public housing tend to have more health and financial challenges than renters living in private market housing. Additionally, federal housing assistance programs primarily serve people of color, older adults, individuals with disabilities, and families with children who are disproportionately impacted by poverty. These compounding factors leave many federally-assisted renters, including the country's over 1.6 million public housing residents[7], facing greater challenges preparing for, evacuating, and recovering from natural disasters than unsubsidized housing residents.[8]

According to a joint report by the Public and Affordable Housing Research Corporation (PAHRC) and the National Low Income Housing Coalition (NLIHC), almost one third of federally assisted housing, which includes public housing, faces a very high or relatively high risk[9] for at least one natural hazard due to location, age of housing, and the effects of a historical lack of investment in public housing maintenance.[10]

Photo courtesy of Image by vecstock on Freepik

Effect of Climate Events

Climate change is intensifying hurricanes, which could place subsidized housing units at risk for severe damage. According to PAHRC and NLIHC, 5% of federally assisted housing units are at a very-high or relatively-high risk of a negative impact from hurricane winds. alone with additional hurricane damage also coming from storm surge and subsequent rainfall. Based on historical National Oceanic and Atmospheric Administration (NOAA) data, 516,013 federally assisted units nationally are within 50 nautical miles of at least one hurricane per decade, and 104,540 are within 50 nautical miles of at least one category three, four, or five hurricanes per decade.[11] In 2016, the Urban Institute reported that roughly 9 percent of all public housing units (approximately 100,000 units) were in 100-or-500-year floodplains, making them susceptible to damage from flooding events.[12, 13] New York state has over 5,000 affordable housing units, one the highest numbers across states nationwide, projected to be at risk of coastal flooding at least once in a typical year by 2050. Moreover, flooding is the most expensive hazard event across New York State with an estimated $129.9 million in annualized loss between 1996-2018, indicating a high cost of flooding for New York state and its PHAs.[14] Flooding substantially impacts public housing facilities by weakening structures and disrupting power, water service, and can lead to mold. Due to the effects of climate change, flooding is estimated to increase in intensity and frequency thus increasing the damage caused by flooding will increase in intensity and frequency, leading to greater destruction of housing structures.

7 https://www.hud.gov/program_offices/public_indian_housing/programs/ph/PH_Dashboard?utmmedium=email&utmsource=govdelivery&utmsource=mc%e2%80%8b&utmmedium=email%e2%80%8b&utm_campaign=tih041522%e2%80%8b&utm_term=20220415-003a0000026q4Q8AAI%e2%80%8b&utmcontent=tih041522&sfmckey=Y3BheWFtcHNAZW50ZXJwcmlzZWNvbW11bml0eS5vcmc=&j=226592&sfmc_sub=11827501&l=2081_HTML&u=12941552&mid=10965565&jb=3

8 https://preservationdatabase.org/wp-content/uploads/2021/06/Taking-Stock.pdf

9 The NRI creates an overall relative risk score of 0 to 100 with 100 indicating the greatest risk, as well as scores for individual hazards. Based on this score, communities' risk to natural hazards is categorized as very high, relatively high, relatively moderate, relatively low, and very low.

10 https://preservationdatabase.org/wp-content/uploads/2021/06/Taking-Stock.pdf

11 https://preservationdatabase.org/wp-content/uploads/2021/06/Taking-Stock.pdf

12 The Future of Public Housing: https://www.urban.org/research/publication/future-public-housing-public-housing-fact-sheet

13 Weiss, Weidman, and Bronson, "Heavy Weather: How Climate Destruction Harms Middle- and Lower-Income Americans," available at: http://www.climateaccess.org/system/files/CAP_ExtremeWeather.pdf

14 https://mitigateny.availabs.org/hazards

15 Kousky, C. et al.. New flood maps show US damage rising 26% in next 30 years due to climate change alone, and the inequity is stark. The Conversation.

Photo courtesy of Freepik

Extreme heat is the leading weather-related cause of death in the United States and a significant, and likely undercounted, cause of death worldwide.[16] In addition to its health effects, extreme heat can damage roads, **electrical wires** and other infrastructure, stress energy systems, such as **air conditioners**, draw more electricity, damage or kill **crops and livestock**, and contribute to natural disasters. Due to the effects of climate change, the rate of temperature increase has nearly doubled in the last 50 years, which increases the likelihood of these dangerous events occurring[17]. Current trends suggest that average surface temperatures could rise between 2°C and 6°C by the end of the 21st century. This **extreme heat** will have a greater impact on urban areas, which contain many heat-absorbing surfaces like roads, parking lots, and buildings, and few cooling green spaces and trees. This "heat island effect," where urban areas experience higher temperatures than the surrounding suburban or rural areas, increases the risk of heat-related illnesses and death for urban residents, particularly for those who are vulnerable. Ultimately, as climate events intensify, preparing and adapting housing structures is essential in ensuring minimal long-term effects on residents' lives.

[16] Elamroussi, A., & Beech, S. (2022, June 24). **More than 90 million in the US endure alarmingly high temperatures Sunday as heat wave persists from mid-South to Northeast**. CNN.

[17] **Global Warming (nasa.gov)**

Disparate Impacts and Equity

Low-income households, people of color, and other vulnerbale populations are hit the hardest by severe natural hazards, experience higher long-term displacement rates, and take longer to recover from disasters. Public housing is a critical source of stable housing for more than 1 million residents, the majority of whom are perceived to be vulnerable by their status as low-income, people of color, older adults or those with disabilities. Forty-three percent of HUD-assisted households of color live in areas with very high or relatively high risk of natural hazards, compared to 28% of HUD-assisted white households.[17]

Photo courtesy of Pexels (pexels.com)

Design and Construction of Public Housing

The building standards used to construct many of the original public housing developments, built between the 1930s and 1970s, pre-date the now-routine building codes, such as roof tie downs and window protection, that mitigate the risks related to wind and other weather-related hazards. Cost was the primary factor driving historical public housing development.

Early guidance from the Federal Public Housing Authority (FPHA), which has since merged with HUD, recognized that special construction standards were needed to deal with “hazardous” conditions, such as flooding, landslides, building over swamp or flood land, or dealing with earthquakes and hurricanes. However, according to the Historic Context of Public Housing 1933-1949, there is a stark similarity of housing style and general site design due to development cost constraints and political forces that ignore modifications for location-specific environmental hazards.[16]

This initial conception of public housing created problems that have only compounded with decades of use and continued reduction of funds for management and maintenance, leaving many PHAs struggling to adapt to or mitigate risks from extreme weather events.

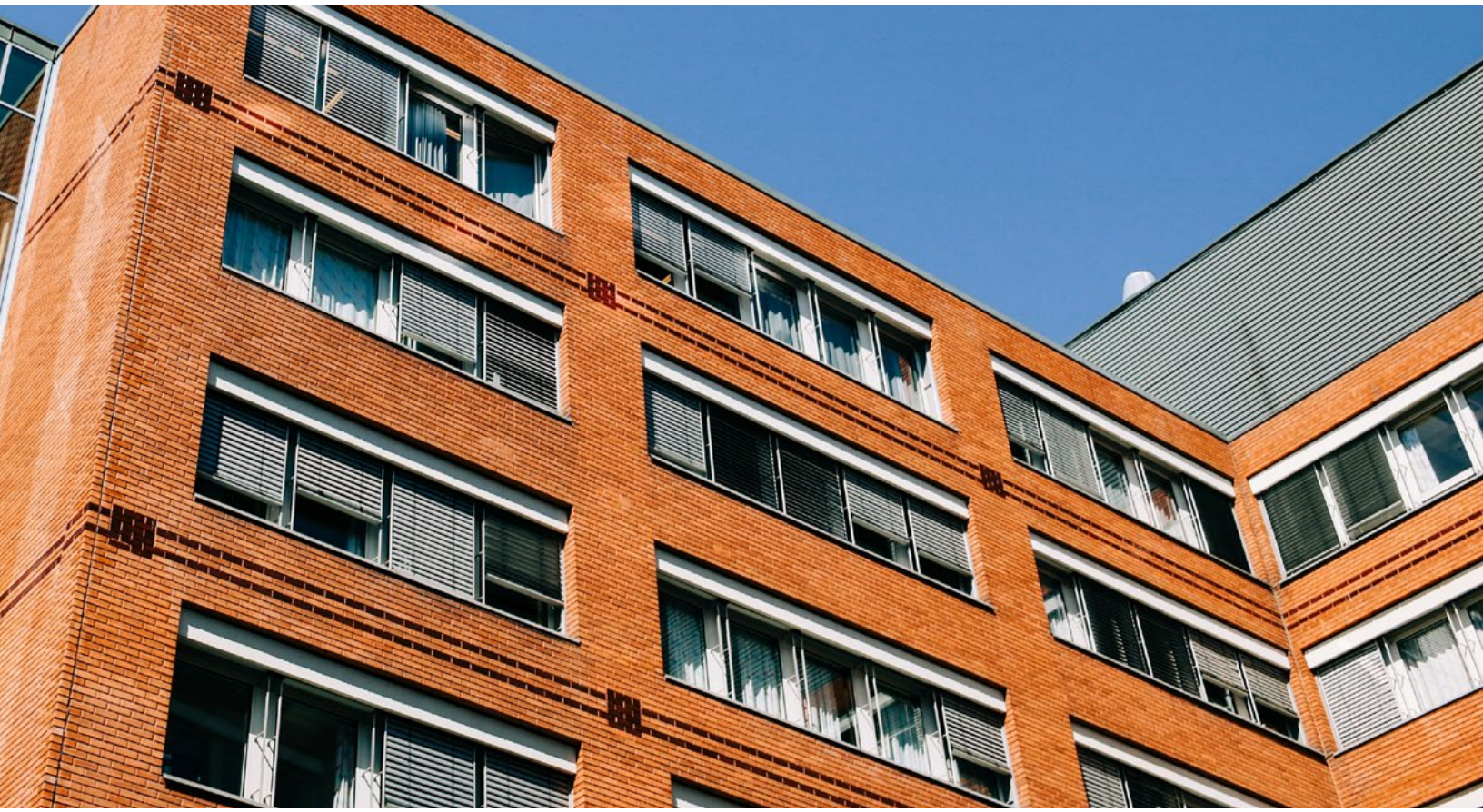
Photo courtesy of Freepik (freepik.com)

