

CLIMATE RESILIENCY AND ADAPTATION



NYC's 520 miles of shoreline feature dozens of diverse, vibrant, mixed-income neighborhoods. Throughout the 21st century, these waterfront neighborhoods will become a proving ground for new policy and planning practices that address climate risks and ensure that New Yorkers can thrive in a changing environment. NYC has the opportunity to realize a vision of climate resiliency and adaptation that centers on climate justice, the principle that all New Yorkers should live, learn, work and play in safe, healthy, resilient and sustainable environments, even as the climate changes.

Climate change is one of the defining issues of our time. For the next generation of climate resiliency and adaptation policies and programs, City agencies will collaborate with communities and each other in new ways to advance climate justice for all New Yorkers, especially those who have been excluded or marginalized based on their race, income, abilities or neighborhoods in which they live. NYC will employ a wide range of different solutions to adapt to a hotter, wetter city – from designing buildings and infrastructure that can safely withstand flooding to training community-based organizations on how to help vulnerable groups stay cool during heat waves. The Goals in the Climate Resiliency and Adaptation theme focus on expanding climate risk awareness and action, using climate risk information in public policies and investments, supporting the housing needs of waterfront residents, managing risks from flooding in NYC's coastal communities, and promoting the design of climate-resilient buildings and infrastructure systems. These goals and strategies present opportunities for the City to proactively and permanently weave climate resiliency and adaptation into processes for long-term planning and everyday decision-making.

Goal 1: Broaden awareness of climate risks and how New Yorkers living and working on the waterfront can take action to adapt to the impacts of climate change.

Goal 2: Apply an understanding of systemic climate vulnerabilities to guide land use policies and infrastructure investments in coastal areas.

Goal 3: Preserve and create new housing for a mix of incomes in appropriate locations and provide waterfront residents with new resources to manage flood impacts on their homes.

Goal 4: Identify opportunities for coastal flood protection, where feasible and practicable, to manage the impacts of coastal storm surge and high tide flooding.

Goal 5: Expand resilient design practices that allow waterfront buildings and infrastructure to withstand the impacts of coastal storms, increased precipitation, extreme heat and sea level rise.

Overview

New Yorkers take pride in living and working by the water. Waterfront communities and City agencies are already taking climate action and rising to the challenges of increasing flood risk. At the same time, NYC is confronted with increasingly severe climate impacts that — without intervention — could strain NYC’s infrastructure, increase the frequency of power outages, cause property damage, and challenge everyday life for waterfront residents and communities.

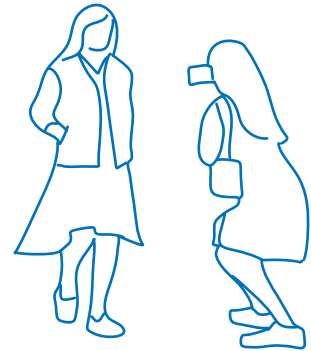
The City’s leadership on climate resiliency — the ability to prepare for, respond to and move forward from climate events — gained momentum after terrible devastation and tragedy. In 2012, Hurricane Sandy swept through waterfront neighborhoods, killing 44 New Yorkers and temporarily displacing tens of thousands of households. Hurricane Sandy caused flooding, fires and power outages, leaving \$19 billion in damage in its wake. The groundwork and research presented in [**Vision 2020: New York City Comprehensive Waterfront Plan**](#) (released in 2011) enabled the City to respond quickly and decisively after Hurricane Sandy. Federal funding was put into action through [**PlaNYC: A Stronger, More Resilient New York**](#) in 2013. Additional resiliency planning continued with [**OneNYC**](#) in 2015 and [**OneNYC 2050**](#) in 2019. Hundreds of projects across the city have been completed, including the reconstructed Rockaway Boardwalk and newly restored wetlands in Queens and Staten Island. Others are currently under construction, including the six-mile-long Rockaways-Atlantic Shorefront project in Queens and the East Side Coastal Resiliency project in Manhattan.

Climate change is a public health, environmental and racial justice priority in NYC. Although waterfront neighborhoods are undoubtedly better prepared today than before Hurricane Sandy, much work remains to be done. The City will continue to be proactive in addressing the needs of populations most vulnerable to harm from climate threats. Today we see the ways that COVID-19 has affected New Yorkers — particularly the pandemic’s shocking disparate effects on the health and livelihoods of people of color and low- and moderate-income households. As climate impacts increase, many of the same New Yorkers who have been most vulnerable to climate impacts will face disproportionate threats to their health, well-being, financial security and livelihoods.

Extreme rainfall adds another layer of risk to NYC’s climate landscape. The [**NYC Stormwater Resiliency Plan**](#), released in May 2021, outlines the City’s approach to managing the risk of extreme rainfall, improving emergency response and planning for increased rainfall in NYC’s infrastructure. In 2021, rainfall records were broken twice: at Central Park during Tropical Storm Henri on August 22 and from

the remnants of Hurricane Ida on September 1. Any New Yorker who experienced the severity and intensity of these storms had a glimpse through a frightening window into a new reality where extreme events will occur more frequently. Ida resulted in 13 fatalities and over \$223 million in estimated damage. These impacts underscored the need for a multihazard approach to address combined flood risk, where waterfront areas are prepared for extreme rainfall in addition to coastal storm surge. [*The New Normal*](#), released in September 2021, provides a blueprint to prepare for and respond to extreme weather in NYC. The Mayor received the report from the Extreme Weather Response Task Force, a top-level convening of senior leaders across City agencies, along with outside climate change and resiliency experts. This report directed the City to compile a new set of protocols and policies to protect New Yorkers from extreme weather events.

“A waterfront that allows the city’s inhabitants to benefit from and enjoy all that it has to offer without sacrificing safety to people, buildings and the environment.”



About the NYC Floodplain

NYC relies on flood risk maps managed by the U.S. Federal Emergency Management Agency (FEMA) to establish a baseline understanding of flood risk across the city. Urban planners, architects and engineers, flood insurance agents, emergency managers, banks and others rely on these maps to understand and manage flood risk in the built and natural environment. The maps can be viewed at the [“NYC Flood Hazard Mapper”](#).

The Flood Insurance Rate Maps (FIRMs) and the Preliminary Flood Insurance Rate Maps (PFIRMs) show areas of flood risk including the 1% annual chance floodplain and 0.5% annual chance floodplain. These boundaries show the area that will be inundated by a flood event that has a one percent chance of happening or being exceeded in any given year.

Today, more than 400,000 New Yorkers live within the 1% annual chance floodplain. By 2050, the 1% annual chance floodplain is expected to cover almost 25% of NYC’s land mass, where more than 800,000 residents (1 out of 10 New Yorkers) live today. Many strategies in this plan will help the City and New Yorkers to manage increasing climate risks in the floodplain.

A 10-Year Vision

Climate change is a risk magnifier, and its impacts will only increase in our lifetimes. The frequency and intensity of extreme weather conditions in NYC — such as coastal storms, high tide flooding, flash flooding and extreme heat — will increase over coming decades. Against a backdrop of systems that continue to marginalize communities of color and low-income communities, the City must design programs that focus on the health and well-being of all residents.

To help New Yorkers reduce their impact on climate change and to mitigate climate risks on people, buildings and infrastructure, the City is pursuing two courses of action:

Climate resiliency and adaptation policies and programs, led and coordinated by the Mayor’s Office of Climate Resiliency (MOCR), ensure that City agencies manage unavoidable climate risks and impacts while also supporting New Yorkers to anticipate their own climate risks and to continue to pursue a better future.

Climate sustainability and mitigation policies and programs, led and coordinated by the Mayor’s Office of Climate & Sustainability (MOC&S), reduce greenhouse gas emissions and help limit the severity of climate impacts by reducing the amount of carbon emissions released into the atmosphere.

Climate Justice — the principle that all residents should live, learn, work and play in safe, healthy, resilient and sustainable environments, even as the climate changes

The critical goal of achieving climate justice and racial equity underlies NYC’s climate response and planning. Centuries of racial discrimination and economic inequality have affected New Yorkers and NYC’s built environment for generations. Planned for release in 2022, the [*Environmental Justice for All Report*](#) (EJ4All) aims to measure the current disparities across NYC in access to healthy, safe, resilient and sustainable environments. Undoing past harms — including decisions about planning, policy and large-scale investments in the built environment — will require a deep commitment to racial equity. The City is urgently doubling down to uphold equity, resiliency and health for all New Yorkers.

The Plan’s “Goals and Strategies for Climate Resiliency and Adaptation” outline actions that can be taken over the next 10 years to address longer-term issues on the waterfront. In addition, the forthcoming [*NYC Climate Adaptation Roadmap*](#) will analyze long term climate impacts across the entire city and create a framework to prioritize future resiliency investments in the neighborhoods facing the greatest physical and social risks. The City’s climate adaptation efforts will be underpinned by a holistic view that assesses multilayered impacts across systems that support day-to-day life over

the course of generations. Climate justice and environmental justice principles will be critical to implement future resiliency investments that both advance the health and well-being of historically marginalized populations and address citywide needs.

Thoughtful and well-coordinated planning, dialogue and action are needed. Climate justice sits at the intersection of climate change and the racial justice movement, the COVID-19 pandemic and the economic recession. The City has numerous roles to play in addressing climate justice, including providing science-based information and tools, making capital investments in neighborhoods, attracting new resources and developing and advancing new programs and projects. The City also collaborates with local leaders on climate resiliency and adaptation issues by balancing communities' needs with limited resources and the need to maintain critical infrastructure and by engaging diverse perspectives around difficult tradeoffs on the path to ongoing climate adaptation. To set the stage for inclusive and equitable outcomes, the City will promote the health and economic stability of all New Yorkers and invite partnerships to dismantle unjust structures along the way.



Riding bikes on the Rockaway Boardwalk, Queens.

NYC Climate Adaptation Roadmap

The ***NYC Climate Adaptation Roadmap*** is an initiative being developed by the Mayor’s Office of Climate Resiliency (MOCR). The roadmap will consist of several components, including a citywide climate impact analysis and a framework for planning and sequencing NYC’s next generation of climate adaptation investments. This framework will identify high-risk areas that will be prioritized for holistic, neighborhood-scale engagement and planning processes that will be undertaken in partnership with local stakeholders. In keeping with the City’s multihazard approach, these neighborhood resiliency processes will consider all of the major climate hazards impacting NYC – coastal storms (such as hurricanes and Nor’easters), chronic high tide flooding, flooding caused by heavy rainfall and extreme heat.

The ***NYC Climate Adaptation Roadmap*** will refresh the City’s climate resiliency strategy and build upon the City’s foundational strategies for storm recovery and resiliency as articulated in ***PlaNYC: A Stronger, More Resilient New York*** and ***OneNYC***. Climate adaptation strategies will encompass improving data collection and analysis; fostering a growing pipeline of new projects and programs; strengthening partnerships with multi-sector partners, including community-based organizations, industry groups and utilities to improve preparedness and coordination; and advocating for funding and better coordination with Federal and state government agencies.

In October 2021, the City Council passed ***Intro 1620***, requiring the development of a Citywide Adaptation Plan. MOCR will fulfill the objectives of this legislation through the release of the ***NYC Climate Adaptation Roadmap***, which will highlight climate impacts and related strategies to mitigate risk to Environmental Justice areas identified in the ***Environmental Justice for All Report***. Both reports are slated for release in 2022.

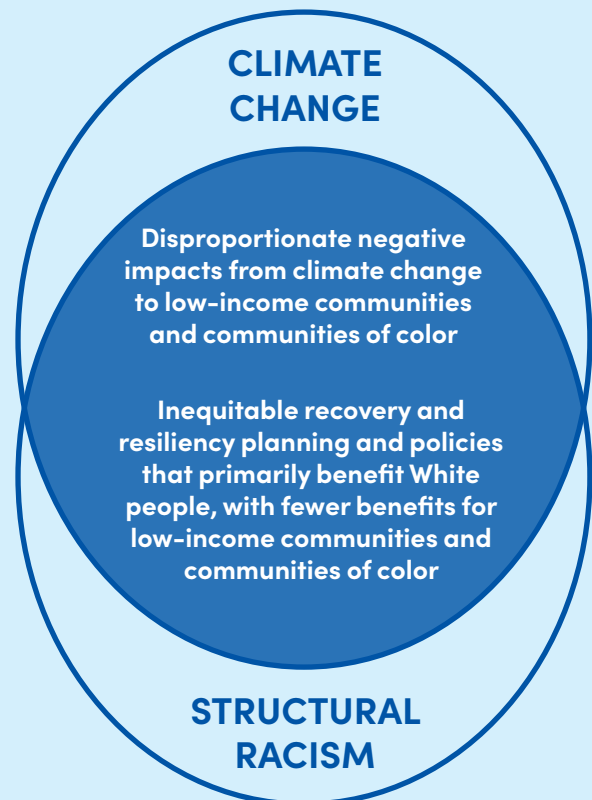
The ***NYC Climate Adaptation Roadmap*** will embody the following core concepts:

Climate Adaptation

Climate adaptation refers to programs, projects and processes that minimize risks to New Yorkers’ health, safety and well-being, while also providing the basis to learn from and evolve the City’s responses to the climate crisis. The City’s response to the climate crisis is multifaceted and includes reinforcing infrastructure and buildings to protect New Yorkers from the impacts of climate change, while also changing the way we interact with NYC’s built and natural environments to reduce the unavoidable and dangerous impacts of climate change.

