A 2022 Onera Prize for Historic Preservation Project

Living Above the Street:

Stewarding New York City's Historic Built Environment Towards Flood Resilience

Ziming Wang | June 2023

Livingabovethestreet.nyc

About

This is the final report for the independent research project "Living Above the Street: Stewarding New York City's Historic Built Environment Towards Flood Resilience," which is supported by Onera Foundation under 2022 Onera Prize for Historic Preservation.

Columbia GSAPP M.S. Historic Preservation '22

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Further Readings

To view the interactive map, interview series and policy & design reports through the project's online platform, please visit: https://www.livingabovethestreet.nyc.

This Onera Prize research project is developed upon the author's M.S. Historic Preservation thesis:

Wang, Ziming. 2022. "Living Above the Street: Flood Retrofitting and Adaptive Streetscape of New York City's Historic Districts." M.S. Historic Preservation Thesis, Columbia University. https://doi.org/10.7916/fn43-vb19.

Cover Image:
Adapted streetscape of East 118th Street in East Harlem Historic District during a flood event.
Rendering by the author; see Digital Report 05 for details.

The Project in a Glance

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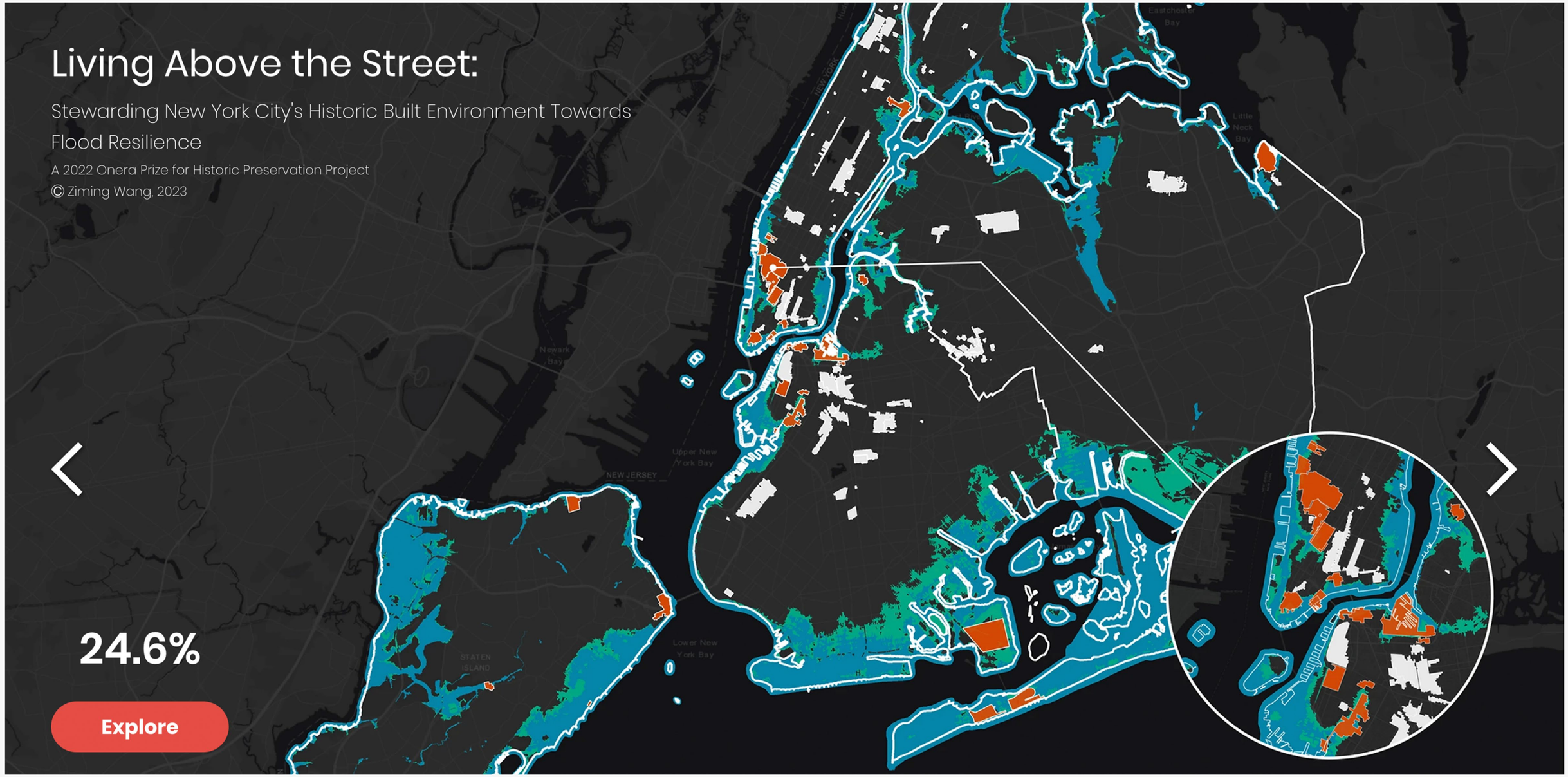


33 National Register Historic Districts intersect with New York City's current floodplain, accounting for **24.6%** of all such designations across the city.

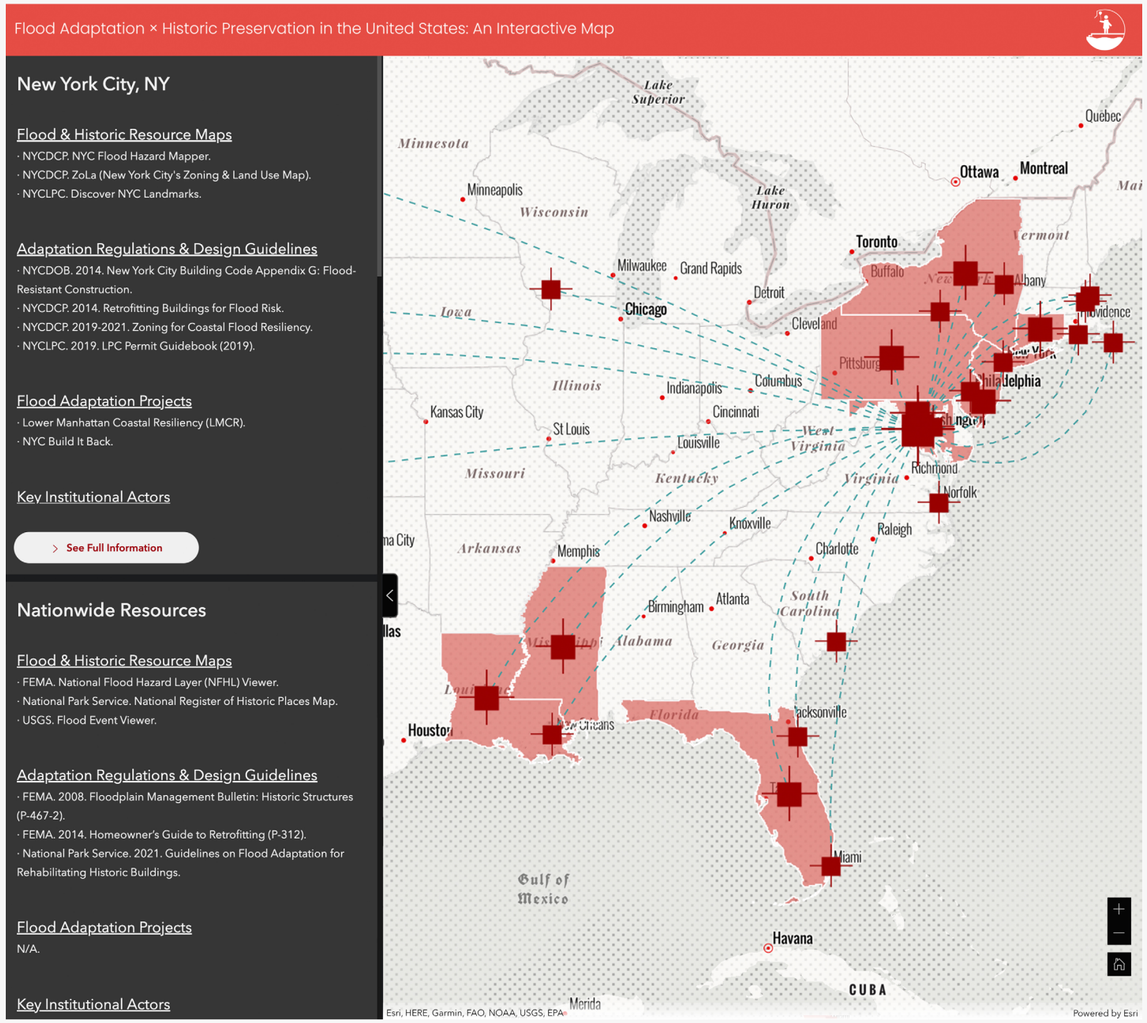
See Digital Report 01: Flood Risk of New York City's Historic Built Environment

Interactive Map:

Flood Adaptation × Historic Preservation in the United States

In recent years, flood retrofitting and streetscape mitigation strategies on historic or existing buildings have been actively developed by various policy-making entities on Federal, state, and local levels. A knowledge of existing flood regulations, retrofitting design guidelines, built cases and financial incentives may benefit researchers and historic property owners, and serve as a valuable reference to the policy-making of New York City and other local communities.

Click "+" marks in the interactive map below to explore nationwide flood adaptation resources on historic built environment. Alternatively, click here to open the map full-screen in a new window.



Policy-Maker & Stakeholder Interviews

The heritage resilience discourse has a broadly interdisciplinary nature. Therefore, a collective dialogue is of vital importance: it allows us to acknowledge different values, knowledge and expertise as we tackle the climate crisis and envision our shared urban future.

On this page, you may explore the opinions of planners, preservationists, architects, contractors and community stakeholders as they identify challenges, set agendas, and discuss solutions for the stewardship of historic built environment towards flood resilience.

Feb 20 · 8 min

Marie Winfield | A'Lelia Bundles Community Scholar, Columbia University

"Resilience planning can be a valuable opportunity for integrated land-use decisions and localized environmental education programs."

8

Feb 15 · 6 min

Robert Sauder | Wolfe House & Building Movers

"Historic buildings often bear great emotional values, which serve as a rationale for property owners to seek elevation or relocation."

12

Feb 12 · 9 min

Jonathan Boulware | South Street Seaport Museum

"Long-term and short-term strategies at different scales should be developed hand-in-hand to ensure us a resilient future."

10

Feb 6 · 7 min

Julia F. Martin & Erin Lanier | Julia F. Martin Architects

"We're confident that local historic buildings can be designed for flood resilience in a way that respects their historic characters."

21

Feb 4 · 9 min

Deborah Tackett | The City of Miami Beach

"While historic preservation can't be the full solution to climate resilience, it can be part of it."

26

Jan 31 · 7 min

Olivia Brazee & Chelsea Towers | New York SHPO

"It'll be a worthy challenge to put information in one place, and to consolidate available resources for the public."

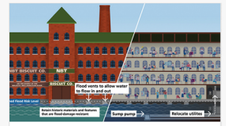
14

Jan 27 · 9 min

Julie Nucci & Jim Overhiser | Historic Homeowners in Owego, NY

"Homeowners shouldn't have to be privileged in order to be able to stay safe."

35



Dec 20, 2022 · 7 min

Jenifer Eggleston | National Park Service

"We have to move forward, accept more change, and better regulate these changes."

33

Nov 29, 2022 · 8 min

Erin Minnigan | Preservation Society of Charleston

"If we continued to deny the elevation of historic homes, it would adversely affect their long-term preservation."

48

Nov 22, 2022 · 5 min

Alyssa Lozupone & Margaret Back | Newport Restoration Foundation

"We're seeing a debate on whether to elevate historic houses up to BFE; whether to prioritize historic character, or flood resilience."

21

Aug 3, 2022 · 4 min

Emily Sun | NYC Department of City Planning

"The ground-floor elevation data provides vital information on a building's risk of coastal and inland flooding."

28

Aug 1, 2022 · 5 min

Michael Marrella | NYC Department of City Planning

"For intact historic districts, structural elevation may not always be the ideal solution."

44

Jul 31, 2022 · 4 min

Interview Question List

In this post, you'll find a set of key questions prepared by the interviewer for all interviewees reached out in this project.

29

Policy & Design Reports

This section features a series of original research reports aimed at developing design and policy tools that address flood adaptation and historic urban form change in the context of New York City.

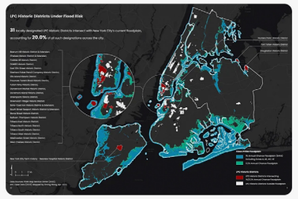
Browse the publications below to learn more about the flood risk faced by New York City's historic built environment; the multiple goals and values involved in the transformation of historic streetscapes towards flood resilience; streetscape-sensitive flood adaptation design strategies for New York City's historic buildings and neighborhoods; real-world design studies, and heritage resilience policy-making agendas.

Digital Report 01

Flood Risk of New York City's Historic Built Environment

This report examines the physical flood risk faced by New York City's historic built environment, which is compounded by potential adverse streetscape impacts brought by flood adaptation interventions, as well as the city's underdeveloped heritage resilience policy framework.

> Read ⇵ Download (24mb)



Digital Report 02

Adaptive Streetscape: Concept & Framework

Identifying streetscape change as a key tension in the heritage resilience discourse, this report proposes an "Adaptive Streetscape" framework and a set of evaluation metrics that serve to understand and measure the various values involved in the transformation of historic streetscapes towards flood resilience.

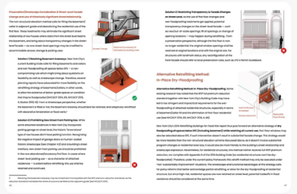
> Read ⇵ Download (26mb)

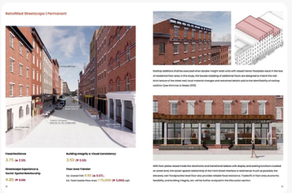
Digital Report 03

Streetscape-Sensitive Design Strategies

Addressing the absence of streetscape-sensitive flood adaptation design strategies targeted at New York City's historic buildings and neighborhoods, this report explores such strategies based on nationwide flood regulations and guidelines, successful built cases, together with the author's own illustrative input.

> Read ⇵ Download (61mb)





Digital Report 04

Adaptation Design Study: South Street Seaport

Building on the Adaptive Streetscape Framework and Streetscape-Sensitive Design Strategies developed in the previous reports, this report envisions the adaptation of a mixed-use street corridor in South Street Seaport historic district as it relates to the retention of the street corridor's vigor, scale, transparency and accessibility.

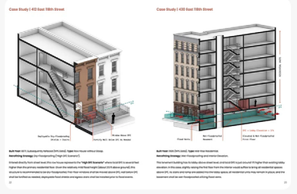
> Read ⇵ Download (21mb)

Digital Report 05

Adaptation Design Study: East Harlem

Paired with Digital Report 04, this design study envisions the flood adaptation of East 118th Street — a historic residential corridor in East Harlem, New York City — by identifying feasible and relatively low-cost retrofitting strategies that are friendly to residential property owners and compatible with historic urban forms.

> Read ⇵ Download (23mb)



Living Above the Street: Stewarding New York City's Historic Built Environment Towards Flood Resilience.
Livingabovethestreet.nyc.
An Onera Prize in Historic Preservation Project by Ziming Wang, M. S. Historic Preservation '22, Columbia University Graduate School of Architecture, Planning and Preservation.
zw2681@columbia.edu.

Contents

Executive Summary

Executive Summary

Flooding and sea level rise are substantially and increasingly threatening the integrity of New York City's waterfront historic built environment. Such physical flood risk is further compounded by potential adverse streetscape impacts brought by flood adaptation interventions such as structural or non-structural elevation as required by the city's Post-Sandy Building Code, and the city's underdeveloped heritage resilience policy framework which is unable to provide much guidance on the flood adaptation of historic properties.

Aiming at flood adaptation and historic urban form change in New York City's context, this project seeks to fill in the missing pieces that lie within the city's heritage resilience framework by better understanding the vulnerability of New York City's historic built environment under physical flood risk and adaptation interventions, exploring design and policy tools that help facilitate an adaptive transformation of the city's historic urban forms towards flood resilience, and creating a collective dialogue on heritage resilience that bridges practitioners of different professions and the public. The final product of this project features a publicly available online portal — www.livingabovethestreet.nyc — that comprises three components:

- A GIS-based Interactive Map: Flood Adaptation × Historic Preservation in the United States that lays out design, policy, technical, and financial resources on the flood adaptation of historic built environment from Federal to local level across the country;

- A Policy-Maker & Stakeholder Interview Series that features the author's conversations with nationwide professional practitioners and community stakeholders, as they identify challenges, set agendas, discuss solutions, and share local practices on heritage resilience;

- A total of 7 Digital Policy & Design Reports that contain the author's original research on flood adaptation and historic urban form change in the context of New York City, covering issues such as flood risk and vulnerability evaluation, value assessment methods for historic streetscapes under flood adaptation, streetscape-sensitive design strategies, real-world adaptation scenarios, as well as policy reform and policy-making agendas.

This independent research project is sponsored by Onera Foundation under 2022 Onera Prize for Historic Preservation, and is an expansion upon the author's M.S. Historic Preservation thesis "Living Above the Street: Flood Retrofitting and Adaptive Streetscape of New York City's Historic Districts" (https://doi.org/10.7916/fn43-vb19) completed in April 2022 at Columbia University. Besides the products listed above, this project will also be presented at Keeping History Above Water 2023 Conference held in Portsmouth, NH, in May 2023.

Project Overview

Context & Rationale

Flooding and sea level rise are threatening the integrity of New York City's waterfront historic built environment. In 2012, Hurricane Sandy brought 8 feet of floodwater into the South Street Seaport area, and inundated the Empire Stores in Brooklyn; in 2019, Wyckoff Farmhouse — the oldest building in New York City and State — was flooded by Hurricane Ida (The City of New York 2013, 374; Frost 2012b; LPC 1965; ABC7NY 2021). As extreme storms repeat, the city's floodplain — which currently covers 71,500 buildings (NYCDCP 2014, 16) — is expected to further expand, leading to a larger amount of historic urban fabric exposed under imminent flood risk in the near future.

Such physical flood risk is further compounded by potential adverse impacts brought by flood adaptation interventions. As a Post-Sandy response to flood risk, New York City's current Building and Zoning Codes require all habitable spaces of structures within the city's 1% floodplain to be elevated to the design flood elevation (DFE) when buildings are constructed or substantially improved (NYCDCP 2013a; 2019a; NYCDOB 2014). Such attempt to lift living spaces above street level has caused uncontrolled streetscape changes in waterfront communities such as Breezy Point, Queens and Red Hook, Brooklyn, where structures are often elevated or built upon concrete piles or blank street walls and accessed by out-of-context stairs, creating a passive and alienating streetscape. As waterfront historic districts and neighborhoods may gradually have to experience similar spatial interventions critical for their continued survival, the city's historic urban forms are left at high stakes.

In the face of various policy and design challenges associated with the flood adaptation of historic properties, New York City doesn't yet have a systematically established heritage resilience framework, and is therefore unable to provide much guidance on these fronts. First of all, although it's empirically known that various historic resources in the city are subject to high risks of flood impact, their count, profile and spatial distribution are not well understood. Meanwhile, historic structures, neighborhoods and districts have been to a considerable extent left out of the city's flood resilience discourse: in spite of various design guidelines and planning studies published by the city's Department of City Planning (e.g. *Retrofitting Buildings for Flood Risk* of 2014, *Resilient Neighborhood* studies since 2013, and *Zoning for Coastal Flood Resiliency* of 2019-21), New York City doesn't have a comprehensive flood retrofitting design guideline for historic buildings, except for two technical guides on equipment relocation and flood shield installation provided by the city's Landmarks Preservation Commission; nor have there been community-scaled studies dedicated to the preservation and adaptation of historic districts and neighborhoods. Furthermore, the flood vulnerability of historic properties may be perpetuated as their flood retrofitting can be exempted from the city's current Building Code, and is not sufficiently incentivized by flood insurance standards. Innovative heritage resilience policy solutions, design guidelines and master plans are in urgent need to be developed to steward the city's historic built environment towards flood resilience.

Heritage resilience is a highly professional and interdisciplinary field. Successful policy-making and planning efforts must simultaneously draw inputs from preservationists, architects, planners, emergency managers, and community stakeholders; therefore, it is crucial for preservationists to understand the regulatory frameworks of other related disciplines, as well as opinions from historic property owners and the public. On the other hand, historic homeowners and property owners often need to go through a painstaking and burdensome process acquiring various pieces of information and regulation (e.g. floodplain designation, design review guidelines, building code, flood zoning, insurance standards, technical guides, and available financial aids) from discrete regulatory entities on Federal, State, and local levels when they intend to carry out flood retrofitting projects (for example, see interview with Julie Nucci & Jim Overhiser, historic homeowners in Owego, NY, as part of the project's interview series). For these reasons, a consolidated, public-facing platform that shares these information may stimulate the exchange of knowledge and best practice on flood adaptation and heritage resilience, and benefit both the public and professional practitioners.

Targeted at the challenges and potentials introduced above, this project seeks to leverage multiple research methods (e.g. spatial analysis, policy analysis, design study and interview) and information sources (e.g. nationwide design guidelines and built cases; policy-makers and community stakeholders) to address the blank spots that lie within New York City's heritage resilience framework. Specifically, the key intentions of this project are listed as follows:

- **To better understand the vulnerability of New York City's historic built environment under physical flood risk and flood adaptation interventions**, through GIS-based spatial analysis and policy analysis;
- **To explore design and policy tools that help facilitate an adaptive transformation of New York City's historic streetscapes towards flood resilience**, by developing value assessment methods, exploring design solutions on building, street and neighborhood scales, and proposing policy-making agendas;
- **To create a collective dialogue on heritage resilience in New York City's context and communicate policy, design and financial resources to a broader public**, by conducting policy-maker and stakeholder interviews, and creating a public-facing online platform for knowledge exchange.

Project Overview

Echoing the intentions set out in the Context & Rationale section, this project comprises three components: **an interactive map, policy-maker and community stakeholder interviews, and digital policy & design reports.** All of these works are published at www.livingabovethestreet.nyc — this project's publicly accessible online portal,

which highlights the project's key findings and serves as a hub for knowledge and information exchange.

The GIS-based **Interactive Map: Flood Adaptation × Historic Preservation in the United States** lays out policy documents and design guidelines for the flood retrofitting of existing or historic buildings that have been made across the country in recent years, successful built cases on building or neighborhood scales, as well as financial and technical resources available for flood adaptation undertakings. As an interactive annotated bibliography that gathers and communicates available resources on Federal, state and local levels, this platform may benefit researchers and policy-makers by informing them of heritage resilience policy-making and best practice across the country, as well as historic property owners by providing a localized and consolidated entry-level guidance for the flood retrofitting of their historic properties. As flood retrofitting and streetscape mitigation strategies on historic or existing buildings have been actively developed by various policy-making entities, an awareness of nationwide developments in the heritage resilience discourse would be particularly valuable for New York City's future policy-making at the intersection of flood adaptation and historic preservation. All contents embedded in the interactive map are recreated into Part I of this report.

The **Policy-Maker & Stakeholder Interview Series** features the author's conversations with nationwide professional practitioners (e.g. architects & contracts, planners, and preservationists) and community stakeholders (e.g. homeowners, community board members, and house museum staff). While many of the interviewees are from New York City, it's again believed that a nationwide scope would be able to bring a broader range of insights at the forefront of heritage resilience theory and practice. In this series, we may hear opinions from leading figures in heritage resilience research and policy-making, as well as explore on-the-ground voices from local communities. As the interviewees identify challenges, set agendas, discuss solutions, and share local practices, these interviews may serve as a means of communication among practitioners of different fields, and between professionals and the general public. Transcripts of all interviews, as well as a summary of key findings, can be found in Part II of this report.

A total of 7 digital **Policy & Design Reports** are produced in this project, and compiled as Part III of this report. Featuring the author's original research, they seek to develop design and policy tools to address flood adaptation and historic urban form change in New York City's context, and fill in the "missing pieces" that lie within the city's heritage resilience framework:

- Digital Report 01 - Flood Risk of New York City's Historic Built Environment demonstrates how New York City's historic urban forms are susceptible to physical flood risks, and subject to potential adverse impacts brought by flood retrofitting interventions.
- Identifying streetscape change as the key area of tension in the flood adaptation of historic built environment, Digital Report 02 - Adaptive Streetscape: Concept & Framework proposes an "Adaptive Streetscape" framework that lays out four key goals ("Flood Resilience," "Building Integrity & Visual Consistency," "Streetscape Experience & Social-Spatial Relationship," and "Floor Area Transfer") in the transformation of New York City's historic streetscapes towards flood resilience, and develops a set of semi-quantitative metrics under these four lenses that measure historic streetscape change brought by flood adaptation, and reveal the intricate conflicts and tradeoffs between these goals.
- Leveraging nationwide flood retrofitting regulations and design guidelines for historic or existing structures, successful built cases, and the author's own illustrative input, Digital Report 03 - Streetscape-Sensitive Design Strategies develops streetscape-sensitive flood retrofitting design strategies targeted at New York City's historic buildings and neighborhoods. Overall retrofitting methods, preservation and streetscape considerations, as well as streetscape mitigation design solutions are developed for each building type and summarized into a streetscape-sensitive design toolbox; tensions between streetscape-sensitive design strategies identified in this study and New York City's current Building Code and Flood Zoning are also analyzed.
- Applying the Adaptive Streetscape framework and streetscape-sensitive design strategies to New York City's real-world historic urban environment, Digital Reports 04 and 05 feature two street-scaled adaptation design studies respectively investigating a historic mixed-use/commercial corridor (Front Street in South Street Seaport) and a historic residential corridor (East 118th Street in East Harlem).
- As a conclusion to the whole research project, in Digital Report 06 - Policy & Procedural Recommendations, the author summarizes findings made in the previous Digital Reports, generalizes a "planning — design — review" procedure for the flood adaptation of historic street corridors, and synthesizes all needs for policy reform and policy-making identified throughout the project into 9 policy-making agendas. These agendas incorporate findings made in the previous Digital Reports, as well as suggestions identified from the interview series; to envision how they may be carried out in the real world, each agenda is paired with one or more governmental agencies identified as key institutional actors on Federal, State, and local level.
- Supplementing Digital Reports 01-06, Digital Report 07 - Terms & Full Bibliography provides a concise glossary of terms and acronyms used in this project, and a compiled full bibliography.

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Perspective Statement

The Onera Prize asks for projects under its sponsorship to test new preservation theories in practice, and bring a contemporary perspective to the preservation field. This project is uniquely situated in alignment with the Prize's vision, as the emerging discourse of heritage resilience reflects today's preservation challenges, gives rise to paradigm changes in preservation practice, and is closely intertwined with new interpretations of heritage values and historic significance.

Heritage resilience under flooding and sea level rise may be viewed as an epitome of today's preservation challenges. Although flood impacts have repeatedly caused irreversible damage to historic resources along the coasts of U.S., policy and design discourses regarding the flood adaptation of historic buildings, districts and neighborhoods are very recent developments in the preservation field. While flood retrofitting regulations and design guidelines for historic buildings have been actively explored by various policy-making entities on Federal, State and local levels, New York City's heritage resilience framework still remains largely underdeveloped. The urgent need for design and policy tools that help guide the city's historic fabrics to transform towards flood resilience speaks for the contemporary nature and real-world significance of this project.

The heritage resilience discourse has the potential to change the paradigm of the historic preservation practice, guiding it towards the creation of thoughtful changes beyond simply to safeguard and conserve the historic formal and material states of properties. As flood retrofitting interventions often involve more significant spatial alteration than normally accepted, preservation design guidelines must be updated to accommodate and regulate these changes, and incorporate resilience considerations into its existing provisions; similarly, as historic urban form change emerges as the key area of tension in New York City's context, the city's preservation master plan mechanism should be able to establish resilience parameters and develop a more sophisticated understanding of the social-spatial values of historic urban forms — which is a crucial first step for the adaptive transformation of historic built environment that balances resilience, heritage, and economic values. Such policy reforms also open up opportunities for a more collaborative and interdisciplinary preservation practice, where preservation practice closely aids and interacts with the city's land use, emergency management, and resilience planning agendas.

Ultimately, these changes lead to a new preservation philosophy that embraces thoughtfully executed flood adaptation interventions as new layers of historic significance, and interpretable characters in the evolution of urban historic built environment. In this sense, the heritage resilience discourse not only connects with new preservation tools and experimental preservation practice, but also demonstrates how preservation actions may serve as a form of cultural production.

Part I

Interactive Map

Charleston, SC

Flood & Historic Resource Maps

· City of Charleston GIS.

Adaptation Regulations & Design Guidelines

· Charleston BAR. 2019. Design Guidelines for Elevating Historic Buildings.

· City of Charleston. "Process for Elevation Projects."

Flood Adaptation Projects

· 1 Water Street.

· 113 Calhoun Street.

· 42 Rutledge Avenue.

· Elevated Houses with "Piazza Screens."

Key Institutional Actors

· Charleston Board of Architectural Review (BAR).