18 Bullard, Robert D., and Beverly Wright. “Disastrous response to natural and man-made disasters: An environmental justice analysis twenty-five years after warren county.” UCLA J. Envtl. L. & Pol’y 26 (2008): 217
19 Ryder, Stacia S. “A Bridge to Challenging Environmental Inequality: Intersectionality, Environmental Justice, and Disaster Vulnerability.” Social Thought & Research, vol. 34, 2017, pp. 85–115
20 Cutter, Susan L., et al. “The long road home: Race, class, and recovery from Hurricane Katrina.” Environment: Science and Policy for Sustainable Development 48.2 (2006): 8-20.
21 https://preservationdatabase.org/wp-content/uploads/2021/06/Taking-Stock.pdf
22 https://www.huduser.gov/portal/sites/default/files/pdf/Public-housing-in-US-1985.pdf

Lack of Funding

Decades-long decreases in capital funding for public housing authorities have led to an aging and deteriorating housing stock in need of repairs that leaves low-income residents disproportionately affected by the extreme weather events associated with climate change.

As of October 2019, the estimated capital fund backlog for public housing was approximately $70 billion and is expected to compound at a yearly rate of nearly 9 percent due to inflation and the increased cost of addressing deferred maintenance.[23] The neighborhoods surrounding public housing often lack quality services and crucial infrastructure, compounding risk even further.[24]



National Shortage of Affordable Rental Housing

Not only is housing for low-income people not ready for the impacts of climate change, but there simply is not enough of it. According to the National Low-Income Housing Coalition, the United States has a shortage of seven million rental homes affordable to extremely low-income renters. For every 100 extremely low-income renter households, there are only thirty-six available rental homes.https://nlihc.org/gap

https://nlihc.org/gap

[23] NAHRO Capital Fund Backlog One Pager: https://www.nahro.org/wp-content/uploads/2020/04/CAPITAL_FUND_BACKLOG_One-Pager.pdf
[24] Ross, "A Disaster in the Making Addressing the Vulnerability of Low-Income Communities to Extreme Weather"

Superstorm Sandy and Its Impacts On New York State Public Housing

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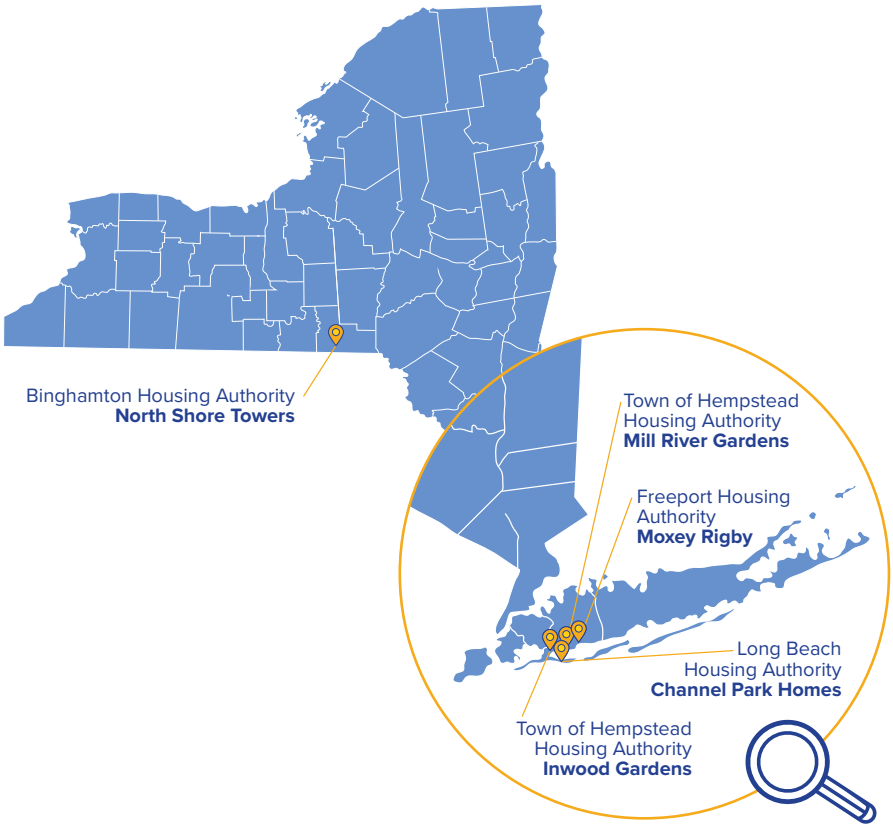
Superstorm Sandy and Impacts on New York State Public Housing

An unusual combination of hurricane conditions, cold fronts, and a full lunar cycle made Superstorm Sandy particularly potent. From late October to early November of 2012, the storm fluctuated between tropical storm status to a Category 2 hurricane, making landfall as a tropical storm near Brigantine, NJ on October 29th. From October 30th to November 5th, 24 states along the US Eastern Seaboard, and as far west as Michigan and Wisconsin, felt Sandy's impacts. Across New York, 305,000 homes were destroyed due primarily to high storm surge and forty-eight people lost their lives. Forty-three of those lost were in New York City, where power outages affected nearly two million people. In New York City alone, floodwaters entered more than 443,000 homes and more than 23,400 businesses.[25] On November 26th, New York Governor Cuomo estimated statewide damage and losses at approximately $32 billion.

In January 2013, the US Senate approved $50.5 billion in Superstorm Sandy aid. In addition, in June of 2015, HUD launched the National Disaster Resilience Competition (NDRC), a two-phase process that awarded nearly $1 billion in HUD Disaster Recovery funds to eligible communities. The purpose of the NDRC was to assist with disaster recovery and improve states' ability to withstand and recover more quickly from future disasters, hazards, and shocks.[26] In October 2015, the New York Office of Resilient Homes & Communities (RHC) was awarded $35.8 million to address public housing resilience throughout the state.

New York Public Housing Authorities

Superstorm Sandy impacted many of New York's smaller public housing authorities in very significant ways, resulting in unreliable services for residents. The majority of the impacted PHAs had disrupted power, flooding in basements and first floors, and minimal access to critical services, including food, medical care, and social services. Following Sandy, RHC was contacted by several smaller PHAs, including those in Binghamton, Freeport, Long Beach, and the Town of Hempstead, requesting assistance for damaged compounded by other storms including Hurricane Irene, and Tropical Storm Lee.