Climate Justice

Climate change affects everyone, but it does not disrupt everyone’s lives in the same way. Low-income communities and communities of color are frequently confronted with more challenges and barriers to adapting to living in a hotter, wetter



world than communities with more resources and greater economic or political power.

In a climate-just future, everyone lives, learns, works and plays in resilient and sustainable built, social and natural environments, even as the climate changes. To achieve this, it is important to recognize the advantages and disadvantages faced by people of different backgrounds, to understand the equity implications of public policy and resource decisions, and to equip all New Yorkers to meet their own needs in adapting to a changing climate. Climate adaptation measures can be one way to repair and restore communities whose greater vulnerability is due to decades of policy choices and disinvestment. The *NYC Climate Adaptation Roadmap* will outline steps toward a climate-just future that acknowledges the structural, root causes of vulnerability to climate change and is driven by community vision, planning and leadership.

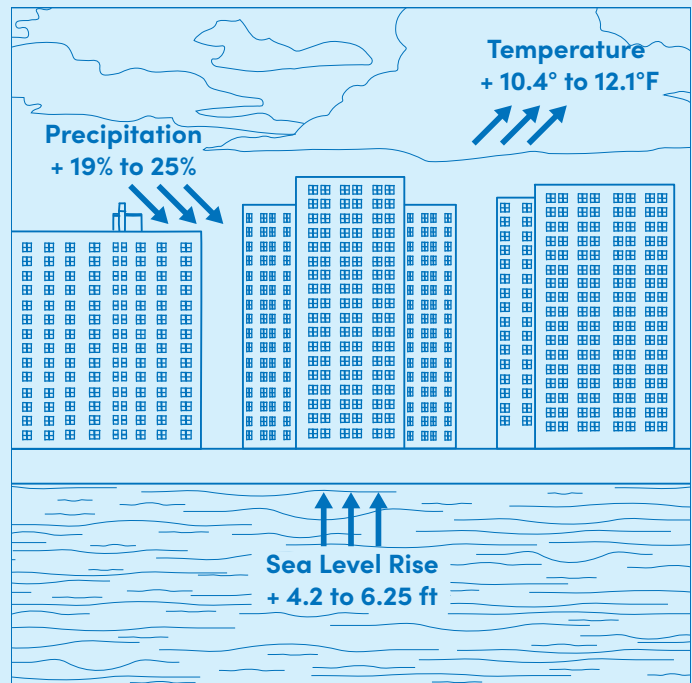
Multihazard Approach

Hurricane Sandy exposed the city's risk to coastal storms. New Yorkers also face a range of other climate risks, including chronic high tide flooding, intense precipitation and extreme heat. The City is taking a multihazard approach to address the full spectrum of climate impacts in a manner that is tailored to meet the greatest near-term climate risks. The *NYC Climate Adaptation Roadmap* aims to better communicate the relative impacts that NYC faces across all climate hazards and how these will increase over time.

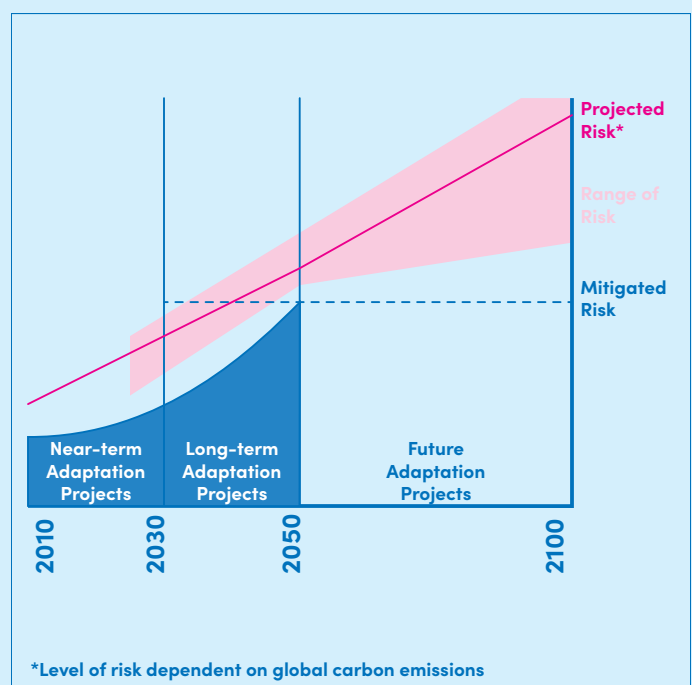
Generational Timescale

Climate adaptation measures will meet the needs of present-day New Yorkers while also anticipating the needs of future generations. The *NYC Climate Adaptation Roadmap* will outline practical risk mitigation strategies through 2050, and identify adaptation pathways through 2100. Climate adaptation will take a full view that addresses multiple timescales, incorporates feedback loops over time, and considers the carbon impact of NYC's climate adaptation measures to the greatest extent possible.

New York in 2100: Climate Projections



Source: New York City Panel on Climate Change



Source: MOCR

Chambers St

Chambers St

ARE YOU
READY TO
WEATHER
THE NEXT
BIG STORM?



[FloodSmart.gov](https://www.floodsmart.gov)



FEMA



Goals and Strategies

Goal 1: Broaden awareness of climate risks and how New Yorkers living and working on the waterfront can take action to adapt to the impacts of climate change

Many New Yorkers are already experiencing climate impacts firsthand and have important perspectives to share about NYC's climate resiliency and adaptation needs. Residents are exploring answers to their own questions and making their voices heard. The City is using their contributions to improve climate risk information and to shape new climate adaptation programs and practices. In 2021, MOCR created new channels for New Yorkers to provide input through the Climate Knowledge Exchange. The Climate Knowledge Exchange encourages the formation of new learning networks that can support new community-driven opportunities to access, use and improve climate risk information and to identify ways New Yorkers can take action to address the impacts of climate change.

In April 2020, Mayor Bill de Blasio (the Mayor) appointed the fourth NYC Panel on Climate Change (NPCC). This independent group of climate experts advises policymakers on local climate projections and adaptation strategies. The new NPCC's expertise reflects the complexity of climate resilience issues across a city of 8.8 million residents. The Panel includes specialists in climate science, risk communications, social science, urban planning, affordable housing and economics. Together, the City, NPCC, and other partners will generate new and creative ways to communicate climate risk and improve climate change awareness, understanding and action.

It is also important to translate climate data into concrete actions by expanding **climate risk awareness** and help New Yorkers prepare for future threats. Partnerships among government agencies, academic entities and nongovernmental organizations can help refine climate research priorities and provide transparent, reliable, freely available climate risk information. The strategies below demonstrate how the City is continuing to refine climate resiliency and adaptation strategies based on the lived experiences and firsthand knowledge of frontline communities.

Opposite:
FEMA ad campaign at Chambers
Street Subway Station,
Manhattan.



Strategy 1.1

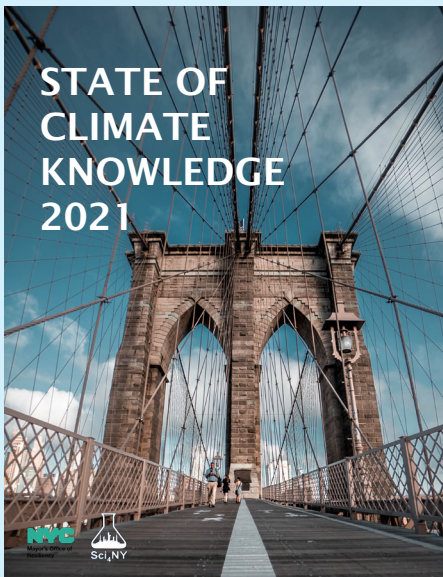
Build a common understanding of local climate risks through sustained conversations between waterfront residents, community leaders, climate and social scientists, private practitioners and government agencies through various programs and platforms.

Strategy 1.2

Expand access to information and other resources for residents and small businesses about flood and heat risks, including timely, accessible information about flood insurance, flood preparedness, heat health and building retrofits.

From Climate Research to Climate Action

Climate research is a critical part of being able to identify and address future threats. Through a wide variety of programs, NYC is actively cultivating a dialogue among frontline residents, community-based organizations, academic institutions and City agencies to share climate knowledge, provide advance learning and spark community-driven action on climate change.



Climate Knowledge Exchange

Launched in 2021, the Climate Knowledge Exchange creates a new channel for dialogue on what we know, do not know and need to know about climate change. Every year, the dialogue will be captured in the [*State of Climate Knowledge*](#) report series, creating a living climate research agenda and offering a platform for communities, academics and City government to identify where research can advance adaptation. Click here for the 2021 [*State of Climate Knowledge*](#) report.

Community Flood Watch

[*Flood Watch*](#) is a community science data collection effort led by the Science and Resiliency Institute of Jamaica Bay and New York Sea Grant in consultation with MOCR and City agencies. The project enables a growing network of residents and organizations to report local flooding, share experiences, and access resources related to flooding in NYC coastal communities. Researchers use these reports to visualize how “normal” high tides could look in the future due to sea level rise, and to improve forecasts of flooding and coastal hazards. Communities can use this shared database of images, reports and maps to communicate their neighborhood’s needs and visions to city leaders.

FloodNet NYC

[*FloodNet NYC*](#) is a pilot flood sensor network being implemented by MOCR in collaboration with academic and community partners in Hamilton Beach, Queens, and Gowanus, Brooklyn. The flood sensors collect real-time data on street flooding that can be used for better emergency preparedness, including more accurate notifications and improved physical interventions and to inform operational resiliency measures for first responders and service providers. The data can also be used by researchers to validate different current and future flooding models.

NYC Hazard Mitigation Plan and Risk Education Tools

NYC Hazard Mitigation Plan

In 2019, NYC Emergency Management launched an online [Hazard Mitigation Plan](#) — the first online plan by a local jurisdiction that uses an innovative platform to deliver up-to-date hazard risk information to the public. The website includes interactive tools for a variety of audiences. The “[Hazard History & Consequence \(HHC\)](#)” tool is a central repository of over 2,000 hazard events and associated consequences. An interactive mitigation actions map tracks existing and completed projects to document how the City is reducing risk. The “[Community Risk Assessment Dashboard](#)” provides localized risk assessments for all 59 community districts. Together, the Hazard Mitigation Plan, online resources and ongoing public education about emergency preparedness ensure that NYCEM and New Yorkers are implementing a culture of preparedness for an array of hazards.

FEMA Hurricane Season Outreach

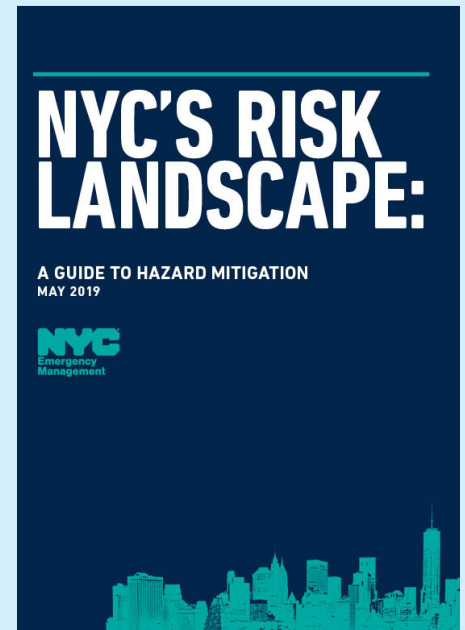
FEMA partnered with the City to launch a marketing campaign in 2021 to encourage flood insurance enrollment during hurricane season. The campaign displayed ads across the five boroughs through outlets including television, radio, the internet and subway posters. NYC and FEMA will continue to partner on flood risk and flood insurance outreach to build greater awareness about hazards and solutions among New Yorkers.

FloodHelpNY.org

[FloodHelpNY.org](#), run by the Center for New York City Neighborhoods, in partnership with the MOCR and the Governor’s Office of Storm Recovery, is a user-friendly website for residents and business owners that provides easy-to-read flood insurance and flood resiliency content. The website builds awareness of current and future flood risks and shares resources on ways New Yorkers can reduce their physical and financial risk. As part of a pilot program after Hurricane Sandy, [FloodHelpNY.org](#) also offers free resiliency audits, including flood insurance counseling, an elevation certificate showing a building’s lowest elevation and flood zone and backwater valve installations in select neighborhoods.

Heat Health Trainings

Heat Health Trainings (an initiative of Cool Neighborhoods NYC) equip trusted messengers such as home health aides, community health workers and community-based organizations to understand heat health risks and to promote protective measures inside the home. [Cool Neighborhoods NYC](#) is NYC’s comprehensive strategy to keep communities safe in extreme heat.