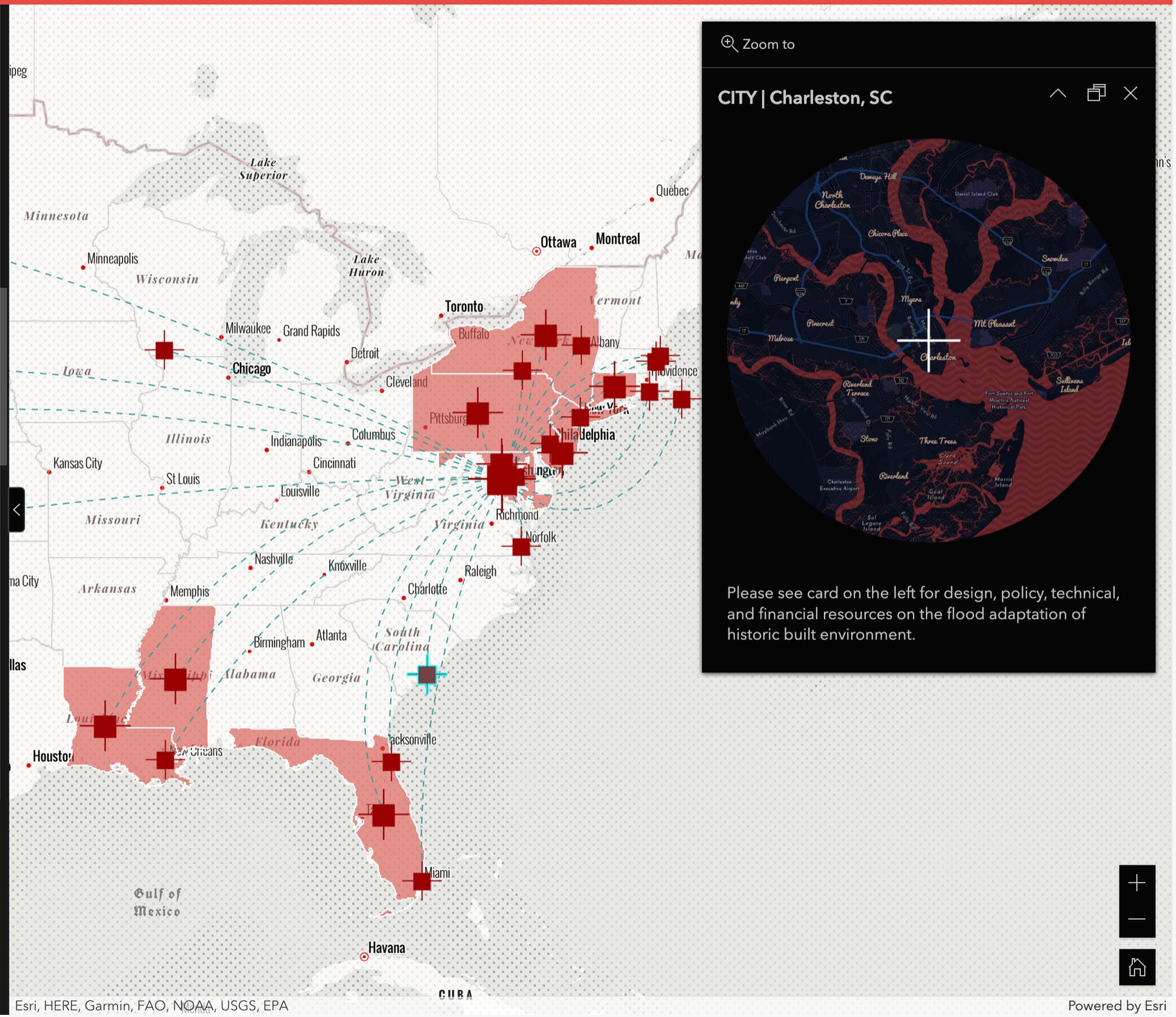
· Preservation Society of Charleston.

> See Full Information

Nantucket, MA

Flood & Historic Resource Maps

· Town & County of Nantucket GIS Maps.



Greater Miami & The Beaches, FL

Back to Home

Greater Miami & The Beaches (GM&B) is a coalition between Miami-Dade County, City of Miami Beach, and City of Miami. In 2015, GM&B was selected to join 100 Resilient Cities, a global initiative pioneered by the Rockefeller Foundation. This page contains resources on both county and city level, as well as plans and studies made on the GM&B scale.

Flood & Historic Resource Maps

Miami-Dade County Flood Zones & Preliminary Flood Zones.
https://mdc.maps.arcgis.com/apps/webappviewer/index.html?id=685a1c5e03c947d9a786df7b4ddb79d3
https://mdc.maps.arcgis.com/apps/webappviewer/index.html?id=5353f6867cf84a99a09c06c664f3195c

These two maps overlay FEMA's FIRM flood zones and preliminary flood zones on county-wide property lots, to inform homeowners the flood risk of their properties.

Miami Design Preservation League (MDPL). Miami Beach Historic Districts Building Database.
https://mdc.maps.arcgis.com/apps/webappviewer/index.html?id=685a1c5e03c947d9a786df7b4ddb79d

Developed by Miami Design Preservation League, this database lays out Miami Beach's local and National Register historic districts, and provides information on 2,110 historic properties individually designated across the city, or contributing to these historic districts.

Adaptation Regulations & Design Guidelines

City of Miami Beach. 2020. Buoyant City: Historic District Resiliency and Adaptation Guidelines.
https://www.miamibeachfl.gov/wp-content/uploads/2020/03/2020-0309-BUOYANT-CITY-FINAL-DRAFT.pdf

One of the most audacious and comprehensive design guidelines published for the flood adaptation of historic built environment across U.S. cities, this report surveys the building typology, morphology and typical landscape features in Miami Beach's historic districts, and purposes creative design strategies on building/site scale that include the "building in a building" approach and the elevation of buildings together with lots. It further considers the prospective financial incentives and development bonuses – such as TDRs and rooftop additions in different forms – that may stimulate adaptation actions. The philosophy that embraces change as an interpretable layer of history is showcased throughout the guideline; and changes in streetscape, public spaces, and urban forms are at the very heart of its design considerations. For more details, please click here for an interview with the city's Chief Historic Preservation and Architecture Officer.

Miami-Dade County. 2021. Resilient Rehab: A Guide for Historic Buildings in the Miami-Dade County.
https://www.miamidade.gov/planning/library/reports/resilient-rehab-report.pdf

Contrasting to *Buoyant City* where bold and forward-looking adaptation strategies are proposed in a non-compulsory manner, *Resilient Rehab* is an attempt to incorporate practical resilience considerations into county-level preservation design review standards. Stemmed from the typical structure of preservation design guidelines, this document provides an analysis on the resilience challenges faced by each building type, and puts forward resilience considerations as part of the design recommendations made for each architectural element. Additionally, there is an independent section that lays out general flood adaptation methods applicable to historic buildings and sites. This guideline provides an example on how resilience strategies can be blended into local preservation design standards, encouraging not only purposeful flood adaptation projects, but also a wider range of renovation and rehabilitation actions with incremental resilience measures.

Flood Adaptation Projects

Government-Led Street Elevation.
See articles in the "Blogs & Media Coverage" section, and Digital Report 03: Streetscape-Sensitive Design Strategies.

Since 2013, Miami Beach has been carrying out an iconic stormwater management program experimenting the elevation of roads and streets. The city has committed to investing nearly $ 600 million to raise at least 60% of the city-owned roads to 3.7 feet above sea level. New stormwater drainage and pump systems are also envisioned in the plan, which are designed to collect stormwater and pump it back to Biscayne Bay through pipes under the elevated streets. Although this program is designed to keep whole neighborhoods dry during storm events, it has sparked an extensive debate as residents sometimes find floodwater being redirected to their properties from elevated streets. For more information, please refer to Digital Report 03: Streetscape-Sensitive Design Strategies.

Key Institutional Actors

Miami Design Preservation League (MDPL).
https://mdpl.org/

Miami-Dade County Historic Preservation Board.
https://www.miamidade.gov/global/government/boards/historic-preservation.page

City of Miami Beach Historic Preservation Board.
https://www.miamibeachfl.gov/city-hall/city-clerk/boards-and-committees/historic-preservation-board/

City of Miami Historic and Environmental Preservation Board (HEPB).
https://www.miamigov.com/My-Government/Boards-Committees/Historic-Environmental-Preservation-Board-HEPB

City of Miami Beach Environment & Sustainability Department.
https://www.miamibeachfl.gov/city-hall/environmental-sustainability/

Plans & Studies

City of Miami Beach. "Miami Beach Rising Above."
https://www.mbrisingabove.com/

Miami Beach Rising Above is Miami Beach's portal for resilience planning, climate and environmental initiatives, as well as studies made by or in collaboration with third-party research institutions (e.g. Urban Land Institute, Harvard GSD, and Columbia University).

Urban Land Institute (ULI). 2018. Miami Beach, Florida: Stormwater and Climate Adaptation Review.
https://ulidigitalmarketing.blob.core.windows.net/ulidcnc/2018/09/Miami-Beach_PanelReport-1.pdf

City of Miami Beach. 2019. 2040 Miami Beach Comprehensive Plan.
https://www.mbrisingabove.com/wp-content/uploads/2040-Comprehensive-Plan-10-16-2019-Adopted-13MB.pdf

City of Miami Beach. 2019. Our Future in Focus: Strategic Plan Through the Lens of Resilience.
https://www.mbrisingabove.com/wp-content/uploads/Miami-Beach-Strategic-Plan-2019-For-Web-8.5.pdf

Greater Miami and the Beaches (GM&B). 2019. Resilient 305.
https://www.mbrisingabove.com/wp-content/uploads/Resilient305_final.pdf

Miami-Dade County. 2021. Miami-Dade County Sea Level Rise Strategy.
https://miami-dade-county-sea-level-rise-strategy-draft-mdc.hub.arcgis.com/

Financial Resources

City of Miami Beach Private Property Adaptation Program.
https://www.mbrisingabove.com/your-home/private-property-adaptation/

Conferences & Workshops

Miami Design Preservation League (MDPL): Annual Resiliency Workshop (Since 2017).
https://mdpl.org/events/annual-resiliency-workshop/

Blogs & Media Coverage

Askew, Susan. "Old Buildings and the Sea." Re: Miami Beach, Dec. 2, 2016.
https://www.remiamibeach.com/north-beach/old-buildings-and-the-sea/

Askew, Susan. "Raise or Raze?" Re: Miami Beach, Apr. 13, 2017.
https://www.remiamibeach.com/citywide/raise-or-raze/

Campo-Flores, Arian. "Bracing for Sea Rise, Miami Beach Fights Tide of Angry Residents." The Wall Street Journal, Mar. 9, 2020.
https://www.wsj.com/articles/bracing-for-sea-rise-miami-beach-fights-a-tide-of-angry-residents-11583526613

Flechas, Joey. "Flood Claim Denied for Restaurant Turned 'Basement' after Miami Beach Raised Street." Miami Herald, Nov. 17, 2016.
https://www.miamiherald.com/news/local/community/miami-dade/miami-beach/article115264938.html

Flechas, Joey. "Miami Beach to Begin New $100 Million Flood Prevention Project in Face of Sea Level Rise." Miami Herald, Mar. 23. 2017.
https://www.miamiherald.com/news/local/community/miami-dade/miami-beach/article129284119.html

Flechas, Joey and Jenny Staletovich. "Miami Beach's Battle to Stem Rising Tides." Miami Herald, Dec. 31, 2015.
https://www.miamiherald.com/news/local/community/miami-dade/miami-beach/article41141856.html

Gurney, Kyra and Alex Harris. "Can a Miami Beach Neighborhood Preserve Its History and Protect Itself from Sea Rise?" Miami Herald, May 1, 2018.
https://www.miamiherald.com/news/local/community/miami-dade/miami-beach/article209784439.html

Gurney, Kyra. "Residents Battle Over Historic Label in Flooding Area." AP News, May 11, 2019.
https://apnews.com/article/597d956a8fa44d1495a48ffb6feaf84d

Harris, Alex. "Raising Flood-prone Roads Has Angered Miami Beach Residents. Experts Say They Need to Go Higher." Miami Herald, Jan. 22, 2020.
https://www.miamiherald.com/news/local/environment/article239486308.html

Harris, Alex. "Can Raising Roads for Sea Rise Make a Home More Valuable? Miami Beach Report Says Yes." Miami Herald, Jan. 29, 2020.
https://www.miamiherald.com/news/local/environment/article239682778.html

Harris, Alex. "Miami Beach is Raising Roads for Sea Rise. Lawsuits Say They're Causing Flooding Too." Miami Herald, Oct. 28, 2021.
https://www.miamiherald.com/news/local/environment/article255171182.html

* All images on this page are generated or cited from individual resources listed above, except for the followings:
The mini-map at the top is produced by the author based on the "Mid-Century Map" template of ArcGIS Online.
The illustration for "Government-Led Street Elevation" is cited from Alex Harris, "Miami Beach is Raising Roads for Sea Rise. Lawsuits Say They're Causing Flooding Too." Miami Herald, Oct. 28, 2021.

Introduction

This ArcGIS-based interactive map lays out design, policy, technical, and financial resources on the flood adaptation of historic built environment across the country, incorporating 28 entries that range from *Nationwide Resources* (e.g. National Park Service and FEMA policies and grants) to resources on state and local levels. As an interactive annotated bibliography that facilitates knowledge exchange and communication, this platform is designed to benefit researchers and policy-makers by informing them of heritage resilience policy-making and best practice across the country, as well as historic property owners by providing a localized and consolidated entry-level guidance for the flood retrofitting of their historic properties.

Located on the Map page of the project's online portal, the interactive map consists of a map window and an information column that features individual cards briefly listing flood adaptation resources identified for each entry. Users may browse a nationwide basemap in the map window, and click on locations (represented by "+" signs) where an annotated bibliography has been made. Once a location is selected, a pop-up window will emerge on the map, visualizing the city (or state)'s relationship with water; in the meantime, the corresponding resource card will be automatically displayed in the information column. Information for each entry is divided into eight sections: "Flood & Historic Resource Maps," "Adaptation Regulations & Design Guidelines," "Flood Adaptation Projects," "Key Institutional Actors," "Plans & Studies," "Financial Resources," "Conferences & Workshops," and "Blogs & Media Coverage." By clicking the "> See Full Information" button at the bottom of any resource card, users will be directed to a dedicated page where the full bibliography may be viewed. Federal-level resources are pinpointed at Washington D.C., and graphically linked to other states and cities through dotted lines.

In line with the project's overall scope, resources selected and annotated in the interactive map are focused on the intersection of flood adaptation and historic urban form change. Therefore, entries are established where flood adaptation projects or policy-making targeted at historic properties has been carried out; general historic preservation guidelines and governmental buy-out programs are not included in the bibliography. The "Key Institutional Actors" include not only governmental agencies or NGOs that have been involved in heritage resilience projects or policy-making, but also those which have the potential to be engaged in the discourse.

All resources identified and incorporated into the interactive map are replicated in the following section. Entries are listed alphabetically by state abbreviations, with *New York City* and *Nationwide Resources* in the beginning.

Interactive Map:

Flood Adaptation × Historic Preservation in the United States

New York City, NY

Flood & Historic Resource Maps

NYC Department of City Planning. NYC Flood Hazard Mapper.

https://dcp.maps.arcgis.com/apps/webappviewer/index.html?id=1c37d271fba14163bbb520517153d6d5

Hosted by NYC Department of City Planning, this GIS-based interactive application visualizes the city's 1% and 0.2% floodplains as outlined by FEMA's FIRM (2007) and PFIRM (2015) flood maps. It also provides information on the height difference between grade and local BFE, as well as future floodplain and high tide projections.

NYC Department of City Planning. ZoLa (New York City's Zoning & Land Use Map).

https://zola.planning.nyc.gov/about/

ZoLa is New York City's zoning & land use map portal. With a myriad of zoning and supportive layers available, users may overlay FIRM/PFIRM maps with LPC landmark and historic district designations, to discover the flood risk faced by New York City's historic built environment.

NYC Landmarks Preservation Commission. Discover NYC Landmarks.

https://nyclpc.maps.arcgis.com/apps/webappviewer/index.html?id=93a88691cace4067828b1eede432022b

This online map visualizes New York City's locally designated individual, interior and scenic landmarks, and historic districts. Each building, site or district is paired with a pop-up window that displays its basic information and photo, along with a link to its LPC designation report.

Adaptation Regulations & Design Guidelines

NYC Department of Buildings. 2014. Building Code Appendix G: Flood Resistant Construction.

https://www.nyc.gov/assets/buildings/apps/pdf_viewer/viewer.html?file=2014CC_BC_Appendix_G_Flood-Resistant_Construction.pdf&section=conscode_2014

In compliance with FEMA regulations, NYC's Building Code *Appendix G* lays out construction standards for structures within the 1% floodplain when they are substantially improved: all residential buildings must be elevated and wet-floodproofed, while mixed-use or non-residential structures have the option to either elevate or dry-floodproof in-place.

NYC Department of City Planning. 2014. Retrofitting Buildings for Flood Risk.

https://www.nyc.gov/assets/planning/download/pdf/plans-studies/retrofitting-buildings/retrofitting_complete_online.pdf

A comprehensive and intense building-scaled flood adaptation design study, this report provides a count and characterization of New York City's floodplain building stock, and features 10 real-world design studies targeted at New York City's unique floodplain building types (including row houses, mid-rise mixed-use buildings, and mid-rise apartments).

NYC Department of City Planning. 2013. Flood Resilience Zoning Amendment.

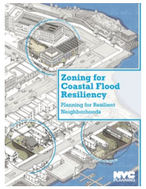
https://www.nyc.gov/site/planning/zoning/districts-tools/flood-text.page

This temporary flood zoning amendment was adopted to support New York City's emergency Building Code revision after Hurricane Sandy. It delineates new provisions for building height measurement, access, and floor area calculation within the 1% floodplain, and provides streetscape design recommendations through two case studies targeted respectively at substantial improvement and new construction.

NYC Department of City Planning. 2019-21. Zoning for Coastal Flood Resiliency.

https://www.nyc.gov/site/planning/plans/flood-resilience-zoning-text-update/flood-resilience-zoning-text-update.page

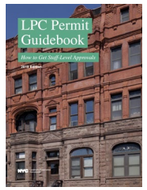
The 2013 flood zoning amendment was further updated in 2019 into the report *Zoning for Coastal Flood Resiliency: Planning for Resilient Neighborhoods*, which was in turn adopted in May 2021 as New York City's current flood zoning. The new flood zoning is applicable to both the city's 1% and 0.2% floodplains, and features a point system regulating streetscape mitigation design for all floodplain developments.



NYC Landmarks Preservation Commission. 2019. LPC Permit Guidebook (2019 Edition).

https://www.nyc.gov/assets/lpc/downloads/pdf/Rules/Rules%20of%20the%20NYC%20Landmarks%20Preservation%20Commission_01.22.2019.pdf

As the general preservation design guideline of New York City, the LPC Guidebook lays out formal and material considerations targeted at key areas and architectural elements. It reveals how the design of street-level features (e.g. storefronts, awning and signage) may impact a building's historic characters and streetscape relationship, and includes some specific recommendations for the installation of flood shields.



NYC Landmarks Preservation Commission. n.d. Technical Guides on Equipment Relocation & Flood Shield Installation.

https://www.nyc.gov/assets/lpc/downloads/pdf/relocation_of_mech.pdf

https://www.nyc.gov/assets/lpc/downloads/pdf/Flood_shields_and_barriers.pdf

These technical guides largely serve as procedural notices to property owners: the equipment relocation guide reiterates LPC's existing rules and procedures for mechanical rooftop additions, and the flood shields and barriers guide confirms that their installation is subject to LPC review.

Flood Adaptation Projects

Lower Manhattan Coastal Resiliency (LMCR).

https://www.nyc.gov/site/lmcr/progress/progress.page

Composed of Battery Park City Resilience Projects, The Battery Coastal Resilience Project, Financial District & Seaport Resilience Master Plan, and Brooklyn Bridge-Montgomery Coastal Resilience, this ongoing initiative seeks to build a continuous landscaped flood barrier surrounding Lower Manhattan.

NYC Build It Back.

https://www.nyc.gov/content/sandytracker/pages/build-it-back

Instagram: @nycbuilditback

Launched by NYC Mayor's Office of Housing Recovery Operations (HRO) since 2013, this program has provided assistance to around 32,000 households impacted by Sandy as of 2021, and has rebuilt and elevated over 1,300 homes to meet today's stringent flood regulations. Build It Back homes are often elevated up to 10 to 14 feet above sea level, and placed on concrete foundations.

Key Institutional Actors

NYC Department of City Planning (DCP).

https://www.nyc.gov/site/planning/index.page

NYC Landmarks Preservation Commission (LPC).

https://www.nyc.gov/site/lpc/index.page

Columbia GSAPP & Columbia Climate School.

https://www.arch.columbia.edu/

https://www.climate.columbia.edu/

Plans & Studies

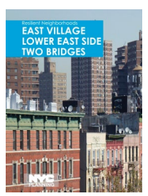
NYC Department of City Planning. 2016. Coastal Climate Resiliency: Resilient Retail.

https://www.nyc.gov/assets/planning/download/pdf/plans-studies/resilient-retail/resilient-retail-full-report-2-pager.pdf

As part of DCP's citywide resilience studies, Resilient Retail critiques existing Federal flood regulations that may be impractical for high-density mixed-use urban fabrics, and argues that additional flexibility shall be provided for retail, office and community spaces. Policy reforms proposed in this report are of close relevance to New York City's high-density, mixed-use historic urban fabric as well.

NYC Department of City Planning. 2013-Present. Resilient Neighborhood Studies.

https://www.nyc.gov/site/planning/plans/climate-resiliency/climate-resiliency.page



DCP's Resilient Neighborhood planning study series aims to work with floodplain communities to reexamine questions of land use, zoning, and development in light of a new understanding of coastal flood risks. So far, 10 neighborhood-scaled studies have been made under this initiative, covering all five boroughs of the city.

NYCEDC; MOCR; Arcadis. 2021. FiDi-Seaport Climate Resilience Master Plan.

https://fidiseaportclimate.nyc/wp-content/uploads/2021/12/FiDi-Seaport-Climate-Resilience-Master-Plan_v2_compressed.pdf

The recently published FiDi-Seaport Resilience Master Plan proposes to extend local shoreline into the East River by 90 to 200 ft, in order to accommodate new flood defense infrastructure. The new flood barrier is composed of a waterfront esplanade system designed at 11ft above sea level, and a raised landscape with buried flood walls designed at 23 to 26 ft above sea level.

NYC Department of City Planning. 2013. Coastal Climate Resilience: Designing for Flood Risk.
https://www.nyc.gov/assets/planning/download/pdf/plans-studies/sustainable-communities/climate-resilience/designing_flood_risk.pdf

NYC Department of City Planning. 2021. New York City Comprehensive Waterfront Plan.
https://www.nyc.gov/assets/planning/download/pdf/plans-studies/comprehensive-waterfront-plan/nyc_comprehensive_waterfront_plan.pdf

US Army Corps of Engineers. NY & NJ Harbor & Tributaries Focus Area Feasibility Study (HATS) (in Progress).
https://www.nan.usace.army.mil/Missions/Civil-Works/Projects-in-New-York/New-York-New-Jersey-Harbor-Tributaries-Focus-Area-Feasibility-Study/

Financial Resources

NYC Department of City Planning. 2016. Flood Insurance Info Brief.
https://www.nyc.gov/assets/planning/download/pdf/plans-studies/climate-resiliency/flood-insurance-info-brief.pdf

Conferences & Workshops

The Waterfront Alliance: Waterfront Conference (Since 2008).
https://waterfrontalliance.org/

Columbia Climate School: Managed Retreat Conference (Since 2019).
https://adaptation.ei.columbia.edu/retreat/home

Blogs & Media Coverage

ABC7NY. “Historic House in NYC Severely Damaged by Flooding from Ida.” ABC7NY, Sep. 4, 2021.
https://abc7ny.com/ wyckoff-house-museum-ida-hurricane-new-york-citys-oldest/10998909/

The Associated Press. “Manhattan’s South Street Seaport a ‘Ghost Town’ Months after Superstorm Sandy.” New York Daily News, Feb. 25, 2013.
https://www.nydailynews.com/new-york/south-street-seaport-ghost-town-sandy-article-1.1272699

Dunlap, David W. 2017. “Flood Barrier in Brooklyn: A 7-Foot Wall, Erected in Hours.” New York Times, Mar. 2, 2017.
https://www.nytimes.com/2017/03/02/nyregion/brooklyn-riverfront-flood-protection-empire-stores.html

Grace, Melissa and Joe Marvilli. 2021. “City Planning Commission Approves Zoning for Coastal Flood Resiliency.” NYC Planning, Mar. 17, 2021.
https://www.nyc.gov/site/planning/about/press-releases/pr-20210317.page

Higgins, Graham. “Historic Buildings and Districts at Risk.” AIA New York, Jun. 3, 2015.
https://www.aiany.org/news/historic-buildings-and-districts-at-risk/

Maldonado, Samantha. “City Eyes New Push to Buy Out Flood-Prone Houses as Climate Change Hits Home.”
The CITY, Oct. 26, 2021.
https://www.thecity.nyc/2021/10/26/22747880/nyc-buy-out-flood-prone-homes-climate-change-sandy-ida

Rice, Andrew. “This is New York in the Not-so-distant Future.” New York Magazine, Sep. 5, 2016.
https://nymag.com/intelligencer/2016/09/new-york-future-flooding-climate-change.html

Nationwide Resources

Flood & Historic Resource Maps

FEMA. National Flood Hazard Layer (NFHL) Viewer.
https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd

As the most comprehensive online database for nationwide flood risk, this interactive map incorporates currently effective flood map designations across the country. It illustrates 1% and 0.2% floodplain extents, and provides links to individual flood map panels that match the area being browsed by the user. For communities such as New York City where Preliminary FIRMs or other forms of non-final flood map updates have been issued, these updates may not have been included in the NFHL Viewer; instead, they may be obtained through FEMA’s Map Service Center, along with FIRM panels and other flood map products.

National Park Service. National Register of Historic Places Map.
https://www.nps.gov/maps/full.html?mapId=7ad17cc9-b808-4ff8-a2f9-a99909164466

National Park Service’s National Register map application provides an interactive overview of nationwide historic properties and districts listed on the National Register. Its spatial data may be acquired at NPS’s Data Download page.

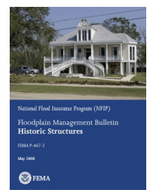
USGS. Flood Event Viewer.
https://stn.wim.usgs.gov/FEV/

This interactive map provides real-time gage height data (if applicable) and observed high water-mark data recorded during flood events across the U.S. for the past decades.

Adaptation Regulations & Design Guidelines

FEMA. 2008. Floodplain Management Bulletin: Historic Structures (P-467-2).
https://www.nj.gov/dep/hpo/Index_HomePage_images_links/FEMA/FEMA%20historic_structures.pdf

This brochure lays out NFIP’s *substantial improvement* provision that has been adopted in the building codes of all participating communities including New York City, and introduces two options that may be chosen by local communities to relieve historic structures (on National or State Register) from the mandate: exempting historic structures from the definition of “substantial improvement,” or requiring historic structures to acquire



FEMA variances when they are substantially renovated. Information was also provided on NFIP's flood insurance policy on historic structures, as well as on cases where historic structures are retrofitted (through structural or non-structural elevation, equipment relocation and floodproofing, etc.) for flood resilience.

FEMA. 2014. Homeowner's Guide to Retrofitting (P-312, 3rd Edition).

https://www.fema.gov/sites/default/files/2020-08/FEMA_P-312.pdf

Aimed at general homeowners, this document lists common types of flood adaptation strategies (elevation, relocation and demolition) and floodproofing treatments (wet floodproofing, dry floodproofing and barrier systems). Although not directly related to streetscape design solutions, it provides a concise and typological review of the current toolbox on building-scaled flood retrofitting.

National Park Service. 2021. Guidelines on Flood Adaptation for Rehabilitating Historic Buildings (2nd Edition).

https://www.nps.gov/orgs/1739/upload/flood-adaptation-guidelines-2021.pdf

This illustrated guideline provides a comprehensive review and visualization of flood adaptation interventions that may be applied to historic structures and sites, ranging from temporary measures and floodproofing treatments to basement fill and structural or non-structural elevation. Using diagrams, photographs, lists of recommended practices and case studies, it also lays out ways in which these flood adaptation strategies — which often involve more extensive spatial changes than normally acceptable — will be able to retain historic characters and meet *The Secretary of the Interior's Standards for Rehabilitation*.

Flood Adaptation Projects

Wolfe House & Building Movers. "Project Gallery."

https://www.wolfehousebuildingmovers.com/project/

Key Institutional Actors

National Park Service (NPS).

https://www.nps.gov/index.htm

Federal Emergency Management Agency (FEMA).

https://www.fema.gov/

National Trust for Historic Preservation.

https://savingplaces.org/

Plans & Studies

FEMA. 2005. Integrating Historic Property and Cultural Resource Considerations Into Hazard Mitigation Planning: State and Local Mitigation Planning How-To Guide (FEMA 386-6).

https://www.fema.gov/pdf/fima/386-6_Book.pdf

Union of Concerned Scientists. 2014. National Landmarks at Risk.

https://www.ucsusa.org/sites/default/files/2019-09/National-Landmarks-at-Risk-Full-Report.pdf

National Trust for Historic Preservation. 2005. "Treatment of Flood-Damaged Older and Historic Buildings."

https://forum.savingplaces.org/blogs/forum-online/2012/11/21/treatment-of-flood-damaged-older-and-historic-buildings

Scott, Roderick, and Louisette Scott. 2018. "Challenges on the Coast-Flood Mitigation of Historic Buildings."

https://portal.ct.gov/-/media/DECD/Historic-Preservation/03_Technical_Assistance_Research/Research/Julies-Resources/Challenges-on-the-Coast.pdf

Financial Resources

FEMA: The National Flood Insurance Program (NFIP).

https://www.fema.gov/flood-insurance

NFIP is the nationwide flood insurance program administered by the FEMA. Properties within the 1% floodplain with Federally-backed mortgages or federal housing subsidies are required to purchase the insurance; premium rates of the insurance is largely determined by the relationship between a building's lowest floor and local Base Flood Elevation (BFE). For more information, please refer to the current NFIP Manual, and FEMA's Risk Rating 2.0 System.

FEMA Grants: FMA, HMGP, BRIC, and PDM.

https://www.fema.gov/grants/mitigation

FEMA administers a number of Hazard Mitigation Assistantce grants. Awarded to local communities or NGOs, these grants provide funding for mitigation measures that reduce disaster losses, and may potentially be used towards flood adaptation projects. Sub-programs under HMA include the Flood Mitigation Assistance Grant (FMA), the Hazard Mitigation Grant Program (HMGP), the Building Resilient Infrastructure and Communities Grant Program (BRIC), and the Pre-Disaster Mitigation Grant Program (PDM). For more information, please refer to FEMA's effective *Hazard Mitigation Assistance Program & Policy Guide*.

National Park Service: Emergency Supplemental Historic Preservation Fund (ESHPF).

https://www.nps.gov/subjects/historicpreservationfund/disaster-recovery.htm

National Park Service's Emergency Supplemental Historic Preservation Fund (ESHPF, usually referred to as disaster recovery grants) are allocated to SHPOs and THPOs for disaster recovery and resilience planning efforts. The ESHPF has been funded in the names of Hurricanes Katrina & Rita (2005) Recovery Program, Hurricane Sandy (2012) Disaster Recovery Grants, Harvey, Irma, Maria (2017) Disaster Recovery Grant Program, and Florence, Yutu, Michael (2018) Disaster Recovery Grant Program. For more details, refer to National Park Service's ESHPF Fact Sheet.