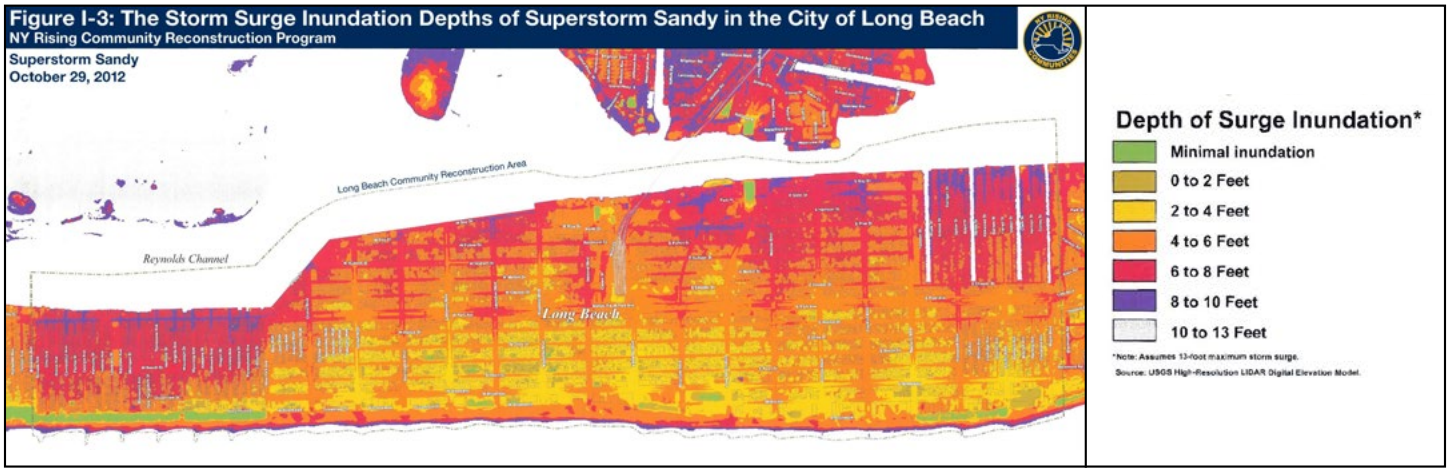
[25] https://www.nyc.gov/site/sirr/report/report.page
[26] https://www.hud.gov/sites/documents/NDRCFACTSHEETFINAL.PDF#:~:text=The%20U.S.%20Department%20of%20Housing%20and%20Urban%20Development,the%20long-term%20well-being%20and%20safety%20of%20their%20residents.

Long Beach Channel Homes

Long Beach Housing Authority

The Long Beach Housing Authority, located in the city of Long Beach off the coast of Long Island, operates five developments consisting of 374 units called Channel Park Homes. Channel Park Homes, a family development, experienced the greatest impact from Superstorm Sandy, including flooding that damaged lower-level homes and community facilities. The brick façade walls of three of the residential buildings collapsed or were severely compromised. The damage required mold remediation, floor and drywall replacement, painting, appliance and kitchen cabinet replacement, and replacement and repair of heating ventilation and air conditioning (HVAC) systems.

Four senior high-rise buildings were damaged by high winds and sustained flooding within basements and community spaces. The damage required repairs to floors and walls, equipment, and HVAC systems. While homes were minimally impacted, damage to elevators, electrical systems, and heating units emphasized the need to relocate emergency generators and heating and cooling systems.[27]



[27] https://stormrecovery.ny.gov/sites/default/files/crp/community/documents/20200903_NDR_ConsolidatedActionPlan_DRGRActionPlan.pdf

Town of Hempstead Mill River

Hempstead Inwood Gardens

Town of Hempstead Housing Authority

The Town of Hempstead Housing Authority (TOHHA), located in Nassau County on Long Island, operates 14 housing developments, five of which are located within a 100-year floodplain and were evacuated before the storm made landfall. All of TOHHA's sites sustained damage, with three sites receiving significant damage. At TOHHA's development, Mill River Gardens, power outages lasted approximately three weeks. Apartments and community spaces suffered significant damage. Wooden bulkheads at the site sustained heavy damage due to storm surges, allowing floodwater to enter units. Residents were displaced for extended periods of time after the storm and were sheltered eight miles away at Nassau Community College.

TOHHA's Inwood Gardens was also damaged by flooding and high winds. Residential units and community spaces were inundated with saltwater. Repairs consisted of mold remediation, asbestos abatement, and replacement of electrical systems, boilers, sheetrock, appliances, cabinets, fixtures, and insulation. In addition, TOHHA's Green Acres development suffered significant roof damage, requiring structural repair.[28, 29]

Town of Hempstead Mill River

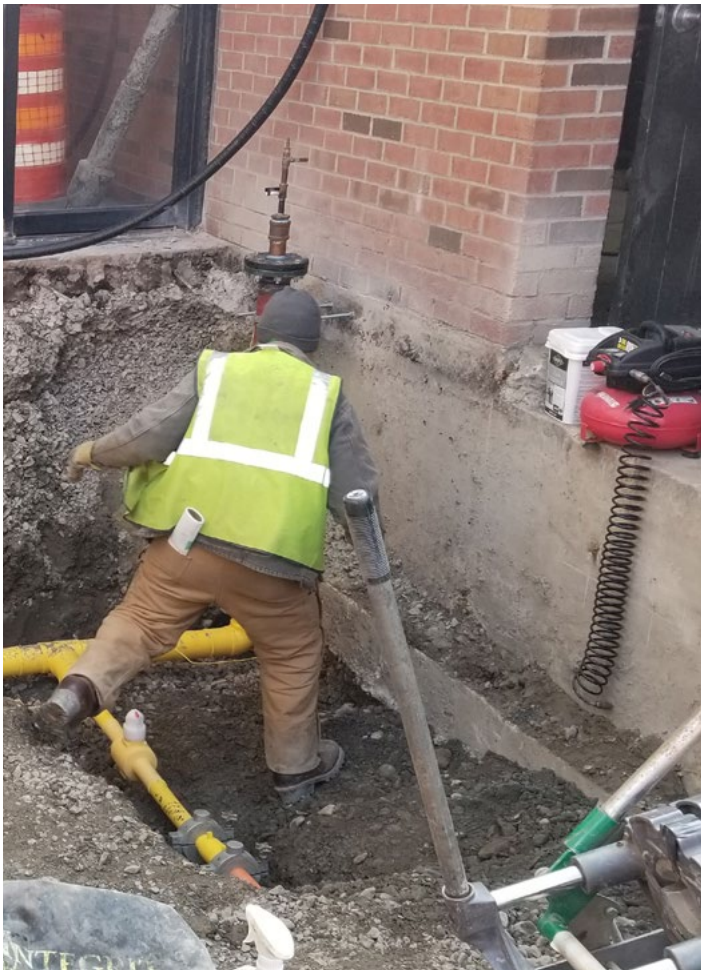
[28] https://stormrecovery.ny.gov/sites/default/files/crp/community/documents/MillRiverGardens_FactSheet_Final.pdf
[29] https://stormrecovery.ny.gov/sites/default/files/crp/community/documents/20200903_NDR_ConsolidatedActionPlan_DRGRActionPlan.pdf

Moxey Rigby

Freeport Housing Authority

The Freeport Housing Authority (FHA), located on Long Island, manages five developments consisting of 351 units within the village limits of Freeport. Of these complexes, the Moxey Rigby development, consisting of 100 units of family housing, was not only impacted by Sandy, but also by Hurricane Irene in 2011.

Sandy floodwaters inundated seven buildings, causing damage to mechanical, electrical, and specialty systems located in the sub-basements of the facilities. The high storm winds blew down trees and caused power surges that put strain on the buildings' water circulation systems, which in turn burned out pumps. Both storms caused significant damage to mechanical, electrical, and plumbing (MEP) systems, which subsequently had to be replaced twice in the two-year period.[30, 31]



New gas main installation at Moxey Rigby

[30] https://stormrecovery.ny.gov/sites/default/files/crp/community/documents/20200903_NDR_ConsolidatedActionPlan_DRGRActionPlan.pdf
[31] https://stormrecovery.ny.gov/ndr-public-housing-programs

Binghamton

Binghamton Housing Authority

The Binghamton Housing Authority (BHA) operates several housing sites within Binghamton, Broome County. In September 2011, Tropical Storm Lee completely flooded the basements of three housing/shelter properties and destroyed the mechanical systems that provided services to 425 rental units and more than 450 residents, many of whom were people with disabilities. The properties were uninhabitable for two months or more, resulting in the highest density and longest displacement of any population in Broome County.[32]

After Superstorm Sandy, the President declared major disasters in ten states, as well as the District of Columbia.[33] In response to the event, Congress passed a supplemental appropriations bill that provided more than $49 billion in assistance for victims of the damage caused by Sandy.[34] The funding in the bill was used to offset the cost of repairs of damaged housing and community infrastructure, and to provide funding for small business loans and recovery aid to businesses. Under the bill, HUD's Community Development Fund provided $16 billion for housing repair and replacement costs, repair needs of small businesses, and public infrastructure investments.