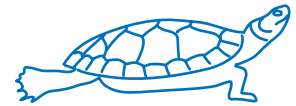
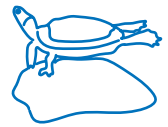


Goal 2: Apply an understanding of systemic climate vulnerabilities to guide land use policies and infrastructure investments in coastal areas

NYC is a coastal city with a diversity of densely settled neighborhoods lining an extensive, varied shoreline. The influence of climate change on sea level rise, storms and groundwater levels causes more frequent floods than in the past. Sea level rise appears as monthly or seasonal high tide flooding that is expected to reach further inland in coming decades. Some residents currently observe cyclical “sunny day” flooding in streets and yards from monthly high tides. Persistent inland ponding occurs in some areas due to a combination of geography, rainfall, high tides, a rising groundwater table and the limitations of street or sewer infrastructure that cannot drain adequately under conditions of increased rainfall and rising tides. Late summer, fall and winter storms present seasonal flooding risks, especially during hurricanes and nor’easters. During the most severe storms, some waterfront stretches are exposed to additional threats from the sheer physical force of wave action. Climate projections show that the frequency and intensity of each flooding source is increasing and will be exacerbated by rising global temperatures.

Neighborhoods and infrastructure systems across NYC were established decades and even centuries before the effects of human-induced climate change were first observed. How the waterfront looks and feels today was shaped by forces such as the shipping and manufacturing industries, the construction of buildings to house the population and workforce, and citywide public works including highways, parks and public housing campuses. Past actions within and beyond NYC have set in motion unavoidable and cascading impacts of climate change, even if global temperature rise remains below 1.5 degrees Celsius. Flooding impacts will be especially hard felt across low-lying stretches of the waterfront, and the human cost of climate change will be worse in neighborhoods that are already burdened with pollution, environmental contaminants, and health vulnerabilities due to chronic floods and extreme heat.

The City’s approach to climate resiliency and adaptation recognizes the interrelationships between the natural and human systems necessary to support everyday life in a city of 8.8 million residents. For example, vulnerabilities in the stormwater drainage systems can affect housing, the transportation systems, and other types of infrastructure. There is no single adaptation strategy to simultaneously address all



“What does a resilient waterfront look like to you? One where coastal and lowlying communities are protected from flooding and rising water levels. But also one where underwater ecological communities are not negatively impacted by any human engineering.”

Opposite:
Red Hook Terminal, Brooklyn.

Credit: MOCR

climate vulnerabilities, but a range of risk mitigations exist that can be applied at scale in dense urban neighborhoods.

Existing public infrastructure systems and neighborhoods are built, with some designed decades before the existence of modern codes and standards. The current state of repair of legacy assets, combined with the increasing stress of climate change, will present a major challenge to maintaining critical public services at adequate levels of service across the city. Under changing climate conditions, the infrastructure and facilities may no longer function as originally intended. A coordinated, systems-level planning approach is needed to inform future retrofits, repairs and system upgrades. Foundational decisions about system design, operations and maintenance must weigh existing capacity, cost and technical feasibility to maintain an acceptable level of system performance under different scenarios. City agencies will continue to prioritize connectivity and continuity of service, among other factors, while also inviting flexibility to promote passive and nature-based features.

Read more about the “Coastal Land Use Framework” on page 69.

To limit greater exposure from future climate risks, long-term plans will also consider changes in land use alongside public investments in infrastructure and housing. The **Coastal Land Use Framework**, introduced in this section, helps to mitigate risk by limiting additional residential density in areas of greatest projected coastal flood risk 30 years from now while promoting resilient construction and retrofits in other vulnerable areas. Although zoning changes do not directly affect existing buildings, they establish limitations on alterations and new development that can be realized over the long term. Residential density influences capital planning, including the siting of coastal flood protection, repairs and upgrades to street and sewer networks and agency operations, such as sanitation services and sewage treatment that maintain day-to-day resident health and safety. The Coastal Land Use Framework is used to align future development and public investments in housing and infrastructure with the City’s understanding of growing flood risks linked to climate change.

Going forward, dense, well-connected areas will continue to contribute new housing and jobs to bolster the local and regional economy. In these areas, the Coastal Land Use Framework applies climate projections that have already been used to inform design standards for the built environment. Infrastructure resiliency retrofits, climate-resilient building codes and zoning updates will enable these waterfront neighborhoods to continue to support new residential development.

Over the next 30 years, it will not be feasible to keep the rising water out of some waterfront areas or to continue delivering the same level of public services. In areas where the magnitude and frequency of flood risks are exceptional, the City has taken steps to limit future residential development with a zoning designation known as a [Special Coastal Risk District \(SCRD\)](#). This zoning designation allows continued investment in existing buildings but restricts growth in the most high-risk coastal neighborhoods and in sensitive natural areas. Residents in southern Brooklyn, the East Shore of Staten Island, and southern Queens have worked with the City to tailor SCRDs to the unique conditions in their neighborhoods.

Climate risk management policies connect the dots between people, places, and climate impacts and will be furthered in the forthcoming [NYC Climate Adaptation Roadmap](#). New programs and services led by the MOCR and City agencies will be needed to uplift and safeguard the self-determination of waterfront residents who are especially vulnerable to economic and social burdens of climate change. Some communities are collaborating with City agencies and researchers on community science initiatives and other research to expand climate risk awareness. Strategies described in Goal 3 are envisioned to support neighborhood housing stability through new programs and services for housing mobility, flood retrofits and community ownership. Meanwhile, the City is advocating aggressively for necessary federal and State funding to construct additional coastal flood protection projects, as described in Goal 4. Goal 5 describes how City agencies that are responsible for land use and infrastructure planning are incorporating climate risk information into capital investment, maintenance and operational decisions.

As the following strategies suggest, future policies and infrastructure investment strategies for high-risk areas along the waterfront will consider multiple factors, including the social vulnerability of current residents, density of existing development, scale of localized flood risks, connectivity to existing infrastructure and the feasibility and viability of infrastructure improvements.

Read on! Jump to:
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[“Climate Resiliency and Adaptation Goal 3” on page 75.](#)

[“Climate Resiliency and Adaptation Goal 4” on page 89.](#)

[“Climate Resiliency and Adaptation Goal 5” on page 95.](#)

Strategy 2.1

Coordinate climate risk-informed land use policy with public investments in development and infrastructure.

Strategy 2.2

Employ the Coastal Land Use Framework to align development and public investments in housing and infrastructure in coastal neighborhoods with future flood risks. Regularly update the framework with the best available climate risk information and evolving understanding of systemic climate vulnerabilities.

Strategy 2.3

Identify adaptation needs, actions and resources for public infrastructure systems. Align target service levels and other adaptation actions to the Coastal Land Use Framework.

Land Use Planning in the Floodplain

Citywide vs. Local Approach

Where flood risk is high, including where sea level rise will lead to future daily tidal flooding

Where risk from extreme events can be managed through infrastructure and context can support growth

Flood risk and Land Use Considerations

Limit Density

In some areas, there is a need to limit future density, as to decrease the exposure to damage and disruption.

Special Coastal Risk Districts

Support Planned Density

Adjust zoning to allow buildings to meet resiliency standards, by providing flexibility and removing zoning obstacles.

Citywide: Flood Resiliency Zoning Text Update (FT2)

Encourage Density

In other areas, the city can encourage new development, as to increase the resilient building stock.

Other DCP's local actions

Coastal Land Use Framework

The Coastal Land Use Framework presents a way to align future development and public investments in housing and infrastructure with an evolving understanding of flood risks. Zoning is a key tool to effectuate land use policies that establish what activities or buildings are permissible on a piece of property, such as land use, density and the size and shape of structures. Zoning covers the entire city, and may be changed as part of a neighborhood plan or site-specific project. Zoning is often used to shape changes to development patterns over a long-term, foreseeable time frame. Although zoning changes do not necessarily affect existing buildings, over time zoning adjustments can reshape the way land is used and density in the City via public and private investment in new construction, rehabilitation or reuse.

The Coastal Land Use Framework will help to reduce exposure to future climate disasters. Based on projections of flood risk covering the next 30 years, zoning changes informed by this framework will support growth and increased resiliency in suitable areas while restricting growth where necessary to reduce neighborhood-scale exposure to risk. While the framework considers a range of uses, intensity of residential use in particular influences capital investment planning and City operational obligations, including the siting of coastal flood protections, repairs and upgrades to street and sewer networks, and agency operations such as sanitation services that maintain resident health and safety in everyday life.

There is no one silver bullet solution to managing risk in a coastal city where neighborhoods and infrastructure systems are already built out. It will be important to advance multiple climate adaptation strategies at the same time. These include new housing programs to support flood retrofits and housing mobility and infrastructure system investments to maintain resident safety and health, all while inviting community leadership to guide positive outcomes for coastal residents.

The framework includes three major strategies:

- Support investment at currently permitted residential densities in waterfront areas where buildings and public infrastructure systems can be adapted to withstand flooding through physical design improvements, flood retrofits, and sound waterfront asset management. This strategy applies to most of NYC's coastal areas.
- Consider increased residential densities and intensity of use in well-connected areas where new development would be appropriate to address the needs of NYC's population. New buildings built to high flood standards can achieve a higher standard of resiliency than many older structures. Prioritize coastal flood protection projects in waterfront areas where coastal flood risks through the 2050s can be practically managed and where land use factors are conducive to growth.
- Limit future residential densities in highly vulnerable or isolated waterfront areas where coastal flood risk through the 2050s presents neighborhood-scale risks that cannot be managed through building-scale improvements and anticipated public investments, including in areas where residential populations do not exist today and where support for a new population would require infrastructure to be extended and maintained at significant public cost.

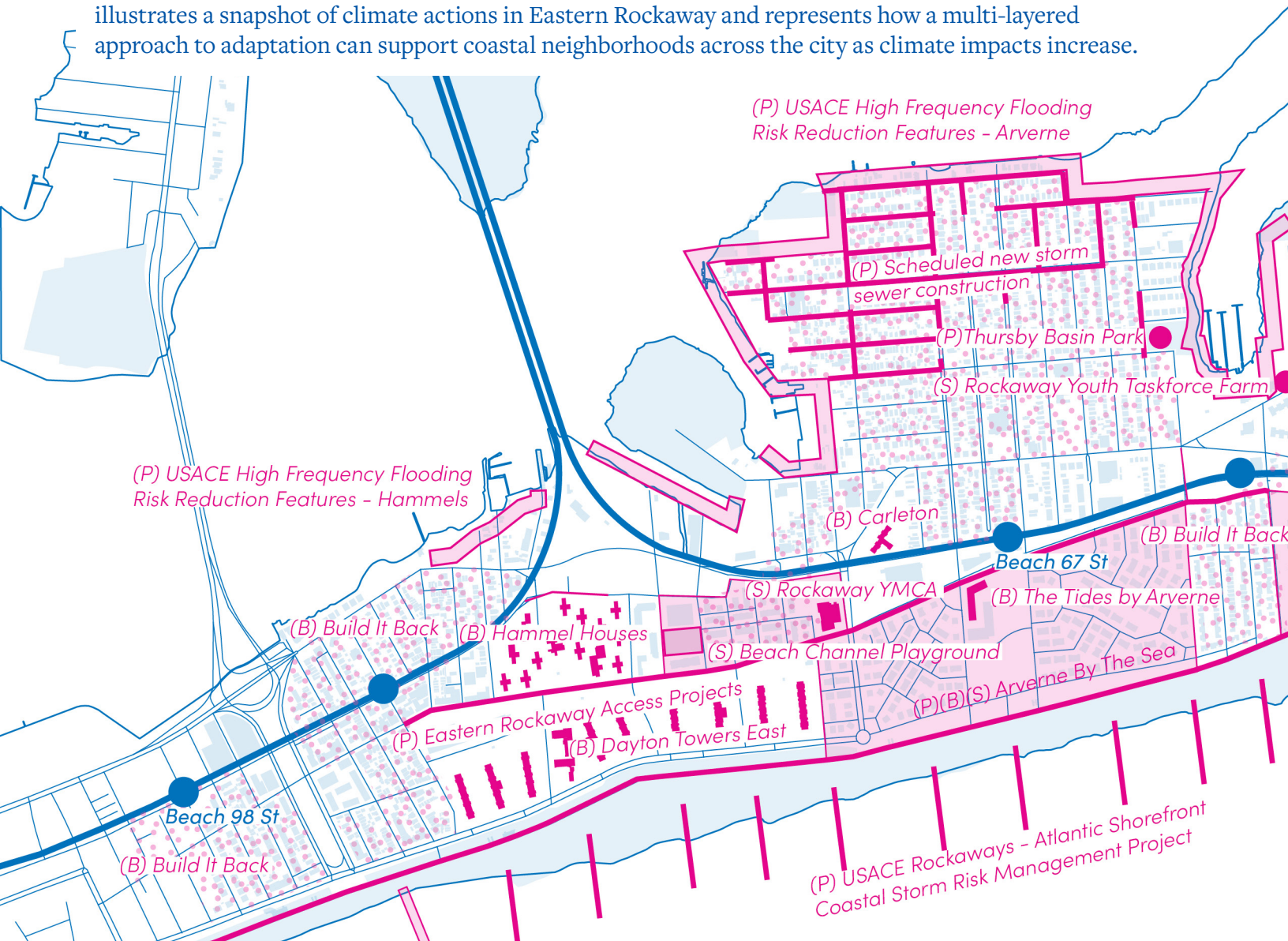
It is also important to recognize that over time, climate change and sea level rise will make some areas unsuitable for residential use, and will result in the loss of some existing housing. Accommodating new housing at locations outside the flood zone, as well as at suitable locations within coastal areas, will be necessary to support the city's long-term needs.