National Park Service: Federal Historic Rehabilitation Tax Credit.

https://www.nps.gov/subjects/taxincentives/index.htm

Conferences & Workshops

Newport Restoration Foundation: Keeping History Above Water (KHAW) Conference Series (Since 2016).

https://historyabovewater.org/

A major conference series on heritage resilience under sea level rise and flooding risks, KHAW was founded in 2016 in Newport, RI, and has subsequently been hosted in Annapolis, MD (2017), Palo Alto, CA (2018), Des Moines, IA (2018), St. Augustine, FL (2019), Nantucket, MA (2019), Charleston, SC (2021), Salem, MA (2021), and Norfolk, VA (2022). It has expanded into an interdisciplinary dialogue engaging preservationists, engineers, city planners, legislators, insurers, historic homeowners and other stakeholders. In 2023, the first international Keeping History Above Water conference will be held in Trinidad and Tobago.

Blogs & Media Coverage

Dunlap, David W. "A Guide to Flood-Resistant Building Terms." New York Times, Jan. 25, 2017.
https://www.nytimes.com/2017/01/25/nyregion/a-guide-to-flood-resistant-building-terms.html

Hurley, Amanda Kolson. "The House of the Future Is Elevated." Bloomberg City Lab, Dec. 8, 2017.
https://www.bloomberg.com/news/articles/2017-12-08/the-high-cost-of-flood-proofing-homes

California

Flood & Historic Resource Maps

California Department of Water Resources. Best Available Maps (BAM).
https://gis.bam.water.ca.gov/bam/

The Best Available Maps application delineates California's 100-year, 200-year, and 500-year floodplain data from multiple sources, including FEMA's effective flood maps, USACE's Sacramento and San Joaquin River Basins Comprehensive Study, and California DWR's own assessments. Users may click on a location to see its floodplain designation under different data sources.

Key Institutional Actors

California Office of Historic Preservation (California SHPO).
https://ohp.parks.ca.gov/

California Preservation Foundation.
https://californiapreservation.org/

Financial Resources

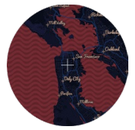
California SHPO: State Historic Rehabilitation Tax Credit.
https://ohp.parks.ca.gov/?page_id=27495

Conferences & Workshops

Keeping History Above Water: 2018 Palo Alto.
https://historyabovewater.org/2018-palo-alto/

Blogs & Media Coverage

California SHPO. "Climate Action."
https://ohp.parks.ca.gov/?page_id=30109



San Francisco, CA

Flood & Historic Resource Maps

San Francisco Public Utilities Commission. 100-Year Storm Flood Risk Map.
https://sfplanninggis.org/floodmap/

This interactive map provides a detailed portrait of citywide storm flood risk by designating a "100-year storm flood risk zone" based on a digital elevation model (DEM) created from LiDAR data and information on existing city-owned infrastructure, and overlays the risk zone on historic shorelines and waterways. Besides the flood risk zone, the city of San Francisco also designates a sea level rise vulnerability zone.

SF Planning. San Francisco Historic Landmarks Map.
https://sfplanning.org/resource/historic-landmarks-map

This interactive map visualizes San Francisco's locally designated historic landmarks and landmark districts, and provides property information, photograph and designation report for each historic resc

Adaptation Regulations & Design Guidelines

San Francisco Office of Resilience and Capital Planning. n.d. "Draft Flood Mitigation Guidelines for Buildings in Zone D and Historic Buildings."
https://www.onesanfrancisco.org/sites/default/files/inline-files/Flood%20Mitigation%20Zone%20D%20and%20%20historic%20buildings%20.pdf

Targeted at Flood Zone D buildings and historic buildings which are both exempt from Building Code regulations on flood resistance, this guideline puts forward a number of suggested practices for their rehabilitation (or new construction). It is recommended that buildings have their lowest floor and utilities above BFE, be appropriately anchored, and incorporate floodproofing measures or floodproofing materials.

Key Institutional Actors

San Francisco Historic Preservation Commission.
https://sfplanning.org/historic-preservation-commission

San Francisco Planning Department (SF Planning).
https://sfplanning.org/

San Francisco Office of Resilience and Capital Planning.
https://onesanfrancisco.org/

Plans & Studies

City and County of San Francisco. 2016. San Francisco Sea Level Rise Action Plan.
https://sfplanning.s3.amazonaws.com/default/files/plans-and-programs/planning-for-the-city/sea-level-rise/160309_SLRAP_Final_ED.pdf

City and County of San Francisco. 2020. Sea Level Rise Vulnerability and Consequences Assessment.
https://sfplanning.s3.amazonaws.com/default/files/plans-and-programs/planning-for-the-city/sea-level-rise/SLRVCA_Report_Full_Report.pdf

Port of San Francisco; Arcadis/Lotus Water. 2020. Floodproofing of Piers: Technical Feasibility Assessment of Adaptive Flood Risk Mitigation Strategies.
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Port of San Francisco. 2023. "Draft Waterfront Adaptation Strategies."
https://sfport.com/wrp/waterfront-adaptation
https://storymaps.arcgis.com/stories/1ed3561c936244f2979ad68cda6a681a

Blogs & Media Coverage

Arcadis. n.d. "Identifying Flood Risk Mitigation Strategies to Protect San Francisco's Historic Piers."
https://www.arcadis.com/en-us/projects/north-america/united-states/posf-flood-risk-strategies

King, John. "Buffing Up San Francisco's Historic Piers to Survive Sea Level Rise." San Francisco Chronicle, Feb. 5, 2020.
https://www.sfchronicle.com/environment/article/Buffing-up-San-Francisco-s-historic-piers-to-15033699.php

SF Planning. n.d. "Sea Level Rise Adaptation."
https://sfplanning.org/sea-level-rise-action-plan

SPI Insights. "San Francisco Shares Plans for $5B Seawall at Conference." SPI Insights, Dec. 6, 2019.
https://www.spartnerships.com/san-francisco-shares-plans-for-5b-seawall-at-conference/

Connecticut

Flood & Historic Resource Maps

Connecticut Institute for Resilience & Climate Adaptation (CIRCA). Sea Level Rise and Storm Surge Viewer.
https://circa.uconn.edu/sea-level-rise-and-storm-surge-viewer/

This interactive map visualizes inundation areas caused by both sea level rise (Mean Higher High Water + 1 ft or 20 in) and storm surge flood events (10-year, 30-year, 100-year, and 500-year). Users view individual sea level rise and storm surge scenarios, as well as the combined impact of these two factors.

Key Institutional Actors

Connecticut State Historic Preservation Office (Connecticut SHPO).
https://portal.ct.gov/DECD/Content/Historic-Preservation/06_About_SHPO/About-SHPO-new

Preservation Connecticut.
https://preservationct.org/

Connecticut Institute for Resilience & Climate Adaptation (CIRCA).
https://circa.uconn.edu/

CIRCA is an climate resilience initiative co-founded by University of Connecticut and Connecticut Department of Energy and Environmental Protection (CTDEEP). It seeks to improve scientific understanding of climate change, undertake pilot resilience projects, create a climate-literate public and foster resilient and sustainable communities. Among its initiatives are the Resilient Connecticut project, an effort to create a regional coastal resilience plan for Fairfield and New Haven Counties; and the Municipal Resilience Planning Assistance project, which develops policy, planning and legal tools for local communities to better address climate risks.

Plans & Studies

Connecticut SHPO. 2019. Resilient Historic Resources: Best Practices for Planners — Guidance for Connecticut Communities in an Era of Climate Change.
https://portal.ct.gov/-/media/DECD/Hurricane_Sandy_Relief/Website-Stuff/BestPracticesGuide_Reduced.pdf

This document is not a flood adaptation design guideline; instead, it's a guideline to assist local planners in the production of community-level heritage resilience plans. It identifies four steps (prepare — withstand — recover — adapt) in the cycle of heritage resilience planning, and illustrates best practices associated with each step through examples and case studies.

Connecticut SHPO. 2018. Shared Stewardship: 2018-2023 Statewide Historic Preservation Plan.
https://portal.ct.gov/-/media/DECD/Historic-Preservation/06_About_SHPO/Strategic-Plan-Final_hyperlinks.pdf

Rath, William R., Christopher P. Kelly, and Kristie A. Beahm. 2018. Floodplain Building Elevation Standards (UConn Municipal Resilience Planning Assistance Project, Law & Policy White Paper Series).
https://circa.uconn.edu/wp-content/uploads/sites/1618/2018/03/Floodplain-Building-Elevation-Standards.pdf

Rath, William R., Christopher P. Kelly, and Kristie A. Beahm. 2018. Height Restrictions on Elevated Residential Buildings in Connecticut Coastal Floodplains (UConn Municipal Resilience Planning Assistance Project, Law & Policy White Paper Series.).
https://circa.uconn.edu/wp-content/uploads/sites/1618/2018/03/Height-Restrictions-on-Elevated-Buildings.pdf

Financial Resources

Connecticut SHPO: Grants and Tax Credits.
https://portal.ct.gov/DECD/Services/Historic-Preservation/Funding-Opportunities/Grant-Opportunities
https://portal.ct.gov/DECD/Services/Historic-Preservation/Funding-Opportunities/Tax-Credits

Preservation Connecticut. "Funding Opportunities."
https://preservationct.org/fund

Connecticut Institute for Resilience & Climate Adaptation (CIRCA): Municipal Resilience Grant Program.
https://circa.uconn.edu/funds-muni-2/

Blogs & Media Coverage

FEMA. "The Town of East Haven Has Lifted Itself Above the Grade." FEMA, Feb. 11, 2021.
https://www.fema.gov/case-study/town-east-haven-has-lifted-itself-above-grade

Housing Development Fund. "HDF Launches Shore Up CT Loan Program to Help Coastal Homeowners." Housing Development Fund, Jul. 30, 2014.
https://hdfconnects.org/2015-shoreupct-launch/

Spiegel, Jan Ellen. "Flood Insurance Rules are Changing, but Some Say Not Enough." CT Mirror, Sep. 30, 2021.
https://ctmirror.org/2021/09/30/flood-insurance-rules-are-changing-but-some-say-not-enough/

Florida

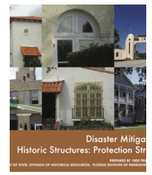
Adaptation Regulations & Design Guidelines

Florida Department of Economic Opportunity. 2015. Adaptation Planning for Historic Properties.
https://floridadep.gov/sites/default/files/Adaptation-Historic-Properties_0.pdf

With an intention to help local communities integrate resilience planning for sea level rise into existing planning systems, this guideline introduces key concepts and legal frameworks regarding heritage resilience, and lays out the process of sea level rise adaptation plans. It further surveys potential strategies for sea level adaptation under the lenses of "Protection," "Accommodation," and "Retreat."

1000 Friends of Florida. 2008. Disaster Mitigation for Historic Structures: Protection Strategies.
https://files.floridados.gov/media/697182/fdem-disaster-mitigation-for-historic-structures.pdf

This guideline provides specific recommendations for work on historic materials and architectural elements (e.g. the repair, replacement, and strengthening of windows, doors, and roofs) that might be taken to enhance the resilience of historic buildings against natural disasters.



Florida Division of Emergency Management. n.d. Flood Resistant Provisions in the 6th Edition of Florida Building Code (2017).
https://www.floridadisaster.org/contentassets/0361499e92914224a26dbdda2586b711/flood-provisions-of-the-6th-edition-florida-building-code.pdf

Key Institutional Actors

Florida Department of State Division of Historical Resources (Florida SHPO).
https://dos.myflorida.com/historical/

Florida Trust for Historic Preservation.
https://www.floridatrust.org/

1000 Friends of Florida.
https://1000fof.org/

University of Florida Historic Preservation Program.
https://dcp.ufl.edu/historic-preservation/

Financial Resources

Cureton, Kenneth H. (Florida SHPO). 2017. "Disaster Recovery Assistance for Historic Properties."
https://files.floridados.gov/media/698297/kcureton-disaster-recovery-0917.pdf

Blogs & Media Coverage

Florida Trust for Historic Preservation. "Keep Loving Your Flooded Historic Building." Florida Trust for Historic Preservation, Sep. 7, 2017.
https://www.floridatrust.org/post/2018/01/30/keep-loving-your-flooded-historic-building

Greater Miami and the Beaches (GM&B), FL

Greater Miami & The Beaches (GM&B) is a coalition between Miami-Dade County, City of Miami Beach, and City of Miami. In 2015, GM&B was selected to join 100 Resilient Cities, a global initiative pioneered by the Rockefeller Foundation. This page contains resources on both county and city level, as well as plans and studies made on the GM&B scale.

Flood & Historic Resource Maps

Miami-Dade County Flood Zones & Preliminary Flood Zones.

https://mdc.maps.arcgis.com/apps/webappviewer/index.html?id=685a1c5e03c947d9a786df7b4ddb79d3

https://mdc.maps.arcgis.com/apps/webappviewer/index.html?id=5353f6867cf84a99a09c06c664f3195c

These two maps overlay FEMA's FIRM flood zones and preliminary flood zones on county-wide property lots, to inform homeowners the flood risk of their properties.

Miami Design Preservation League (MDPL). Miami Beach Historic Districts Building Database.

https://mdc.maps.arcgis.com/apps/webappviewer/index.html?id=685a1c5e03c947d9a786df7b4ddb79d

Developed by Miami Design Preservation League, this database lays out Miami Beach's local and National Register historic districts, and provides information on 2,110 historic properties individually designated across the city, or contributing to these historic districts.

Adaptation Regulations & Design Guidelines

City of Miami Beach. 2020. Buoyant City: Historic District Resiliency and Adaptation Guidelines.

https://www.miamibeachfl.gov/wp-content/uploads/2020/03/2020-0309-BUOYANT-CITY-FINAL-DRAFT.pdf

One of the most audacious and comprehensive design guidelines published for the flood adaptation of historic built environment across U.S. cities, this report surveys the building typology, morphology and typical landscape features in Miami Beach's historic districts, and purposes creative design strategies on building/site scale that include the "building in a building" approach and the elevation of buildings together with lots. It further considers the prospective financial incentives and development bonuses — such as TDRs and rooftop additions in different forms — that may stimulate adaptation actions. The philosophy that embraces change as an interpretable layer of history is showcased throughout the guideline; and changes in streetscape, public spaces, and urban forms are at the very heart of its design considerations. For more details, please click here for an interview with the city's Chief Historic Preservation and Architecture Officer.

Miami-Dade County. 2021. Resilient Rehab: A Guide for Historic Buildings in the Miami-Dade County.

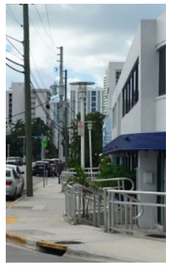
https://www.miamidade.gov/planning/library/reports/resilient-rehab-report.pdf

Contrasting to *Buoyant City* where bold and forward-looking adaptation strategies are proposed in a non-compulsory manner, *Resilient Rehab* is an attempt to incorporate practical resilience considerations into county-level preservation design review standards. Stemmed from the typical structure of preservation design guidelines, this document provides an analysis on the resilience challenges faced by each building type, and puts forward resilience considerations as part of the design recommendations made for each architectural element. Additionally, there is an independent section that lays out general flood adaptation methods applicable to historic buildings and sites. This guideline provides an example on how resilience strategies can be blended into local preservation design standards, encouraging not only purposeful flood adaptation projects, but also a wider range of renovation and rehabilitation actions with incremental resilience measures.

Flood Adaptation Projects

Government-Led Street Elevation.

See articles in the "Blogs & Media Coverage" section, and Digital Report 03: Streetscape-Sensitive Design Strategies.



Since 2013, Miami Beach has been carrying out an iconic stormwater management program experimenting the elevation of roads and streets. The city has committed to investing nearly $ 600 million to raise at least 60% of the city-owned roads to 3.7 feet above sea level. New stormwater drainage and pump systems are also envisioned in the plan, which are designed to collect stormwater and pump it back to Biscayne Bay through pipes under the elevated streets. Although this program is designed to keep whole neighborhoods dry during storm events, it has sparked an extensive debate as residents sometimes find floodwater being redirected to their properties from elevated streets. For more information, please refer to Digital Report 03: Streetscape-Sensitive Design Strategies.

Key Institutional Actors

Miami Design Preservation League (MDPL).

https://mdpl.org/

Miami-Dade County Historic Preservation Board.

https://www.miamidade.gov/global/government/boards/historic-preservation.page

City of Miami Beach Historic Preservation Board.

https://www.miamibeachfl.gov/city-hall/city-clerk/boards-and-committees/historic-preservation-board/

City of Miami Historic and Environmental Preservation Board (HEPB).

https://www.miamigov.com/My-Government/Boards-Committees/Historic-Environmental-Preservation-Board-HEPB

City of Miami Beach Environment & Sustainability Department.

https://www.miamibeachfl.gov/city-hall/environmental-sustainability/

Plans & Studies

City of Miami Beach. "Miami Beach Rising Above."

https://www.mbrisingabove.com/

Miami Beach Rising Above is Miami Beach's portal for resilience planning, climate and environmental initiatives, as well as studies made by or in collaboration with third-party research institutions (e.g. Urban Land Institute, Harvard GSD, and Columbia University).

Urban Land Institute (ULI). 2018. Miami Beach, Florida: Stormwater and Climate Adaptation Review.
https://ulidigitalmarketing.blob.core.windows.net/ulidcnc/2018/09/Miami-Beach_PanelReport-1.pdf

City of Miami Beach. 2019. 2040 Miami Beach Comprehensive Plan.
https://www.mbrisingabove.com/wp-content/uploads/2040-Comprehensive-Plan-10-16-2019-Adopted-13MB.pdf

City of Miami Beach. 2019. Our Future in Focus: Strategic Plan Through the Lens of Resilience.
https://www.mbrisingabove.com/wp-content/uploads/Miami-Beach-Strategic-Plan-2019-For-Web-8.5.pdf

Greater Miami and the Beaches (GM&B). 2019. Resilient 305.
https://www.mbrisingabove.com/wp-content/uploads/Resilient305_final.pdf

Miami-Dade County. 2021. Miami-Dade County Sea Level Rise Strategy.
https://miami-dade-county-sea-level-rise-strategy-draft-mdc.hub.arcgis.com/

Financial Resources

City of Miami Beach Private Property Adaptation Program.
https://www.mbrisingabove.com/your-home/private-property-adaptation/

Conferences & Workshops

Miami Design Preservation League (MDPL): Annual Resiliency Workshop (Since 2017).
https://mdpl.org/events/annual-resiliency-workshop/

Blogs & News Coverage

Askew, Susan. "Old Buildings and the Sea." Re: Miami Beach, Dec. 2, 2016.
https://www.remiamibeach.com/north-beach/old-buildings-and-the-sea/

Askew, Susan. "Raise or Raze?" Re: Miami Beach, Apr. 13, 2017.
https://www.remiamibeach.com/citywide/raise-or-raze/

Campo-Flores, Arian. "Bracing for Sea Rise, Miami Beach Fights Tide of Angry Residents." The Wall Street Journal, Mar. 9, 2020.
https://www.wsj.com/articles/bracing-for-sea-rise-miami-beach-fights-a-tide-of-angry-residents-11583526613

Flechas, Joey. "Flood Claim Denied for Restaurant Turned 'Basement' after Miami Beach Raised Street." Miami Herald, Nov. 17, 2016.
https://www.miamiherald.com/news/local/community/miami-dade/miami-beach/article115264938.html

Flechas, Joey. "Miami Beach to Begin New $100 Million Flood Prevention Project in Face of Sea Level Rise." Miami Herald, Mar. 23. 2017.
https://www.miamiherald.com/news/local/community/miami-dade/miami-beach/article129284119.html

Flechas, Joey and Jenny Staletovich. "Miami Beach's Battle to Stem Rising Tides." Miami Herald, Dec. 31, 2015.
https://www.miamiherald.com/news/local/community/miami-dade/miami-beach/article41141856.html

Gurney, Kyra and Alex Harris. "Can a Miami Beach Neighborhood Preserve Its History and Protect Itself from Sea Rise?" Miami Herald, May 1, 2018.
https://www.miamiherald.com/news/local/community/miami-dade/miami-beach/article209784439.html

Gurney, Kyra. "Residents Battle Over Historic Label in Flooding Area." AP News, May 11, 2019.
https://apnews.com/article/597d956a8fa44d1495a48ffb6feaf84d

Harris, Alex. "Raising Flood-prone Roads Has Angered Miami Beach Residents. Experts Say They Need to Go Higher." Miami Herald, Jan. 22, 2020.
https://www.miamiherald.com/news/local/environment/article239486308.html

Harris, Alex. "Can Raising Roads for Sea Rise Make a Home More Valuable? Miami Beach Report Says Yes." Miami Herald, Jan. 29, 2020.
https://www.miamiherald.com/news/local/environment/article239682778.html

Harris, Alex. "Miami Beach is Raising Roads for Sea Rise. Lawsuits Say They're Causing Flooding Too." Miami Herald, Oct. 28, 2021.
https://www.miamiherald.com/news/local/environment/article255171182.html

St. Augustine, FL

Flood & Historic Resource Maps

City of St. Augustine Interactive Map Viewer.
https://staug.maps.arcgis.com/apps/webappviewer/index.html?id=23b4948e3b3b4380bd5f5075b6aac6be

In the city's integrated GIS interface, public users may overlay St. Augustine's National Register listed resources with FEMA floodplains, local storm surge zones, local hurricane evacuation zones, pavement management plan, and hurricane evacuation routes.

Adaptation Regulations & Design Guidelines

City of St. Augustine. 2021. Flood Mitigation Design Guidance for Historic Residences.
https://www.citystaug.com/DocumentCenter/View/5001/Flood-Mitigation-Design-Guidance

Developed in response to recent hurricanes, this guideline identifies basic improvements, building elevation, and wet floodproofing as suitable flood mitigation strategies for the largely wood-frame residential building stock in St. Augustine's historic districts. Design studies are provided to envision the elevation of local historic buildings, where designs for new foundation and stairs are informed by historic architectural styles and layouts.

City of St. Augustine. 2021. Flood Mitigation Design Guidance for Historic Coquina Buildings.
https://www.citystaug.com/DocumentCenter/View/5406/Flood-Mitigation-Design-Guidance-for-Historic-Coquina-Buildings

Paralleling the *Historic Residences* guideline that deals with a largely wood-frame building stock, this document identifies temporary measures, dry floodproofing, wet proofing and site floodproofing as recommended flood adaptation strategies for St. Augustine's historic buildings that are built partially or entirely of natural coquina. Due to the soft and heavy nature of coquina masonry construction, elevation is deemed as impractical and potentially destructive. Suitable strategies are identified for 31 pre-1820 coquina structures located in the St. Augustine Town Plan National Historic Landmark District.

Key Institutional Actors

St. Augustine Historic Architectural Review Board (HARB).
https://www.citystaug.com/601/Historic-Architectural-Review-Board-HARB

University of Florida Preservation Institute St. Augustine.
https://dcp.ufl.edu/historic-preservation/research/pisa/

Univeristy of Florida St. Augustine Inc.
https://staugustine.ufl.edu/

Plans & Studies

City of St. Augustine. "Flooding and Historic Properties: Resilient Heritage in the Nation's Oldest City."
https://www.citystaug.com/905/Flooding-and-Historic-Properties

This is St. Augustine's homepage for its heritage resilience initiatives. It contains the city's preservation masterplan, heritage policy-making, financial resources for property owners, as well as links to nationwide publications.

City of St. Augustine. 2018. City of St. Augustine Historic Preservation Master Plan.
https://www.citystaug.com/DocumentCenter/View/994/2018-Historic-Preservation-Master-Plan-PDF

City of St. Augustine. 2020. Resilient Heritage in the Nation's Oldest City.
https://www.citystaug.com/DocumentCenter/View/4058/St-Augustine-Resilient-Heritage-Report

Wolfe, Jenny. 2019. "Resilient Heritage in the Nation's Oldest City: A Survey of the Immediate and Long Term Impacts of Flooding in Historic St. Augustine."
https://www.citystaug.com/DocumentCenter/View/508/Planning-for-Community-Resilience-and-Historic-Preservation-in-the-Nations-Oldest-City-PDF

Financial Resources

City of St. Augustine: Ad Valorem Tax Exemptions for Historic Properties.
https://www.citystaug.com/DocumentCenter/View/195/Ad-Valorem-Tax-Exemption-for-Historic-Properties-PDF

Conferences & Workshops

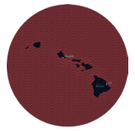
Keeping History Above Water 2019 St. Augustine: Envision 2050.
https://historyabovewater.org/2019-st-augustine/

Blogs & Media Coverage

City of St. Augustine. "Historic Preservation."
https://www.citystaug.com/192/Historic-Preservation

City of St. Augustine. "Resilient Heritage in the Nation's Oldest City" (ArcGIS Story Map).
https://staug.maps.arcgis.com/apps/MapSeries/index.html?appid=c74ff833b2b94c2e9d863d78fd77d00b

Rivers, Brendan. "Deluged by Floods, America's 'Oldest City' Struggles to Save Landmarks from Climate Crisis." The Guardian, Oct. 28, 2020.
https://www.theguardian.com/us-news/2020/oct/28/st-augustine-florida-floods-climate-crisis



Hawaii

Flood & Historic Resource Maps

Hawaii Department of Land and Natural Resources. Flood Hazard Assessment Tool.
http://gis.hawaiinfip.org/FHAT/

This online map visualizes the Haiwaiian portion of FEMA's FIRM and DFIRM floodplains, and overlays them on statewide land parcels.

Historic Hawai'i Foundation. Hawai'i's Historic Properties.
https://historichawaii.org/historic-properties/hawaii-county/

The Historic Hawai'i Foundation provides an online database for historic properties in Hawaii, Maui, Oahu, and Kauai counties. The State Historic Preservation Division is also developing a GIS database for all historic resources listed in the State Inventory of Historic Places, as well as the National and State Registers.

Key Institutional Actors

Hawai'i State Historic Preservation Division (Hawaii SHPO).
https://dlnr.hawaii.gov/shpd/

Historic Hawai'i Foundation.
https://historichawaii.org/

Plans & Studies

Kim, Karl. "Charlot House: Retrofitting and Preserving Resilience."
https://historichawaii.org/wp-content/uploads/KK-Charlot-CaseStudyFinal.pdf

Conferences & Workshops

Historic Hawai'i Foundation. Resiliency & Storm Preparedness for Historic Homes: Protecting Your Heritage Home from High Winds & Flood (Aug. 2019).
https://historichawaii.org/2019/07/26/resiliencyhistorichomes/
https://historichawaii.org/wp-content/uploads/2019/08/HHF-Storm-Preparedness-Presentation_FINAL.pdf

Historic Hawai'i Foundation. Hawai'i Preservation Webinar: Flood Adaptation for Historic Buildings (Mar. 2022).
https://historichawaii.org/2022/01/21/floodadaptation/

Blogs & Media Coverage

Murison, Virginia. "Trends and Issues: Guidelines on Flood Adaptation for Historic Buildings." Historic Hawai'i Foundation, Sep. 24, 2021.
https://historichawaii.org/2021/09/24/guidelines-on-flood-adaption-for-historic-buildings/

Louisiana

Flood & Historic Resource Maps

LSU AgCenter. LA Floodmaps.
https://www.lsuagcenter.com/topics/family_home/home/design_construction/laws%20licenses%20permits/getting%20a%20permit/your%20flood%20zone/flood_maps
http://maps.lsuagcenter.com/floodmaps/

This interactive map allows statewide users to discover lot-level BFE and ground elevation information. The map portal also incorporates a Base Flood Elevation Scenarios tool, where users can simulate the physical elevation of their homes with reference to local BFE designation.

Adaptation Regulations & Design Guidelines

Louisiana SHPO; NCPTT; National Park Service. 2015. Resilient Heritage: Protecting Your Historic Home from Natural Disasters.
https://www.crt.state.la.us/Assets/OCD/hp/uniquely-louisiana-education/Disaster-Recovery/GOHSEP%20BOOKLET%20Final%20For%20Web.pdf

Aimed at historic homeowners, this guideline lays out the various natural disasters at play in the state, and introduces how resilience measures — such as structural fortification, building elevation, floodproofing, and the strengthening of building elements (e.g. doors, windows and roofs) — may be appropriately applied to protect historic homes from natural disasters.

Louisiana SHPO. 2015. Elevation Design Guidelines for Historic Buildings in the Louisiana GO Zone.
https://www.crt.state.la.us/Assets/OCD/hp/uniquely-louisiana-education/Disaster-Recovery/Final%20Elevation%20Design%20Booklet%2012-07-15%20v2.pdf

Targeted at the structural elevation of local detached homes, this guideline uses successful built cases to lay out recommended practices in the design of site features, building facade, foundation, fence and stairs — areas closely related to historic characters and streetscape change. A particular emphasis is given to stair and landing areas in this guideline, with case studies provided for a number of different stair layouts.

Key Institutional Actors

Louisiana Office of Cultural Development Division of Historic Preservation (Louisiana SHPO).
https://www.crt.state.la.us/cultural-development/historic-preservation/

Louisiana Trust for Historic Preservation.
https://www.lthp.org/

Louisiana Landmarks Society.
https://www.louisianalandmarks.org/

Louisiana Coastal Protection and Restoration Authority (CPRA).
https://coastal.la.gov/

Plans & Studies

Louisiana Coastal Protection and Restoration Authority (CPRA). 2017. Louisiana's Comprehensive Master Plan for a Sustainable Coast.
https://www.crt.state.la.us/cultural-development/historic-preservation/

Resilient Louisiana Commission. 2020. Comprehensive Game Plan for a More Resilient Louisiana.
https://www.crt.state.la.us/cultural-development/historic-preservation/

Financial Resources

Louisiana SHPO. "Tax Incentives Map."
https://www.crt.state.la.us/cultural-development/historic-preservation/tax-incentives/

National Park Service: Hurricane Harvey (2019) Grant.

https://www.crt.state.la.us/cultural-development/historic-preservation/grants/nps-harvey-grant/more-information/index

National Park Service: Katrina & Rita (2005) Disaster Recovery Grant Program.
https://www.nps.gov/subjects/historicpreservationfund/katrina-rita-disaster-recovery-grant-program.htm
https://www.nps.gov/subjects/historicpreservationfund/upload/Katrina-Final-Report-WEB-version-2015-08-30.pdf

Blogs & Media Coverage

Bosteels, Amy. "Elevating Mandeville: One City's Flight to Stay Afloat" (ArcGIS Story Map). Dec. 8, 2019.
https://storymaps.arcgis.com/stories/7259e1716e22449986199dfd03b44421

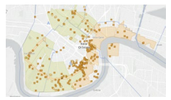
Scott, Roderick. "Mandeville: How One Louisiana City Became Flood Resilient." National Institute of Building Science Blog, Mar. 1, 2022.
https://www.nibs.org/blog/mandeville-how-one-louisiana-city-became-flood-resilient

Dyer, Jenny. "Historic Houses in the Shifting Landscape of Climate Change." American Alliance of Museums, Aug. 3, 2022.
https://www.aam-us.org/2022/08/03/historic-houses-in-the-shifting-landscape-of-climate-change/

New Orleans, LA

Flood & Historic Resource Maps

New Orleans Historic District Landmarks Commission. Historic Districts & Landmarks Map.
https://maps.nola.gov/portal/apps/webappviewer/index.html?id=83fd504d45f842279034a13de20a1114



This interactive map enables users to discover local historic districts and designated landmarks. For local floodplain information, please refer to LSU AgCenter's LA Floodmaps, or FEMA's National Flood Hazard Layer (NFHL) Viewer.