Binghamton courtyard project

[32] https://stormrecovery.ny.gov/sites/default/files/crp/community/documents/20200903_NDR_ConsolidatedActionPlan_DRGRActionPlan.pdf
[33] https://www.fema.gov/disaster/declarations?field_dv2_state_territory_tribal_value=All&field_year_value%5B2012%5D=2012&field_dv2_declaration_type_value=DR&field_dv2_incident_type_target_id_selective=49124&page=0
[34] https://www.fema.gov/about/openfema/data-sets/sandy-pmo-disaster-relief-appropriations-act-2013-sandy-supplemental-bill#:~:text=The%20Disaster%20Relief%20Appropriations%20Act%20of%202013%2C%20or%20Sandy%20Supplemental,2011%2C%202012%2C%20and%202013

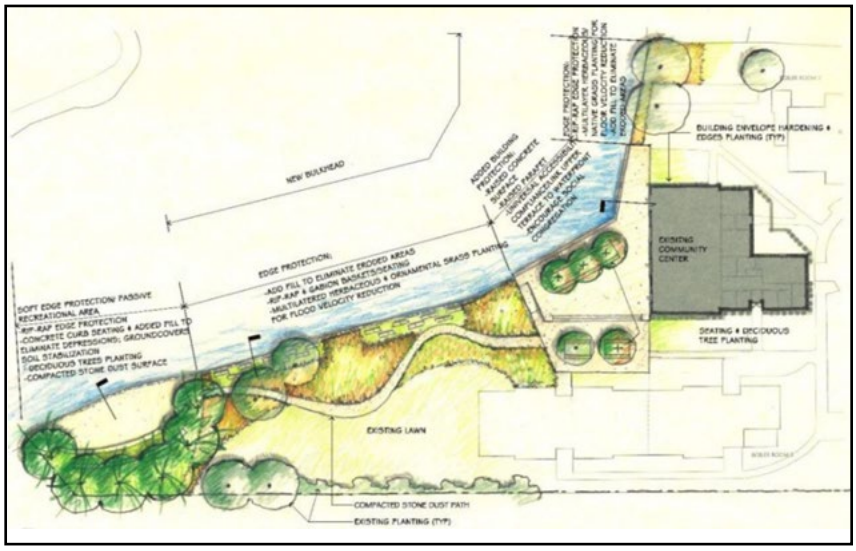
Project Scope and Delivery

Long Beach Housing Authority: Channel Park Homes Scope of Work								
	Risks				**Mitigation**	**Adaptation**	**Community**	**Backup**
	Flooding	**Extreme Temperature**	**Community Impacts**	**Power Loss**	**Strategies to reduce a building's vulnerability to extreme weather**	**Strategies that improve a facility's ability to adapt to changing climate conditions**	**Strategies that encourage behavior which enhances resilience**	**Strategies that provide critical needs for when a facility loses power or other services**
Unit Rehab: Flat and mansard roof replacement, new flood barrier, new exterior waterproof siding, new doors, A/C minisplit units, toilet and showerhead replacement; apartment breaker panel replacement to increase efficiency, reduce flooding and increase resident health and well-being	√	√	√	√	√	√	√	√
Install roof mounted generator at the Administration and Residential Buildings	√		√	√	√		√	√
Remove existing window and modify framing and finishes to install new door with side light and transom at Administration Building roof	√			√		√	√	

Photos of Channel Homes

Town of Hempstead Housing Authority: Mill River Gardens Scope of Work								
	Risks				**Mitigation**	**Adaptation**	**Community**	**Backup**
	Flooding	**Extreme Temperature**	**Community Impacts**	**Power Loss**	**Strategies to reduce a building's vulnerability to extreme weather**	**Strategies that improve a facility's ability to adapt to changing climate conditions**	**Strategies that encourage behavior which enhances resilience**	**Strategies that provide critical needs for when a facility loses power or other services**
Site work including earthwork, structural foundations, new finished grade elevations, fencing, walkable surfaces, planters and plantings, benches, pavers, concrete stairs and coordination with electrician for site lighting and Installation of site drainage structures to increase community pedestrian access to waterfront;	√		√		√	√	√	
Bulkhead removal, replacement, and repair, along Mill River to prevent flooding on site and additional erosion which destabalizes site during flood event;	√		√	√	√		√	√
Installation of concrete flood walls, piles, flood doors and passive flood barriers at the Community Center and Boiler room to prevent flooding in center;	√				√		√	
New flood vents in existing foundations at Residential Buildings to prevent flooding of buildings and allow for exit of water during flood events;	√				√			

Photos of Mill River Gardens



Town of Hempstead Housing Authority: Inwood Gardens Scope of Work								
	Risks				**Mitigation**	**Adaptation**	**Community**	**Backup**
	Flooding	**Extreme Temperature**	**Community Impacts**	**Power Loss**	**Strategies to reduce a building's vulnerability to extreme weather**	**Strategies that improve a facility's ability to adapt to changing climate conditions**	**Strategies that encourage behavior which enhances resilience**	**Strategies that provide critical needs for when a facility loses power or other services**
New energy efficient community Resilience center for housing community featuring an array of resilient retrofits to provide space for residents during an emergency event, to learn about new programs, to get trained on CERT and emergency preparedness, and cultivate community activities.	√	√	√	√	√	√	√	√
Hardening 3 boiler rooms & transformer to reduce flooding	√			√	√		√	√
Backup generator for critical emergency need during poweroutage	√	√		√	√		√	√
Perimeter Flood Proofing to reduce flooding at community center.	√		√		√		√	
Space for kitchen and community ammenities to cultivate community conectivity.			√			√	√	√

Photos of Inwood Gardens

Freeport Housing Authority: Moxey Rigby Scope of Work								
	Risks				**Mitigation**	**Adaptation**	**Community**	**Backup**
	Flooding	**Extreme Temperature**	**Community Impacts**	**Power Loss**	**Strategies to reduce a building's vulnerability to extreme weather**	**Strategies that improve a facility's ability to adapt to changing climate conditions**	**Strategies that encourage behavior which enhances resilience**	**Strategies that provide critical needs for when a facility loses power or other services**
Resilient new housing development that replaces 75 year old housing facility that flooded and lost power during Sandy. New Facility includes:	√	√		√	√			
On site Stormwater storage and infiltration and implementation of bioswales to provent flooding on site;	√				√	√		
Backup LED lights for redundancy in case of power outage, cell phone charging connected to critical backup power;				√			√	√
HVAC on roof, DHW on 5 th floor to prevent flooding interupting service;	√				√		√	
Drought resistant plantings that are able to adapt to changing water conditions. Even though site coulod experience flooding, there is alos the potential for reduced water for platings--plantings are importnat part of community health and well being experience;		√	√			√		
Basketball Court and Community gardens to support community needs and wellness;			√			√	√	
Envelope design has an R value of R 38 (code is R 21) to support changing temperature conditions;		√				√		
Apartments above parking at Base Flood Elevation of 25.08 (2 feet of freeboard) to reduce flooding impact to facility;	√				√			
Backflow prevention to prevent flooding in first floors and common spaces;					√			
Generator with minimum 72 hour runtime to provide backup power should grid go down.				√			√	√

Photos of Moxey Rigby

Binghamton Housing Authority: North Shore Towers in Binghamton Scope of Work								
	Risks				**Mitigation**	**Adaptation**	**Community**	**Backup**
	Flooding	**Extreme Temperature**	**Community Impacts**	**Power Loss**	**Strategies to reduce a building's vulnerability to extreme weather**	**Strategies that improve a facility's ability to adapt to changing climate conditions**	**Strategies that encourage behavior which enhances resilience**	**Strategies that provide critical needs for when a facility loses power or other services**
New maintenance garage that is flood proofed	√			√	√			
New domestic hot water system in apartment buildings to reduce fuel consumpion and increase resiliency during power loss				√		√	√	√
Relocation of electrical switchgear in apartment buildings above Base Flood Elevation to prevent flooding	√			√	√		√	
New cool coating flat roofing system on apartment buildings to prevent heating of buildings which causes higher cooling use		√	√			√		√
Community courtyard improved site drainage with rain garden and pervious pavement to manage stormwater			√		√	√	√	

Photos of North Shore Towers Binghamton

The 8 Steps of Climate Risk Reduction

Millions of households and communities are exposed to natural hazards and related climate risks across the nation. Some households are more vulnerable than others, considering economic realities and preparedness of their homes and community infrastructure. It is critical that owners and operators of affordable housing understand their exposure so they can determine the highest risk properties and protect residents.

PHA Climate Risk Reduction Steps

There are key steps that are integral to the process of implementing public housing climate risk reduction projects. These are the benchmarks that each project hit when moving from funding to concept to construction. The intent was to use a process that would move through stages from assess to design, and finally to build.