Supporting Thriving Neighborhoods Through Climate Adaptation

Eastern Rockaway, Queens

Eastern Rockaway comprises several coastal neighborhoods on the Rockaway Peninsula, a barrier island along the southern coast of Queens. The area's beaches and bayfront setting have long been a regional waterfront destination and are accessed via the A Train, the Long Island Railroad, and several Metropolitan Transportation Authority (MTA) bus routes. About 100,000 New Yorkers live here in mixed-income communities that present opportunities for resiliency, sustainability, and supporting thriving neighborhoods. Beginning in the mid-1900s, Eastern Rockaway residents lived through the trauma of urban renewal programs. Large stretches inhabited largely by low-income New Yorkers were cleared, some of which remains vacant today. In addition to this history of disinvestment, residents may face long commute times to work, shop and go to school.

Eastern Rockaway is highly exposed to coastal flood risk. Severe flooding and damage occurred during Hurricane Sandy in 2012, exacerbating deep-rooted inequities. High groundwater levels and a flat, level geography also put the area at risk of chronic flooding during heavy rains and high tides. Without interventions, sea level rise projections show that low-lying areas in Eastern Rockaway face a high risk of chronic flooding by the 2050s. The City is working with area residents and local elected officials to advance projects that will help manage increasing flood risks and improve quality of life. This spotlight illustrates a snapshot of climate actions in Eastern Rockaway and represents how a multi-layered approach to adaptation can support coastal neighborhoods across the city as climate impacts increase.



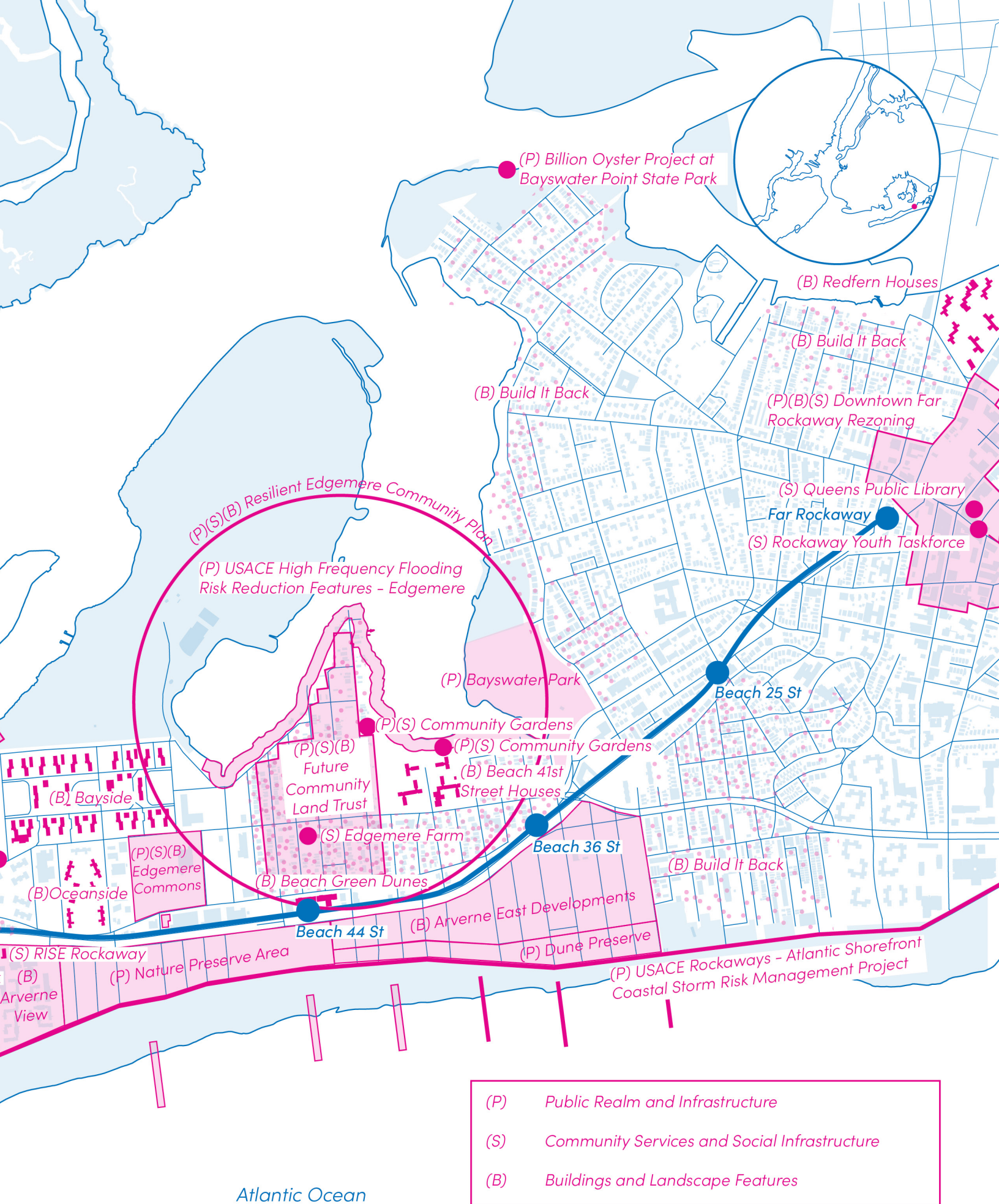


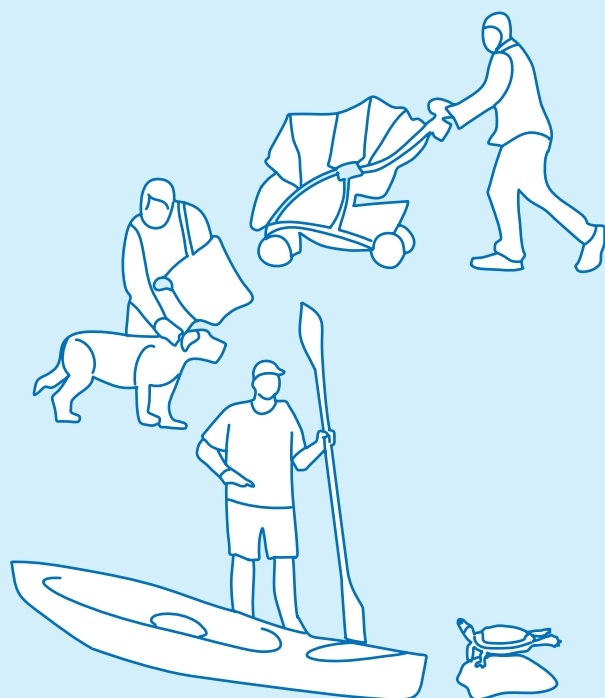
Figure is for illustrative purposes only.

Supporting Thriving Neighborhoods Through Climate Adaptation



Neighborhood Planning

Community engagement has been foundational to neighborhood planning initiatives that advance long-term climate adaptation. Planning processes organize stakeholders and align climate risks with adaptation needs and opportunities. Visioning plans like **Resilient Edgemere** apply knowledge of climate hazards like flooding and heat to inform adaptation investments. Post-disaster recovery planning like the **NY Rising Community Reconstruction Plan - Rockaway East** integrates hazard mitigation principles to support community resiliency and reduce disaster risk. Neighborhood plans are complemented by resiliency planning for citywide urban systems like transportation and sewer services, as well as natural ecosystems like urban forests and wetlands. These plans can advance climate risk management, increase quality and resilient affordable housing supply, promote local retail and community services, and cultivate a safe, healthy public realm.



Public Realm and Infrastructure

The public realm encompasses publicly accessible streets, roadways, sidewalks, parks, plazas and other open spaces where civic interaction occurs. Projects designed to reduce flood risk exposure in Eastern Rockaway are being constructed on public sites, facilities and rights of way that are managed by several agencies, including NYC Parks, New York City Department of Transportation (NYC DOT), and New York City Transit (NYCT). Funding for large-scale projects in the public realm comes from a mix of federal, state, and local sources. The **Access to Opportunity** study and recent transit improvements will make it safer and easier for New Yorkers to get around. USACE projects will mitigate flooding in the area while also improving waterfront public access and recreation opportunities. Continued investments in Bayswater Park, Thursby Basin Park, Rockaway Community Park, Rockaway Boardwalk and Beach, and a new nature preserve at Arverne East can enhance wetland ecosystems and support healthy active lifestyles.



Community Services and Social Infrastructure

Frontline communities are leading by example on climate justice. Strong social networks and community-based risk awareness programs underpin both responsive and equitable disaster recovery and long-term climate resiliency. Numerous organizations serve important roles in Eastern Rockaway's social infrastructure and provide essential services. Projects like the **Billion Oyster Project** are organizing and educating residents on how to boost ecosystem services in natural areas, including at Bayswater Point State Park. Grassroots organizations like the **Rockaway Youth Task Force** and **RISE** are powering a shift toward a culture of healthy food systems at local farms and community gardens while also deepening Eastern Rockaway residents' relationship with the environment.



Buildings and Landscape Features

Eastern Rockaway residents live and work in a range of building types. As climate impacts increase, climate resilient design for new and rehabilitated buildings can substantially reduce flood risk and heat exposure. While most buildings in Eastern Rockaway are privately owned, many buildings and campuses receive public funds through NYCHA and HPD. Numerous existing buildings have been retrofitted and rehabilitated to the latest flood resistant construction standards, though more retrofit needs remain. In accordance with NYC Building Code, all new construction situated in the floodplain must be designed to flood resilient standards. Landscape features such as plantings, soils and green infrastructure can help to absorb stormwater and cool the neighborhood.



Goal 3: Preserve and create new housing for a mix of incomes in appropriate locations and provide waterfront residents with new resources to manage flood impacts on their homes

NYC is a dense, interconnected, vibrant cultural center that has long celebrated and thrived on its connection to water. Waterfront populations are as diverse as those of the entire city — the elderly; low- and moderate-income (LMI) households; people with disabilities; immigrant households; Black, Indigenous, and people of color (BIPOC) residents and others who have been historically marginalized; residents who have weathered many floods; and newcomers. Climate change will continue to fundamentally alter NYC's housing market, neighborhoods and the daily lives of New Yorkers and further complicate the already formidable challenges of maintaining thriving neighborhoods and economies. Rising tides, increasing severity of rainfall and storms, urban heat, and the social and economic repercussions of these changes threaten the choice, agency, and physical and financial well-being of vulnerable populations regarding their housing options across the city.

Sea level rise will also change how the City provides services to residents and communities. In NYC's lowest-lying communities, chronic flooding will increasingly affect health, safety and quality of life for residents, including disruptions to everyday life and influencing displacement, accessibility and environmental health issues. Flooding will also increase the financial burden associated with homeownership in coastal areas due to the cost of flood recovery, diminished long-term value of property, and the impacts of neighborhood-wide transitions, especially for homeowners and renters who cannot afford to maintain flood insurance. Climate change, along with other economic factors, will lead to greater pressures on housing across the city in neighborhoods outside the flood zone. Without proactive approaches, the cumulative impacts of climate change will disproportionately affect BIPOC and LMI households who are already disadvantaged in the housing market. These impacts are already felt today in some communities, where exposure to chronic flooding is causing stress and isolation, travel delays, water damage and saltwater corrosion to cars and property.

Opposite:
Homes in Edgemere, Queens.

Credit: MOCR

The magnitude of climate impacts creates great challenges but also a unique opportunity to transition to more equitable practices and outcomes for NYC's housing and neighborhoods. [*Where We Live NYC*](#) (released in 2020) outlines a balanced approach to advancing fair housing and guides all City housing policy. This approach includes making substantial investments in housing, infrastructure and services in neighborhoods that historically have been disadvantaged by discrimination, disinvestment and exclusion, as well as strategies to provide affordable housing opportunities in neighborhoods already rich with amenities such as schools, shops and restaurants, public transportation, and healthcare facilities. It also advances support for renters' ability to maintain and preserve their homes, including through free legal representation to renters facing eviction, harassment, or disrepair. As referenced in [*Where We Live NYC*](#), fair housing laws protect residents in every home in NYC.

Housing stability:
secure access to a safe
and healthy home and
neighborhood that meets
a resident's needs.

Housing programs serve New Yorkers by expanding **housing stability**. Traditionally, housing stabilization programs have been oriented toward securing housing tenure and neighborhoods in place, through measures such as improving economic and living conditions for residents and supporting local economic development to prevent displacement in areas negatively impacted by market conditions. However, in areas that face increasing exposure to chronic high tide flooding, the ability to maintain uninterrupted access to a decent, safe and healthy home is likely to become compromised over time. Losing ground floor space poses significant financial risks to many building types, from single family homes to cooperative apartment buildings. New strategies and resources are needed to support residents in managing their climate risks and coping with impacts.

Housing mobility:
the ability of residents to
find and secure a home
that improves their
housing or neighborhood
conditions.