Dan Swenson. "Hurricane Katrina Flooding: 2005."
https://www.nola.com/image_6a3a0a22-c37b-11e9-867c-037f316a3170.html

This map visualizes approximate standing water depths in New Orlean's neighborhoods during the storm surge caused by levee breaches in Hurricane Katrina, and may be used as an empirical reference to the flood risk faced by the city's historic built environment.

Adaptation Regulations & Design Guidelines

City of New Orleans Historic District Landmarks Commission (HDLC). 2019. HDLC Design Guidelines.
https://nola.gov/nola/media/HDLC/Guidelines/HDLC-Design-Guidelines-(Combined).pdf

As the general preservation design guideline for New Orleans, this document incorporates a "Storm Preparedness & Resilience" section that delineates flood adaptation strategies on historic buildings. Such strategies include maintenance and drainage, structural fortification, elevating critical equipment, and structural elevation. The height limit for structural elevation is set at BFE + 1' or 3', whichever is greater.

Flood Adaptation Projects

Elevation Projects Carried Out by Roubion Elevation + Shoring.
https://www.roubionshoring.com/

Roubion Elevation & Shoring is a major building elevation contractor in the New Orleans Area. Among their many house elevation projects is the raise of a ranch house featured in National Park Service's *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (NPS 2021, 75).

US Army Corps of Engineers. Seabrook Floodgate Complex.
https://www.mvn.usace.army.mil/Portals/56/docs/PAO/FactSheets/SeabrookFloodgateComplex.pdf

US Army Corps of Engineers. IHNC-Lake Borgne Surge Barrier.
https://www.mvn.usace.army.mil/Portals/56/docs/PAO/FactSheets/IHNC-LakeBorgneSurgeBarrier.pdf

Key Institutional Actors

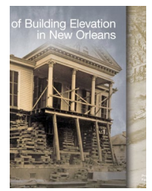
City of New Orleans Historic District Landmarks Commission (HDLC).
https://nola.gov/next/hdlc/home/

City of New Orleans Office of Resilience & Sustainability (ORS).
https://nola.gov/resilience-sustainability/

Preservation Resource Center of New Orleans (PRCNO).
https://prcno.org/

Plans & Studies

FEMA. 2012. The History of Building Elevation in New Orleans.
https://www.crt.state.la.us/Assets/OCD/hp/uniquely-louisiana-education/Disaster-Recovery/The%20History%20of%20Building%20Elevation%20in%20New%20Orleans%2012-21-12.pdf



Due to recurring flood risks, houses in the New Orleans area have been historically elevated or built with principal living areas above the ground. This report traces the history of building elevation in New Orleans, and surveys the historic raised house types that resulted from local construction and elevation practice. These house types may provide traditional wisdoms that aid the design of contemporary elevation projects.

City of New Orleans. 2015. Resilient New Orleans: Strategic Actions to Shape Our Future City.
http://resilientnola.org/wp-content/uploads/2015/08/Resilient_New_Orleans_Strategy.pdf

Financial Resources

New Orleans Redevelopment Authority: Community Adaptation Program.
https://www.noraworks.org/cap

Blogs & Media Coverage

City of New Orleans Office of Resilience & Sustainability. "HMGP - Stormwater Projects."
https://nola.gov/resilience-sustainability/(hmgp)-stormwater-projects/

Chatelain, Kim. "Several Homes Elevated in Old Mandeville amid Frequent Flooding Concerns." Preservation in Print, Sep. 2019.
https://prcno.org/several-homes-elevated-in-old-mandeville-amid-frequent-flooding-concerns/

Mitchell, David J. "After Katrina, House Elevations in New Orleans Depended on Timing, Funding, Mindset." The Advocate, Sep. 17, 2016.
https://www.theadvocate.com/baton_rouge/news/after-katrina-house-elevations-in-new-orleans-depended-on-timing-funding-mindset/article_f3cc3bd4-7446-11e6-9ca3-b3b2a9f0baf9.html

Preservation Resource Center. "City Receives FEMA Grant to Elevate Repeatedly Flooded Homes." Preservation in Print, May 2021.
https://prcno.org/city-receives-fema-grant-to-elevate-repeatedly-flooded-homes/

Maryland

Flood & Historic Resource Maps

Maryland DFIRM Outreach Program. Maryland Flood Maps.
https://mdfloodmaps.net/map/

This integrated map platform visualizes Maryland's FEMA floodplains as outlined by the FIRM and Preliminary DFIRM maps, along with sea level rise vulnerability and storm surge extents. It also features a tool that enables homeowners to retrieve the floodplain status of their properties by pinpointing their addresses on the map.

Maryland Historical Trust (MDSHPO). Maryland's Cultural Resources Information System (MEDUSA).
https://mht.maryland.gov/secure/medusa/

Established by Maryland SHPO, this database contains spatial and designation information of Maryland's National Register of Historic Places properties, determinations of eligibility records, and records for properties in the Maryland Historic Preservation Easement program.

Adaptation Regulations & Design Guidelines

Maryland Historical Trust (MDSHPO). 2018. Flood Mitigation Guide: Maryland's Historic Buildings.
https://mht.maryland.gov/documents/PDF/plan/floodpaper/2018-06-30_MD%20Flood%20Mitigation%20Guide.pdf

Designed to help local governments form community-level flood resilience strategies for historic properties, this guideline explains key concepts of floodplain management, and addresses the whole cycle of emergency management (planning & preparedness — response & recovery — mitigation — adaptation) with a focus on its preservation relevance. Matrices were provided to illustrate the pool of available community-wide and property-specific flood adaptation options; a number of the state's historic communities were surveyed, with possible flood adaptation strategies identified.

Key Institutional Actors

Maryland Historical Trust (Maryland SHPO).
https://mht.maryland.gov/

Preservation Maryland.
https://www.preservationmaryland.org/

Plans & Studies

Joyce, John M., and Michael S. Scott. 2005. An Assessment of Maryland's Vulnerability to Flood Damage.
https://www.researchgate.net/publication/237388828_An_Assessment_Of_Maryland's_Vulnerability_To_Flood_Damage

US Army Corps of Engineers Baltimore District. 2018. Nonstructural Flood Proofing Study for Ellicott City, MD.
https://www.howardcountymd.gov/sites/default/files/2021-08/ELLICOTT%20CITY%20NSFP_COMBINED%20REPORT%202018.pdf?fileticket=dHPynlDuG5I=&portalid=0

US Army Corps of Engineers Baltimore District. 2019. Assessment of Flood Risk Adaptive Measures, Baltimore, Maryland.
https://chap.baltimorecity.gov/sites/default/files/Baltimore%20City%20Nonstructural%20FINAL%20March2019.pdf

US Army Corps of Engineers Baltimore District. 2022. Baltimore Metropolitan Coastal Storm Risk Management Feasibility Study: Draft Integrated Feasibility Report & Environmental Assessment.
https://www.nab.usace.army.mil/Portals/63/docs/Civil%20Works/Balt%20CSRM/NAB%20-%2005%20-%20BaltCSRM%20-%20Draft%20Report%20-%20Draft%20Feasibility%20Report%20and%20EA.pdf

Financial Resources

Preservation Maryland & Maryland Historical Trust: Heritage Fund Grants.
https://www.preservationmaryland.org/programs/heritage-fund-grants/

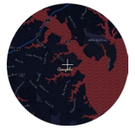
Conferences & Workshops

Preservation Maryland. "Old Line State Summit: Lessons from the Preservation Response to the Elliott City Flood" (Jun. 2017).
https://www.preservationmaryland.org/old-line-state-summit-session-ellicott-city-flood/

Blogs & Media Coverage

Poon, Linda. "How Historic Ellicott City Plans to Survive the Next Flood." Blomberg City Lab, Apr. 19, 2019.
https://www.bloomberg.com/news/articles/2019-04-18/how-to-save-a-historic-maryland-town-from-flooding

Vivano, Meg Walburn. "County Buys 9 Buildings In $100M Ellicott City Flood Plan." Chesapeake Bay Magazine, Nov. 19, 2019.
https://chesapeakebaymagazine.com/county-buys-9-buildings-in-100m-ellicott-city-flood-plan/



Annapolis, MD

Flood & Historic Resource Maps

City of Annapolis Historic District Map.
https://www.annapolis.gov/DocumentCenter/View/24022/Annapolis-Historic-District-Map-PDF

City of Annapolis offers a downloadable historic district map that lays out the locally designated Annapolis Historic District, and the Federally designated National Register and National Historic Landmark Districts. These three districts share similar but slightly different boundaries. For local floodplain data, please refer to the statewide Maryland Flood Maps database.

Flood Adaptation Projects

Preservation Maryland: Burtis House Stabilization Project (in Progress).
https://www.preservationmaryland.org/rfp-burtis-house-stabilization-project-in-annapolis/

Preservation Maryland is in the progress of rehabilitating the historic Burtis House in Annapolis's waterfront for reuse. Part of the multi-phase effort seeks to stabilize the house, safeguard it from coastal flooding, and potentially elevate it to a higher foundation.

Key Institutional Actors

Annapolis Historic Preservation Commission.
https://www.annapolis.gov/1381/Historic-Preservation-Commission

Annapolis Planning & Zoning Department Historic Preservation Division.
https://www.annapolis.gov/876/Historic-Preservation-Division

Historic Annapolis.
https://www.annapolis.org/

Plans & Studies

City of Annapolis. 2018. Weather It Together: A Cultural Resource Hazard Mitigation Plan.
https://www.annapolis.gov/DocumentCenter/View/10064/Consolidated-CRHMP-Report-April-2018

As a city-level resilience master plan dedicated to historic and cultural resources, this document analyzes the heritage and economic values of Annapolis's downtown urban fabrics as well as cultural and natural landscapes (such as Chesapeake Bay), and introduces the flood and sea level rise risks faced by the city. It then develops a cultural resource hazard mitigation plan based on steps recommended in the FEMA publication *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning* (FEMA 386-6), identifying nine recommended agendas to be carried out — ranging from natural and structural adaptation to flood preparedness programs and updated data resources. This document showcases how heritage resilience plan may go hand-in-hand with city-level hazard mitigation planning mechanisms to better align a city's land use and economic development schemes to the protection of historic resources.

Sparenberg, Jennifer (Maryland Historical Trust). 2016. "City of Annapolis – Weather It Together: Revising Floodplain Regulations for the Increased Protection of Historic Structures from Flooding."
https://www.annapolis.gov/DocumentCenter/View/2187/Revising-Floodplain-Regulations-for-the-Increased-Protection-of-Historic-District-PDF

Craig, Lisa. 2014. "National Landmarks at Risk: A Colonial Capital Case Study — Annapolis, Maryland."
https://www.eesi.org/files/Lisa-Craig-052014.pdf

US Army Corps of Engineers Baltimore District Planning Division. 2014. Nonstructural Mitigation Assessment for the City of Annapolis Historic District.
https://www.annapolis.gov/DocumentCenter/View/2177/Nonstructural-Mitigation-Assessment-for-Annapolis-Historic-District-PDF

City of Annapolis Department of Neighborhood and Environmental Programs. 2011. Flood Mitigation Strategies for the City of Annapolis, MD: City Dock and Eastport Area.
https://www.annapolis.gov/DocumentCenter/View/405/March-1-2011-Sea-Level-Study-PDF

Conferences & Workshops

Keeping History Above Water: 2017 Annapolis.
https://historyabovewater.org/2017-conference/

Blogs & Media Coverage

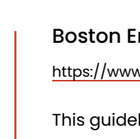
National Trust for Historic Preservation. n.d. "11 Most Endangered Historic Places (2018): Annapolis."

https://savingplaces.org/places/annapolis

Bear, Carson. “Annapolis, Maryland, Uses Its Maritime History to Combat Flooding, Parking, and More.” National Trust for Historic Preservation, Mar. 22, 2019.
https://savingplaces.org/stories/annapolis-maryland-uses-its-maritime-history-to-combat-flooding-parking-and-more

Joselow, Maxine. “Floods Are Washing Away Black History in This Md. City.” ClimateWire, Aug. 16, 2021.
https://www.eenews.net/articles/floods-are-washing-away-black-history-in-this-md-city/

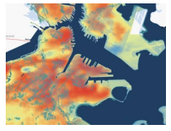
Weather It Together Team, City of Annapolis; Michael Baker International. “Landmark at Risk: Protecting the Historic Seaport of Annapolis, Maryland” (ArcGIS Story Map).
https://annapolis.maps.arcgis.com/apps/MapSeries/index.html?appid=a8e43f5101d14748a037603e2a120520&folderid=70b9f5d6e4f54a2bae08ad3becbce954



Boston, MA

Flood & Historic Resource Maps

City of Boston. Climate Ready Boston Map Explorer.
https://boston.maps.arcgis.com/apps/View/index.html?appid=77e5ead45a664676b7d404d6df3d7f05&extent=-71.0996,42.3244,-70.9606,42.3940



Featuring spatial data used in the Climate Ready Boston initiative, this online map visualizes future stormwater flooding projections, floodplain and high tide projections, extreme heat, as well as the distribution of social vulnerability indicators (e.g. low-income population, the elderly, and people of color). Users are allowed to overlay these layers to better understand how different factors contribute to local climate vulnerability.

City of Boston. Map of Boston Historic Landmarks and Districts.
https://boston.maps.arcgis.com/apps/instant/minimalist/index.html?appid=2fa4d1ebd00948248c7600692890b6f3

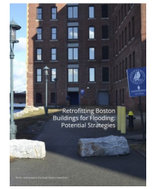
This interactive map lays out Boston’s locally designated landmarks, historic districts, and historic districts protection area. Tabular info and a link to designation report are provided for each building or site.

Adaptation Regulations & Design Guidelines

Boston Environment Department. 2018. Boston: Resilient, Historic Buildings Design Guide.
https://www.boston.gov/sites/default/files/embed/file/2018-10/resilient_historic_design_guide_updated.pdf

This guideline positions flood adaptation under a larger framework of resilience, which also includes climate mitigation measures such as solar panels, and climate resilience measures such as rain gardens. Illustrated design studies are provided for local historic building types that range from row houses to industrial lofts, where non-structural elevation methods are preferred due to streetscape considerations.

BPDA. 2016. Retrofitting Boston Buildings for Flooding: Potential Strategies.
https://www.boston.gov/sites/default/files/embed/file/2017-01/retrofitting_report_10.7.2016.pdf



An exploratory guideline designed for Boston’s general existing building stock, this document uses the concept of “Retrofi+” to illustrate design strategies beyond FEMA’s minimum requirements. Illustrated case studies are provided for various building types, with a range of design solutions addressing streetscape and urban design considerations (e.g. landscaping, interior elevation and temporary programming below DFE) proposed.

BPDA. 2019. Coastal Flood Resilience Design Guidelines.
https://www.bostonplans.org/getattachment/d1114318-1b95-487c-bc36-682f8594e8b2

An expansion to the *Potential Strategies* report, this guideline establishes six major building types in Boston’s floodplain, and features illustrated design studies for each building type as well as general retrofitting strategies that may be applied across the board. Under the principle that building-scale solutions should contribute to the public realm, streetscape and urban design impacts are analyzed for each retrofitting strategy.

Flood Adaptation Projects

Climate Ready Boston: Coastal Resilience Projects (in Progress).
https://boston.maps.arcgis.com/apps/Cascade/index.html?appid=c438a8a66e9d470b8b305a973fc192f7

A number of coastal project recommendations have been made in the neigborhood-scaled resilience plans published under the Climate Ready Boston initiative, ranging from buidling and site-scaled intervention to urban-scaled resilience infrastructure (e.g. elevated waterfront parks and harborwalks) and ecological restoration. These projects are in different stages of development and implementation under city-level coordination, and can be tracked on the Climate Ready portal.

Key Institutional Actors

Boston Environment Department / Boston Landmarks Commission.
https://www.boston.gov/departments/environment

Boston Planning & Development Agency (BPDA).
https://www.bostonplans.org/

Harvard Graduate School of Design.
https://www.gsd.harvard.edu/

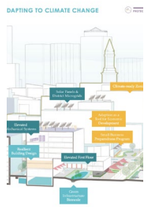
MIT School of Architecture + Planning.
https://sap.mit.edu/

Plans & Studies

City of Boston. Climate Ready Boston & Resilient Boston Harbor.
https://www.boston.gov/environment-and-energy/climate-ready-boston

https://www.boston.gov/environment-and-energy/resilient-boston-harbor

Boston's overarching Climate Ready initiative started from the *Climate Ready Boston* report published in 2016. The coastal resilience section of the original report was subsequently developed into the "Resilient Boston Harbor" initiative, which includes resilience plans for Boston's 5 coastal neighborhoods (Downtown & North End, South Boston, East Boston, Dorchester and Charlestown), and a vision for all 47 miles of Boston's coastline. Recommendations made in these plans are currently being implemented (see the "Flood Adaptation Projects" section above); besides coastal flood resilience, the Climate Ready initiative also includes urban heat resilience, energy efficiency and green infrastructure within its scope.



Blogs & Media Coverage

Union of Concerned Scientists. "Boston's Historic Districts and Faneuil Hall Are Increasingly Vulnerable to Floods." Union of Concerned Scientists, Jul. 15, 2016.
https://www.ucsusa.org/resources/bostons-historic-districts-and-faneuil-hall-increasingly-vulnerable-floods

Webb, Mariana Jordan. "What Sea Level Rise Could Mean for Boston's Historic Structures." National Trust for Historic Preservation Leadership Forum, Jun. 5, 2017.
https://forum.savingplaces.org/blogs/special-contributor/2017/06/05/what-sea-level-rise-could-mean-for-bostons-historic-structures

Nantucket, MA

Flood & Historic Resource Maps

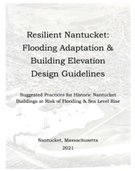
Town & County of Nantucket GIS Maps.
https://www.nantucket-ma.gov/151/GIS-Maps

Nantucket's GIS portal features an online interface where users may view current flood maps and future flood projections, and overlay them onto the city's historic districts. The portal also provides a printable map of the city's historic districts.

Adaptation Regulations & Design Guidelines

Town of Nantucket. 2021. Resilient Nantucket: Flooding Adaptation & Building Elevation Design Guidelines.
https://nantucket-ma.gov/DocumentCenter/View/39431/Resilient-Nantucket-PDF-Guideline

This guideline discusses how flood adaptation strategies may be appropriately applied to Nantucket's sensitive historic built environment, which features freestanding commercial or residential houses built mostly in wood frame that can be traced back to the 1700s. As is the case for many other historic towns, the design of foundation, stair, and landscape features as well as the choice of finishing materials are critical for the retaining of detached houses' historic characters under flood adaptation and elevation.



Key Institutional Actors

Nantucket Historical Commission.
https://nantucket-ma.gov/439/Nantucket-Historical-Commission

Nantucket Historic District Commission.
https://nantucket-ma.gov/283/Historic-District-Commission

Nantucket Preservation Trust.
https://www.nantucketpreservation.org/

Nantucket Historical Association.
https://nha.org/

University of Florida Preservation Institute Nantucket.
https://dcp.ufl.edu/historic-preservation/pin/

Plans & Studies

University of Florida. 2019. Resilient Nantucket: 3D Digital Documentation and Sea Level Rise Visualization.
https://dcp.ufl.edu/historic-preservation/wp-content/uploads/sites/14/2019/06/Resilient-Nantucket-Report-with-SLR-Visualizations.pdf

Combining 3D laser scanning, GIS and digital visualization techniques, this project established a historic building database for Nantucket's Downtown and Brant Point areas, visualized inundation scenarios based on NOAA's sea level rise projections, and identified structures subject to sea level rise impact by the years of 2040, 2060, 2080 and 2100 through spatial analysis. This project was carried out under the *Resilient Nantucket* initiative, through a collaboration between the Town of Nantucket, Nantucket Preservation Trust, and UF Preservation Institute Nantucket.

Town of Nantucket: Resilient Nantucket.
https://nantucket-ma.gov/1634/Resilient-Nantucket

Town of Nantucket. 2021. Nantucket Coastal Resilience Plan.
https://nantucket-ma.gov/DocumentCenter/View/40278/Nantucket-Coastal-Resilience-Plan-PDF

Town of Nantucket. 2021. Nantucket Resilience Toolkit.
https://nantucket-ma.gov/DocumentCenter/View/39406/Nantucket-Resilience-Toolkit-PDF

Conferences & Workshops

Keeping History Above Water: 2019 Nantucket.
https://historyabovewater.org/2019-nantucket/

Town of Nantucket. Resilient Nantucket: Designed for Adaptation Forum (Apr. 2021).
https://www.nantucket-ma.gov/2081/Events-Presentations

Blogs & Media Coverage

Carr, Rita. "New Flooding Adaptation & Building Elevation Design Guidelines Adopted." Nantucket Preservation Trust, Jun. 30, 2021.
https://www.nantucketpreservation.org/new-flooding-adaptation-building-elevation-design-guidelines-adapted-8438/

Nantucket Footprints. "Resilient Nantucket: Flooding Adaptation & Building Elevation Design Guidelines." Nantucket Footprints, Aug. 1, 2021.
https://nantucketfootprints.net/2021/08/01/resilient-nantucket-flooding-adaptation-building-elevation-design-guidelines/

Salem, MA

Flood & Historic Resource Maps

City of Salem. Salem NRHP Resources.
https://salemma.maps.arcgis.com/apps/PublicInformation/index.html?appid=631be8abcc604c548f3a5b64d7c142c3&extent=-70.9195,42.5069,-70.8662,42.5339

City of Salem. Local Historic District Maps.
https://www.salemma.gov/historical-commission/pages/individual-local-historic-district-maps
https://www.salemma.gov/sites/g/files/vyhlif7986/f/uploads/localhistoricdistricts_0.pdf

These individual map resources lay out the historic properties and districts recognized by the National Register of Historic Places in Salem, as well as Salem's locally designated historic districts.

City of Salem. Salem Climate Hazard Viewer.
https://salemma.maps.arcgis.com/apps/View/index.html?appid=3aeca8bf598e44858195754ebdcdcdf0&extent=-70.9240,42.5127,-70.8417,42.5393

This interactive map incorporates Salem's FEMA floodplain designation, storm surge extents, and inundation areas under a number of sea level rise scenarios. It also contains a preliminary designation of urban heat islands.

Key Institutional Actors

Salem Historical Commission.
https://www.salemma.gov/historical-commission
https://www.preservingsalem.com/

Historic Salem Inc.
https://www.historicsalem.org/

Plans & Studies

City of Salem. 2014. Ready for Tomorrow: The City of Salem Climate Change Vulnerability Assessment & Adaptation Plan.
https://www.salemma.gov/sites/g/files/vyhlif7986/f/news/climate_change_vulnerabilty_assessment_adaptation_plan.pdf

City of Salem Department of Planning and Community Development. 2015. City of Salem Historic Preservation Plan Update.
https://www.salemma.gov/sites/g/files/vyhlif7986/f/uploads/final_plan_12.11.15.pdf

Conferences & Workshops

City of Salem & The Salem Preservation Partners: Preservation in a Changing Climate (Annual Conference Since 2021).
https://www.preservingsalem.com/preservation-in-a-changing-climate-1

Keeping History Above Water: 2021 Salem.
https://historyabovewater.org/2021-salem/

Blogs & Media Coverage

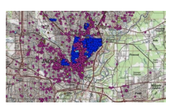
Historic Salem Inc. "HSI Position on the Pioneer Village Move to Camp Naumkeag Site." Historic Salem Inc., Sep. 14, 2021.
https://www.historicsalem.org/blog/hsi-position-on-the-pioneer-village-move-to-camp-naumkeag-site

Associated Press. "Workshop Focuses on Climate Change Impacts in Historic Salem." Boston.com, Sep. 12, 2021.
https://www.boston.com/news/local-news/2021/09/12/workshop-focuses-on-climate-change-impacts-in-historic-salem/

Mississippi

Flood & Historic Resource Maps

Mississippi Department of Archives and History (MDAH). Historic Resources Inventory Map.
https://www.apps.mdah.ms.gov/mapping_pub/



Through this online map, MDAH offers an interactive interface where users may view the National Register and locally designated historic resources at the same time. Users may also search for historic resources by name, or by drawing a spatial boundary.

Mississippi Department of Environmental Quality. MS-NFHL Web Map Viewer.

https://geology.deq.ms.gov/floodmaps/Viewer/index.html

This map features the Mississippi portion of FEMA's National Flood Hazard Layer (NFHL) Viewer, and combines it with statewide building footprint and LIDAR hillshade data.

Adaptation Regulations & Design Guidelines

Mississippi Development Authority. 2008. Elevation Design Guidelines for Historic Homes in the Mississippi Gulf Coast Region.

https://www.nj.gov/dep/hpo/hrrcn_sandy_pdf%20files/mississippi.pdf

Developed after Hurricane Katrina, this document serves to guide elevation projects on historic homes carried out in the disaster recovery process. Featuring recommendations for site, architecture and foundation, this guideline advocates for elevation designs that complement and match historic facade composition, and mitigate streetscape changes through treatments such as planting, screening, and site regrading.

Flood Adaptation Projects

Honor-Attaya Cottage, Ocean Springs.

See National Park Service, *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (2021), 135-138.

The one-story Queen-Anne style cottage was originally built circa 1890 on high, open-tier foundations, and had been moved to an adjacent site by 1918. After the severe damages caused by Hurricane Katrina, its owners decided to elevate the house above its pre-Katrina height. The layout of stairs had to be revised from straight run to L-plan, in order to save a surviving tree in front of the house. This project is featured as a case study in National Park Service's *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*.

Key Institutional Actors

MDAH Historic Preservation Division (Mississippi SHPO).

https://www.mdah.ms.gov/historic-preservation

Mississippi Heritage Trust.

https://www.mississippiheritage.com/

Mississippi Development Authority (MDA).

https://mississippi.org/

Mississippi Department of Marine Resources Office of Coastal Restoration and Resiliency.

https://dmr.ms.gov/restoration-and-resiliency/

Plans & Studies

Mississippi Department of Marine Resources. 2005. Mississippi Gulf Coast National Heritage Area Management Plan.

https://msgulfcoastheritage.ms.gov/wp-content/uploads/2020/10/MGCNHA-ManagementPlan-final.pdf

Financial Resources

Mississippi Development Authority. n.d. Elevating Historic Properties: Grant Applicant Guide.

https://www.msdisasterrecovery.com/documents/historic_prop_grant_app.pdf

Mississippi Department of Marine Resources: Heritage Community Grants.

https://msgulfcoastheritage.ms.gov/heritage-community-grants/

New Jersey

Flood & Historic Resource Maps

Rutgers University CRSSA et al. NJ Flood Mapper.

https://www.njfloodmapper.org/

The NJ Flood Mapper contains a wide range of flood hazard indicators (e.g. Sandy storm surge extent, sea level rise and FEMA flood zones), and allows users to get visualization based on self-defined flood risk scenarios (e.g. sea level rise by 2 ft). It also incorporates statewide land use, infrastructure, transportation and sociodemographic information as supporting layers.

New Jersey Historic Preservation Office (NJSHPO). NJ Cultural Resources GIS Online Map Viewer (LUCY).

https://share-open-data-njtpa.hub.arcgis.com/apps/njdep::lucy-njdep-crgis-online-viewer/explore

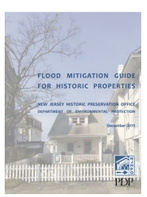
As New Jersey's online cultural resources database, this interactive map visualizes historic resources that are listed on or eligible for the National and State Register, as well as those designated as local landmarks or districts and those documented through cultural resource surveys.

Adaptation Regulations & Design Guidelines

New Jersey Historic Preservation Office (NJSHPO). 2019. Flood Mitigation Guide for Historic Properties.

https://www.nj.gov/dep/hpo/images/_MULT_DG_32_v1_ID14076r.pdf

Similar to Maryland's *Flood Mitigation Guide* published in 2018, this document situates New Jersey's historic built environment into the emergency management cycle (planning — response — recovery — mitigation). This guideline further stresses policy-making actions that local community can take to encourage the sensitive flood adaptation of historic properties, such as modifying zoning ordinance or building code, developing financial incentives, and creating streamlined review processes.



New Jersey Historic Preservation Office (NJSHPO). 2019. Elevation Design Guidelines for Historic Structures.
https://www.nj.gov/dep/hpo/images/_MULT_DG_32_v2_ID14078r.pdf

As a companion to the state's *Flood Mitigation Guide for Historic Properties*, this guideline lays out considerations on neighborhood, site and building scales for the structural elevation of historic houses. Most of these considerations are related to the mitigation of changes in proportion, historic character, and streetscape; illustrated case studies are provided for local building types such as row house, duplex, and detached home.

Flood Adaptation Projects

Methodist Camp Cottage, Ocean City.

See National Park Service, *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (2021), 131-134.

Wet-floodproofed without abandoning ground-floor living space, this house demonstrates a non-intrusive and incremental approach to flood adaptation. Instead of physically elevating the house, the homeowner chose to allow floodwater to come in during flood events, while being able clean up relatively easily afterwards. The ground floor is fortified, and walls repaired with flood-resistant materials; gaps and removable pieces are also designed in the floor and wall systems, to allow for air circulation that help dry out structural cavities. A pully system is fixed to the ceiling of ground-floor living room, which may be used to hoist furniture in the air before anticipated flood events. This project is featured as a case study in National Park Service's *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*.