STEP 1	Assessment of Existing Properties and Include an Energy Audit	Use Portfolio Protect | Enterprise Community Partners
STEP 2	Identify Strategies to reduce Climate Risk	Using Climate Safe Housing: www.climatesafehousing.org
STEP 3	Training Opportunities	Identify appropriate training opportunities for staff to attend
STEP 4	Determine Course of Action for Properties	Using Climate Safe Housing www.climatesafehousing.org
STEP 5	Re-engage Residents and Report Back	Engage residents through community meetings, presentations, and surveys
STEP 6	Develop Emergency Plan for Business Continuity	Build Your Team | Business Continuity Toolkit for Affordable Housing Organizations (enterprisecommunity.org)
STEP 7	Design and Build	Incorporate all Resiliency improvements
STEP 8	Operate and Maintain	Monitor Energy and Water Usage

STEP 1

Assessment of Properties

PHAs were assessed for building and site-level resilience using a variety of tools developed by Enterprise including:

Resilience Capital Needs Assessment Tool. The Resilience Capital Needs Assessment Tool prompts review of site vulnerability, asking questions about flood protection at buildings and asking a reviewer to consider floodplain exposure and building elevation certificates. The assessment conducted was a green and resiliency focused rehabilitation assessment of all properties that outlines vulnerability to climate change hazards and "new normal" conditions, such as flooding from storm surge, stormwater, sewer, major storms, extreme high and low temperatures, and energy shortage or brownouts, as well as others. An additional purpose of the assessment was to identify opportunities to provide participating PHAs direction on resilience strategies that improve the health and well-being of residents. The assessments emphasized practical, cost-effective greening and resilience strategies that maximized building performance. These included building envelope upgrades, energy and water efficiency improvements, lighting upgrades, landscape measures, better choices in materials, and improving indoor air quality.

These questions, coupled with others about utility lines and appliances, such as: *"Are appliances located below base flood elevation?"* were written to anticipate recovery needs with the goal of bringing buildings back online more quickly after flooding events. Also considered was the capacity to help residents age in place, prompting consideration of what aging residents may need to help them move around building grounds, as well as in-unit features like grab bars in showers that may aid in daily living. Healthy housing related items, resilient building systems, resident and community related resilience planning, and overall building energy efficiency were also considered so that any needed updates can be planned.

The Enterprise Portfolio Protect℠ tool, **utilized as an additional assessment tool**, was developed to assist affordable housing owners, operators, and developers of affordable housing understand which properties may be at highest risk of flooding, fire, earthquakes, and other natural hazards. This tool offers users the ability to identify highest risk properties and offers recommendations and resources to help minimize potential harm to the property or properties and keep residents' homes safe.

An ASHRAE Level 2 Audit was delivered for Binghamton Housing Authority's North Shore Apartments and were analyzed as an example development. The energy assessments conducted provided direction on the overall value and performance of buildings. Analysis of historical energy and water usage data for each PHA portfolio was conducted using the WegoWise benchmarking software. The historical energy and water use analysis showed that the property had a water consumption rate that was 17% lower than the benchmark average, and electricity and natural gas usage were 9% and 38% above benchmark consumption averages, respectively. Recommendations to drive down gas consumption included steam boiler controls designed to fire based on a combination of indoor and outdoor temperature rather than the original built-in steam pressure controls that can lead to overheating of spaces. Several upgrades to lighting systems were made to reduce electricity consumption, many of which could be partially or fully funded by utility incentive programs.

STEP 2 Determine Resiliency Strategies

Project Development During the Schematic Design Phase

To identify and reduce risks, the Enterprise team facilitated conversations to define project goals and review project progress. At early stages, sustainable design charrettes were planned to bring together PHAs, architects, Enterprise, and other consultant groups to discuss project challenges and to find applicable strategies for greening, resiliency, efficiency, and sustainable building features.

The Enterprise team facilitated an integrated design workshop with the design/development team for the rehabilitation of the Freeport Housing Authority to review preliminary design concepts and develop a greening and resiliency approach that met the 2015 Enterprise Green Communities program requirements and worked within the project's operational and financial realities. Topics discussed at the workshop included emergency planning, infrastructure protection, business continuity, post-disaster recovery, and a timeline for action. The goal was the production of a summary document outlining consensus and next steps related to climate resiliency design options.

Topics of discussion included:

Fundamental concepts of climate risk management:

- Enterprise Green Communities 2015 was the sustainability rating system chosen to guide project goals including goals for resident health, building efficiency and materials choices
- Stormwater management
- Wind design
- HVAC
- Backup Power
- Materials - all materials used below Base Flood Elevation (BFE) were to be resilient and able to be used for wet floodproofing
- Health - Site design to consider walkability, inclusion of exercise areas such as the planned basketball court, and any other viable features, possibly including community gardens and play spaces

Photo courtesy of Pexels (pexels.com)

STEP 3 Climate Risk Training for PHAs

As part of project goal setting, a survey was delivered to participating PHAs to identify training opportunities and to inform learning collaborative and portfolio-wide training program goals. The outcomes of the survey identified the following training goals:

1. Emergency management manual development and resident and community engagement around emergency preparedness;
2. Sharing energy and water efficiency information, including operations and maintenance best practices, utility tracking and benchmarking, and renewable energy sources; and
3. Further developing understanding of how to incorporate healthy housing, universal design, and active design into developments.

These training goals were integrated into the project, with emergency management manual training and tabletop exercises built into the project scope. Exercises were run at PHAs in collaboration with staff. Energy benchmarking was part of the pilot project reports, and PHAs followed up by implementing building performance benchmarking at properties. Healthy housing and universal design considerations have become part of site audit review tools.

Photo courtesy of Pexels (pexels.com)

STEP 4 Engage Residents

To ensure residents were engaged in the process, the Enterprise team held community meetings at each project site. Dinner was served so residents and their families could attend, and translation services were provided. These sessions enabled public housing authority leaders to learn about the project scope, meet the design teams, and voice their vision and concerns. Many residents voiced concern about their own unit's exposure to climate risks, with particular attention to repair and recovery following Superstorm Sandy and the ability for residents to congregate in the PHA complexes for emergency planning and recovery.

Presentations were done in collaboration with each PHA and RHC leadership and staff and were designed to facilitate collaborative discussion and planning. The meetings focused on introducing the team's approach to resiliency work, and proposing the resilience strategies developed for implementation at each unique project site. The community was asked to evaluate these proposals, and the team sought to hear how resilience strategies could best be deployed to meet the most pressing needs of the community.

The process enabled residents to share priorities, opinions, advice and, worries through an extended Q&A session and a written survey with small group discussion. The survey exercise asked residents to rank the resilience strategies proposed for their PHA on a scale from highest priority to lowest priority. It also welcomed suggestions for other resilience measures beyond those recommended by the project team. Across the surveys at each PHA, residents emphasized resilience to water damage and water issues to be of primary concern. Community members consistently ranked forms of physical or structural protection against floodwater to be a top priority. In general, floodproofing protection for apartment buildings, and other types of comprehensive exterior protections, such as floodproofing or waterproof doors, were seen as preferable to landscape drainage improvements. Most respondents labeled energy resiliency to be in the next tier of priority. Resilience strategies, including solar emergency lighting, back-up generators, and the wetproofing, elevation, or relocation of critical equipment, were identified as key in the case of an extreme event and the subsequent recovery process.

The survey process highlighted disparities across PHAs and demonstrated that resiliency approaches need to be adapted to specific populations, sites, and communities, and are not a "one size fits all approach". For instance, community center building upgrades were a low priority at two sites, but were the top priority at another. Residents at one site appreciated the community centers' utility in emergency events, but were worried about access, usage, and programming of the space. Furthermore, the survey exercise revealed significant local concerns that ought to be considered in planning and implementation designs. For example, at BHA's North Shore Village Housing Complex, a key resident concern was considered many residents' limited physical mobility and the risk posed by loss of function of elevators during emergency situations.

Photo courtesy of rawpixel.com via pexels.com

STEP 5 Determine Course of Action for Properties

Design for each of the sites was developed by contractors and design teams hired by Dormitory Authority of the State of New York (DASNY) to oversee the projects. Designs considered the following inputs:

- Resilience Capital Needs Assessment's outputs
- Interviews with PHA leaders and residents
- Site walk-throughs
- Benchmarking
- Goals of project funding

Enterprise provided a series of trainings for the architecture and engineering firms on the strategies for multifamily housing resilience core concepts, which were based on the experience of multifamily owners in the New York region following Sandy, along with guidance from resiliency leaders and experts across the nation. Using the resiliency capital needs project reports produced by the Enterprise teams, architecture and engineering firms, in consult with Enterprise and RHC, rendered priority solutions.