Particularly in the context of increasing flood risk, housing stability can be reframed as supporting people's agency to meet their own housing needs, wherever they live. Consistent with the Coastal Land Use Framework, affordable housing investments along the waterfront are evaluated alongside climate risk information and are supported by flood risk management practices, such as coastal flood protection strategies and resilient design standards. In areas where existing buildings are likely to remain, this includes new programs that support flood retrofits so that homes can withstand the impacts of flooding, as well as programs to support **housing mobility**. These resources may include supportive services for individual households, as well as facilitating housing production in areas that are not facing similar risks from high tides and combined flood hazards.

Housing mobility and flood retrofit programs are categories of anti-displacement measures envisioned to support residents in the planning and financing of their long-term housing decisions. Housing mobility services can include a menu of options such as housing counseling, grants and low-interest loans, rental assistance, real estate brokerage services, estate planning, and moving assistance to serve both property owners and renters in flood-vulnerable areas. Under current federally funded models, some support for housing mobility exists through voluntary post-storm buyout and acquisition programs that can be made available after a declared disaster. FEMA grant programs also provide a degree of support for both housing mobility and flood retrofits. Recognizing the need for further proactive approaches, the City can continue to advocate for increasing the magnitude and range of resources available to offer housing mobility services and flood retrofits on an ongoing, long-term basis. Meaningful resident engagement would inform the planning, design and implementation of new housing programs. These programs would complement neighborhood planning and be intended to improve residents' ability to either stay in a neighborhood, even as it changes, or to move to a different neighborhood in the future.

Working in concert with housing mobility services, **land adaptation** can facilitate the transition of flood-vulnerable structures to climate resilient and sustainable land uses, reducing the exposure of residents to climate risk. Future land uses of these sites should be adapted to chronic flooding and where possible serve community and other public needs, whether as a natural area, neighborhood amenity, flood-resilient housing, or another use. As residents exercise their housing mobility options and move away from highly vulnerable areas, public or private land management entities need to take ownership of and maintain flood-vulnerable properties and facilitate new uses. Land adaptation may involve actions like acquiring title, demolishing flood-vulnerable structures, securing and maintaining vacant sites for a period of time, and working collaboratively to identify and steward new uses that reduce climate risk in the neighborhood. Today, responsibility for coastal land management lies primarily with private property owners and government agencies. Land adaptation in an era of climate change may require creative solutions for land management, such as land trusts, community land trusts, land banks, new financing tools, and the ongoing engagement of multiple stakeholders from residents to public agencies and community partners. As with housing mobility programs, land adaptation programs and site-specific projects would be informed by resident engagement and neighborhood planning.

Land adaptation: the transition of flood-vulnerable structures to a range of climate resilient and sustainable land uses that are adapted to chronic flooding and serve community needs.



Communities have good reason to approach new housing and land adaptation programs with caution. The history of redlining, disinvestment and urban renewal shows the harm that can occur to low-income communities and communities of color when affirmative efforts are not made to safeguard them from environmental hazards, pollution, displacement, dispossession and dislocation. Some New Yorkers experienced jarring injustices through urban renewal, a period of racist top-down planning in the 20th century that drove large-scale investments in the built environment and that frequently targeted communities of color. The legacy of racist and marginalizing practices and policies in real estate, the financial and banking sector, and land use planning has excluded generations of low-income New Yorkers, especially BIPOC New Yorkers, from opportunities for housing, financial stability and wealth-building. In creating new programs, it will be important for City agencies and State and federal partners to acknowledge history, repair mistrust and build meaningful relationships with historically marginalized and excluded groups.

The following strategies will help support all New Yorkers, especially BIPOC, LMI and historically marginalized populations, in their agency to design and follow their preferred housing pathways. Equipped with knowledge and tools, and supported by public policies and programs, New Yorkers would be equipped to navigate financial and logistical barriers and able to exercise choice in their housing options. Climate resiliency and adaptation initiatives can seek to yield equitable outcomes through solutions that continually adapt to meet the demands of a dynamic climate and city.

Opposite:
Coney Island from pier, Brooklyn.

Credit: City of New York

For more information, see [“Climate Resiliency and Adaptation Goal 2” on page 65.](#)

Strategy 3.1

Help meet NYC’s need to preserve and create new housing for a mix of incomes in appropriate locations to encourage healthy, equitable and resilient waterfront neighborhoods.

Advance neighborhood planning initiatives to support the vitality and resiliency of waterfront neighborhoods, consistent with the Coastal Land Use Framework and through the [NYC Climate Adaptation Roadmap](#).

Support the redevelopment of select underutilized City-owned properties for affordable housing in waterfront neighborhoods, consistent with the Coastal Land Use Framework.

Encourage affordable housing production and the production of a diversity of housing options citywide to enable housing mobility.

Strategy 3.2

Establish programs for renters and property owners in waterfront neighborhoods that are informed by meaningful engagement and neighborhood planning.

Support residents in improving their housing conditions through new or improved policies and programs that may offer financial, technical or counseling assistance, while seeking to affirmatively further fair housing, through the initiatives identified in [Where We Live NYC](#).

Expand community ownership through shared equity housing and economic development models.

Identify new models for coastal land management that reduce long-term climate risks and offer pathways to acquire and manage land and steward community-oriented uses in partnership with the City, community partners and coastal residents, such as the proposed New York State Environmental Bond Act.

Strategy 3.3

Promote housing stability through flood retrofit and housing mobility services, prioritizing low- and moderate-income households that are affected by chronic high tide flooding and other compound flooding risks.

Pursue multiple funding sources to support flood retrofit and voluntary housing mobility assistance for homeowners and renters, including technical assistance, financial counseling, construction assistance, rehousing assistance and retrofits that reduce exposure to flooding risks. Prioritize assistance in areas with financial need and chronic flood risks.

Update the [NYC Coastal Storm Activation Playbook](#) to enhance interagency coordination for post-storm communication and to equip storm survivors with actionable information on housing reconstruction, flood retrofit and housing mobility options shortly after a federally declared disaster, when available.

Investigate the impacts of sea level rise and extreme weather on New York's diverse housing stock to accelerate new and augmented programs to reduce risk exposure; increase risk awareness; provide retrofit assistance; develop buyout assistance; explore climate migration opportunities; identify post-disaster housing recovery needs; and consider regional housing and transportation mobility needs from coastal neighborhoods.

From Post-Storm Buyouts to Housing Mobility Services and Land Adaptation

After Hurricane Sandy in 2012, the federal government allocated recovery funding for City, State, and federal agencies to pilot time-limited, voluntary post-storm buyout programs. The programs mitigated housing displacement by providing recovery grants to homeowners and renters in substantially damaged homes across Queens, Staten Island and Brooklyn. The programs also transitioned flood-vulnerable homes and property to safer, healthier uses, such as open space and elevated homes.

Because post-storm buyout programs have significant limitations, more equitable solutions are needed on an ongoing basis. Researchers studying these programs across the United States have documented that buyout programs reinforce existing patterns of housing inequality [1], especially for BIPOC and lower-income homeowners whose homes may receive lower valuations in the appraisal process [2] and who may experience housing discrimination in their search for a new home [3]. Additionally, buyout programs nationally have been found to leave behind vacant, underutilized parcels [4] that have a blighting impact in neighborhoods [5]. Redesigned buyout programs that produce equitable results will employ a broadened focus on residents' long-term goals and needs.

New Yorkers should not have to wait for a disaster to access government support to move away from flood risk. New, proactive climate adaptation services are needed to support well-being and financial security as residents weigh difficult decisions. After acquisitions are completed, public agencies, neighbors who stay, and community leaders will need to engage on questions of what happens with the land. The answers will depend on numerous interconnected decisions at the household, neighborhood and citywide level.

Today, no public agency or community partner is equipped with all the tools and resources needed to advance housing mobility and land adaptation initiatives. Meaningful dialogue, resources to adapt and integrated long-term planning will help to inform difficult tradeoffs to maintain safe, thriving communities. The City is in the process of exploring multiple opportunities to expand services and to identify resources to support this expansion. The City will continue to invite input and leadership from New Yorkers as this research evolves and as ongoing dialogues begin to inform policy, planning and programs.

[1] Daniel Cusick. ["Racial Inequalities in Housing Extend to Flood Buyout Programs."](#) E&E News. *Scientific American*, February 19, 2020.

[2] Brentin Mock. ["Freddie Mac Finds 'Pervasive' Bias in Home Appraisal Industry."](#) Bloomberg CityLab + Equality, September 28, 2021.

[3] NYC Human Rights Commission. ["Black New Yorkers on their Experiences with Anti-Black Racism."](#) City of New York, June 9, 2020.

[4] Urban Land Institute. ["On Safer Ground: Floodplain Buyouts and Community Resilience."](#) June 15, 2021.

[5] Erwin de Leon and Joseph Schilling. ["Urban Blight and Public Health: Addressing the Impact of Substandard Housing, Abandoned Buildings, and Vacant Lots."](#) Urban Institute, April 2017.

Create housing mobility services to support New Yorkers to safely stay or move away from chronic flooding

Housing mobility is the ability of residents to find and secure a home that improves their housing or neighborhood conditions. Voluntary post-storm buyout programs have offered recovery grants that provide fair compensation based on property value minus mortgages and debts. When homes are destroyed or made uninhabitable by a major flood, these services are typically sought by homeowners who are at the highest risk of long-term housing displacement. Some programs also offer financial incentives to help storm survivors secure a new home and get back on their feet. Renters living in these homes may be able to access temporary housing benefits and are entitled to housing mobility services through the Uniform Relocation Act, including financial assistance for a rent differential and moving costs.

However, neither post-storm buyouts nor the NYC's housing system — which is already challenged by limited availability of affordable housing, the impacts of COVID-19, and patterns of displacement — are designed to address chronic flooding impacts on a proactive and ongoing basis.

In addition to a one-time recovery grant for down payment assistance, residents in the voluntary post-Hurricane Sandy programs also relied on a number of housing counseling services, loan programs and renter support to navigate complex real estate and legal circumstances.

Housing mobility services are envisioned to provide homeowners and renters with a variety of tools and programs that will allow them either to stay safely in their homes or move into a more stable housing condition. The services can encourage equitable outcomes and advance climate justice by focusing on people and their housing needs instead of their property value. Housing decisions are personal, and decisions about managing risk will inevitably vary from neighbor to neighbor. At what point in family planning, career planning or estate planning might a resident seek a new home to buy or rent? What decisions will they prioritize in their housing search? What financial, legal or social services support is needed to lower and remove barriers to housing choice? How can the City facilitate an adequate affordable housing supply to enable mobility?

As the City begins considering how to develop and resource these potential services, housing stability and resident engagement will rank among the most important priorities.

Examples of Housing Mobility Services



Housing counseling



Credit check and credit repair



Moving and closing costs



Housing search assistance



Mortgage payoff and down payment assistance



Rental assistance and Section 8 vouchers

What happens with the land after residential buyouts?

Housing mobility services involving buyouts will lead to sales of homes and properties, and some of those housing units will be retired to reduce flood risk. At the same time, residents will also continue to live and work in coastal neighborhoods. It will be important to respect residents' housing decisions and accommodate a range of scenarios over time.

Parcels that are suitable for buyout may have potential to serve community needs or to support critical infrastructure services. What new needs and opportunities might arise in wetter environmental conditions? What processes should facilitate the transition of flood-vulnerable lands to new adaptive uses? How can stewardship that prevents nuisance and blight be provided for land where suitable uses are limited?

Land adaptation facilitates the transition of flood-vulnerable structures to a range of climate resilient and sustainable land uses that are adapted to chronic flooding and serve community needs. This process requires both a public or private entity to act as steward of the land and requires revenues or other funding sources to support acquisition, maintenance and stewardship. In the post-Hurricane Sandy buyout programs, public agencies, nonprofit institutions and community stakeholders leveraged their collective experience to acquire, maintain and steward hundreds of small sites across more than 20 NYC neighborhoods on a time-limited basis. Some post-Sandy buyout parcels were appropriate for public agencies to manage and maintain as public assets.

For example, NYC Parks is taking up sites that preserve natural resources and create public recreation opportunities, while NYC Department of Environmental Protection (DEP) will manage a number of sites that can support stormwater management and water quality. Housing and open space sites will also be transferred to community ownership through an NYC HPD initiative to

create a new community land trust in Edgemere. These pilots are built upon decades of partnership between City agencies and local, mission-driven organizations to identify and implement new uses for vacant parcels, such as the creation of community gardens and urban farmland through the Green Thumb program and transferring public sites to create new community hubs like The RISE Center in the Rockaways.

While there are not resources today, NYC can learn from precedents like New Jersey Blue Acres which relies on dedicated sales tax revenue to preserve open space and reduce disaster risk in floodways by purchasing land from willing sellers. Going forward, public agencies, neighbors and community leaders will need to develop new partnership models and identify sustainable funding sources to take up, transform and steward flood-vulnerable parcels into new public, private and community-oriented uses that are adapted to chronic flooding and improve everyday life in coastal neighborhoods.



In Oakwood Beach, Staten Island, where residents petitioned for a community-scale buyout option, the vacant, city-owned land will be used to build several components of the USACE South Shore of Staten Island Coastal Storm Risk Management Project (SSSI), including the buried seawall, tidal wetlands and required open space preservation.

Credit: MOCR



In Edgemere, Queens, sites will become resilient housing and open space as part of the Edgemere Community Land Trust.