Key Institutional Actors

New Jersey Historic Preservation Office (NJSHPO).
https://www.nj.gov/dep/hpo/

New Jersey Historic Trust.
https://www.nj.gov/dca/njht/

Rutgers NJ Climate Change Resource Center.
https://njclimateresourcecenter.rutgers.edu/

Plans & Studies

O'Lear, Amanda (NJ Climate Change Resource Center). 2022. "Historic Preservation and Climate Change: Inland and Coastal Flood Risk" (ArcGIS Story Map).
https://storymaps.arcgis.com/stories/dbb2caa9fdab4942b4b682eff6b2e3bc

Financial Resources

National Park Service: Hurricane Sandy (2012) Disaster Recovery Grant Program.
https://www.nps.gov/subjects/historicpreservationfund/hurricane-sandy-disaster-recovery-grant-program.htm

FEMA. 2020. New Jersey Mitigation Resource Guide.
https://www.fema.gov/sites/default/files/2020-09/fema_region-03_mitigation-funding-resource-guide_new-jersey_09-24-2020.pdf

New Jersey Historic Trust. "Funding Programs Overview."
https://www.nj.gov/dca/njht/programs/overview/

Conferences & Workshops

Rutgers NJ Climate Change Resource Center. Summer Climate Academy: Protecting Our Historical and Cultural Assets (Jun. 2020).
https://njclimateresourcecenter.rutgers.edu/past_events/summer-climate-academy-protecting-our-historical-and-cultural-assets/

Blogs & Media Coverage

Beeler, Carolyn. "Flood-proofing Historic Buildings Post-Sandy." WHYY, Nov. 26, 2014.
https://whyy.org/articles/flood-proofing-historic-buildings-post-sandy/

Ocean City. "Home Elevation FAQs."
https://www.ocnj.us/home-elevation-faqs

Paik, Eugene. "What Sandy Victims Need to Know about New Height Rules for Their Homes." NJ.com, Feb. 5, 2013.
https://www.nj.com/news/2013/02/what_sandy_victims_need_to_kno.html

Valera, Stephanie. "Houseraising: The Elevated Homes of Post-Sandy Jersey Shore." The Weather Channel, Oct. 26, 2017.
https://weather.com/travel/news/elevated-houses-new-jersey

New York State

Flood & Historic Resource Maps

New York State Office of Parks, Recreation & Historic Preservation. Cultural Resource Information System (CRIS).
https://cris.parks.ny.gov/

As New York State's cultural resource management system, CRIS allows public users to view buildings and historic districts listed on or eligible for the National Register, together with New York City's locally designated LPC landmarks and districts as well as areas of archaeological and building surveys. Users may also search for a certain project or resource, and acquire relevant documents (e.g. designation or survey reports) through the interface. For statewide floodplain data, please refer to FEMA's National Flood Hazard Layer

(NFHL) Viewer, or the Flood Maps section of New York Climate Change Science Clearinghouse's map portal.

Key Institutional Actors

New York State Historic Preservation Office (NYSHPO).
https://parks.ny.gov/shpo/

New York Department of State.
https://dos.ny.gov/

New York State Department of Environmental Conservation (DEC).
https://www.dec.ny.gov/

New York State Floodplain and Stormwater Managers Association.
https://nyfloods.org/

New York State Water Resource Institute at Cornell University (NYSWRI).
https://cals.cornell.edu/water-resources-institute

The New York Climate Change Science Clearinghouse (NYCCSC).
https://www.nyclimatescience.org/

Plans & Studies

New York SHPO. The New York State Historic Preservation Plan (2021-2026).
https://parks.ny.gov/documents/shpo/preservation-plan/NewYorkStateHistoricPreservationPlan20212026.pdf

New York SHPO: Hurricane Sandy Historic Resource Survey of Selected Waterfront Communities.
Accessible via NYS Cultural Resource Information System (CRIS).

With the support of National Park Service's Hurricane Sandy Disaster Relief Grants, New York SHPO carried out this five-year initiative to document historic resources within communities vulnerable to flooding. In general, the survey looked at the waterfront areas of Suffolk and Nassau Counties, select communities within Orange, Rockland and Westchester Counties, and New York City's Five Boroughs. A total of approximately 11,000 properties were added to, or updated in, the New York State Cultural Resource Information System (CRIS).

Public users may visit CRIS, click "Proceed as a Guest," go to the "Search" page through the top navigation bar, select "Library" under the "Criteria" tab, and type in "Sandy" in the Name field to access survey reports and context statements associated with the Sandy survey.


The City of Brooklyn (Currier & Ives, 1870)

oric Context
lyn, Kings County, New York
ic Resources Survey of Selected Waterfront Communit
Island and New York City

Financial Resources

National Park Service: Hurricane Sandy (2012) Disaster Recovery Grant Program.
https://www.nps.gov/subjects/historicpreservationfund/hurricane-sandy-disaster-recovery-grant-program.htm

FEMA Region II. 2020. New York Mitigation Resource Guide.
https://www.fema.gov/sites/default/files/2020-09/fema_region-03_mitigation-funding-resource-guide_new-york-09-24-2020.pdf

New York State Department of Environmental Conservation: Climate Smart Communities Grant Program.
https://www.dec.ny.gov/energy/109181.html

New York SHPO: State Historic Preservation Tax Credits.
https://parks.ny.gov/shpo/tax-credit-programs/

New York SHPO administers a number of state-level preservation tax credit programs, including the **State Historic Preservation Tax Credit Program for Income Producing Properties**, **New York State Historic Homeownership Rehabilitation Credit**, and **New York State Historic Barn Rehabilitation Tax Credit**. The Homeownership Rehabilitation Credit offers a state income tax credit equal to 20% of qualified rehabilitation expenses associated with repair, maintenance, and upgrades to historic homes, and may be used for the flood retrofitting of historic houses. Click here for an interview with the homeowners of 260 Main Street, NY, who used the Homeownership Rehabilitation Credit to assist the elevation of their flood-threatened historic house.

Blogs & Media Coverage

New York Department of State. n.d. "Resilience Planning."
https://dos.ny.gov/resilience-planning

New York State Department of Environmental Conservation. n.d. "Floodplain Management."
https://www.dec.ny.gov/lands/24267.html

New York State Department of Environmental Conservation. n.d. "Flood Recovery and Resiliency."
https://www.dec.ny.gov/lands/121102.html

Owego, NY

Flood Adaptation Projects

260 Main Street.
http://www.owegopennysaver.com/PS/2015/10/02/first-historic-home-elevated-in-owego/
https://www.ithacajournal.com/story/news/2015/12/04/above-flood-historic-owego-house-raised-first-ny/76641234/
See National Park Service, *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (2021), 88.

This circa-1849 Greek Revival residence was substantially elevated, but with very little visual impacts. Successful streetscape design treatments in this project include: 1) the entrance stairs that are broken into two materials, with the lower run made of stone that disguises itself in the landscape; 2) terraced front yard with plantings; 3) the new foundation coated in matching finishing, and the pilasters and flood vents on it that align with the historic house's three-bay elevation composition. This project is featured in National Park Service's *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*, as well as a number of local

news media. Click here for an interview with its homeowners.

Key Institutional Actors

Owego Historic Preservation Commission (OHPC).
https://www.villageofowego.com/boards___committees/owego_historic_preservation_commission/index.php

Plans & Studies

Village of Owego. 2013. Long Term Community Recovery Strategy.
https://www.tiogacountyny.com/media/2334/village-of-owego-ltcrs-final.pdf

US Army Corps of Engineers. Upper Susquehanna River Basin (USRB) Comprehensive Flood Damage Reduction Feasibility Study.
https://www.nab.usace.army.mil/USRB_Feasibility_Study/

Blogs & Media Coverage

Owego Pennysaver. "First Historic Home Elevated in Owego." Owego Pennysaver, Oct. 2, 2015.
http://www.owegopennysaver.com/PS/2015/10/02/first-historic-home-elevated-in-owego/

Roby, John R. "Above the Flood: Historic Owego House Raised." Ithaca Journal, Dec. 4, 2015.
https://www.ithacajournal.com/story/news/2015/12/04/above-flood-historic-owego-house-raised-first-ny/76641234/

Joseph, Bob. "Historic Owego Home Gets a 'Lift.'" WNBF, Nov. 15, 2015.
https://wnbf.com/historic-owego-home-gets-a-lift/

Schenectady, NY

Flood & Historic Resource Maps

City of Schenectady. 2018. "Historic Districts and Local Landmarks."
https://www.cityofschenectady.com/DocumentCenter/View/2107/Historic-Districts-PDF?bidId=

This map provides information on Schenectady's locally designated historic districts and landmarks. For local floodplain information, please refer to FEMA's National Flood Hazard Layer (NFHL) Viewer.

Flood Adaptation Projects

Stockade Historic District Flood Mitigation Project (in Progress).
https://projectupdate.wixsite.com/stockaderesilience

Supported by FEMA's Hazard Mitigation Grant Program (HMGP), the City of Schenectady is carrying out a two-phase project to determine and implement a preferred approach to mitigate flooding impacts in the Stockade historic district and assist property owners to preserve their homes. Phase One of the project will evaluate existing conditions and identify a recommended solution; Phase Two will then implement the recommended solution.

Key Institutional Actors

City of Schenectady.
https://www.cityofschenectady.com/

Schenectady Historic District Commission.
http://ny-schenectady.civicplus.com/203/Historic-District-Commission

The Stockade Association.
https://www.historicstockade.org/

Schenectady Heritage Foundation.
https://www.schenectadyheritage.org/

Plans & Studies

City of Schenectady. 2017. Stockade Historic District Flood Mitigation Design Guidelines.
https://www.cityofschenectady.com/DocumentCenter/View/1984/Stockade-Historic-District-Flood-Mitigation-Design-Guidelines

City of Schenectady. 2019. "Interactive 3D Model of Entire Project Area."
https://projectupdate.wixsite.com/stockaderesilience/existing-conditions-model

City of Schenectady. 2019. "Flood Mitigation Analysis and Design in the Historic Stockade Neighborhood."
https://9cb54243-32ad-45a7-9086-a34ff34cb5dc.filesusr.com/ugd/fea6f4_b6e6b3399ab34eec9d396414b1bb0ffb.pdf

Conferences & Workshops

City of Schenectady: "Building a Resilient Stockade" Community Design Workshop (Apr. 2019).
https://www.cityofschenectady.com/DocumentCenter/View/2479/3-8-19-Building-Resilient-Stockade-Workshops-PR-merged
https://9cb54243-32ad-45a7-9086-a34ff34cb5dc.filesusr.com/ugd/fea6f4_25d9bd14ce8a48ee9685db7ed903b03f.pdf

Blogs & Media Coverage

The Stockade Association. n.d. "Special Projects."

https://www.historicstockade.org/special-projects/

City of Schenectady. n.d. “Project Updates.”
https://projectupdate.wixsite.com/stockaderesilience/project-updates

Samuels, Brett. “Schenectady Creating Flood-Mitigation Design Guidelines.” Daily Gazette, Jun. 7, 2017.
https://dailygazette.com/2017/06/07/schenectady-creating-flood-mitigation-design-guidelines/

Nelson, Paul. “Schenectady to Get $1.2M for Stockade Flood Study.” Times Union, Nov. 10, 2017.
https://www.timesunion.com/news/article/Schenectady-to-get-1-2M-for-Stockade-flood-study-12348590.php

Nelson, Paul. “Phase 1 for Flood-prone Stockade Project Detailed.” Times Union, Oct. 23, 2018.
https://www.timesunion.com/7dayarchive/article/Phase-One-for-flood-prone-Stockade-project-13331275.php

Nelson, Paul. “Despite Delay, Schenectady Says $7.5M Stockade Flood Project Still in the Works.” Times Union, Jul. 27, 2020.
https://www.timesunion.com/news/article/Despite-delay-7-5M-Stockade-flood-project-still-15437793.php

Demola, Pete. “Move ‘em Out? Relocating Houses in Stockade Considered as Flooding Solution.” Times Union, Mar. 26, 2021.
https://www.timesunion.com/news/article/As-Stockade-flood-resilience-project-takes-shape-16055974.php

Willard, Lucas. “Schenectady Floats Idea To Relocate Homes In Flood-Prone Stockade.” WAMC, Mar. 31, 2021.
https://www.wamc.org/new-york-news/2021-03-31/schenectady-floats-idea-to-relocate-homes-in-flood-prone-stockade

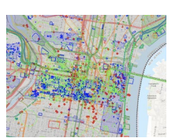
Pennsylvania

Flood & Historic Resource Maps

Penn State University. PA Flood Risk.
https://pafloodrisk.psu.edu/

Based on FEMA’s flood maps, the PA Flood Risk tool visualizes effective flood zones in Pennsylvania, as well as regulatory floodways and areas protected by levees. Users may type an address or click on a location to acquire an automatically generated flood risk summary.

Pennsylvania SHPO. PA-SHARE.
https://share.phmc.pa.gov/pashare/landing



As Pennsylvania’s statewide heritage management database, PA-SHARE provides information on historic properties and districts listed on or eligible for the National Register, as well as existing cultural landscape surveys and historical markers. It also allows users to search for a particular project, or submit information to SHPO.

Key Institutional Actors

Pennsylvania Historical and Museum Commission (PHMC).
https://www.phmc.pa.gov/Pages/default.aspx

Pennsylvania Historic Preservation Office (PASHPO; a bureau of PHMC).
https://www.phmc.pa.gov/Preservation/Pages/default.aspx

Preservation Pennsylvania.
https://www.preservationpa.org/

Plans & Studies

Pennsylvania SHPO. n.d. “Disaster Planning for Historic Properties Initiative.”
https://www.phmc.pa.gov/Preservation/Disaster-Planning/Pages/default.aspx

Pennsylvania SHPO. n.d. “Integrating Disaster Planning into Historic Resource Survey.”
https://www.phmc.pa.gov/Preservation/Disaster-Planning/Pages/Mitigation-Projects.aspx

Young, Jeremy R. 2015. “Disaster Planning for Historic Properties: Integrating Hazard Mitigation and Historic Preservation in Pennsylvania.”
https://planningpa.org/wp-content/uploads/B1.-Hazard-Mitigation-Plan-Young.pdf

Financial Resources

National Park Service: Hurricane Sandy (2012) Disaster Recovery Grant Program.
https://www.nps.gov/subjects/historicpreservationfund/hurricane-sandy-disaster-recovery-grant-program.htm

Pennsylvania SHPO: Grant Programs.
https://www.phmc.pa.gov/Preservation/Grants-Funding/Pages/default.aspx

Pennsylvania Department of Community and Economic Development: State Historic Preservation Tax Credit (HPTC).
https://dced.pa.gov/programs/historic-preservation-tax-credit-hptc/

Preservation Pennsylvania. “Preservation Funding.”
https://www.preservationpa.org/funding/

Conferences & Workshops

The Pennsylvania Silver Jackets. “Protecting Against Future Floods” Workshops (Aug. 2018).
https://pahistoricpreservation.com/floodproofing-workshops/

Blogs & Media Coverage

Young, Jeremy R. "Before the (Next) Storm: The Disaster Planning for Historic Properties Initiative." Pennsylvania Historic Preservation, Feb. 4, 2015.
https://pahistoricpreservation.com/next-storm-disaster-planning-historic-properties-initiative/

Young, Jeremy R. "'Disaster Planning for Historic Properties' Exhibit Debuts at the PA State Association of Township Supervisors Conference." Pennsylvania Historic Preservation, Apr. 29, 2015.
https://pahistoricpreservation.com/disaster-planning-for-historic-properties-exhibit-debuts-at-the-pa-state-association-of-township-supervisors-conference/

Pierce, David. "Historic Buildings in Flood Zones Surveyed." Pocono Record, Nov. 20, 2015.
https://www.poconorecord.com/story/news/2015/11/21/historic-buildings-in-flood-zones/32972943007/

Philadelphia, PA

Key Institutional Actors

Philadelphia Historical Commission.
https://www.phila.gov/departments/philadelphia-historical-commission/

Preservation Alliance for Greater Philadelphia.
https://preservationalliance.com/

UPenn Weitzman School of Design.
https://www.design.upenn.edu/

City of Philadelphia Flood Management Program.
https://www.phila.gov/programs/flood-management-program/

Plans & Studies

PDP Architects. 2020. Manayunk Main Street Historic District Flood Guide.
https://gis.penndot.gov/CRGISAttachments/Survey/2020H004101A_3.pdf

Commissioned by Pennsylvania SHPO, this project studied floodplain extents around the Main Street of Manayunk, Philadelphia, identified typical maintenance needs for historic structures along the street corridor, and put forward two flood retrofitting design scenarios — wet-floodproofing and dry-floodproofing — applicable to the predominant mid-rise, masonry building type. Street-scaled thinking may potentially help retrofitted residential and mixed-use buildings to retain a consistent proportion and streetscape relationship.

City of Philadelphia Flood Risk Management Task Force (FRMTF). n.d. A Guide to Flooding in Philadelphia (Version 1.2).
https://water.phila.gov/pool/files/flooding-guide.pdf

Blogs & Media Coverage

Everett, Emily Paulus. "Disaster Planning for Historic Properties in a World Heritage City." Pennsylvania Historic Preservation, Mar. 9, 2016.
https://pahistoricpreservation.com/disaster-planning-historic-properties-world-heritage-city/

Jaffe, Alan. "Philadelphia to Be First Big City with Disaster Plan to Protect Historic Buildings." WHYY, Apr. 25, 2016.
https://whyy.org/articles/philadelphia-to-be-first-big-city-with-disaster-plan-to-protect-historic-buildings/

Kinney, Jen. "Philadelphia Considers Impact of Flooding on Historic Sites." Next City, Apr. 26, 2016.
https://nextcity.org/urbanist-news/philadelphia-planning-for-disaster-mitigation-for-historic-buildings

Rademaekers, Brian. "Flood Risk Management Task Force Manayunk Public Meeting." Philadelphia Water Department, Apr. 28, 2017.
https://water.phila.gov/blog/flood-risk-management-task-force-manayunk-public-meeting/

Schmidt, Sophia. "This New Haunted House in Philly is Terrifying. It's also an Adaptation to Flooding." WHYY, Oct. 7, 2022.
https://whyy.org/articles/philadelphia-manayunk-haunted-house-ida-flooding-adaptation/

Newport, RI

Flood & Historic Resource Maps

City of Newport GIS Portal.
https://newportri.mapgeo.io/datasets/property?abuttersDistance=200&latlng=41.486088%2C-71.324669&modal=disclaimer

Newport's city-level GIS portal offers an integrated interface. Public users may view the city's flood zones, hurricane inundation areas and elevation contours, and overlay these data on the city's historic districts by turning on corresponding layers.

Adaptation Regulations & Design Guidelines

Newport Historic District Commission. 2020. Policy Statement and Design Guidelines for Elevating Historic Buildings.
https://www.cityofnewport.com/CityOfNewport/media/City-Hall/Boards-Commissions/Commissions/Historic%20District%20

Commission/HDC-Policy-Statement-Design-Guidelines-for-Elevating-Historic-Buildings-Jan-21-2020-APPROVED.pdf

This guideline provides recommendations for the structural elevation of historic buildings under four key areas: streetscape and context, site design, foundation design, and architecture and preservation. Its structure and provisions mirror Charleston's 2019 *Design Guidelines for Elevating Historic Buildings*; however, it is applicable to not only historic buildings, but also non-contributing buildings in historic districts.

City of Newport. "Elevating History."

https://www.cityofnewport.com/en-us/city-hall/departments/planning/historic-preservation/elevating-history

Accompanying the HDC Design Guidelines, this webpage outlines key concepts and considerations in the elevation of contributing and non-contributing buildings in local historic districts. It also directs homeowners to various other resources, such as Newport's flood and historic district maps, and background readings on heritage resilience.

Flood Adaptation Projects

74 Bridge Street.

https://www.nytimes.com/2019/07/08/science/historic-preservation-climate-newport.html

https://historyabovewater.org/wp-content/uploads/2016/09/74-Bridge-Case-Study-Booklet.pdf

As the case study featured in Newport Restoration Foundation's 74 Bridge Street report (see below), the Christopher Townsend House at 74 Bridge Street is currently protected by dry-floodproofing measures and relocated critical equipment. However, a wider range of building and site-level interventions (e.g. basement fill and site regrading) as well as long-term community-level solutions have been proposed in NRF's design study for the site.

Key Institutional Actors

Newport Historic District Commission (HDC).

https://www.cityofnewport.com/living-in-newport/historic-preservation/historic-district-commission

Newport Restoration Foundation (NRF).

https://www.newportrestoration.org/

With nearly eighty 18th and early 19th century houses, the Newport Restoration Foundation owns and maintains what is likely the largest collection of Colonial-era houses that belongs to a single organization in the U.S. Through its Keeping History Above Water conference initiative, NRF has become a leading non-governmental organization in the promotion of heritage resilience under sea level rise and flood risks. Besides hosting the KHAW conferences, in recent years, NRF also conducted an adaptation design study on its historic 74 Bridge Street house, held a design studio in conjunction with RISD to envision resilient design options for the Point neighborhood, completed a comprehensive vulnerability assessment of its properties, and partnered with the City in the development of graphics to accompany Newport's *Policy Statement and Design Guidelines for Elevating Historic Buildings*.

Rhode Island School of Design (RISD).

https://www.risd.edu/

Roger Williams University Cummings School of Architecture.

https://www.rwu.edu/academics/schools-and-colleges/architecture

Plans & Studies

RISD Interior Architecture. 2017. Projecting Change: Adapting Heritage in Rising Waters (Advanced Design Studio).

https://www.vbcf-risd.com/

https://historyabovewater.org/partnerships/projecting-change/

In this studio, RISD Interior Architecture graduate students explored adaptation design strategies for the Point Neighborhood over the next 80 years. Design proposals ranged from blue streets and canals to vertical city blocks and memorial sites after anticipated retreat.

RWU Cummings School of Architecture. 2020. Adaptation Without Loss (Advanced Topical Studio).

https://issuu.com/saahprwu/docs/arch517_20sp_newport

In this studio, students documented historic built environment of the Point Neighborhood, and developed conceptual adaptation or flood-resilient designs for contributing and non-contributing buildings in the historic district, as well as local new constructions.

City of Newport. 2016. Hazard Mitigation Plan (2016 Update).

https://www.cityofnewport.com/CityOfNewport/media/City-Hall/Departments/Planning%20Zoning%20Inspections/Planning/Planning%20Documents/Newport_Hazard-Mitigation-Plan_ApprovedPrint-(1).pdf

Rhode Island Coastal Resources Management Council (CRMC) & University of Rhode Island Coastal Resources Center (URI CRC). 2016. Historical Waterfront Preservation – Resilient Newport/Coastal Climate Adaptation.

https://www.newportwaterfront.org/PDF_Files/Historical-Waterfront-Presevation-Resilient-Newport.pdf

Conferences & Workshops

Keeping History Above Water: 2016 Newport.

https://historyabovewater.org/conference-information/

Blogs & Media Coverage

Dean, Cornelia. "'We Cannot Save Everything': A Historic Neighborhood Confronts Rising Seas." New York Times, Jul. 8, 2019.

https://www.nytimes.com/2019/07/08/science/historic-preservation-climate-newport.html

Newport Daily News. "Newport Adopts Guidelines for Elevating Historic Homes in the Face of Climate Change." Newport Daily News, Jan. 27, 2020.

https://www.newportri.com/story/news/local/2020/01/27/newport-adopts-guidelines-for-elevating-historic-homes-in-face-of-climate-change/1823857007/

Newport Restoration Foundation. n.d. "Projecting Change with RISD: Adapting Heritage in Rising Waters."
https://historyabovewater.org/partnerships/projecting-change/

Roos, Pieter N. "Climate Change in Newport." National Trust for Historic Preservation Leadership Forum, Sep. 4, 2015.
https://forum.savingplaces.org/blogs/special-contributor/2015/09/04/climate-change-in-newport

Charleston, SC

Flood & Historic Resource Maps

City of Charleston GIS.
https://gis.charleston-sc.gov/

Charleston's local GIS portal provides a variety of apps and tools available for public use. Historic designation data (e.g. Old and Historic District and local landmarks) can be viewed by turning on historic preservation supporting layers in the Zoning Map app; local floodplain information can be viewed through FEMA's National Flood Hazard Layer (NFHL) Viewer linked into the portal.

Adaptation Regulations & Design Guidelines

Charleston Board of Architectural Review. 2019. Design Guidelines for Elevating Historic Buildings.
https://www.charleston-sc.gov/DocumentCenter/View/18518/BAR-Elevation-Design-Guidelines-Adopted

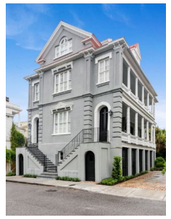
An innovative design guidance and review standard published to support the elevation of historic homes in Charleston's peninsula-shaped downtown, this guideline provides recommendations under the focus areas of streetscape/context, site design, foundation design, and architecture/preservation. Stressing streetscape quality and visual consistency across all of its four focus areas, this guideline promotes a number of creative design solutions including "piazza screening," articulated and fenestrated foundation, and landscaping.

City of Charleston. n.d. "Process for Elevation Projects."
https://www.charleston-sc.gov/2333/Elevating-Your-Structure

Echoing BAR's elevation design guidelines, this webpage outlines the planning, design, review and certificate process of building elevation projects, and lays out the additional steps (e.g. BAR review, SHPO review, and Building Code Board of Appeals review) that may be necessary for designated historic buildings.

Flood Adaptation Projects

1 Water Street.
https://www.jfmarchitects.com/#/water-street-elevation-of-historic-residence/
https://www.youtube.com/watch?v=_C_FlkI-VGE
https://www.wolfehousebuildingmovers.com/project/historic-charleston-home-elevated/



As the first historic brick structure structurally raised in Charleston, the 1 Water Street residence now resides above a full-story concrete foundation cladded in matching light blue stucco, embellished by a pair of elegant L-shaped stairs leading to the elevated main entrance and arched door openings on street level with restrained forms that reference the building's original design. The 1 Water Street elevation project integrates a number of streetscape mitigation strategies that add to the symmetry and characters of the historic residence, and was featured in the Elevated Buildings Walking Tour of KHAW 2021 Charleston. Click here for an interview with the project's preservation architects.

113 Calhoun Street.

See FEMA, *Floodplain Management Bulletin: Historic Structures (P-467-2)*, 14.

An early flood retrofitting experiment on historic building, 113 Calhoun Street was only mildly elevated by 1 ft due to historic character considerations; however, it was equipped with above-BFE HVAC and electrical systems, flood-resistant interior wainscoting, and reinforced foundation. These features enable the house to be protected from minor flooding, and suffer less damage in major flood events. The project was primarily funded by FEMA, and carried out under a partnership between South Carolina Sea Grant Consortium, Clemson University, and the City of Charleston.

42 Rutledge Avenue.

https://www.postandcourier.com/news/historic-charleston-home-at-rutledge-raised-up-several-feet-a/article_e881205c-cee8-11e7-bd50-1ff2f691d659.html
https://www.postandcourier.com/business/real_estate/charleston-dealing-with-rapid-rise-in-applications-for-raising-homes/article_9dcb3d48-734e-11e9-a99d-6b04f36f3035.html
https://www.wolfehousebuildingmovers.com/news/lifting-historic-charleston-home-out-of-the-flood-plain/

42 Rutledge is known as the first historic home lifted in Charleston. Its elevation parallels Charleston's local policy-making for historic building elevation guidelines, and helped to set a precedent for similar flood-threatened historic homes. The "piazza screen" strategy (see below) is utilized in the elevation of this house.

Elevated Houses with Piazza Screens.

See Charleston BAR, *Design Guidelines for Elevating Historic Buildings*, 6-7.

Piazza screening is an ingenious local practice commonly deployed in the elevation of Charleston's historic homes. To retain the entrance context and streetscape relationship, the entrance opening is pinned at the original height while every other part of the building gets elevated; a set of stairs are then placed behind the entrance door, leading to the elevated first floor. Since in Charleston's local house typology, the space behind the entrance door is typically a lengthy side porch ("piazza"), a few stairs of new stairs would be easily accommodated. This treatment may go hand-in-hand with other strategies (e.g. articulated, solid foundation wall) recommended in BAR's *Design Guidelines*. For more information, see Digital Report 03: Streetscape-Sensitive Design Strategies.

Key Institutional Actors

Charleston Board of Architectural Review (BAR).
https://www.charleston-sc.gov/293/Board-of-Architectural-Review-BAR-L-BAR-

Preservation Society of Charleston.
https://www.preservationsociety.org/

Historic Charleston Foundation.
https://www.historiccharleston.org/

Clemson University School of Architecture.
https://www.clemson.edu/caah/academics/architecture/index.html

Plans & Studies

Dutch Dialogues Charleston.
https://www.charleston-sc.gov/1974/Dutch-Dialogues
https://www.historiccharleston.org/dutch-dialogues/

Launched by Historic Charleston Foundation and the City of Charleston in 2019, *Dutch Dialogues Charleston* seeks to develop an integrated vision of land use, water management and waterfront development for Charleston, and propose recommended strategies for a number of focus areas. These strategies range from natural restoration and flexible waterway, to zoning reforms and resilience infrastructure.

US Army Corps of Engineers. Charleson Peninsula Coastal Storm Risk Management Study.
https://www.sac.usace.army.mil/Missions/Civil-Works/Charleston-Peninsula-Study/

This Federally-funded study identifies potential storm risk reduction measures for the city of Charleston, including a 12 ft storm surge wall surrounding the peninsula, pump stations and nonstructural measures. In 2022, an Environmental Impact Statement (EIS) was published for the project.