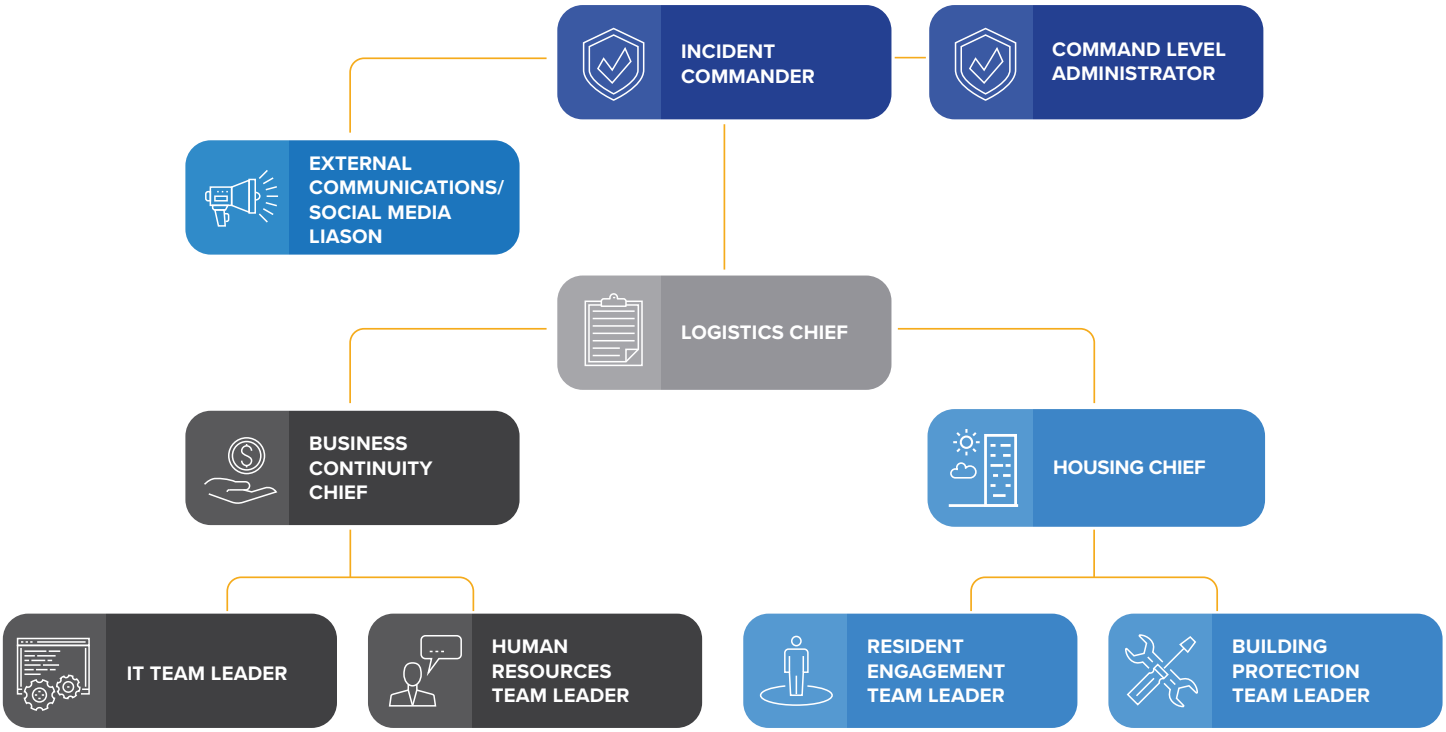
Workers at Mill River

STEP 6 Develop Emergency Plan

The Enterprise team created a toolkit called "Ready to Respond", which was developed with and for multifamily housing owners to help them manage risk. **The Ready to Respond: Business Continuity Toolkit** is based on the Incident Command System (ICS), a planning framework used by federal, state and local first-responder agencies to help structure command, control, and coordination of emergency response. By modeling a staffing plan on this standard, housing organizations can draw on best practices and align their protocols and response timelines with key public agencies, while sharing a common language to describe preparedness efforts. By following the modules in this Toolkit, the staff at the PHAs were able to form a shared operating picture of their emergency protocols and procedures.

Development of the plan was led by an Emergency Preparedness Coordinator at each PHA. The first step of the process was to assign disaster response roles to staff, as guided by the Toolkit, which lays out specific staff roles and responsibilities and the disaster-related protocols needed to support an effective emergency response. Each PHA followed the recommended staffing structure and assigned individuals to positions, such as Incident Commander, Housing Chief, Business Continuity Chief, and Building Protection Team Leader.

After being assigned a role, individuals received position overviews and job action packets to prepare them for their emergency responsibilities. The Enterprise team coordinated with each PHA toward completing and assembling all components of an emergency preparedness plan, referred to as Emergency Management Manuals. To test and gather feedback on the Manuals, the Enterprise team provided customized three-hour tabletop disaster scenario planning exercises for each participating PHA using materials contained in the Business Continuity Toolkit. The tabletop exercises helped PHA staff assess their crisis response and identify areas to improve the emergency management plan.



STEP 7

Build

RHC worked with each individual HA to tailor the construction needs. Enterprise provided support along the development and construction process including support on the construction green materials strategy.

The aim was to facilitate two Workforce Development courses via the Public Housing Resiliency Pilot Program. The Adult Learning Center (ALC) Initiated the second iteration of the course in February 2020 but closed its shop facilities on March 16th in response to the novel coronavirus outbreak. The ALC subsequently outlined a remote learning curriculum for the rest of the semester that meets the requirements associated with the program.

In 2019, students completed First Aid training, Occupational Safety and Health Administration (OSHA) 10-hour training, and the Home Builders Institute Pre-Apprenticeship Certificate Training (HBI PACT) with an accompanying Basic Carpentry Certification. In 2020, students completed requisite shop courses for HBI PACT, along with OSHA and First Aid training before the ALC closed its facilities. The ALC transitioned to remote learning for the duration of the outbreak. The ALC noted that students did not encounter technology access issues and were able to attend classes and complete assignments. The ALC awarded students the HBI PACT Certificate upon their completion of the coursework.

Through the partnership with the Adult Learning Center (ALC), the NDR Workforce Development Program enrolled 22 participants in the program. Of the 22 enrolled students, 20 students successfully graduated from the program by completing OSHA 10, CPR/First Aid, Carpentry Math, Interview Skills and PACT Certifications. Upon completion of the program, RHC engaged the Long Beach Adult Learning Center in the hiring process including resume workshops, virtual job fairs and interviews for our CDBG-NDR funded PHA Resiliency Construction Projects at Long Beach and Town of Hempstead Housing Authorities. Three of the students from the NDR Workforce Development Program were hired for positions at the Channel Park Homes and Inwood Gardens projects. In addition, two other Section 3 eligible individuals were hired for these projects through the virtual job fairs.

Long Beach ALC has been diligent in their efforts to obtain post-program employment documentation for the students who were enrolled in the workforce development program through calling and emailing participants. Of the 20 graduates who completed the program, 12 are employed including the three hired for CDBG-NDR PHA Projects.

Construction at Inwood Gardens

Workforce Development Case Study:

RHC brought in HBI to create pre-apprenticeship workforce training program.

HBI's pre-apprenticeship program is designed to prepare individuals to enter and succeed in our apprenticeship program. Pre-Apprenticeship Certificate Training (PACT) can help participants diversify their skillset and meet the basic qualifications for admittance into a formal apprenticeship program. The program includes approved training curriculum based on industry standards, education, pre-vocational services, hands-on experience in a simulated lab or with a volunteer opportunity, and apprenticeship application support.

The pre-apprenticeship program is extended through Job Corps or WTE PACT and is currently offered in the following areas:

- Building Construction Technology
- Electrical
- HVAC
- Landscaping
- Plumbing

PACT Certificate Type	Units	Total # of SAR Tasks	# of Tasks Needed for 80%
Core	Units 1-4	Unit 1 = 18 Unit 2 = 13 Unit 3 = 28 Unit 4 = 17 Total = 76	Unit 1 = 15 Unit 2 = 11 Unit 3 = 23 Unit 4 = 14 Total = 61
Core Green	Units 1 thru 5	128	103
Carpentry	Units 1 thru 4 + 6 (for Green add Unit 5)	106	85
Electrical	Units 1 thru 4 + 7 (for Green add unit 5)	103	83
Plumbing	Units 1 thru 4 + 8 (for Green add unit 5)	111	89
Masonry	Units 1 thru 4 + 9 (for Green add unit 5)	98	79
Landscaping	Units 1 thru 4 + 10 (for Green add unit 5)	101	81
Painting & Finishing	Units 1 thru 4 + 11 (for Green add unit 5)	99	80
Building Construction Technology (BCT)	Units 1 thru 4 + 12 (for Green add unit 5)	152	122
Weatherization	Units 1 thru 4 + 13 (for Green add unit 5)	111	89
Basic HVAC Technology	Units 1 thru 4 + 14 (for Green add unit 5)	193	155

STEP 8

Operate and Maintain

Systems will be operated and maintained using the PHA's operating fund and capital funds, as appropriate, to ensure the system works in accordance with design standards. PHAs will continue to benchmark utilities to ascertain performance of systems and installations.