Credit: MOCR



Some Midland Beach sites will be incorporated into Staten Island's Bluebelt system to help manage stormwater and reduce flooding while protecting natural areas.

Credit: NYC DEP



In Ramblersville, Queens, the City is prioritizing restoration of a number of sites in connection with the surrounding salt marsh.

Credit: NYC Parks

Supporting Community Ownership for Just Transition

Environmental justice and climate justice advocates, including the [NYC Environmental Justice Alliance](#), are calling for a Just Transition, a unifying and place-based vision to shift from an extractive economy to a regenerative economy. A Just Transition relies on acknowledging past harms and traumas and creating new power relationships to facilitate a society-wide shift to a regenerative economy.

City agencies are currently partnering with community leaders on pilot projects that will create clean energy and affordable, resilient housing in the coming years. These projects aim to shift power and resources to environmental justice communities that have endured the lasting effects of urban renewal and fossil fuel-driven industrial pollution. Many of these same communities face growing threats from flooding and heat due to climate change.

Edgemere Community Land Trust

HPD is supporting the formation of a community land trust to facilitate long-term housing affordability and resilient land management in Edgemere, Queens. Through a competitive process, HPD will identify and work with a community partner to establish a community land trust in the Edgemere neighborhood to promote the stewardship and development of affordable housing and open spaces on vacant City-owned land. The initiative furthers the vision of the [Resilient Edgemere Community Plan](#), released in 2017 after an 18-month community-based planning process, that seeks to pair the City's Hurricane Sandy recovery efforts with a long-term vision for a higher quality of life for Edgemere residents. The plan also builds on the City's commitment to expand community ownership and shared equity housing and economic development models citywide.

What is a Community Land Trust?

1. A community struggles with things like rising housing costs, overcrowding, and vacant buildings.

2. Community members work together to form a **Community Land Trust (CLT)**, a nonprofit, democratically governed organization that gets and keeps land in trust on behalf of the community.

3. The CLT facilitates community driven planning to address the community's immediate and long term needs. It works with resident groups, developers and other groups to preserve and enhance low income housing and develops unused spaces to meet community needs.

Homeowner

- Owns house
- Leases land from CLT
- Leases rental units to tenants



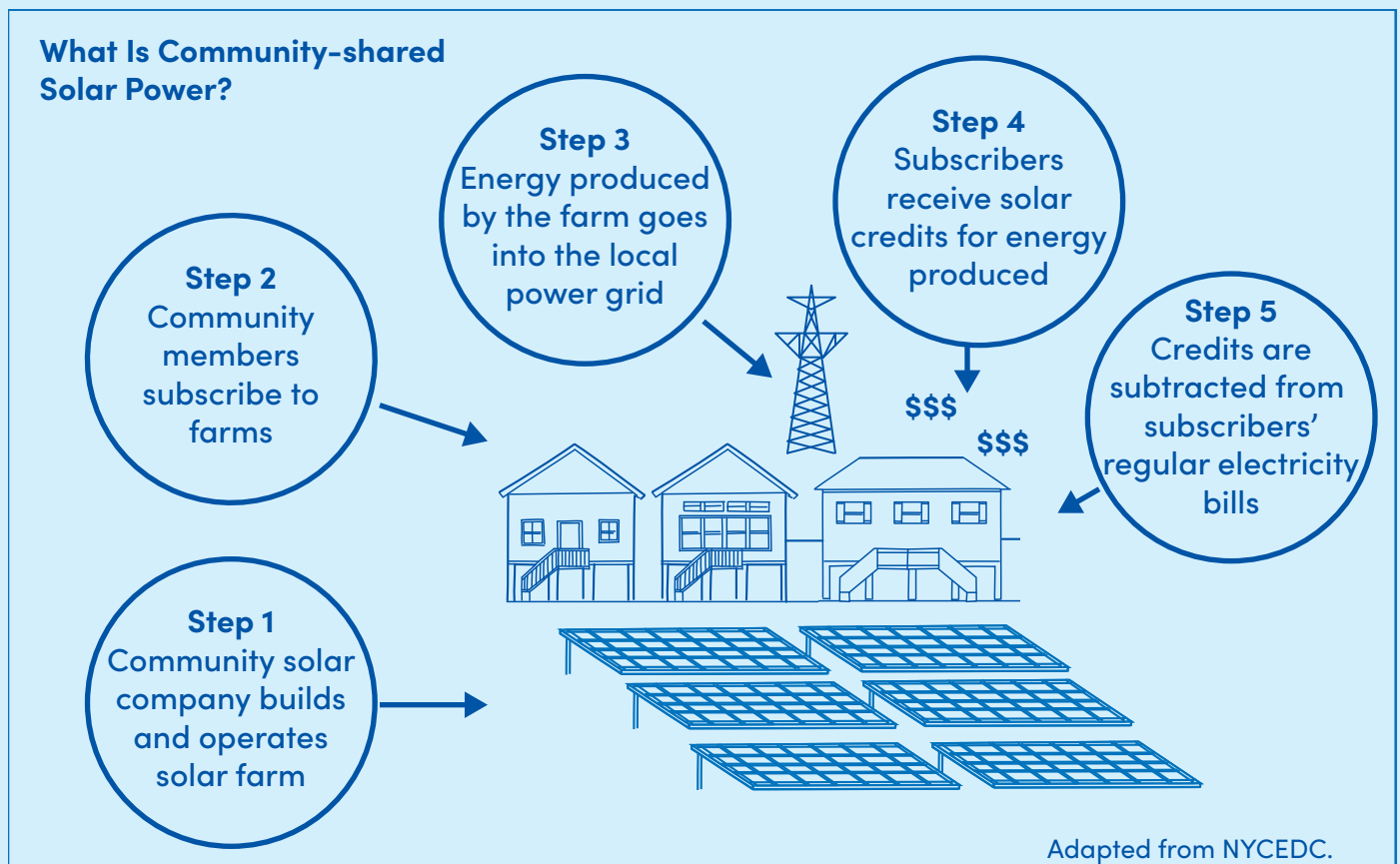
Community Land Trust

- Owns land
- Receives stewardship fee from land lease payments
- Maintains common infrastructure
- Supports housing stewardship

Adapted from HPD.

Sunset Park Solar

In 2018, NYCEDC selected a multi-stakeholder team, led by UPROSE, to develop the State's first community-owned solar project. Community solar allows community members to share the benefits of local solar projects, even if they rent or do not own a building that is appropriate for a rooftop solar installation. This model is intended to promote clean energy and represents an opportunity to support community ownership, in contrast to privately owned infrastructure systems. Sunset Park Solar ultimately will be owned and operated by a cooperative for the benefit of Sunset Park residents, businesses and not-for-profit organizations. Community-owned energy systems can complement traditional infrastructure services by supporting job training, leveraging energy savings to invest in healthier, more efficient homes, and giving communities more of a voice in the clean energy transition.





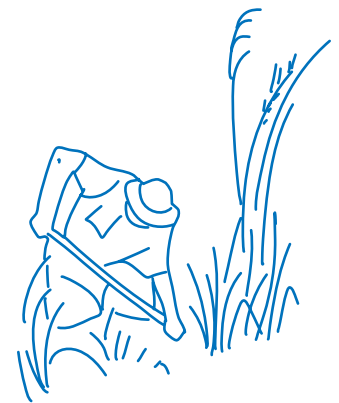
Goal 4: Identify opportunities for coastal flood protection, where feasible and practicable, to manage the impacts of coastal storm surge and high tide flooding

Through [*PlaNYC: A Stronger, More Resilient New York*](#) in 2013, the City identified a series of projects to strengthen areas of the coastline most devastated by Hurricane Sandy and protect against high tide flooding from sea level rise. This plan laid the successful foundation for NYC to pursue federal post-disaster recovery grants totaling approximately \$15 billion. Since then, the City has used these funds to plan and design coastal flood protection across the five boroughs. These will comprise an entirely new class of infrastructure that reduces coastal flooding by seamlessly integrating flood barriers into waterfront neighborhoods.

Coastal protection projects can be large-scale, spanning miles of the coast. The projects are major investments whose scope is significantly greater than locally funded improvements. These are cross-jurisdictional projects that require extensive coordination and collaboration among City, State, and federal agencies. Coastal protection projects are designed to reduce flood risk from coastal storm surge across neighborhoods and to manage inland drainage issues. Through community-informed planning processes, they also provide or improve waterfront public access and open space. Although the City seized on an opportunity after a large-scale disaster to advance a significant coastal protection portfolio, continued advocacy is needed for federal resources to study and implement additional coastal protection projects.

NYC's planned coastal protection projects rely on a wide-ranging set of engineering and design strategies that depend on the local flood risk profile, visual impacts, waterfront public access, physical landscape, land uses and natural ecology. The City's overall coastal flood protection strategy achieves the following goals:

- Protect against storm surge with integrated flood protection systems, floodwalls, levees and floodgates.
- Raise coastal edge elevations to prevent high tide flooding through beach renourishment, revetments, bulkhead raisings, street raisings and the installation of tide gates.
- Minimize upland wave impacts through new dunes, jetties, wetlands and living shorelines.



“What does a resilient waterfront look like? It must be prepared to handle flooding and sea level rise, and must also be able to connect the city’s economy to maritime uses.”

Opposite:
The reconstructed Rockaway Boardwalk in Queens includes state-of-the-art amenities, a more resilient concrete boardwalk, coastal protection measures and dune plantings.

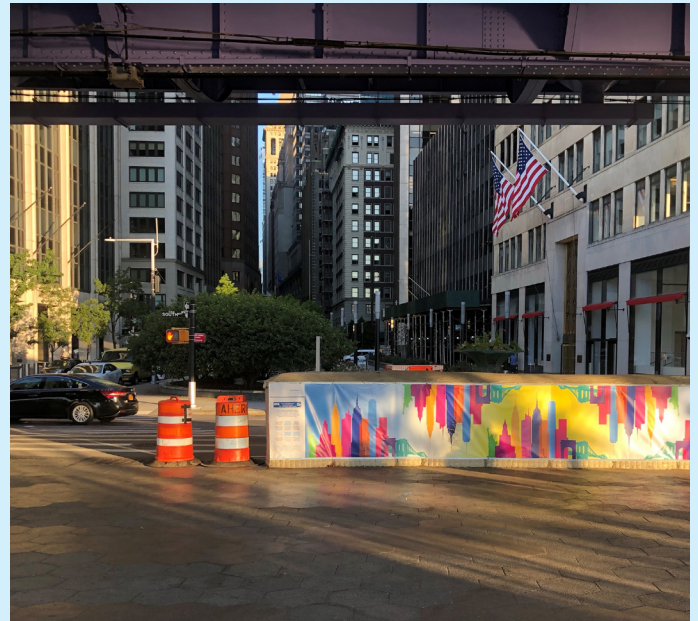
Credit: MOCR

During the planning and design phases of the post-Hurricane Sandy coastal protection portfolio, the City learned a great deal about strategies to reduce coastal flood risk along the waterfront. Every choice came with opportunities and tradeoffs at each stage of the engagement, planning and design process. For example, some projects may change elements that people love about their neighborhoods, including view corridors or the ability to access the water directly. Coastal flood protection projects also may affect maritime activities and commercial uses. Other considerations include the effect on local drainage patterns, limitations presented by existing infrastructure, and land use patterns. Sometimes coastal protection is not the best solution to address a neighborhood's coastal flood risk. Close review and assessment of each neighborhood is needed to understand each location's overall flood risk and social vulnerability. An ongoing partnership between City agencies and communities helps to elevate community priorities and concerns to key decision-makers throughout the planning and design process.

The post-Hurricane Sandy coastal protection portfolio has entered its construction phase. Given different funding sources and varying complexity, the new infrastructure will come online in different stages throughout the 2020s. When completed, neighborhood and citywide coastal protection strategies will be based on multiple lines of defense. Coastal flood protection projects work in tandem with engineering and design features for buildings and critical infrastructure that raise electrical equipment, livable space, offices and other uses higher than projected flood elevations. The built environment is complemented by the actions of infrastructure operators, building management staff and everyday residents through emergency plans for evacuation and the deployment and operation of certain flood barriers. Together with these important elements, coastal protection projects will form a system that integrates into neighborhoods to protect communities from major floods during high tides, severe rainfall events and hurricanes.

A Multilayered Approach to Coastal Flood Protection Systems

Since Hurricane Sandy, the City, in partnership with State and federal agencies, has completed several coastal flood protection projects. These collaborations include the reconstructed Rockaway Boardwalk; a T-groin project in Sea Gate, Brooklyn; a wetlands restoration project in Broad Channel, Queens; beach renourishments in the Rockaways between Beach 92nd and 103rd streets in Queens; street raisings in Broad Channel, Queens; 26 completed Bluebelt projects across three boroughs; and NYCEM's Interim Flood Protection Measures program, which now covers more than 55 sites citywide. The City also has started construction on two large-scale coastal flood protection projects—the East Side Coastal Resiliency Project and the Rockaways - Atlantic Shorefront—with more in the pipeline to begin construction in 2022.



Top Left:
Bluebelt and roadway reconstruction project—
“Gateway to the Bluebelt.”

Credit: NYC DEP

Top Right:
Interim flood protection measures at The Seaport,
Manhattan.