Financial Resources

Preservation Society of Charleston. "Technical Preservation: Grants and Financial Incentives."
https://www.preservationsociety.org/what-we-do/partnering-in-preservation/technical-preservation/grants-and-financial-incentives/

Conferences & Workshops

Keeping History Above Water 2021 Charleston: Communities in Action.
https://historyabovewater.org/2021-charleston/

Blogs & Media Coverage

Behre, Robert. "Charleston Dealing with Rapid Rise in Applications for Raising Homes." The Post and Courier, May 19, 2019.
https://www.postandcourier.com/business/real_estate/charleston-dealing-with-rapid-rise-in-applications-for-raising-homes/article_9dcb3d48-734e-11e9-a99d-6b04f36f3035.html

Behre, Robert. "Historic Charleston Home at 42 Rutledge Raised Up Several Feet, a Fraction of an Inch at a Time." The Post and Courier, Nov. 22, 2017.
https://www.postandcourier.com/news/historic-charleston-home-at-rutledge-raised-up-several-feet-a/article_e881205c-cee8-11e7-bd50-1ff2f691d659.html

Behre, Robert. "In Charleston, Historic Preservation Versus Rising Seas: When Is It OK to Raise a Historic Home? " AP News, Oct. 8, 2017.
https://apnews.com/article/3711c1cbd964463c9dadb9d8f02fbd36

Fausset, Richard and Christopher Flavelle. "In Charleston, S.C., Saving Historic Homes Means Hoisting Them in the Air." New York Times, Jul. 24, 2021.
https://www.nytimes.com/2021/07/24/us/charleston-sc-flooding-climate-change.html

Historic Charleston Foundation. "Elevating Historic Structures in Charleston." Historic Charleston Foundation, Oct. 4, 2018.
https://www.historiccharleston.org/blog/elevating-historic-structures-charleston/

Historic Charleston Foundation. "The Controversy Over Raising Historic Buildings." Historic Charleston Foundation, Aug. 7, 2018.
https://www.historiccharleston.org/blog/controversy-raising-historic-buildings/

Olgin, Alexandra. "Approval of Flood Based Historic Home Elevation Signals Change in Charleston." South Carolina Public Radio, May 26, 2017.
https://www.southcarolinapublicradio.org/sc-news/2017-05-26/approval-of-flood-based-historic-home-elevation-signals-change-in-charleston

Preservation Society of Charleston. "Voices of Charleston – Dr. And Mrs. Bernard Mansheim." Preservation Society of Charleston, May 10, 2022.
https://www.preservationsociety.org/voices-of-charleston-dr-and-mrs-bernard-mansheim/

Traditional Building Magazine. "Preservation and Sustainability Work Together in Historic Charleston, SC." Traditional Building, Nov. 10, 2015.
https://www.traditionalbuilding.com/features/historic-charleston

Norfolk, VA

Flood & Historic Resource Maps

City of Norfolk. Interactive Norfolk.

https://orf.maps.arcgis.com/apps/webappviewer/index.html?id=eb7164021ada45fea397d66fa84f4441

In the City of Norfolk's Interactive Norfolk portal, users may find local historic districts, and overlay them with FEMA flood zones, hurricane evacuation zones, and local stormwater infrastructure. The city of Norfolk also provides a map on streets and intersections reported to have been flooded during past storm events.

Key Institutional Actors

City of Norfolk Office of Resilience.

https://www.norfolk.gov/3612/Office-of-Resilience

City of Norfolk Architectural Review Board.

https://www.norfolk.gov/1090/Architectural-Review-Board

Norfolk Preservation Collective.

https://www.norfolkpreservationcollective.org/

Plans & Studies

City of Norfolk. 2018. Building a Better Norfolk: A Zoning Ordinance for the 21st Century.

https://www.norfolk.gov/DocumentCenter/View/35581/Adopted-Zoning-Ordinance?bidId=

https://www.norfolk.gov/DocumentCenter/View/36605/Zoning-Ordinance-Executive-Summary?bidId= (Executive Summary)

City of Norfolk Office of Resilience. n.d. Norfolk Resilience Strategy.

https://www.norfolk.gov/DocumentCenter/View/27257/Norfolk-Resilience-Strategy-?bidId=

Work Program Architects. 2017. Coastal Character District Pattern Book.

https://www.norfolk.gov/DocumentCenter/View/32307/Coastal-Pattern-Book?bidId=

Conferences & Workshops

Keeping History Above Water 2022 Norfolk: Informed Communities Charting Solutions.

https://historyabovewater.org/2022-norfolk/

Blogs & Media Coverage

City of Norfolk. n.d. "Flooding Awareness and Mitigation."

https://www.norfolk.gov/1055/Flooding-Awareness-Mitigation

Hafner, Katherine. "Building Resilience Solutions Wants to Save Historic Hampton Roads Homes from FloodWaters." VPM News, Jun. 10, 2022.

https://www.vpm.org/news/2022-06-10/building-resilient-solutions-wants-to-save-historic-hampton-roads-homes-from

Jarvis, Brook. "When Rising Seas Transform Risk Into Certainty." New York Times, Apr. 18, 2017.

https://www.nytimes.com/2017/04/18/magazine/when-rising-seas-transform-risk-into-certainty.html

The Pew Charitable Trusts. "Norfolk's Revised Zoning Ordinance Aims to Improve Flood Resilience." Pew Charitable Trusts, Nov. 19, 2019.

https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2019/11/norfolks-revised-zoning-ordinance-aims-to-improve-flood-resilience

Tarpey, Savannah. "A Riverfront Neighborhood at Risk: Fortifying Chesterfield Heights." AIA, Jul. 14, 2017.

https://www.aia.org/articles/139171-a-riverfront-neighborhood-at-risk-fortifyin:56

Washington State

Flood & Historic Resource Maps

Washington State Department of Ecology. Flood Hazard Maps.

https://gis.ecology.wa.gov/portal/apps/webappviewer/index.html?id=7779e901b22340f8892c8dcb1181a677

This statewide interactive map features floodway information and 1% floodplain (A Zone and V Zone) designations.

Washington DAHP. WISAARD (Washington Information System for Architectural and Archaeological Records Data).

https://wisaard.dahp.wa.gov/

This state-level preservation database allows users to browse or search for the listing and eligibility information of historic properties, archaeological sites, as well as cultural survey reports.

Key Institutional Actors

Washington State Department of Archaeology and Historic Preservation (DAHP) (Washington SHPO).

https://dahp.wa.gov/

Washington State Historical Society (WSHS).

https://www.washingtonhistory.org/

Conferences & Workshops

DAHP & WSHS: Adapting Historic Buildings to Flooding Workshop (Feb. 2020).

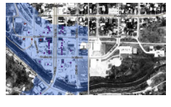
https://dahp.wa.gov/floodingworkshop

Darlington, WI

Flood & Historic Resource Maps

FEMA Region 5. 2018. Darlington Wisconsin Swipe Map.

https://www.arcgis.com/apps/webappviewer/index.html?id=f21334581e7e4d2caa1904f34bb4b4a9



This map visualizes the FEMA 1% floodplain in Darlington, as well as local properties that have been floodproofed or bought out.

Wisconsin Historical Society. Property Records — Darlington.

https://www.wisconsinhistory.org/Records?&facets=Community%3a%22Darlington%22&nodes=Preserve--Sites&more=Community

As of March 2023, Wisconsin Historical Society (WISHPO)'s historic property database includes 219 entries in Darlington, including 3 historic resources on the National or State Register (Main Street Historic District, 525 Main St, and 626 Main St).

Flood Adaptation Projects

Interior Elevation of Downtown Historic Retail Structures.

See FEMA, *Floodplain Management Bulletin: Historic Structures* (P-467-2; 2008), 17;

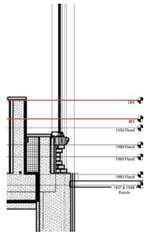
Town of Nantucket, *Resilient Nantucket: Flooding Adaptation & Building Elevation Design Guidelines* (2021), 65-67.

After extensive damages brought by a flood in 1993, Darlington managed to floodproof a number of its Main Street retail structures by elevating their first floors from the interior. Due to the high ceilings typically seen in Darlington's historic storefronts, first floors can be raised without affecting upper-floor spaces or leading to unusable ceiling height. After entering a business, customers may access elevated retail space by stairs or ADA-compliant ramps. In some cases, To provide additional protection, stub walls are built at the edge of the elevated retail spaces, which may work with deployable flood shields at stair and ramp landings to dry-floodproof the retail use to an even higher elevation.

Dry-Floodproofing of Driver Opera House.

See National Park Service, *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (2021), 127-130.

Constructed of brick in 1883, the Driver Opera House features ground-floor retail spaces and upper-floor assembly space. To floodproof the building in a manner that respects historic storefront features, a two-part system is designed and implemented: a lower concrete knee wall that matches bulkhead height is placed right behind the storefront bulkhead, and a taller, code-compliant barrier is placed behind the knee wall by about 18 inches. The project also involves the fill of the basement, reinforced structure, new drainage systems, relocated utilities, and reconstructed storefronts with flood-resistant materials below flood level. It is featured in National Park Service's *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* as a case study.



Key Institutional Actors

City of Darlington.

https://darlingtonwi.org/

Wisconsin Historical Society (Wisconsin SHPO).

https://www.wisconsinhistory.org/

Plans & Studies

City of Darlington. 2014. Multi-Hazard Mitigation Plan.

https://darlingtonwi.org/wp-content/uploads/2020/01/Darlington_Hazard_Mitigation_Plan.pdf

Blogs & Media Coverage

FEMA. "Multiple Mitigation Measures Give Darlington an Elevating Experience." FEMA, Feb. 11, 2021.

https://www.fema.gov/case-study/multiple-mitigation-measures-give-darlington-elevating-experience

Note: All images in this section are generated or cited from individual resources listed in map entries, except for the followings:

- The mini-maps for each location are produced by the author based on the "Mid-Century Map" template of ArcGIS Online.
- The illustration for "Elevated House with Piazza Screens" in the *Charleston* entry is a photograph taken by the author during Keeping History Above Water 2021 Conference.
- The illustration for "Government-Led Street Elevation" in the *Greater Miami and the Beaches* entry is cited from Alex Harris, "Miami Beach is Raising Roads for Sea Rise. Lawsuits Say They're Causing Flooding Too." Miami Herald, Oct. 28, 2021.

Part II

Policy-Maker & Stakeholder Interviews

Introduction

This part features the author's conversations with nationwide policy-makers and community stakeholders on flood adaptation and historic urban form change. In this series, we may hear opinions from leading figures in heritage resilience research and policy-making as well as on-the-ground voices from local communities, as the interviewees identify challenges, set agendas, discuss solutions, and share local practices regarding the transformation of historic built environment towards a resilient future. Since heritage resilience is an inherently complicated and interdisciplinary discourse, a collective dialogue is of vital importance for any successful policy-making and planning effort; in such context, this interview series is carried out as an attempt to facilitate the exchange of knowledge, information and values both among different disciplines and between professionals and the general public.

In this interview series, the author identified and invited interviewees under the focus groups of "Urban Planners," "Preservation Policy-Makers," "Community Stakeholders," and "Architects & Contractors," and conducted semi-structured interviews with them. To connect practitioners of different fields to the discourse of heritage resilience, a general set of questions are prepared for each focus group, which are further tailored for each interviewee based on the author's knowledge of their background and expertise. While New York City-based interviewees have revealed new trends and preservation considerations in the city's resilience planning process, and narrated challenges encountered in community and building-level resilience or recovery projects within this project's design study areas (South Street Seaport and East Harlem), nationwide policy-makers have brought valuable insights on how cutting-edge policy documents and design guidelines — such as National Park Service's *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (2021), Charleston, SC's *Design Guidelines for Elevating Historic Buildings* (2019), and Miami Beach, FL's *Buoyant City* (2020) — are made, and how the discourse of heritage resilience is being propelled by preservation NGOs both in theory and in practice.

A total of 12 interviews are carried out throughout the process of this research project, with the information of interviewees listed below. Given the exceptional support that this project has received from both leading policy-makers and local community members, the author would like to express sincere gratitude to all interviewees.

Urban Planners:

- Michael Marrella | New York City Department of City Planning;
- Emily Sun | New York City Department of City Planning.

Preservation Policy-Makers:

- Alyssa Lozupone & Margaret Back | Newport Restoration Foundation;
- Erin Minnigan | Preservation Society of Charleston;
- Jenifer Eggleston | National Park Service;
- Olivia Brazee & Chelsea Towers | New York SHPO;
- Deborah Tackett | The City of Miami Beach.

Community Stakeholders:

- Julie Nucci & Jim Overhiser | Historic Homeowners in Owego, NY;
- Jonathan Boulware | South Street Seaport Museum;
- Marie Winfield | A'Lelia Bundles Community Scholar, Columbia University.

Architects & Contractors:

- Julia F. Martin & Erin Lanier | Julia F. Martin Architects;
- Robert Sauder | Wolfe House & Building Movers.

All interviews are posted on the Interviews page of the *Living Above the Street* online platform. The following sections feature the lists of general questions prepared by the author for each focus group, interview transcripts (each with Q&As and a brief contextual introduction), and a summary of findings and observations made from the interviews.

Interview Question List

For Urban Planners

1 Background

- What are the key goals and motives of your organization's recent planning efforts on flood resilience? Have you included, or do you plan to include waterfront historic resources within your purview?

2 Policy-Making Awareness & Inter-Agency Collaboration

- How do you evaluate your organization's progress in flood resilience policy-making, as compared to other cities or Federal agencies?
- Which governmental or non-governmental agencies do you work with in your policy-making process?

3 How Policies Are Made within the Agency

- What are the professional backgrounds of policy-makers in your agency (e.g. architects, planners, preservationists, technical experts, climate scientists)? Are third-party vendors or consultants involved in your policy-making?

4 How Publics Are Reached by the Agency

- Have you executed public engagement programs to communicate your organization's policy-making effort to community stakeholders and the public? If so, when and where are these programs held? What's the target audience?

5 Future Streetscape

- With the rapid emergence of flood adaptation projects in different scales across the country, how do you imagine New York City (or your city)'s future waterfront streetscape? How do you image New York City (or your city)'s future *historic* streetscape?

6 Stewardship of Historic Built Environment

- Which governmental agencies or non-governmental organizations should take the responsibility to research, support, and oversee the flood adaptation of New York City (or your city)'s historic built environment?

7 Policy Tools & Policy Reform Opportunities

- In your point of view, which policy tool is most effective in stewarding historic or existing built environment towards flood resilience? How should existing policy tools be revised and updated to better facilitate flood

adaptation?

8 Identifying Challenges

- From your perspective, what's the biggest challenge in adapting New York City (or your city)'s historic/existing built environment towards flood resilience?

9 Next Steps & Future Policy Change

- What's your organization's current priority and next steps in flood resilience policy-making? How would you envision key policy changes in building code, flood zoning or preservation standards within the near future?

For Preservation Policy-Makers

1 Organization Background

- What are your organization's key missions? Have you incorporated, or do you plan to incorporate the flood resilience of historic built environment into your visions?

2 Local Heritage Background

- What impacts did recent hurricanes or flooding events cause to local built heritage? What types of heritage are threatened by flood risk, and where are they located? What are the major needs and claims from local heritage sites after flood events? How many of them have been adapted for flood resilience?

3 How the Organization Works & Inter-Organization Collaboration

- How is flood resilience planning and management situated in your organization? What kinds of work (e.g. grant distribution, design review, professional education, preservation planning/research, guideline production and policy-making) do you carry out to promote flood resilience? Which governmental or non-governmental organizations do you work with in your projects?

4 Policy-Making Awareness

- How do you evaluate your organization's progress in flood resilience policy-making, as compared to other cities or Federal agencies?

5 How the Public & Professionals Are Reached by the Organization

- Have you conducted public or professional engagement programs (workshops, exhibitions, lectures, conferences, etc.) to communicate your organization's policies or research outcomes? If so, when and where are these programs held? What's the target audience?

6 Design Strategies & Future Streetscape

- Given the flood adaptation projects that you've launched, reviewed or supervised, what conflicts have you observed between flood adaptation interventions and the formal, material and experiential qualities of historic properties? What successful retrofitting design strategies have you discovered? How do you imagine New York City (or your city)'s future waterfront *historic* streetscape?

7 Stewardship of Historic Built Environment

- Which governmental agencies or non-governmental organizations should take the responsibility to research, support, and oversee the flood adaptation of New York City (or your city)'s historic built environment?

8 Key Policy Tools & Policy Reform Opportunities

- In your point of view, which policy or advocacy tool is most effective in stewarding historic or existing built environment towards flood resilience? How should nationwide/local preservation policy be revised and updated to better facilitate flood adaptation?

9 Identifying Challenges

- From your perspective, what's the biggest challenge in adapting New York City (or your city)'s historic/existing built environment towards flood resilience?

10 Next Steps & Future Policy Change

- What's your organization's current priority and next steps in flood resilience policy-making or heritage retrofitting? What key changes at the intersection of flood adaptation and historic preservation would you like to imagine within the near future?

For Community Stakeholders

1 Background

- Has your property been impacted or threatened by recent flooding events? What damage did the flood(s) cause? Is your property designated or landmarked?

2 Challenges in Recovery and Adaptation

- Has your property been repaired or adapted? What's the funding structure of your recovery/adaptation project? What physical interventions have been made? What challenges have you faced in terms of funding, design/technical assistance, and coping with preservation and flood regulations?
- Did the recovery/adaptation project bring a significant impact on the operation and income of your property

(for museums and commercial properties only)?

3 Resource Awareness & Key Policy Tools

- Are you aware of existing funding opportunities, policy resources and design guidelines for flood adaptation? How hard is it to find such information?
- What preservation and flood adaptation policy tools have you used during recovery/adaptation? (e.g. tax credit, federal grant, retrofitting design guidelines, etc.)

4 Knowledge Exchange & Public Engagement Effectiveness

- Are you aware of the city's recent floodproofing efforts in your neighborhood (e.g. neighborhood flood masterplan/placement of temporary flood shields)? Are you aware of any public outreach process associated with these efforts?
- Have you heard of any other flood adaptation projects on historic buildings or neighborhoods?

5 Stewardship of Historic Built Environment

- Which governmental or non-governmental agencies should take the lead to support flood recovery or adaptation of historic properties?

6 Material, Form, and Streetscape Change

- How will your historic property change after flood repair/adaptation? Will the historic significance of your property be impacted or reshaped?
- How do you imagine New York City (or your city)'s future waterfront historic streetscape?

7 Next Steps

- In your eyes, what's the most urgent action that should be taken to mitigate flood risk and impact on your neighborhood or property?

For Architects & Contractors

1 Demand for Flood Adaptation

- How many projects or commissions are you able to get each year? Among them, how many are flood adaptation (or building elevation) projects? How have flood adaptation demands evolved in recent years?
- Among the flood adaptation projects you've carried out, how many are for residential homes, versus buildings of commercial or community use?

2 Policy-Making Awareness and Participation

- Are you aware of the local flood regulations or design guidelines that regulate the flood adaptation of historic properties? Are you involved in the making of these policies?

3 Design Considerations and Future Streetscape Change

- What are the major design considerations (or key architectural elements) that you typically pay attention to when working on historic properties? How do you ensure a consistent and inviting streetscape expression for adapted or elevated buildings?
- Besides building-level interventions, are there other design strategies (e.g. rain gardens, landscape design, public space design and permeable surfaces) that can be carried out to more holistically transform historic urban environment towards flood resilience?
- With more and more buildings adapted or elevated for flood resilience, how would you imagine future historic urban form change?

4 Financial Incentives

- How are local flood adaptation projects funded? Among the flood adaptation projects that you've worked on, how many are able to secure external funding? How important are funding, incentive and grant opportunities (from FEMA, National Park Service, etc.) to historic property owners?

5 Identifying Key Institutional Actors

- Which governmental or non-governmental organizations do you work with in your projects?

6 Identifying Challenges

- Are there any technical challenges that you've encountered when working on flood adaptation projects for historic properties (e.g. narrow lots, attached construction, or the structural elevation of masonry structures)?
- From your perspective, what's the biggest challenge in adapting New York City (or your city)'s historic/existing built environment towards flood resilience?

7 Next Steps

- What changes in flood regulations and preservation standards would you like to see in the near future, to make flood adaptation projects on historic properties more common and affordable?

Michael Marrella | NYC Department of City Planning

Mr. Michael Marrella is the Director of Climate and Sustainability Planning at New York City Department of City Planning (NYCDCP). Recently reorganized from the Waterfront and Open Space Division, DCP's Climate and Sustainability Planning Division oversees New York City's waterfront and climate agendas, and develops key planning policies such as New York City's Zoning for Coastal Flood Resiliency (2019-2021) and Comprehensive Waterfront Plan (2021).

This interview was carried out on Aug. 1, 2022, at New York City Department of City Planning.

> ***"For intact historic districts, structural elevation may not always be the ideal solution."***

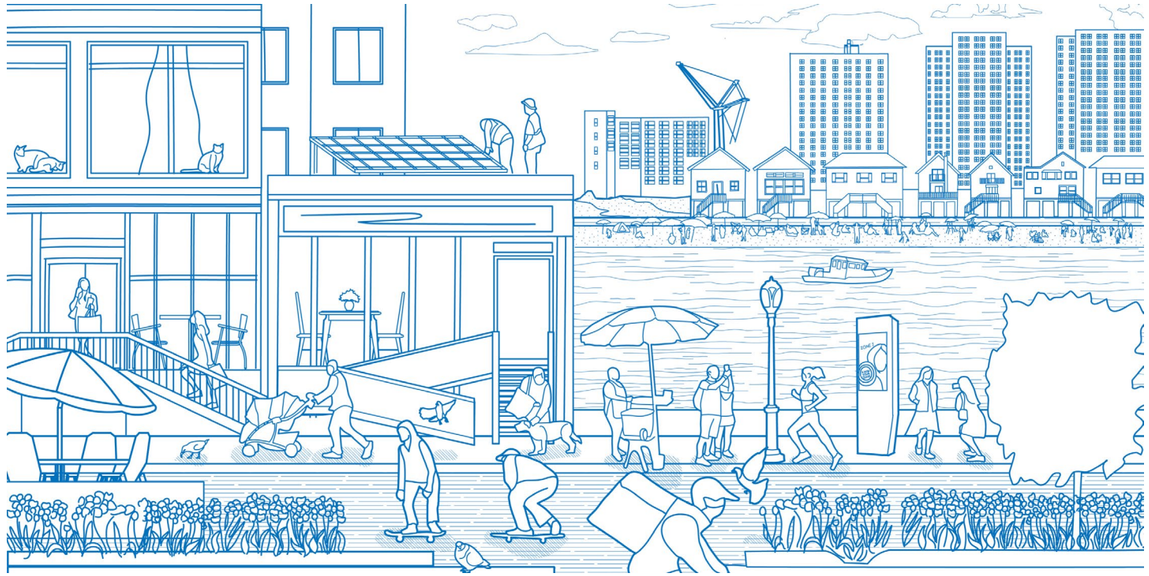


Image source: New York City Department of City Planning, New York City Comprehensive Waterfront Plan (2021).

Ziming Wang: On May 20, 2022, DCP celebrated its new Comprehensive Waterfront Plan with multiple walking tours and public activities. Could you tell me a bit more about the motives and intentions behind the new Comprehensive Plan, and introduce how waterfront historic resources are positioned in its scope?

Michael Marrella: The 2021 Comprehensive Waterfront Plan came out at the end of the De Blasio administration, as a legislation that happens every 10 years as required by the City Council. The current Comprehensive Waterfront Plan succeeds *Vision 2020*, which was released in 2011. Making the 10-year waterfront plan has always been a very good opportunity to set up some markers for the future of NYC's waterfront.

We have acknowledged waterfront historic resources in both *Vision 2020* and the current Comprehensive Waterfront Plan. Historic resources play an important part in the city's waterfront, and can be in various forms – such as waterfront structures, floating assets, or even bulkheads (you know, the Hudson River Bulkhead has been list as National Register eligible).

Ziming Wang: How do you evaluate DCP's progress in flood resilience policy-making, as compared to other cities or Federal agencies? What's behind the Waterfront division's new name — Climate & Sustainability Planning?

Michael Marrella: I feel humbled to evaluate our own work. I'll quote Laurie Schoeman's comment on our recent Zoning for Coastal Flood Resiliency (ZCFR): "It is the most progressive climate resiliency-focused land-use proposal of any city in the United States."

When we started to work on the Flood Zoning, we learned that to the majority of the public, **flood adaptation was often perceived as coastal protection measures (seawalls, sea gates, etc.) that take great cost and a long time to build.** Through our policy-making, we were able to explore diverse tools (e.g. land use regulation and retrofitting guidelines) that allow for more rapid progress towards flood resilience.

With the name change, we're ready to take the lead in planning for the larger scope of climate change and resiliency. This repositioning also reflects changes that happened with the incorporation of the Mayor's Office of Climate and Environmental Justice.

Ziming Wang: Which governmental agencies or non-governmental organizations should take the responsibility to research, support, and oversee the flood adaptation of New York City's historic built environment?

Michael Marrella: Definitely LPC. We actually work with LPC quite a bit. I've kept in touch with Lisa Kersavage since even before Hurricane Sandy, discussing issues regarding preservation and sustainability.

Ziming Wang: But I personally feel that LPC's retrofitting guideline-making still remains relatively preliminary as compared to DCP's studies such as the *Retrofitting Buildings for Flood Risk* report. I noticed that LPC has recently included some instructions on the installation of flood shields and barriers into its *Permit Guidebook*, but it'll certainly be interesting to see more comprehensive research of building-scale design strategies.

Michael Marrella: Well, climate change and flood resiliency poses an interesting challenge to historic structures. **The key question is financial motivator – many property owners choose to retrofit their properties for a significant reduction of NFIP premium. But if a property is listed on National Register, it can be totally exempted from NFIP regulations.**

That being said, **I also feel the need for an economic analysis on the flood damage to each historic building type in New York City's waterfront.** If you have a bungalow in the floodplain, a flood will likely destroy it; but if you have a mid-rise building of more solid construction, the flood impact will be comparatively moderate. The structure itself will likely withstand flood events; it is the building systems and equipment that need to be floodproofed or relocated. In this case, **structural elevation may not always be necessary for the purpose of flood resilience.**

Ziming Wang: We're seeing many flood resilience projects being constructed or proposed in New York City — from NYC Build It Back to Army Corps of Engineers' proposed seawall and the East Side Coastal Resiliency project designed by BIG. How do you imagine New York City's future waterfront streetscape? And, how do you image New York City's future *historic* streetscape?

Michael Marrella: Yes, we're seeing some of these streetscape changes now. But for largely intact historic districts – such as West Chelsea, East Harlem and South Street Seaport – **I again question whether structural elevation is always the ideal solution. But I reckon that under current NFIP & Building Code regulations, this is not a choice that we can make.**

Ziming Wang: In both the fields of historic preservation and urban planning, it seems that we have many policy tools on the table — flood zoning, tax credit, historic district master plan, neighborhood-level resilience planning, preservation design review guidelines, etc. In your view, which tool is most effective in stewarding New York City's waterfront built environment towards flood resilience? How should existing policy tools be revised to better facilitate flood adaptation undertakings?

Michael Marrella: Many of these policy tools are useful under different circumstances. But to individual homeowners and property owners, **there is a precursor to the application of almost any policy tool that you just mentioned – the access to capital.** Governmental bodies such as DCP or LPC may issue a permit, a research report or a design standard, **but the missing piece would be direct investment on property-level to facilitate flood and climate adaptation.**

Ziming Wang: From your perspective, what's the biggest challenge in adapting New York City's historic/existing built environment towards flood resilience?

Michael Marrella: Well, there is a challenge to New York City as a whole — **our floodplain building stock looks very different than nationwide statistics, and only occupy a small percentage of FEMA's risk portfolio. The historic buildings you are researching may be even further down on the checklist.** But we have worked and will continue to work with FEMA — they have invited us to D.C. for discussions on flood policy and standards, and we're one of the few city-level agencies that may have influence on FEMA's decision-making.

Ziming Wang: This has been a really informative and thought-provoking interview. Thank you!

* This interview text has been transcribed and edited based on the interviewer's notes.

Emily Sun | NYC Department of City Planning

Ms. Emily Sun is an Associate Waterfront Planner at the Climate and Sustainability Planning Division of New York City Department of City Planning. Recently reorganized from the Waterfront and Open Space Division, DCP's Climate and Sustainability Planning Division oversees New York City's waterfront and climate agendas, and develops key planning policies such as New York City's Zoning for Coastal Flood Resiliency (2019-2021) and Comprehensive Waterfront Plan (2021).

Emily is currently working on a project that seeks to develop a public-facing database that contains the ground floor elevation data of buildings all across New York City. This interview was carried out on Aug. 3, 2022, at New York City Department of City Planning.

> ***"We are now working with New York City Emergency Management to collect elevation data for buildings all across New York City. The ground-floor elevation data provides vital information on a building's risk of coastal and inland flooding."***

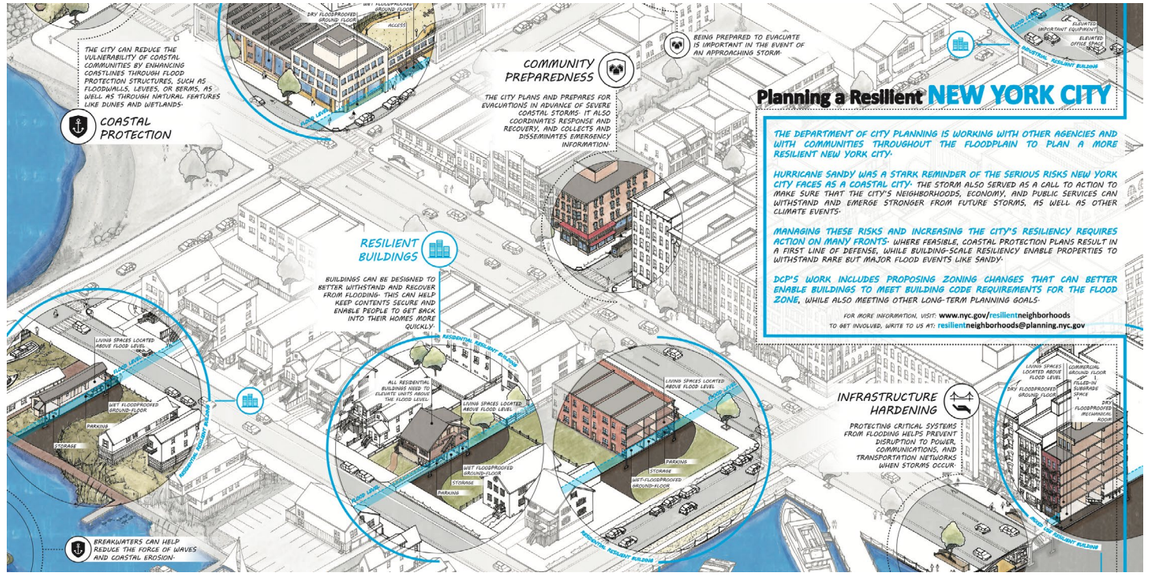


Image Source: New York City Department of City Planning, "Planning a Resilient New York City."

Ziming Wang: Through my flood adaptation design studies on New York City's historic districts, I've come to realize the critical role that elevation data plays for an accurate reading of building-level flood risk. Therefore, I'm thrilled when I heard about the elevation data collection and publication project that you are working on. Could you tell me a little bit more about this project?

Emily Sun: Yes. We are now working with New York City Emergency Management to collect elevation data for buildings all across New York City. The data are recorded by vendors and are coming in batches; we plan to publish these data into a public-facing search engine that enables homeowners to better understand the flood risk of their individual properties.