Overhead Elec Condui Installation at Moxey Rigby

HVAC ductwork at Inwood Gardens

Lessons Learned

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Lessons Learned

Throughout the development and early implementation of the pilot project several lessons were learned that can help both the participating PHAs move forward with continued resiliency efforts and other PHAs that are looking to make their public housing portfolios more resilient.

PHA Organizational Perspectives

Staff Participation and Training

Staff at the participating PHAs reported often feeling overwhelmed with work, with little-to-no capacity to take on new endeavors. It is critical when budgeting and creating new work streams that staff are provided with additional capacity via a third-party vendor or staff member to support. There are opportunities to provide additional support to staff by:

1. Identifying automated tools, such as WegoWise platform, that can help monitor and manage areas of need, such as energy efficiency and utility management.
2. Training and paying residents to engage their neighbors can add capacity to PHAs in support of resident engagement efforts.
3. Working with housing authority leadership to identify top priority projects and set workplan and goals for delivery.

Based on three learning collaborative meetings with PHAs, we encountered opportunities to create mutual support with several partners on this work as follows:

1. Federal budget appropriations have not provided PHAs with enough funding to cover 100% of administrative costs for many years, leaving many staff stretched to support activities beyond daily PHA operations and need more staff to support activities, going beyond necessity. Any work stream above and beyond the baseline operations needs additional support. Generation of support for emergency planning or climate risk reduction needs to have a proven return or yield on investment.
2. Being climate resilient is, at its core, being able to manage and maintain housing on blue sky days as much as during extreme weather events. Many PHAs face continued budget shortfalls and need to be creative as to how they program and budget their operations. Fixing a roof that is aging and in need of repair is a standard capital improvement and is the first line of establishing resiliency for a PHA.
3. PHAs need financing that can be accessible and patient, considering how much time it takes to procure and construct site improvements.
4. There needs to be better coordination between local and federal partners, before and after an emergency. Several housing authorities did not get reimbursement from federal partners in a timely manner and, as a result, their operating and capital budget were constrained to a great degree.
5. Tracking energy use through systems like WegoWise is important regarding lowering expenses.
6. Providing third party support for Public Housing Authorities to bolster their capacity is critical when undergoing additional repairs and retrofit.

Financing Retrofit Activities

There are a variety of ways to finance affordable housing retrofits or leverage funding sources to support housing interventions. PHAs commonly use capital funds in addition to any state and local funds they may be eligible for. These funds are typically very limited and PHAs need to be prepared to prioritize resiliency when able, leverage those funds with other sources, and as needed incorporate resiliency into ongoing capital and maintenance activities.

Energy Benchmarking

Participation in the pilot program gave PHAs new tools to monitor and evaluate future energy usage, specifically through the WegoWise reporting system. At the writing of this report, it was generally too early given the PHA's construction schedules to see vast energy usage improvements. However, there have been a few notable early utility usage improvements, particularly with water and/or gas usage at two properties, Channel Park Homes and Inwood Gardens.

Resident Perspectives

Surveys and input gathered through feedback meetings with residents helped guide project priorities and reveal underlying resident concerns. For example, while physical mobility was a top concern, ensuring backup power to elevators was a high priority for residents.

Across the surveys at each PHA, residents emphasized concerns regarding resilience to water damage and water issues. Residents consistently ranked forms of physical or structural protection against floodwater to be a top priority. Many residents also labeled energy resiliency to be of priority to them. Resilience strategies, including solar emergency lighting, back-up generators, and the floodproofing, elevation, or relocation of critical equipment, were viewed to be important in the case of an extreme event and subsequent recovery process. During the Channel Park Homes survey exercise, some of the most frequently noted concerns mentioned back-up power, while others highlighted the need for maintaining communication during emergencies. Energy efficiency improvements to promote passive survivability were welcomed, if non-invasive, but were viewed as a lower priority on average across the PHAs. Responses to other improvements varied by site and need. Community center building upgrades were the lowest ranking priority at two project sites, but the clear top priority at another. Residents appreciated the possibility to be able to shelter on site, but were worried about access, usage, and programming of the space.

Conclusion

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Conclusion

PHAs and affordable housing owners at large can utilize the tools, insights, and lessons learned in this document to help preserve critical affordable housing stock during climate and weather-related disasters. Given the high likelihood of future and more intense storms, it is critical to implement practical strategies for adapting affordable housing. Ultimately, this will help ensure that communities depending on these housing structures can adapt and thrive.

REFLECTIONS FROM MIKE CRUZ
EXECUTIVE DIRECTOR OF THE LONG BEACH HOUSING AUTHORITY

Reflecting on the past few years as part of the pilot program, what did taking part in the pilot mean for your agency? How did it impact how your staff and board think about resiliency?

The overall improvements that took place as result of the pilot were great! The fact that it was improving the buildings and as a result creating resiliency after Sandy was a moral lift to the staff and board.

What advice would you give another housing authority that wants to start a resiliency project like yours?

Following proper procurement processes is essential to getting the project completed. We would also recommend housing authorities have proper financing processes in place for payments and reimbursements.

What approaches did you take to engage stakeholders to consider the impacts of climate change and to develop pathways to resilience based on sound science?

We took an educational approach to ensure stakeholders understood the long-term effects of climate change while combining science-based research during planning, and needs expressed by stakeholders during engagement, to develop an environmental plan.

REFLECTIONS FROM TOWN OF HEMPSTEAD HOUSING AUTHORITY

Reflecting on the past few years as part of the pilot program, what did taking part in the pilot mean for your agency? How did it impact how your staff and board think about resiliency?

With the storm damage sustained we prioritized rebuilding, and are appreciative of the valuable lessons learned from RHC and other stakeholders on building resiliency. The board and staff now have tools to plan, prepare, respond, and mitigate for future events.

Now that construction is underway or mostly completed, what has been the response from the community and your residents? How has being part of the pilot program impacted how you work with your local stakeholders?

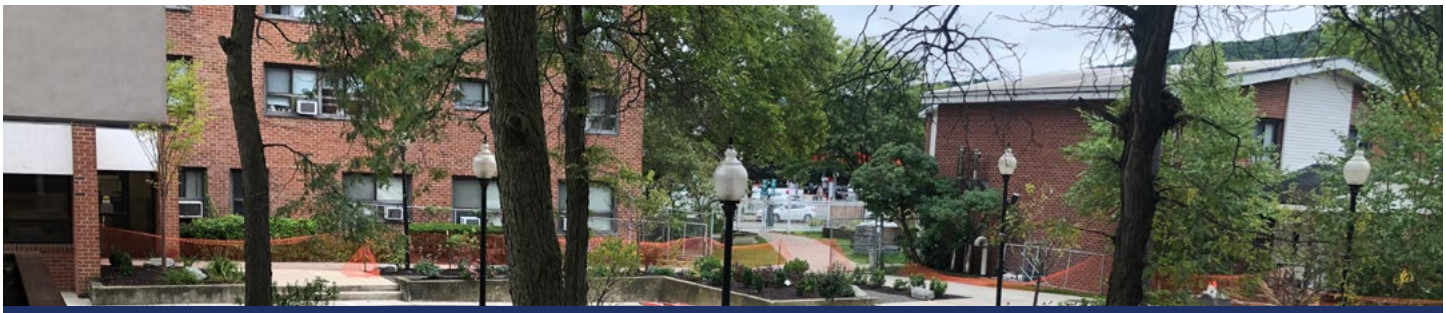
The residents understand the current construction is to ensure a quick recovery if a future event were to occur. We are planning for mitigation efforts that prioritize a quick recovery for our older population and families, so their return to normalcy would be with as little interruption as possible.

What advice would you give another housing authority that wants to start a resiliency project like yours?

Take advantage of resiliency efforts that RHC and other partners offer while avoiding the temptation to complete quick repairs to damaged facilities!

How has your PHA's project applied science-based and forward-looking risk analysis to address recovery, resilience, and revitalization needs?

We have prioritized a return to normalcy after any event but recognize the challenges with relying on outside providers for services. We are now looking at ways to provide our own services, including solar and wind power generation.



REFLECTIONS FROM BINGHAMTON HOUSING AUTHORITY - NORTH SHORE TOWERS

Reflecting on the past few years as part of the pilot program, what did taking part in the pilot mean for your agency? How did it impact how your staff and board think about resiliency?

Being part of the program helped us fund projects that we would not have been able to fund otherwise. These projects are helping us keep our residents safe while improving the physical resilience of our housing.

Now that construction is underway or mostly completed, what has been the response from the community and your residents? How has being part of the pilot program impacted how you work with your local stakeholders?