Credit: MOCR

Left:
The Rockaways - Atlantic Shorefront Project being
built in Queens in October 2020.

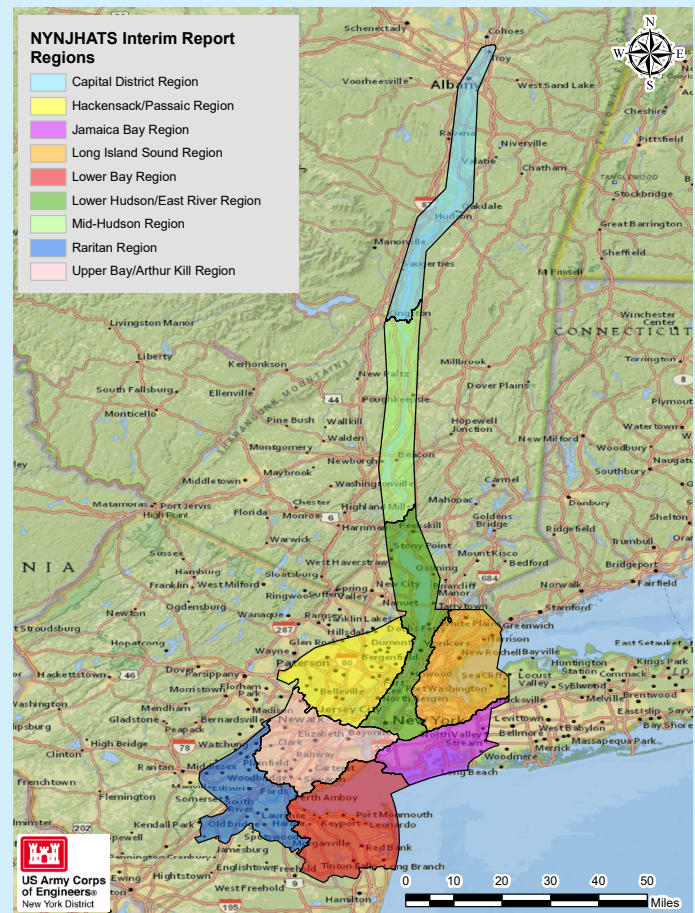
Credit: Michael Appleton/Mayoral Photography
Office

Identifying Regional Coastal Flood Protection Solutions

The City is working with the United States Army Corps of Engineers (USACE) on the New York-New Jersey Harbor and Tributaries Coastal Storm Risk Management Study (NYNJHATS), which covers New York Harbor and tidally affected tributaries in NYC, and parts of Long Island, New Jersey and the Hudson Valley. This is incredibly important because the study will identify a regional coastal flood protection approach and provide a vital blueprint for the region's next generation of coastal resiliency.

Since initiating the study, USACE has identified five potential approaches based on elevation analyses, feasibility studies and environmental impact assessments. Most of these potential approaches would be implemented through dozens of individual land-based and water-based projects across NYC and the region. These include projects for which the City has long advocated, such as land-based protections for Long Island City, in-water storm surge barriers in Newtown Creek, the Gowanus Canal, Jamaica Bay and a Coney Island tie-off.

The study restarted in November 2021 after a 20-month pause during which funding had not been allocated by the previous federal administration. The study will enable USACE to select the best approach and publicly announce their choice, known as their “preferred alternative.” From there, NYC can begin advocating for federal funding to plan, design and construct this next phase of the city's coastal flood protection.



The study area of the USACE Harbor and Tributaries Study includes 2,150+ square miles and covers more than 900 miles of shoreline. The population of the study area as of 2019 is approximately 16 million.

Credit: USACE

Strategy 4.1

Complete the remaining planned post-Hurricane Sandy coastal flood protection projects, including sites in Red Hook, the Rockaway Peninsula, Coney Island, Staten Island South Shore, the East Side of Manhattan and Lower Manhattan.

Strategy 4.2

Incorporate natural and nature-based features into coastal flood protection projects, where feasible and practicable.

Strategy 4.3

Improve interagency and jurisdictional coordination to encourage effective engagement, implementation, operations and maintenance of coastal flood protection projects.

Strategy 4.4

Work with City, State and Federal partners to identify opportunities for future coastal flood protection projects in the areas of all five boroughs where the greatest potential exists to reduce flood vulnerability.

Strategy 4.5

Explore funding sources for new coastal flood protection projects and their ongoing operations and maintenance.



Goal 5: Expand resilient design practices that allow waterfront buildings and infrastructure to withstand the impacts of coastal storms, increased precipitation, extreme heat and sea level rise

The emerging field of **resilient design** incorporates climate change projections into the design of buildings, landscapes and infrastructure so that structures constructed today are designed to withstand the climate risks they will experience in the future. Resilient design helps protect building occupants and their possessions, reduce wear and tear from increased loads caused by climate change, maintain continuity of service during a severe event, and reduce the magnitude of major damage that may result. NYC's waterfront neighborhoods are exposed to coastal flood risks like those experienced during Hurricane Sandy and other storms. Climate change will continue to exacerbate weather extremes citywide, including risks presented by heavy precipitation and extreme heat. Therefore, ensuring resilient design for new and substantially improved construction forms a cornerstone of climate adaptation strategies in coastal neighborhoods and beyond.

Resilient design principles take into account current conditions and future risks, and will enable neighborhoods and many buildings to remain safe and desirable places to live even as flood risk increases. This includes building-specific design guidelines as well as urban design strategies to maintain active streetscapes in flood resilient areas. The experience of Hurricane Sandy, remnants of Hurricane Ida, and other natural disasters across the country demonstrate that resilient design helps to minimize damage to structures during an extreme weather event and enables them to come back online quickly after extreme weather. Resilient design principles are applied in concert with other tools, including the Coastal Land Use Framework described in Goal 2 and coastal flood protection strategies described in Goal 4. Together, these strategies will continue to support the economy and neighborhoods across much of NYC's coastal neighborhoods, including within the 1% annual chance floodplain.

The City is advancing climate policies that will require buildings to be both climate resilient and energy efficient. As of 2014, buildings accounted for 68 percent of carbon emissions in NYC. The [Climate Mobilization Act](#), a series of local laws passed in 2019, is designed to reduce carbon emissions and energy consumption within all buildings larger than 25,000 square feet in floor area. In 2021, the [Climate Resiliency Design Guidelines \(Version 4.0\)](#) were codified in [NYC](#)

Resilient design: incorporating climate change projections into the design of buildings, landscapes, and infrastructure so that structures constructed today are designed to withstand the climate risks they will experience in the future.

For more information, see [“Climate Resiliency and Adaptation Goal 2” on page 65.](#)

[“Climate Resiliency and Adaptation Goal 4” on page 89](#)

Opposite:
Resilient infrastructure at NYCHA
Coney Island Houses, Brooklyn.

Credit: NYCHA

[Local Law 41](#), representing an important learning opportunity and milestone in the early stages of integrating climate risk information and resilient design principles into building codes. The City will collaborate with the private sector to identify the most feasible, cost-effective ways that new and existing buildings could deploy strategies that mitigate both climate risks and carbon emissions.

Expanding resilient design practices also requires planning for future drainage conditions. During heavy rains, higher sea levels may cause stormwater flows to back up through the sewer system and limit the ability of some wastewater resource recovery facilities to operate at full capacity, leading to CSO events that release partially treated sewage into area waterways. Designs for sewer infrastructure must include, whenever possible, projected sea level rise, increased precipitation and frequency of high-intensity storm events. The City will continue to consult with other cities facing similar challenges to exchange best practices for addressing issues related to managing intense rainfall and sea level rise. Efforts include identifying and developing innovative solutions to prepare for more extreme rain events (also known as cloudbursts), that will be exacerbated by climate change.



Hunter's Point Park, Queens.

Credit: Julianne Schaer/
NYC & Company

Strategy 5.1

Further incorporate resilient design principles into all public buildings and infrastructure on the waterfront to ensure that new and retrofitted assets withstand increasing climate risk exposure.

Strategy 5.2

Update local regulations to anticipate future flood risks based on the best available climate risk information from FEMA and the New York City Panel on Climate Change (NPCC).

Strategy 5.3

Accelerate the implementation of resilient design in private buildings by expanding technical, design and financing resources available to property owners and renters in high-heat areas and in areas with flood risk from rainfall and coastal storms.

Strategy 5.4

Identify at-risk neighborhoods for implementation of cloudburst design strategies to improve stormwater management in partnership with MOCR, NYCHA, NYC DOT, NYC Parks, and other City agencies.

Strategy 5.5

Incorporate future rainfall projections into drainage planning, where hydraulically feasible and with other considerations, to help manage future flood risks from increased precipitation.



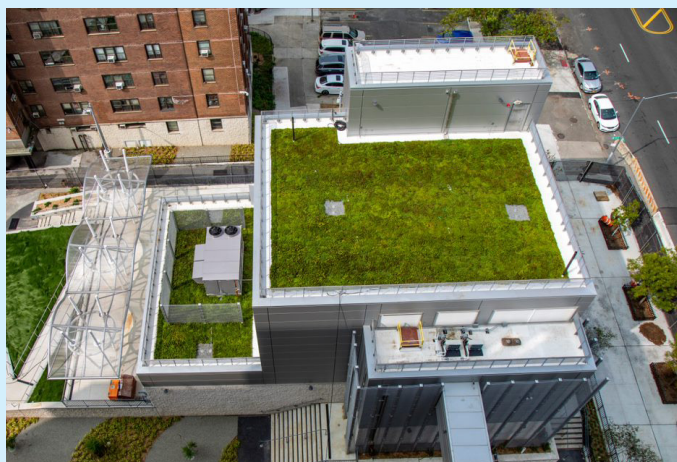
“What does a resilient waterfront look like to you? For example, the development of the waterfront site for Hunters Point South Park was the reuse of the refuse. The landfill that was created from the excavated material from the Midsown Tunnel filled the site to a substantial elevation. The park carves into the landfill to create a destination island; a bioswale filtration system was created using tidal sea grasses and planting meandering along the park edges; indirect lighting, eliminating the traditional light posts throughout represent a resilient waterfront.”

NYCHA: Spearheading Resilient Design in NYC's Multifamily Public Housing Campuses

Many New Yorkers reside in large, multifamily apartment buildings. Hundreds of these buildings are in the floodplain, and many were affected by Hurricane Sandy. Large-scale investments in recovery and resiliency are underway to ensure that New Yorkers' homes are retrofitted to withstand flooding, maintain power and avoid other costly, dangerous climate impacts. These improvements embody Goal 5 and model how New Yorkers can live safely in the floodplain.

Released in October 2021, *Climate Change at NYCHA: A Plan to Adapt* outlines NYCHA's approach to mitigating climate-induced hazards that will impact NYCHA developments and their immediate surroundings. The plan is complemented by NYCHA's *Urban Forest: A Vital Resource for New York City*, a report on NYCHA's trees and articulation of its commitments to preserve and enhance the benefits they bring to residents and *Flood Resilience at NYCHA: Memorializing Lessons Learned from the Hurricane Sandy Disaster Recovery Program*, a reflection on NYCHA's Hurricane Sandy recovery work that informs future coastal protection at NYCHA and beyond. Together, these plans outline how NYCHA will adapt its buildings and infrastructure to changing climate conditions, ensure the longevity of current investments, and monitor emerging climate science to adjust and update plans over time.

The examples here are from NYCHA, whose \$3 billion recovery program is the largest investment in NYC's public housing since its inception. NYCHA's Recovery and Resilience Program represents a transformative case study in how to increase the resiliency of multifamily housing to withstand the impacts of coastal storms. NYCHA's work shows that resiliency measures can be integrated seamlessly into the built environment, help meet sustainability goals, and enhance amenities, all while protecting the buildings that thousands of New Yorkers call home.



Elevated boiler building, with shade structures, community space, green roofs and site improvements serving multiple buildings at Coney Island Houses in Brooklyn
Credit: NYCHA



Passive impermeable barriers below grade stop water infiltration and protect building foundations. This photo shows flexible liners being installed below grade at Wald Houses in Manhattan.
Credit: NYCHA



Generators and solar panels installed on the roof of each building of Ocean Bay Bayside Apartments in Arverne, Queens.
Credit: NYCHA



Structural reinforcement to reduce damage from water and infiltration at (from left to right) Coney Island Houses in Brooklyn, East River Houses in Manhattan, and Lower East Side V Houses in Manhattan.
Credit: NYCHA



Elevated utility annexes serving NYCHA developments at LaGuardia Houses in Manhattan and Coney Island Houses in Brooklyn.
Credit: NYCHA

Zoning for Coastal Flood Resiliency

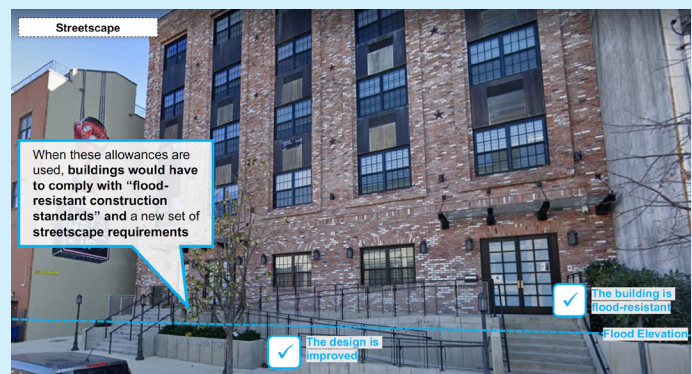
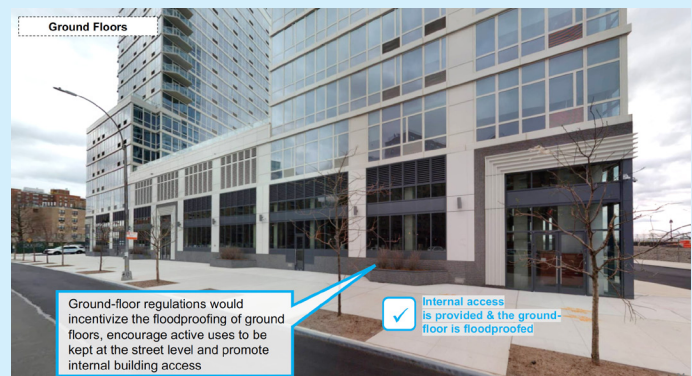
Zoning for Coastal Flood Resiliency (ZCFR), adopted in 2021, demonstrates how zoning regulations can provide flexibility for existing and new buildings to be more flood resilient. ZCFR provides important new design tools that enable waterfront sites to support resilient shorelines and healthy coastal ecosystems.