The ground-floor elevation data — especially when paired with currently available topography and street elevation data — provides vital information on a building's risk of coastal and inland flooding. For example, neighborhoods consisting of buildings that are accessed through stairs descending from street level may be more susceptible to flood impact during extreme weather events.

In this project, we are not only recording ground floor elevations for buildings in New York City, but also collecting other flood-related variables. Besides ground floor elevation, we are recording the elevation of the first floor of active use, as well as whether there are basements in buildings — in fact, this dataset will become the most accurate count of basements in New York City so far.

Several New York City agencies — including Department of Buildings (DOB) and Department of Housing Preservation and Development (HPD) — have expressed interest in this dataset. They're interested in seeing the flood risk is distributed among their properties. We also hope that this dataset will give us a better idea on how and where people should evacuate in events like Hurricane Ida.

Ziming Wang: Speaking of your daily work, what are the professional backgrounds of policy-makers in DCP's Climate & Sustainability Planning Division?

Emily Sun: Our division consists primarily of **planners**; and our core task is to review waterfront applications in ULURP (Uniform Land Use Review Procedure) and ensure that they comply with rules for Waterfront Public Access Areas. On this front, we have recently applied for a state grant with a proposed project researching equality issues associated with public access to the waterfront, and how resilient infrastructure may be achieved by design.

Ziming Wang: I noticed that DCP held quite a number of public events in May celebrating the city's new Comprehensive Waterfront Plan — I wonder how the public is engaged in your policy-making process.

Emily Sun: What you have seen are essentially walking tours and public events for celebration. We did launch public engagement programs during the making of our Zoning for Coastal Flood Resiliency and Comprehensive

Waterfront Plan, but overall speaking, I think there's **not that much** public outreach. Luckily, in our proposed state grant project, there will be a survey directly facing local residents and public space users.

Ziming Wang: With all the policy-making that you've been involved in, how would you imagine New York City's future waterfront streetscape? How do you image New York City's future *historic* streetscape?

Emily Sun: I'm not an architect by training, but I do believe that when we make policies and guidelines for streetscapes, **we should consider a broader scope of street elements** including plants, pavement and the sewer system. These features may help eliminate flood runoff and also create a friendly street environment.

Ziming Wang: From your perspective, what's the biggest challenge in adapting New York City's historic/existing built environment towards flood resilience?

Emily Sun: Cost and Funding. Without enough funding and investment, there's always going to be a gap between what is advertised by our policies and what is actually available to homeowners. We should plan for systematic funding mechanisms in flood adaptation under both short-term and long-term scopes. In our state grant project, we are hoping to look into **bond financing** as a potential method to adapt underserved communities for climate resilience.

Ziming Wang: What do you think should be the next step in New York City's flood resilience policy-making? How would you envision key policy changes within the near future?

Emily Sun: I believe that there are spaces for us to think more creatively about how we can better use zoning in the city. For example, the Flood Zoning may be updated in the future with a broader range of considerations: it should address housing and mobility issues, as buy-outs are happening and new housing supply is being added to the city; it should also connect with other resilience planning initiatives, such as the Zoning for Zero Carbon currently in production. **Similarly, it'll be interesting to see how flood retrofitting and energy retrofitting may work together in historic buildings and potentially share funding resources.**

In terms of flood adaptation, we planners should consider both sea level rise and inland storm surges, and lay out all options and alternatives. When buyouts are necessary, we need to make sure they are not coercive. **Information sharing would also be important** as we try to develop solutions with local communities.

Overall, I'd like to envision ways for people to be able to still live their lives in the places they love, while acknowledging and mitigating existing flooding and climate risks. Our Zoning codes won't be truly useful if they don't apply to specific hyper-local situations.

* This interview text has been transcribed and edited based on the interviewer's notes. Per interviewee's instruction, this article is currently not published on the online platform, but will be available after DCP's official announcement for the ground-floor elevation dataset is made.

Alyssa Lozupone & Margaret Back | Newport Restoration Foundation

Originated in the historic city of Newport, RI, Newport Restoration Foundation (NRF) owns and maintains nearly eighty 18th and early 19th-century houses, which likely constitute the largest collection of Colonial-era houses owned by a single organization in the U.S. Most of NRF's properties are clustered in Easton's Point ("The Point") and Historic Hill neighborhoods, and are rented as private residences to tenant stewards.

Through its "Keeping History Above Water®" (KHAW) conference initiative, the Newport Restoration Foundation has become a leading non-governmental organization in the promotion of heritage resilience under sea level rise and flooding risks. Founded in Newport in 2016, the Keeping History Above Water conference series was subsequently held in Annapolis, MD (2017), Palo Alto, CA (2018), Des Moines, IA (2018), St. Augustine, FL (2019), Nantucket, MA (2019), Charleston, SC (2021), Salem, MA (2021), and Norfolk, VA (2022), and has expanded into an interdisciplinary dialogue engaging preservationists, engineers, city planners, legislators, insurers, historic homeowners and other stakeholders. The first international conference was held in March 2023 in Trinidad and Tobago.

The Inaugural *Keeping History Above Water* Conference, Newport, 2016. Source: Newport Restoration Foundation.

Besides organizing KHAW conferences, in recent years, NRF also conducted an adaptation design study on its historic 74 Bridge Street house, held a design studio in conjunction with RISD to envision resilient design options for the Point neighborhood, completed a comprehensive vulnerability assessment of its 80 properties, and partnered with the City in the development of graphics to accompany Newport's *Policy Statement and Design Guidelines for Elevating Historic Buildings*. Their work was featured in a New York Times article in 2019.

This interview was carried out on Nov. 22, 2022 over Zoom, with Ms. Alyssa Lozupone, Director of Preservation at NRF, and Ms. Margaret Back, Preservation Associate at NRF.

> ***"We're seeing a debate on whether or not to elevate historic houses up to meet the Basic Flood Elevation (BFE); in other words, whether to prioritize historic character, or to prioritize flood resilience."***

Ziming Wang: It's hard not to notice the pioneering and influential work that you've done in the past several years — from the KHAW conference series to experimental research and retrofitting projects on the Point's historic properties. What made you become such a leading advocator in climate resilience and historic preservation? How is climate resilience positioned in NRF's mission and daily operation?

Alyssa Lozupone & Margaret Back: Well, there are a number of impetuses behind our focus on sea level rise and climate resilience — first of all, we are one of the largest owners of historic single-family homes in Newport, if not of single-family homes in general; since many of our properties are located in the Point neighborhood which sits only a few feet above sea level, **developing strategies and solutions towards sea level rise and flooding is vital to the management of our real estate.** Furthermore, climate change and resilience is also an important part of NRF's missions, as we advocate for the preservation of Newport's historic urban environment, and seek to develop resources needed by the community.

Ziming Wang: What impacts did recent hurricanes cause to the Point? What unique challenges are faced by these 18th and 19th-century wooden houses?

Alyssa Lozupone & Margaret Back: We were definitely hit hardest by Hurricane Sandy — there are many pictures online showing Sandy's impact (for example, see here for a set of photographs on Hurricane Sandy in Newport). **But we are not only facing major hurricanes; there are also heavy rains, high tides and king tides. Flooding resulting from these events has become more and more frequent in recent years.**

And yes, wood post-and-beam construction is one of the major character-defining features of the Point, and we try to encourage adaptation approaches developed by architects and designers to follow the City's guidelines and preserve historic construction techniques while sustaining the neighborhood's character and scale.

Ziming Wang: Speaking of your experience in organizing the Keeping History Above Water conferences, how do different cities across the country respond to the discourse on heritage resilience? Is every waterfront city eager to join this conversation, or is it only receiving more attention in some places?

Alyssa Lozupone & Margaret Back: The KHAW conferences are designed to engage like-minded professionals from diverse fields, so it's generally very well received in host cities; however, we have seen that **each community has a unique dynamic between stakeholders.** For example, in Nantucket, MA, we saw a ramped-up synergy between NGOs, local government, and the community; in Norfolk, VA, the dialogue was more community-driven; in Newport, we were doing a lot of coordination work to bring different actors together for a discussion on sea level rise, flood adaptation, and heritage resilience. And, it has been our intention to bring the conference to vulnerable communities across the country — many of them have been repeatedly impacted by extreme storm events.

Ziming Wang: Besides the KHAW conference series, have you conducted other public-oriented programs to communicate your research and vision for heritage resilience? What can other NGOs learn from your public engagement efforts?

Alyssa Lozupone & Margaret Back: A project we're now working on with the city is to produce illustrations for the city's recently-published *Policy Statement and Design Guidelines for Elevating Historic Buildings*. We hope that a visualized version of the guidelines will be more comprehensible to the public, serving beyond a policy document aimed only at preservationists and design professionals.

Another attempt made in 2021 was to co-create a performing art piece titled In the Waves — where local residents were invited to collaborate in performances and create movements that represent rising sea levels and a rapidly changing climate. In this experimental project, we engaged the public through more creative and participatory measures that helped strengthen an understanding of the effects of climate change.

Ziming Wang: What interested me most in NRF's 74 Bridge Street report is that it identifies the physical elevation of streets together with all houses as a potential solution that both achieves regulatory compliance and retains historic characters. What do you think are the prospects of this solution? And how do you imagine Newport's future historic streetscapes?

Alyssa Lozupone & Margaret Back: Raising both streets and houses may seem like an ideal solution, but we've come to understand that it's really not something we can realize as a non-governmental organization. So, we've shifted our focus to educating local homeowners by existing examples of building elevation and flood retrofitting. **Apart from the street-raising solution, we're still seeing a debate on whether or not to elevate historic houses up to meet the Basic Flood Elevation (BFE); in other words, whether to prioritize historic character, or to prioritize flood resilience.**

Speaking of streetscapes and urban environments, we believe that there's another important element worth paying attention to — landscape design. The selection of driveway materials and the design of landscape features may have a significant impact on the flood resilience of historic neighborhoods, and they influence the aesthetics as well; however, the local Historic District Commission (HDC) has no current purview over features outside historic houses, so we're looking forward to new mechanisms that may potentially incorporate these site considerations.

Ziming Wang: From your perspective, what's the biggest challenge in adapting Newport's historic built environment towards flood resilience? What are your next steps in promoting heritage resilience and flood adaptation?

Alyssa Lozupone & Margaret Back: The biggest issue in our eyes is that there hasn't been much financial incentive for the elevation or flood adaptation of historic houses. Those who have retrofitted their houses are those lucky to have the means — and they have to finance these projects on their own. In fact, almost all elevated houses in Newport are privately funded by homeowners.

So one of our next steps would be to take a further look into the cost and financial issues associated with building retrofitting, and to explore ways that serve to make building retrofitting more accessible to everyone in the neighborhood.

On top of that, we'll continue to organize our KHAW conferences — potential future focus areas that we can think of right now include fundraising flood adaptation, solutions for physical adaptation, and neighborhood-scaled strategies.

* This interview text has been transcribed and edited based on the interviewer's notes.

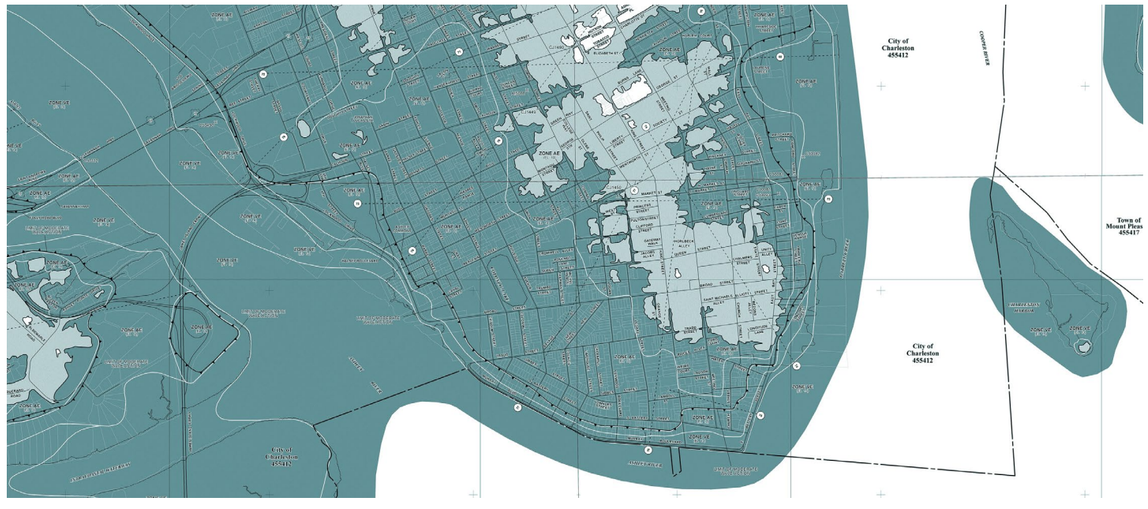
Erin Minnigan | Preservation Society of Charleston

Ms. Erin Minnigan is the Director of Preservation & Planning at Preservation Society of Charleston. She previously served as BAR-S Administrator at Charleston's Board of Architectural Review (BAR), and as Historic Preservation and Community Development Planner for the City of St. Augustine. She was closely involved in the development of Charleston BAR's *Design Guidelines for Elevating Historic Buildings* (2019), an innovative guiding document and review standard for the flood retrofitting design of historic houses that gained nationwide attention.

Established in 1931 as the first historic district protected by local legislation in the United States, Charleston's "Old and Historic District" encompasses a vibrant collection of 18th and 19th-century architecture — including many distinctive local single dwellings. However, since a considerable portion of the peninsula was developed upon landfills, flooding has historically and increasingly been a critical challenge to the city. In 2016, the city experienced a record-breaking 50 days of tidal flooding; between 2015 and 2017, the city was hit back-to-back by three major storms: Hurricane Joaquin, Hurricane Matthew, and Hurricane Irma.

This interview was carried out on Nov. 29, 2022 over Zoom.

> ***"To that point, we realized that if we continued to deny the elevation of historic homes and disallow them to be brought up to code, it would adversely affect their long-term preservation."***



Current Flood Map of Charleston's Peninsular Historic City Center. Source: Ziming Wang based on FEMA Map Service.

Ziming Wang: Charleston's history of major storm events and flooding can be traced as far back as to Hurricane Hugo of 1989. What pushed the recent spike of historic building elevation in the city, and made Charleston a leading policy-maker on this matter? How many historic buildings are elevated each year?

Erin Minnigan: Flooding really became a quality-of-life issue during the back-to-back storms we encountered between 2015 and 2017. As water repeatedly intruded living spaces, many homeowners would have to fully replace utility and HVAC equipment in their homes every year, just for them to be flooded again. That was when public opinions shifted towards supporting building elevation.

During these flood events, some homeowners were left with no money to further repair their homes, and had to sell their properties; but those who held out and had resources to elevate started to put pressure on BAR for policy reform and guidance.

This is because BAR had largely rejected elevation applications due to form, material and contextual concerns. Homeowners would typically seek FEMA variances when they substantially renovate their homes, so their homes would have the right to not elevate at all, or not elevate up to FEMA requirements. But to that point we realized that **if we continued to deny the elevation of historic homes and disallow them to be brought up to code, it would adversely affect their long-term preservation.** This crisis justifies the necessity for elevation. [1]

The number of elevation cases usually varies year by year, but over the last five years, the BAR has seen around 50 elevation applications filed in the city's historic district.

Ziming Wang: In my interviews, many people have stressed the importance of governmental financial support in promoting the retrofitting or elevation of historic buildings. How many of the elevation projects you just mentioned are supported by financial grants or governmental subsidies?

Erin Minnigan: Yes, there theoretically is some funding from FEMA's Hazard Mitigation Grant Program that funnels through the city's Department of Stormwater Management, but not many elevation projects have been able to use it. Homeowners seeking FEMA grants are often denied because it takes so long from the opening of a grant application to the closing of it — and so, at some point, they're not accepting new applications. I also read somewhere that there have only been slightly more than a handful of grant applications (from homeowners) approved in Charleston so far — it is not the official count, but does reflect the complicated process of securing a Federal grant. However, without these grants, some homeowners would have to turn to mortgage loans with high interest rates. Furthermore, it's also not easy to get information on the availability and allocation of these funds from the local government.

Ziming Wang: The Charleston guideline consists of many creative measures — such as "piazza screening" and

articulated foundation expression — to help retain the proportion and characters of historic buildings under structural elevation. How did BAR gather the necessary professional resources to make this guideline? Did the policy-making process involve collaboration with other governmental or non-governmental agencies?

Erin Minnigan: In the early stage, it was really just BAR trying to respond to homeowners' cries for assistance by developing recommended practices. But in the process we also tried to be more collaborative — **in November 2017 and March 2018, we held two workshops together with 10-15 professionals including architects, developers, contractors, and preservationists, as well as members of the public.**

In the first workshop, we showed a lot of pictures of existing elevated buildings in Charleston and reviewed the existing elevation guidelines for historic buildings made in other places such as Louisiana and Mississippi, and asked attendees about their preferred design treatments used in these projects and guidelines. There was a great interest from both professionals and the public who donated their lay time to attend this workshop — and we ended up with a consensus to provide policy procedures and design guidelines for the elevation of historic buildings.

In the second workshop, we broke the professionals into four focus groups — Streetscape/Context Considerations, Site Considerations, Foundation Design Considerations, and Preservation and Architecture Considerations — to formulate more refined design rules. Few local residents showed up this time, since they already knew their elevation applications would be permitted. Nevertheless, we still had some in-depth debate on the details of the guidelines: one debate that I remember was on whether the material of a new/extended foundation should match that of the original foundation, or be differentiated from it — which connects to the twofold requirement of "Compatible but Differentiated Design" stated in the Secretary of Interior's Standards. We finally recommended matching material and salvaged material to be used. At this point, we also produced a procedure for the elevation of "sister houses," where the first house to be raised would set an example for adjacent houses with the same design, and would thus be reviewed under great scrutiny.

I agree that the production of this guideline is somewhat remarkable — and I hope that with more and more similar guidelines emerging across the country, policy-making today would be much more comprehensive and collaborative.

Ziming Wang: Speaking of the design of these elevation projects — is there a group of preservation architects who specialize in flood retrofitting design in Charleston? Or are they just preservation architects at-large undertaking retrofitting design commissions?

Erin Minnigan: There really isn't an "elevation design specialist" group among local preservation architects — we are all learning this together, and nobody has done this before. Nevertheless, these architects do know local architecture well — many of them have known and worked on these historic houses for decades. So it's in their blood to be able to come up with creative solutions, and they did a nice job extending the characters and styles of historic buildings in elevation projects.

Ziming Wang: Like 1 Water Street — the waterfront residence elevated with an elegant staircase and new arched entrance featured in the walking tour of Keeping History Above Water 2021 conference.

Erin Minnigan: Yes, it was designed by Julia F. Martin Architects. One thing I like about this design is that it kept a simple and reduced form for the new ground-level arched entrances — so they stay as a context for the original entrances lifted above, not an overboard presentation. Other architects have also designed dry-floodproofing barriers and peripheral walls around historic properties — I believe you've seen some of these during the walking tour.

Ziming Wang: I noticed your new role as the Director of Preservation & Planning at Preservation Society of Charleston. How different is working as an NGO director compared to working as a preservation agency administrator?

Erin Minnigan: At BAR, my role was to some extent limited to the daily tasks of reviewing applications and processing requests; however, in my current advocacy role, I'm able to work on a variety of projects. The Preservation Society is a member-based non-profit that advocates for Charleston's preservation and development, so in this role I've been able to better understand what changes people desire, and to advocate on their behalf. Currently, we're engaged in some active talking with the city's Chief Resilience Officer to develop a citywide water plan that studies and plans water issues from all angles.

I still go to BAR meetings every month, where I express my organization's opinions about new elevation projects.

Ziming Wang: The flood adaptation of historic built environment is a complicated and highly interdisciplinary field. How can the public and professional practitioners better collaborate in this collective discourse?

Erin Minnigan: Information sharing is vital. Many homeowners may not be interested in formal "public education," but they surely need information and guidance throughout the process of building elevation. **They want to know how to get their projects approved, where they can find funding opportunities, what are the regulatory requirements and design review regulations, how the NFIP system works, and so on. Without a channel to get such information, they may feel that they're continuously bumping into walls.**

With that being said, I also feel an urgent need for professional education in this field. In the making of the

BAR Guidelines, I was constantly trying to understand new information from different sources; since it's a highly interdisciplinary arena, I do feel we as preservationists would be better off if we could get some education from emergency management professionals, flood experts, or policy-makers in other related fields. Social media may be helpful in promoting education and information exchange for both the public and professionals.

Ziming Wang: How do you imagine Charleston's future historic streetscape?

Erin Minnigan: It's a transformation we're still waiting to see. But as I mentioned, the BAR guideline did change some rules for building elevation: We shifted our mindset from "don't elevate or slightly elevate" to "elevate up to what you need"; as elevations up to FEMA's requirements are now possible upon design review, Charleston's historic homes may now have better long-term resiliency.

Ziming Wang: What's your organization's current priority? What key changes in policy-making, advocacy, resilience planning or building retrofitting do you expect in the near future?

Erin Minnigan: I feel that flood policy-making is now moving forward from only protection and fortification to investigating ways through which we may more comprehensively manage water. Currently, there's a discussion in Charleston on the master plan of the Union Pier as it is going up for sale — and there have been multiple visions of "resilient design," including using green space as water storage.

And of course, we'll continue to see more buildings elevated. **Maybe after some time, everyone will see new foundations as a nice addition.**

The Preservation Society is actually involved in many projects — such as the Union Pier as I just mentioned, and the US Army Corps of Engineers' 12-foot-tall sea wall proposal that would encircle the peninsula. We want to engage the public and make sure that these projects are designed with our unique historic environment in mind.

* This interview text has been transcribed and edited based on the interviewer's notes. For more information, see Erin Minnigan's presentation "A Shift in Mindset to Support Elevating Historic Buildings" at 2020 Nantucket Preservation Symposium.

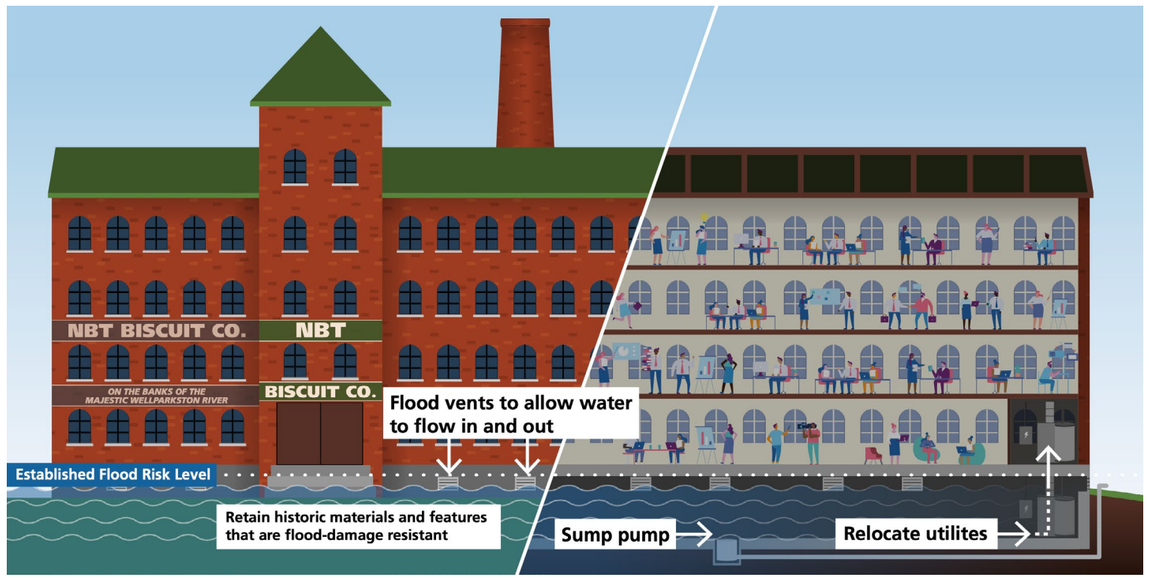
[1] Charleston BAR's current elevation guideline still encourages Category 1 ("Exceptional") or Category 2 ("Excellent") historic buildings to gain FEMA variances; while Category 3 and Category 4 buildings may elevate for more than 3 feet upon design review.

Jenifer Eggleston | National Park Service

Ms. Jenifer Eggleston currently serves as Chief of Staff at National Park Service's Cultural Resources, Partnerships, and Science Directorate. She joined National Park Service in 2007 to serve as the primary grants manager for the Hurricane Katrina and Rita Recovery Grant program, and is one of the co-authors of National Park Service's *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*. First published in 2019, the *Guidelines* was updated into an illustrated version in 2021, and has been featured in nationwide conferences and workshops.

This interview was carried out on Dec. 20, 2022 over Zoom.

> ***"That was the 'aha moment' for me, as I realized that the tools that we had at our disposal were not enough to bring our historic resources to resilience — especially under today's increasing risks of natural disasters. We have to move forward, accept more change, and better regulate these changes."***



An Illustration for the Wet Floodproofing of Historic Structures in NPS's *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*.

Ziming Wang: National Park Service's Federal-level policy-making for the flood adaptation of historic buildings parallels the emergence of State and local-level guidelines in recent years; and it's stated in the document's

foreword that the guidelines were produced "in response to a request for technical preservation guidance specific to historic properties." Could you tell me a bit more about the background of the project?

Jenifer Eggleston: My personal work experience with flood started in 2007, when I was appointed by National Park Service as the administrator for Hurricane Katrina recovery grant programs. In that capacity I got in contact with homeowners and business owners, and was able to learn the real-world concerns and issues in the process of disaster recovery. That was the "aha moment" for me, as **I realized that the tools that we had at our disposal were not enough to bring our historic resources to resilience — especially under today's increasing risks of natural disasters. We have to move forward, accept more change, and better regulate these changes.** So we developed this national guideline over the past several years in conjunction with local partners, State Historic Preservation Offices (SHPOs), and Tribal Historic Preservation Offices (THPO), with the intention to formulate flood adaptation strategies for historic resources that are compatible with historic design, material, and characters. Federal agencies such as FEMA and HUD (Department of Housing and Urban Development) also provided assistance to this project, especially on the financial front of flood adaptation.

Ziming Wang: As you just mentioned, flood adaptation may require more significant formal and material change than normally accepted in today's preservation standards. So, what's the relationship between this guideline and established preservation regulations such as The Secretary of the Interior's Standards for Rehabilitation? Is it an exception, or a reinterpretation?

Jenifer Eggleston: If you look closely at the Secretary of the Interior's Standards for Rehabilitation, you'll find that it uses a more broad and general language, such as requiring "minimal change to distinctive materials, features, spaces and spatial relationships." So I would say that the hierarchy of regulations still remains; instead of a reinterpretation, we are offering a more detailed and applied explanation of the Secretary of the Interior's Standards in the case of flood adaptation. **We want to be able to say that if a project meets the recommended practices listed in our flood adaptation guidelines, then it will meet the Secretary of the Interior's Standards.** It's good for historic property owners and architects to have a clear pathway towards regulation compliance, which gives them confidence in adaptation projects.

Ziming Wang: I found in my research that a unique challenge faced by New York City lies in the very diverse historic building types within its floodplain. I wonder what are the major types of flood-threatened historic buildings across the country? In which areas are they clustered?

Jenifer Eggleston: It would be great to have a nationwide overlay of floodplain over designated historic resources — so we could get a better idea on the number and types of historic resources under flood risk, and use this information for advocacy and decision-making. But unfortunately, because our database is organized in a manner where historic districts, designated buildings, and historic resource surveys are often listed together, it will be extremely difficult to get a precise count on nationwide scale. It's good to see your overlay and count based on New York City.

But empirically speaking, there are indeed diverse types of historic resources — not only buildings — in areas of high flood risk. There's an emerging attention being paid to archaeological sites within the floodplain, as coastal erosion may threaten their continued existence; there are also cultural landscapes and historic districts, in addition to historic businesses and homes.

And yes, many existing guidelines and procedures pinpoint single-family homes, as they aim to walk individual homeowners through the adaptation process and relevant flood insurance policies. Retrofitting strategies for other types of buildings — those with shared party walls, commercial buildings, duplexes, etc. — shall be explored not only in terms of new design guidelines, but also through reforms in financial and insurance standards.

Ziming Wang: I've noticed that you and your co-authors have been featured in multiple presentations and workshops from the East Coast to the West Coast introducing the *Guidelines*. So how are the guidelines received in different states? Is it influencing local policy-making, or is local policy-making influencing your work?

Jenifer Eggleston: We're very excited and ready to see how the guidelines are working in local contexts. We fully hope that it'll get recognition in different places, but we're also eager to hear where the guidelines didn't make sense — you know, **real-world work always happens on the local level.**

What we are seeing is that local municipalities are slowly updating their language and referencing the NPS flood guidelines. I was searching for the floodplain ordinance of the town in Virginia that I live in the other day — guess what it says? It says rehabilitation of historic buildings in the floodplain shall be carried out pursuant to the *Guidelines on Flood Adaptation* published by the National Park Service. I'm glad that the guidelines are being seen as a tool, and applied to different places.

Ziming Wang: And, speaking of financial grants and subsidies — I know there are established programs at National Park Service, such as the Federal Tax Credit program and the Emergency Supplemental Historic Preservation Fund programs (ESHPF; which include recovery grants for Hurricane Katrina and Hurricane Sandy). How have these grant programs facilitated the flood adaptation of historic buildings?

Jenifer Eggleston: In terms of disaster recovery, most grant funding actually comes from FEMA and HUD; in fact, we are the "little guy in the town." FEMA's Hazard Mitigation Grant Program (HMGP) is one of the largest funding resources in the field, which can be used to provide assistance towards the relocation, elevation and demolition

of historic buildings. We often administer our own grant programs in conjunction with FEMA & HUD grants to better help bring local historic resources back after hurricane impact. For example, a repair or reconstruction project after Hurricane Katrina or Sandy may be funded by FEMA or HUD grants, and we'll pay for specific historic materials or finishings used in the project. In HMGP applications, FEMA would be the leading agency responsible for Section 106 Review, which helps make sure that elevation or other works on historic structures don't result in their de-listing from the National Register.

There's a longer history for historic preservation tax credits to be used in flood adaptation. Even before Hurricane Katrina, there had been adaptation projects dealing with riverine/inland flooding risks that secured Federal tax credits. If State tax credits are also available, 20% — 25% of the construction cost of a rehabilitation project may be recouped.