Our residents are eager to utilize the upgraded outdoor space! Residents, staff, and the board are excited to see the most recent project nearing completion and the updates to accessibility.

What advice would you give another housing authority that wants to start a resiliency project like yours?

Have a dedicated point person that will keep track of activities, budgets, invoicing and draw requests, and reporting.

How has your PHA's project applied science-based and forward-looking risk analysis to address recovery, resilience, and revitalization needs?

We rely on science-based reporting, such as energy-use reports that guide our improvements.

How will your PHA's project leave a legacy of thoughtful, innovative, and resilient approaches to addressing future risks?

We hope to leave a legacy of limiting resilience risks by taking a proactive approach.

What approaches did you take to engage stakeholders to consider the impacts of climate change and to develop pathways to resilience based on sound science?

We tried to keep residents engaged with the project details throughout the process. We engaged residents with surveys and flyers that detailed the usage and resiliency of project spaces.

C

Appendix:
Resilience Capital Needs Assessment

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Appendix: Resilience Capital Needs Assessment

Resilience Capital Needs Assessment

Introduction

This assessment tool is a guide for a walk-through audit and staff interview to identify potential resilience preparedness, aging-in-place, healthy housing, and energy and water efficiency strategies to best protect vulnerable residents, reduce operating costs, and improve building durability. The tool is intended for use by architecture, green rater, and engineering professionals, but several items will require input from facility staff and leadership. Recommendations are derived from the Enterprise Community Partners, Inc.

Assessment Instructions

1. Complete the basic contact information, building information, and resilience goals blanks on Tab 1. Note photos requested below and provide via Dropbox link or other method following assessment walk-through.
2. Answer the yes/no/maybe/NA questions on Tab 2 as you walk through the building with the property manager or head of maintenance and complete the questions in the second portion of Tab 2 as an interview with the property manager and executive director.
3. Recommended resilience, aging-in-place, healthy housing, and energy and water efficiency strategies will auto populate in Tab 3. Complete the table in Tab 3 by selecting whether each strategy will be applied to this project, providing a narrative description of where and how each selected strategy will be implemented, and identifying an estimated quantity, unit type, and unit cost for each selected strategy.
4. Print each tab as a PDF and save as the final report.

(Complete all cells shaded yellow)

Assessment Completed By					
Date Updated					
PHA Address					
Executive Director					
Executive Director Phone					
Executive Director Email					
Property Manager					
Property Manager Phone					
Property Manager Email					
Building Address(es)					
Total Building Area	Building 1	Building 2	Building 3	Building 4	Building 5
	Building 6	Building 7	Building 8	Building 9	Building 10
Ground Floor Area	Building 1	Building 2	Building 3	Building 4	Building 5
	Building 6	Building 7	Building 8	Building 9	Building 10
Number of Floors	Building 1	Building 2	Building 3	Building 4	Building 5
	Building 6	Building 7	Building 8	Building 9	Building 10
Residential Unit Count	Family	Senior	Supportive	Individuals	Total
Total Occupancy Percentage					
Non-Residential Building Uses	Building 1	Building 2	Building 3	Building 4	Building 5
	Building 6	Building 7	Building 8	Building 9	Building 10
Location of Community Room(s)					
Ground Floor Uses					
Basement Uses					
Building(s) Resilience Goals (How should the buildings in this development respond to a significant event? Will they be evacuated or serve as long or short-term shelter-in-place locations?)					

PHA Resilience Goals (In general, how will the PHA respond to a significant event?)	
Planned Rehab Scope	
Rehab Project Status	
Please Provide Photos	Overall building, site at all sides of building, landscape features, interior corridors, staircases, common areas, and a sample unit, key envelope details, roof, and heating, cooling, DHW, and pump nameplates

Category		Question	Assessment	More Information Needed From
Aging-in-Place	1	Is exterior signage easy to read?		
	2	Are exterior pathways and entrances well lit?		
	3	Are exterior pathways slip-resistant?		
	4	Are exterior pathways free of tripping hazards, broken steps, or uneven surfaces?		
	5	Is at least one entry at each building with accessible units accessed by a ramp?		
	6	Is elevator(s) wheelchair accessible?		
	7	Is landscaping trimmed away from paths?		
	8	Is there an entry awning(s) or vestibule(s)?		
	9	Is there at least one 36" wide entry door?		
	10	Are exterior doors equipped with push-style levers?		
	11	Are keypads and locks wheelchair accessible?		
	12	Are mailboxes wheelchair accessible?		
	13	Is bicycle storage on site, covered, and at ground level?		
	14	Are grab bars present in stairways, hallways, and bathrooms?		

Category		Question	Assessment	More Information Needed From
Resilience - Mitigation and Adaptation	15	Is the building located in a FEMA flood zone?		
	16	Is there an elevation certificate for the building (if yes, please provide)?		
	17	Are there stormwater catch basins located around or on the site?		
	18	Are stormwater and sanitary sewer systems separated at this location?		
	19	If known, is the size of stormwater sewer piping adequate?		
	20	Is more than 50% of the site, not including building footprint, impervious surface or compacted soil?		
	21	Does the building share a party wall(s) with neighboring buildings?		
	22	Is the exterior siding flood damage resistant?		
	23	Is there visible evidence of rot at the exterior walls, especially near the ground?		
	24	Is there structural wood in direct contact with soil?		
	25	Are there ground-level apartments located below the base flood elevation (BFE)?		
	26	Does the building have a basement or crawlspace below the BFE?		
	27	Is the foundation material a permeable type such as brick, stone, or rubble?		
	28	Is the foundation in fair or poor condition?		
	29	Are any vents or penetrations located below the BFE?		
	30	Are any utility connections, mechanical, electrical, telecom, or plumbing equipment located below the BFE?		
	31	Are washers and dryers located below the BFE?		
	32	Are there interior floor drains?		
	33	Do all storm and sanitary sewer lines have backwater valves?		
	34	Does the building have an elevator(s) with motors, controls and other equipment located below the BFE?		
	35	Do elevators have flooding sensors and second floor return programming in the event of flooding?		
	36	Is HVAC equipment distributed (for example, is the main heating and cooling equipment for each apartment located in that apartment)?		
	37	Does the roof have stone ballast?		
	38	Are chimneys and appurtenances supported or braced?		

Category		Question	Assessment	More Information Needed From
Energy Efficiency	39	Is the building located in a FEMA flood zone?		
	40	Is there an elevation certificate for the building (if yes, please provide)?		
	41	Are there stormwater catch basins located around or on the site?		
	42	Are stormwater and sanitary sewer systems separated at this location?		
	43	If known, is the size of stormwater sewer piping adequate?		
	44	Is more than 50% of the site, not including building footprint, impervious surface or compacted soil?		
	45	Does the building share a party wall(s) with neighboring buildings?		
	46	Is the exterior siding flood damage resistant?		
	47	Is there visible evidence of rot at the exterior walls, especially near the ground?		
	48	Is there structural wood in direct contact with soil?		
	49	Are there ground-level apartments located below the base flood elevation (BFE)?		
	50	Does the building have a basement or crawlspace below the BFE?		
	51	Is the foundation material a permeable type such as brick, stone, or rubble?		
	52	Is the foundation in fair or poor condition?		
	53	Are any vents or penetrations located below the BFE?		
Healthy Housing	54	Is combustion equipment vented to the outside?		
	55	Is combustion equipment supply and exhaust ducting sealed?		
	56	Does the building have balanced outdoor air supply and exhaust ventilation to units?		
	57	Are clothes dryers vented to the outside?		
	58	Is there evidence of mold?		
	59	Is there peeling or chipping paint, especially around doors and windows?		
	60	Is there bare soil on site or directly underneath eaves?		
	61	Are there carbon monoxide detectors in each unit?		

Category		Question	Assessment	More Information Needed From
Resilience - Backup	62	Is there a backup generator?		
	63	Is there an islandable solar PV and/or battery backup system?		
	64	If backup power is provided, is any critical equipment or fuel storage below the BFE?		
	65	Has a vendor been identified for temporary backup power, heating, and cooling?		
	66	Is the elevator tied to a backup power source?		
	67	Is there a backup potable water supply or potable water storage on site?		
Resilience - Community	68	Does the building have a community room?		
	69	Is the community room below the BFE?		
	70	Does the community room include a bathroom and a kitchen with a refrigerator?		
	71	If the building does not currently have a community center, does it have an unoccupied space or a space that can be repurposed as a community room?		

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Promoting Climate Resilient Public Housing

Lessons Learned from New York State Public Housing Climate Resilience Pilot, a National Disaster Resilience Competition Project

State of New York Office of Resilient Homes and Communities,
U.S. Department of Housing and Urban Development and Enterprise Community Partners

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Office of Resilient Homes and Communities

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