Flood-Resilient Buildings and Attractive, Friendly Streetscapes

ZCFR allows neighborhoods to be adapted over time, as individual building owners make decisions based on long-term risks. It advances long-term resiliency by removing impediments that prevented buildings from exceeding minimum flood-resistant construction requirements.

These provisions extend more flexible zoning to all existing and new proposed buildings in the 1% annual chance floodplain to increase options available for designing attractive and flood-resilient buildings that are well integrated into neighborhoods. The zoning relief also allows property owners in the 0.2% annual chance floodplain – an area most likely to fall within the 1% annual chance floodplain by the 2050s – to elevate habitable spaces proactively in residential buildings, as well as mechanical systems and other important building features.

The regulations also enable an improved relationship between elevated buildings and the pedestrian experience at the street level. Ground-floor regulations now further encourage the floodproofing of ground floors so that active non-residential uses can be maintained at the street level, with vertical circulation located inside the building. These regulations are joined with requirements to soften the effect of elevated buildings to support a pedestrian-friendly streetscape.



Credit: NYCDP

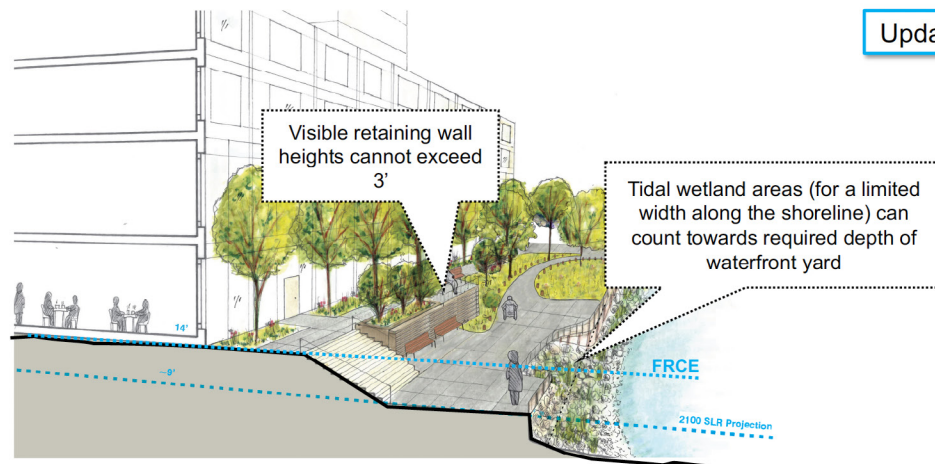
Flood-Resilient Shorelines, Nature-Based Features, and Public Access

ZCFR included modifications to rules requiring public access on developing waterfront sites to enable the design of living shorelines. It also enables the design of bi-level esplanades that provide public access both near the level of the water and at higher elevations. These provisions soften the transition from the streetscape to flood elevations at the building level and include greater flexibility for grading, planting, and locating visual sightlines throughout the site. Together, these provisions balance the need for long-term flood resilience and priorities for public access and circulation.

The regulations also promote the creation of intertidal wetland areas by allowing non-bulkhead treatments such as living shorelines, which can support intertidal habitat and gentler get-downs to the water while attenuating sea level rise and storm driven flooding. The new rules encourage designers to include nature-based shoreline features that bolster healthy ecosystems and can also protect properties and neighborhoods from chronic flooding.

Waterfront Sites

Modifications to waterfront yards, visual corridors and other rules for waterfront sites would enable the design of soft shorelines and bi-level esplanades, providing public access both at the water level and at a higher elevation to meet flood elevations at the building level.



Proposed Rule: provides flexibility for the grading of waterfront yards and visual corridors and to the design of the shoreline, helping balance flood resiliency with the public experience at the water

Excerpt from "Zoning for Coastal Flood Resiliency" presentation, NYCDP

Creating Design Tools for Climate Resiliency

NYC has implemented some of the most progressive climate planning regulations in the nation by incorporating future climate change projections into building codes and zoning regulations. Code updates are on the critical path to ensuring that all new buildings and substantial improvements anticipate future climate hazards based upon their use and useful life, backed by science and experience.

To date, most local regulatory reforms have focused on minimizing exposure to coastal storm surge risk. For example, after Hurricane Sandy — and again in 2021—the New York City Department of Buildings (DOB) expanded minimum freeboard requirements. These requirements ensure a level of protection for different classes of buildings above the flood elevation. In parallel, the City is exploring how resilient design practices can be applied to other climate risks, including stormwater floods, high tide flooding and extreme heat. Based on its research, the City will continue to update its building code to make resilient design an integral part of design and construction.



Wetland plantings, porous paving, and structural soil at Beach Green Dunes in Queens help to mitigate flooding by absorbing stormwater and lowering groundwater.

Credit: Local Office Landscape + Urban Design

Defining Resilient Design for NYC

The *NYC Climate Resiliency Design Guidelines* (“Guidelines”) translate future climate change projections into technical guidelines to be used by engineers and architects in designing buildings, landscapes and infrastructure. These Guidelines go beyond existing code requirements and will encourage the design of new City facilities—like schools, libraries, bridges and affordable housing developments—that can withstand the climate threats of the future.

Following nearly five years of refinement and testing of the Guidelines, with active partnership and participation with more than fifteen City agencies, the de Blasio administration partnered with City Council to pass Local Law 41 of 2021. This Local Law mandates that all City capital projects will be built to the Guidelines’ resilient design standard starting in 2026. A five-year pilot program featuring 40 projects across twenty agencies will allow MOCR to apply the Guidelines’ resilient design criteria, develop a new resiliency scoring system, and test methods for determining the most cost-effective approaches to use in the future.

Local Law 41 of 2021 will ensure that public dollars will be spent on projects that are intentionally designed to withstand future climate risks. This mandate is also an important step towards broader implementation of resilient design. A staged rollout of the mandate for City projects offers an opportunity for the City engineers, planners and policy makers to learn by doing and identify how best to integrate climate risk information and

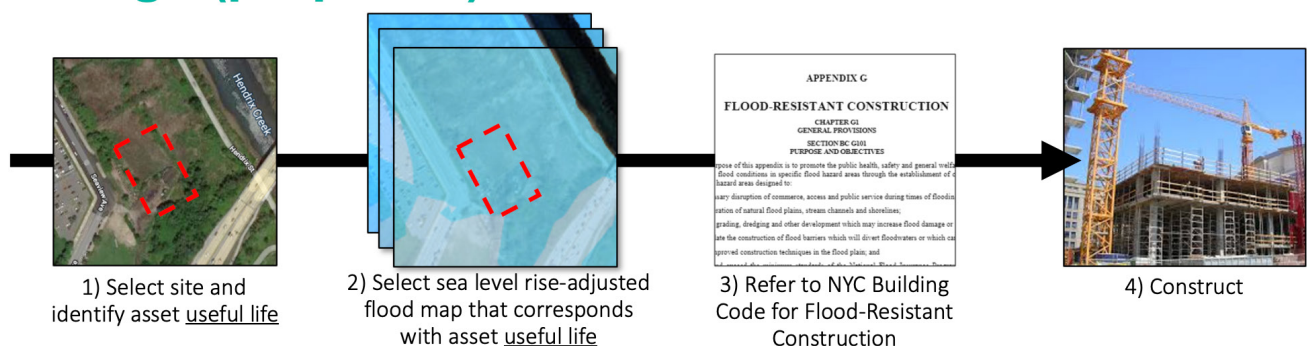
resilient design principles into mandatory building codes for all public and private buildings and NYC infrastructure. This upfront resilient design investment is particularly valuable for City facilities that provide essential services to New Yorkers, and that are required to operate or return online quickly during and after extreme weather events.

Creating a New Kind of Design-Focused, Future Flood Risk Map

Like most cities in the United States, NYC currently relies on FEMA’s FIRMs to define its floodplain for the purposes of construction codes. However, these maps are based on historical weather data and do not incorporate forward-looking climate projections. As the City continues to update its building and zoning regulations, it needs new design maps that account for future risk to regulate the design of buildings and infrastructure. This is important because buildings and infrastructure are typically designed to last for many decades and will experience more severe climate conditions as they advance through their useful life.

To account for increasing flood risk caused by climate change, the City is partnering with FEMA to develop Future Flood Risk Maps (FFRMs). Once finished, these maps will provide property-specific information on future flood risk and will replace the FIRMs as NYC’s new flood reference maps for its building code. The FFRM maps will be a key part of making flood-resilient design a part of all new construction and substantial improvement and will complement existing resources like the “[Flood Hazard Mapper](#)” and [FloodHelpNY.org](#).

How Future Flood Risk Maps could support resilient design (proposed)



Credit: MOCR

Goal 1: Broaden awareness of climate risks and how New Yorkers living and working on the waterfront can take action to adapt to the impacts of climate change

Strategy 1.1: Build a common understanding of local climate risks through sustained conversations between waterfront residents, community leaders, climate and social scientists, private practitioners and government agencies through various programs and platforms.

Strategy 1.2: Expand access to information and other resources for residents and small businesses about flood and heat risks, including timely, accessible information about flood insurance, flood preparedness, heat health and building retrofits.

Goal 2: Apply an understanding of systemic climate vulnerabilities to guide land use policies and infrastructure investments in coastal areas

Strategy 2.1: Coordinate climate risk-informed land use policy with public investments in development and infrastructure.

Strategy 2.2: Employ the Coastal Land Use Framework to align development and public investments in housing and infrastructure in coastal neighborhoods with future flood risks. Regularly update the framework with the best available climate risk information and evolving understanding of systemic climate vulnerabilities.

Strategy 2.3: Identify adaptation needs, actions and resources for public infrastructure systems. Align target service levels and other adaptation actions to the Coastal Land Use Framework.

Goal 3: Preserve and create new housing for a mix of incomes in appropriate locations and provide waterfront residents with new resources to manage flood impacts on their homes

Strategy 3.1: Help meet NYC's need to preserve and create new housing for a mix of incomes in appropriate locations to encourage healthy, equitable and resilient waterfront neighborhoods.

Strategy 3.2: Establish programs for renters and property owners in waterfront neighborhoods that are informed by meaningful engagement and neighborhood planning.

Strategy 3.3: Promote housing stability through flood retrofit and housing mobility services, prioritizing low- and moderate-income households that are affected by chronic high tide flooding and other compound flooding risks.

Goal 4: Identify opportunities for coastal flood protection, where feasible and practicable, to manage the impacts of coastal storm surge and high tide flooding

Strategy 4.1: Complete the remaining planned post-Hurricane Sandy coastal flood protection projects, including sites in Red Hook, the Rockaway Peninsula, Coney Island, Staten Island South Shore, the East Side of Manhattan and Lower Manhattan.

Strategy 4.2: Incorporate natural and nature-based features into coastal flood protection projects, where feasible and practicable.

Strategy 4.3: Improve interagency and jurisdictional coordination to encourage effective engagement, implementation, operations and maintenance of coastal flood protection projects.

Strategy 4.4: Work with City, State and Federal partners to identify opportunities for future coastal flood protection projects in the areas of all five boroughs where the greatest potential exists to reduce flood vulnerability.

Strategy 4.5: Explore funding sources for new coastal flood protection projects and their ongoing operations and maintenance.

Goal 5: Expand resilient design practices that allow waterfront buildings and infrastructure to withstand the impacts of coastal storms, increased precipitation, extreme heat and sea level rise

Strategy 5.1: Further incorporate resilient design principles into all public buildings and infrastructure on the waterfront to ensure that new and retrofitted assets withstand increasing climate risk exposure.

Strategy 5.2: Update local regulations to anticipate future flood risks based on the best available climate risk information from FEMA and the NPCC.

Strategy 5.3: Accelerate the implementation of resilient design in private buildings by expanding technical and design resources available to property owners and tenants in high-heat areas and in areas with flood risk from rainfall and coastal storms.

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