Ziming Wang: There're many partners listed in the *Guidelines*' Acknowledgements section — SHPOs, THPOs, FEMA, The National Trust for Historic Preservation, etc. It really looks like a vibrant coalition between flood experts and preservationists on multiple scales — a mechanism that I believe is still lacking in New York City and many other local communities. How was that kind of collaboration organized, and what can local preservation agencies learn from your experience?

Jenifer Eggleston: Everybody has their own expertise — and yes, our partners from Federal to local level have offered us valuable insights. **The key is to be as active and open as possible while still being able to make progress.** We would convene with our partners and say "Help us get this right"; or ask them, "Would this help you to get your work forward?" Of course, every partner has a different opinion, and consensuses are sometimes even harder to reach on Federal level — so it can only be achieved through slow and arduous work. But hurricane and flooding are such big issues and we can't just sit here and wait — so my advice would be to go out, find friends, and leverage their expertise, instead of sitting in the room saying "I don't know."

Ziming Wang: The NPS *Guidelines* specifically mentioned the importance of the planning and assessment process before any form of intervention is taken. How can we formalize and incentivize such process in the flood adaptation of historic properties?

Jenifer Eggleston: Early-stage planning is super critical — although it might not be a typical process in many actual projects. Sometimes people tend to jump to treatments, without fully understanding the priority of physical risks, or documenting the reasons for those treatments.

But I'm also seeing a flip side to that question — in many ways, local governments tend to be very good at planning, but not so much at doing. **So it's also important to urge local policy-makers to reach active decisions, and implement the minimum necessary interventions to deal with flood risk.**

Ziming Wang: And one final question — Can you share your vision for the next steps of National Park Service's policy-making on the flood adaptation of historic built environment?

Jenifer Eggleston: Well, first of all, we want to keep the *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* as a living document — we'll be actively listening to feedback regarding what adjustments may be needed, and keep updating our policy recommendations.

In addition to the *Guidelines on Flood Adaptation*, I'm also envisioning potential guidelines for other forms of environmental risks. As our project has demonstrated, guidelines may be a useful tool in regulating adaptation and hazard mitigation projects, and connecting these projects with the Secretary of the Interior's Standards.

Another thing I've found out is that many local municipalities have robust planning departments or preservation agencies — while the National Park Service doesn't yet have a full-time team for guideline production (all of the *Guidelines on Flood Adaptation*'s authors were holding full-time office positions). So, I'm excited to see more policies and guidelines made on the local level, and I also hope that there would be a more dedicated guideline team at the National Park Service, which could help strengthen our efforts on policy-making, internal training, and public outreach.

* This interview text has been transcribed and edited based on the interviewer's notes. For more information on National Park Service's *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*, please refer to this presentation made by its authors.

Julie Nucci & Jim Overhiser | Historic Homeowners in Owego, NY

Dr. Julie Nucci and Mr. Jim Overhiser own 260 Main Street — a circa-1849 Greek Revival temple-front residence in the Village of Owego, NY. After a flood in 2011 that peaked at the house's doorknob, they decided to elevate their house above the floodplain. In 2015, their house became the first home on the National Register of Historic Places in New York State to be elevated for flood mitigation. The house's elevation design features a number of elegant and creative solutions that serve to mitigate the visual impact of height change, including front stairs broken into two smaller runs with different materials, a raised yard with plantings, and flood vents in new foundation that align with the historic house's three-bay elevation composition. The elevation project is featured in National Park Service's *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*, and has been covered by local news media such as The Ithaca Journal and Owego Pennysaver.

Dr. Nucci and Mr. Overhiser's Greek Revival home in Owego, NY after structural elevation. Source: National Park Service.

A "charming, authentic historic village along the Susquehanna River" according to its official website, the Village of Owego boasts the state designated Owego Central Historic District, which includes more than 250 structures in a village with a population of less than 4,000 people. In spite of its rich and intact historic fabrics, Owego is vulnerable to flooding: before the 500-year flood in 2011 that reached 75% of all properties within the village, the village experienced back-to-back floods in 2005 and 2006. In fact, the NYSDEC recently designated Owego as a disadvantaged community, with an environmental burden higher than 86% of census tracts statewide and population vulnerability higher than 43% of census tracts statewide.

After the 2011 flood, the village successfully applied for FEMA's Hazard Mitigation Grant Program (HMGP) to elevate over 20 Owego homes. This funding reimburses 75% of eligible elevation expenses. Unfortunately, only four homes were elevated using this grant funding, one of which is 260 Main Street. Additional financial incentives were provided by NFIP, as well as New York State Historic Preservation Office (NYSHPO)'s Historic Homeownership Rehabilitation Credit.

Elevating a designated historic house in a time that predated many of today's design and policy resources was by no means an easy task. Nucci spent most of the multi-year process painstakingly navigating through governmental agencies on federal, state and local levels such as FEMA, New York SHPO, and the Owego Historic

Preservation Commission (OHPC). After the successful completion of the elevation project, Nucci and Overhiser have been keen on sharing their experience with other homeowners and the general public. They gave a joint presentation on their elevation project at the New York State Floodplain and Stormwater Managers Association's annual conference in 2022; Nucci has presented the project at various occasions including the Keeping History Above Water 2021 conference and training sessions offered by National Alliance of Preservation Commissions (NAPC)'s Commission Assistance and Mentoring Program (CAMP). Nucci is the Flood Resiliency Coordinator for the Village of Owego and chairs Owego's Climate Smart Communities' task force. Mr. Overhiser chairs the Owego Historic Preservation Commission (OHPC).

This interview was carried out on Jan. 27, 2023 over Zoom. In this interview, Dr. Nucci and Mr. Overhiser shared details of their elevation project, introduced recent flood adaptation efforts in the Village of Owego, and envisioned changes within the fields of historic preservation and floodplain management from the perspective of homeowners.

> ***"Homeowners shouldn't have to be privileged to be able to stay safe."***

Dr. Nucci measuring the progress of the elevation project. Source: Andrew Thayer for The Ithaca Journal.

Ziming Wang: It's my privilege to have both of you here. Let's get started with some more context — how have flooding risks evolved in Owego after the historic flood of 2011? Besides your Greek Revival home, are there other flood adaptation projects taking place in the village?

Julie Nucci & Jim Overhiser: The 500-year flood caused by Tropical Storm Lee in 2011 and the 100-year flood in 2006 are the largest flood events the Village of Owego has experienced in recent years. **However, these past flood events may have a long-lasting influence, both emotionally and physically.** Physically, a number of homes were damaged, abandoned or fell into disrepair after the flood of 2011, which led to a municipal buyout program that managed to acquire about a dozen flood-impacted homes. When Hurricane Sandy hit the East Coast in 2012, traumatized local residents rushed to empty their basements and anxiously awaited flood impact. At that time, we knew from weather data that Sandy was not going to hit us, and in fact it didn't; but the anxiety among residents really demonstrated the PTSD caused by memories of earlier floods. To repay the kindness of communities that helped us in 2011, the Owego fire department sent out a crew and supplies to help Sandy victims.

Speaking of flood adaptation projects, the village of Owego submitted two HMGP applications in the spring of 2022, one for generators to back up critical village infrastructure and another to elevate an 1802 Greek Revival home. These applications are still pending. There are some larger-scale adaptation proposals under consideration by the United States Army Corps of Engineers (USACE). In the fall of 2022, two applications were submitted for USACE funding via the Floodplain Management Services program. One is to generate adaptation strategies for village buildings in the floodplain and the second is to redesign the village's stormwater system. The Village of Owego joined the state's Climate Smart Communities Grant Program, and received a $125K grant early in 2023. The grant will fund a private partner to help the village pursue entry into FEMA's Community Rating System.

Ziming Wang: Following the historic flood of 2011, it took you around four years to elevate your house. What was the most time-consuming task in the whole process? Which federal, state and local agencies did you encounter as you worked through project review, permit, grant and insurance procedures?

Julie Nucci & Jim Overhiser: The FEMA HMGP funding was awarded about two years after the flood. Since we were the first house on the National Register in New York State to be elevated for flood mitigation, it took another six months to get approval from the SHPO for our elevation project. FEMA determined that we must elevate the house two feet and the SHPO determined we couldn't elevate it more than four feet. We worked closely with the Owego Historic Preservation Commission (OHPC) for local design reviews. The state-level Historic Homeownership Rehabilitation Tax Credit is a great program to pursue: it provided an income tax credit equal to 20% of our qualified rehabilitation expenditures, on the condition that at least 5% of all rehabilitation expenses were allocated to the exterior of the building. Elevation is an expensive process and the 20% historic tax credit is a great resource to help defray uncovered costs and the homeowner's 25% responsibility for the FEMA grant.

Ziming Wang: How difficult was it for a homeowner to get information about policies, procedures, and available technical/financial assistance on flood adaptation? What changes in the systems of historic preservation and emergency management would you like to see in order to make flood adaptation easier and more efficient?

Julie Nucci & Jim Overhiser: Well, based on our trials and tribulations, there are several things that we believe will benefit historic homeowners like us in the process of flood adaptation:

First of all, better collaboration between SHPO and local preservation commission during project review. Our project went through independent design reviews by SHPO and OHPC, and the final design scheme approved by the local commission was not approved by SHPO. Our landscape architect had to rework the design into a version acceptable to the SHPO. We understand that there's a hierarchy in the historic preservation system, but in retrospect, we think it would be great if we could have had SHPO representatives virtually attend our local preservation commission reviews. It would have saved time and design fees.

Secondly, a more streamlined workflow between homeowners and various governmental entities. One thing Nucci notes is that it was possible for her to navigate the review and permit process because she is a PhD degree holder with extensive research training — there are mitigation standards and regulations, historic preservation standards, insurance processes, application procedures, tax credit processes and procedures to be learned, etc., which can easily become a major roadblock to homeowners. **We believe that homeowners shouldn't have to be privileged to be able to stay safe; there needs to be more equity in mitigation projects, since everyone deserves to be safer.** One photograph that Nucci uses in her presentation is the pile of paperwork and receipts produced in the project, which measures several inches thick. A simpler, more straightforward process would enable more people to participate.

Moreover, homeowners will also benefit from better public outreach and information sharing mechanisms. Nucci noted: "We learned about New York State's Historic Homeownership Rehabilitation Credit because my sister found it online and shared the information with me."

All that being said, we are very thankful to the dedicated FEMA, DHSES, and SHPO staff who worked with us — they were very supportive in providing guidance and assistance throughout the elevation process.

Ziming Wang: Speaking of information sharing — would you prefer to see it done through the creation of local resilience officers or coordinators, or through online portals and virtual platforms?

Julie Nucci & Jim Overhiser: The short answer is "Yes" — anything that strengthens communication and breaks the silos of regulatory systems would be helpful. If we had a local resilience officer guiding us, it would surely have been easier for us to navigate the elevation process.

Ziming Wang: Many preservationists and planners I've spoken to have stressed the critical importance of financial incentives in bringing flood adaptation projects into reality. How have various grants and incentives financed the elevation of your house, and how important were them to you?

Julie Nucci & Jim Overhiser: FEMA's HMGP funding covered 75% of eligible expenses that occurred in our project. This included the structural elevation of our house, but not building a new garage in our backyard and patio work. The old garage had to be removed to enable the beams used for elevation to be placed under the house. We gave away our garage. Someone came, carefully deconstructed it, and reassembled it in a nearby village. That was much better than putting a perfectly good building in the landfill. However, This is an area where equity is again an issue: we had to front 100% of the costs and wait for the 75% reimbursement. This is a financial barrier antithetical to equity.

As previously discussed, the state Historic Homeownership Rehabilitation Credit program was also instrumental in making elevation financially viable. Although we had to pay a portion of our elevation project by ourselves, our income taxes were offset for several years following the project's completion.
Our flood insurance went from over $1800 to about $372 per year, at least initially. However, under FEMA's current Risk Rating 2.0 System, our insurance will increase by a factor of 5 since Risk Rating 2.0 is not incentivizing and rewarding flood mitigation. To be specific, the mitigation discount in our current Risk Rating 2.0 policy is $23! That is crazy after elevating the house 4' and moving the electrical and HVAC from the basement to high on the elevated first floor. **FEMA needs to acknowledge this weakness in their new model and address it. If they don't, property owners who would have mitigated will opt out – which is bad for the owners' mental health and the safety and integrity of their community.** Homeowners also need to know that if there is a lapse in coverage, then policies currently gliding towards the full risk rate at 18% per year, will be reinstated at full risk rate.

Another issue we're seeing in our town has to do with FEMA's Benefit-Cost Analysis (BCA) process required as part of grant applications. The high cost of elevating historic homes in an area with low real estate values can pose challenges for local homeowners to clear the BCA process.

Ziming Wang: As owners of the first house that was elevated in the village, how would you imagine built environment changes in Owego as it transforms towards flood resilience? Would you imagine walking along a group of historic houses elevated above the floodplain, in a manner similar to your house?

Julie Nucci & Jim Overhiser: We'd like to imagine walking among appropriately adapted historic houses in our village, whether they are elevated, dry-floodproofed, or wet-floodproofed — whichever works the best. These are signs that people are safe from flood risks. We're hoping that more homeowners will mitigate risk by moving critical equipment out of their basements. When Jim speaks with other historic homeowners on flood adaptation, many would ask "Why doesn't the government just dredge the river in front of us?" It's important to build

community awareness and understand that there are things that can be done by a homeowner in response to flood risk. Large-scale waterway modifications are rare, as they are very expensive and can only be done if they don't push the danger downstream.

Ziming Wang: I noticed that besides being homeowners, you are also serving as resilience and preservation officers in the village. What opportunities have these positions brought you? What are some important next steps that should be taken to steward the village towards flood resilience?

Julie Nucci & Jim Overhiser: We actually have a complementary partnership with each other — one of us (Julie) is the "flood person," and the other (Jim) the "preservation person." We hold advisory roles in the village — homeowners come to us when they need us, and we share our information and recommendations with them. We tell people that we will be flooded again, and resilience can be achieved if you have the will. We have sometimes acted as tour guides — a lot of local residents stopped by our house when it was temporarily lifted by pillars and beams, and we have been visited by SHPO staff, local floodplain managers, as well as a group of Cornell faculty and students since the completion of elevation.

While Jim is devoted to overseeing the preservation of this impressive little village and making it eventually more resilient, Julie has recently taken on a consultation role with the National Hazard Mitigation Association (NHMA), which aims to share information and resources on community-based climate resilience undertakings.
As for the immediate next step, we believe it is crucial that we continue to un-silo ourselves and engage more partners in various fields. "Resilience to Natural Hazards" has already been written into OHPC's Design Guidelines. We will both participate in the Village of Owego's Hazard Mitigation Plan update starting in May 2023, with a goal of integrating climate adaptation, flood mitigation, and historic preservation into the plan. Doing this will open up opportunities for future funding. Finally, the OHPC is working with local real estate agents, so they can better communicate information on flood adaptation, historic preservation, flood insurance, and the historic tax credit program to prospective homeowners.

* This interview text has been transcribed and edited based on the interviewer's notes.

Olivia Brazee & Chelsea Towers | New York SHPO

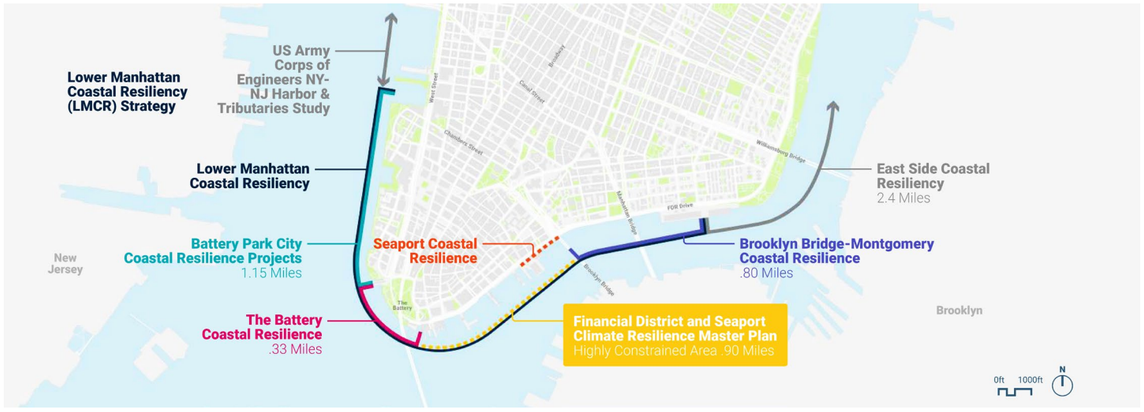


Diagram for Lower Manhattan Coastal Resiliency (LMCR), a collection of neighborhood-scaled infrastructural adaptation projects launched by New York City that will form a continuous landscaped flood barrier surrounding Lower Manhattan.
Source: NYCEDC; NYC Mayor's Office of Climate Resiliency; ARCADIS. 2021. *Financial District and Seaport Climate Resilience Master Plan*.

As New York State's governmental historic preservation agency, the New York State Historic Preservation Office (SHPO) administers Federal and State-level preservation programs including Statewide Historic Resources Survey, New York State and National Registers of Historic Places, Federal Historic Rehabilitation Tax Credit, Certified Local Government program, the State Historic Preservation Tax Credit & Grant programs, State and Federal Environmental review, and a wide range of technical assistance.

After Hurricane Sandy, New York SHPO became one of the 12 SHPOs and 2 THPOs (Tribal Historic Preservation Offices) in Northeast and Mid-Atlantic regions that received National Park Service's Hurricane Sandy Disaster Recovery Grants, which helped it to carry out a five-year initiative to survey historic resources within flood-threatened communities, as well as fund brick-and-mortar rehabilitation projects on several flood-damaged sites including the Saugerties Lighthouse on the Hudson River. New York SHPO has also administered Section 106 Reviews or State Historic Preservation Act (Section 14.09) Reviews for a number of Lower Manhattan's neighborhood-scaled resiliency plans.

In this interview, New York SHPO staff share information on how heritage resilience relates to their scope of work and recent project reviews. A Zoom interview with Ms. Olivia Brazee, New York SHPO's Historic Site Restoration Coordinator for New York City, was carried out on Jan. 31, 2023; Ms. Chelsea Towers, New York SHPO's Survey & National Register Coordinator, answered questions about SHPO's Hurricane Sandy Survey via email. Ms. Kathy Howe, Director of New York SHPO's Community Preservation Services Bureau, also contributed to the interview.

> ***"It'll be a worthy challenge to put information in one place, and to consolidate available resources for the public."***

Ziming Wang: What impacts did Hurricane Sandy cause to New York State's historic resources? What are some major projects that were launched under National Park Service's Hurricane Sandy Disaster Recovery Grants, and which geographic locations did these projects focus on?

Chelsea Towers: After Hurricane Sandy hit the Eastern seaboard in 2012, New York SHPO realized the need to evaluate damages and flooding risks faced by the State's historic properties; however, our ability to assess damages was hampered by a lack of consistent and up-to-date information on resources within affected areas. So under National Park Service's Hurricane Sandy Disaster Recovery Grants, we launched **Hurricane Sandy Historic Resource Survey of Select Waterfront Communities** — a five-year initiative to document historic resources within communities vulnerable to flooding. Communities surveyed in this initiative were selected based on aggregated data from FEMA's "Hurricane Sandy Storm Surge Extents" and NOAA's "NY Preliminary Coastal Inundation Risk Assessment," and included study areas affected by Hurricane Sandy, as well as locations that were designated at extreme, high or moderate risk for future flooding.

In general, the survey looked at waterfront areas of Suffolk and Nassau Counties, select communities within Orange, Rockland and Westchester Counties, and New York City's Five Boroughs; for each of the study areas, our consultants produced a context statement about the history of the community, and made recommendations for National Register eligible individual resources and historic districts. **In total, 14,293 properties were surveyed; 28 historic districts were identified or updated; and approximately 11,000 properties were added to, or updated in, the New York State Cultural Resource Information System (CRIS).**

In addition to the Hurricane Sandy Survey, the National Park Service grants also funded several brick-and-mortar rehabilitation projects for historic resources affected by the hurricane.

Ziming Wang: How did Hurricane Sandy change New York City's flood adaptation and historic preservation policy-making? During the Section 106 Review process, has New York SHPO identified any challenge to the heritage values of historic properties brought by flood adaptation projects?

Olivia Brazee: After Hurricane Irene and Hurricane Sandy, we really started to see some changes in citywide resilience policy thinking. We've seen the development of planning regulations and studies that seek to proactively protect communities and properties from future flood events; and the city has launched a number of community-scaled infrastructural adaptation plans under the Lower Manhattan Coastal Resiliency (LMCR) initiative. It's exciting to see these ambitiously scaled proposals, which are to some extent informed by the huge

financial losses caused by past flood events.

In New York City, the SHPO was involved in the review of several community-scaled resilience infrastructure plans — such as the East Side Coastal Resiliency Plan which envisions a series of floodwalls, floodgates and raised landscapes designed at 16.5 feet above sea level, the Battery Coastal Resilience Plan that will raise the Battery Wharf by 5 feet, and the Battery City Coastal Resilience Projects that features a landscaped barrier system that cuts through Wagner Park. We have evaluated potential impacts on local historic resources and important viewsheds (e.g. the viewshed between the Battery and the Statue of Liberty) brought by these projects, and voiced our considerations when adverse impacts are identified. If all these projects do get built, Lower Manhattan's waterfront will be significantly transformed, in a way that provides a new context for adjacent historic districts and landmarks.

Speaking of building and site-level interventions, many appropriately designed flood adaptation solutions — such as the installation of flood vents, flip-up flood barriers, relocation of mechanical and electric equipment, and basement fill — typically don't interfere with a building's historic character, and are therefore deemed as not causing adverse effects by SHPO. But in the case for historic districts, the considerations must be made for more than just a number of individual buildings — so I guess we have to really wait and see some of the more nuanced impacts brought by large and small-scaled adaptation interventions on our historic districts. One interesting neighborhood to observe would be Red Hook: it's an officially undesignated but obviously historic neighborhood, and the city has proposed above-grade floodwalls there.

Ziming Wang: Flood adaptation and historic preservation are both complicated and professional fields — and sometimes it may be hard for historic homeowners and property owners to get information on available design, policy, and financial resources from different governmental agencies. How do you think preservation standards and public information-sharing mechanisms should involve to better serve flood adaptation projects?

Olivia Brazee: Yes, it may be difficult and challenging for home and property owners to know where to go for information — and ultimately they may have to deal with multiple agencies and get information in a piecemeal manner. We know **it's important to put information in one place, and to consolidate available resources for the public** — but so far, we can only do so for programs and resources under our purview. It might be a worthy challenge for researchers like you to create an integrated, interdisciplinary information platform on heritage resilience.

Our review work at SHPO only deals with projects that are funded, approved, or licensed by State or Federal agencies — so we don't often serve as a direct interface to homeowners. However, when projects come to us for review, we'll try to convey information and procedures as clearly as possible. At SHPO, we actually administer three different kinds of project review: the Federal Section 106 Review, State-level historic preservation review

under New York State Historic Preservation Act, and additionally, environmental review pursuant to the State Environmental Quality Review Act (SEQRA). There are overlaps between these reviews, and the procedures may seem overwhelming to applicants; but we constantly try to streamline the process for applicants or direct them to the right agency to consult, very often through email correspondence and phone calls. On the flood resilience front, we are regularly in contact with preservation officers at FEMA, who carry out Section 106 Reviews for flood mitigation grant applications filed to them that may involve designated historic properties.

Another program closely associated with project applications is Federal and State-level tax credits and grants — they are the ambassadors of historic preservation in the real world. We've done quite some public education on tax credits: we used to conduct in-person tax credit workshops, which turned virtual during Covid.

Ziming Wang: Speaking of these historic preservation financial incentives — as the ambassadors of historic preservation, have they facilitated flood adaptation projects on New York State or New York City's historic properties?

Olivia Brazee: I've seen project applications for tax credits and preservation grant programs where flood resilience is part of the project design — however, for projects applying for historic preservation incentives, flood adaptation is often a secondary goal within the whole scheme. A rule in Federal and State tax credit programs relevant to flood adaptation is the definition of Qualified Rehabilitation Expenditures (QREs) — which covers interventions on the building, but not necessarily site works (such as levees and barriers) related to flood resilience.

Ziming Wang: I noticed that in New York State's latest *Historic Preservation Plan (2021-2026)*, "Disaster Planning and Resilience" was identified as one of the key topics. What are some of the next steps that New York SHPO is taking to address heritage resilience?

Olivia Brazee: Yes, we incorporated Resilience as a key goal in our current State-level preservation plan, which means that we'll take more resilience considerations into account when we review the projects that come to us.

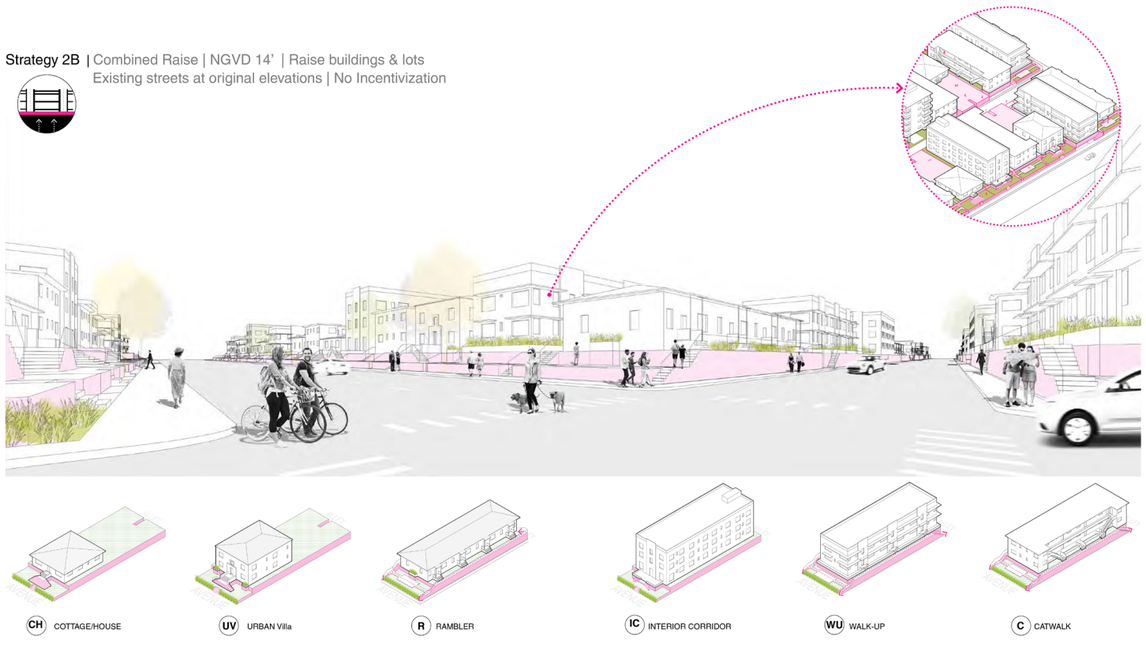
At SHPO's Technical Assistance and Compliance Unit, our role may be pretty reactive or advisory; however, after Hurricane Irene which wiped across some historic towns in New York State, the SHPO provided direct technical support in the post-disaster recovery process, and helped to make sure that works happening on-site were compliant with Secretary of the Interior's Standards for Rehabilitation.

The National Park Service has recently published *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*; looking forward to the future, I would hope to see more standards to be developed to help delineate agreed-upon flood resilience design treatments that are compatible with the unique character of historic

buildings and sites, as well as potential reforms in tax credit programs so they may better work for flood adaptation and flood resilience projects.

* This interview text has been transcribed and edited based on the interviewer's notes.

Deborah Tackett | The City of Miami Beach



A Streetscape Change Scheme Visualized in Miami Beach's *Buoyant City* Guidelines.
Source: Allan Shulman et al. 2020. *Buoyant City: Historic District Resiliency & Adaptation Guidelines, Miami Beach*.

Miami Beach is a city with both iconic architectural heritage and great climate vulnerability. While gifted with 4 National Register Historic Districts and 14 local historic districts, 93% of the city's buildings are located within the 1% floodplain. As a national leader in flood adaptation planning and resilient infrastructure construction, Miami Beach has in recent years elevated streets in low-lying urban sections, and published a series of studies and plans on climate resilience (see for example, the 2018 *Stormwater Management and Climate Adaptation Review*, the 2019 *Miami Beach Strategic Plan*, and the *2040 Miami Beach Comprehensive Plan*). In 2015, Greater Miami and the Beaches (GM&B) — as a coalition between Miami-Dade County, the City of Miami Beach and the City of Miami — was selected to join 100 Resilient Cities, a global initiative pioneered by the Rockefeller Foundation. This initiative led to the creation of the Office of Resilience and the Chief Resilience Officer position in the City of Miami Beach, as well as regional studies (for example, *Resilient 305*) developed on GM&B scale. Recent efforts on regional flood resilience planning also include Miami-Dade County's *Sea Level Rise Strategy*, published in 2021.

Miami Beach's latest historic preservation response to the discourse on climate resilience and flood adaptation is found in *Buoyant City*, the city's guideline for historic district resiliency and adaptation. Published in 2020 as

the result of an interdisciplinary policy-making effort led by architect Allan Shulman, *Buoyant City* may in many ways be regarded as one of the most progressive and experimental guidelines of its kind made across the country. Advancing from existing design studies and flood retrofitting guidelines, *Buoyant City* features not only adaptation solutions on individual historic buildings, but also richly illustrated design strategies proposed on block and historic district scales. It also envisions changes in streetscape and street section brought by flood adaptation, and touches on the urban form impact of potential zoning incentives — such as ground-up additions and rooftop additions — that can be used to stimulate adaptation projects.

Ms. Debbie Tackett is the Chief Historic Preservation and Architecture Officer for the City of Miami Beach. During her time with the city, she has been responsible for overseeing the survey, research, and historic designation of 6 local historic districts, 3 National Register historic districts, and numerous historic sites and single-family homes; she has also guided new development projects within all 14 of the City's historic districts. As a member of the city staff, she was closely involved in the making of *Buoyant City*.

This interview was carried out on Feb. 3, 2023 over Zoom. For more information on flood resilience planning in Miami Beach, please visit www.mbrisingabove.com. Further details of the *Buoyant City* guideline may be heard in "2100 and the Buoyant City," a podcast featuring a panel discussion among those who are involved in the development of the guidelines.

> ***"While historic preservation can't be the full solution to climate resilience, it can be part of it."***

Ziming Wang: Miami Beach is known as a city associated with both iconic architectural heritage and great climate vulnerability. What threat did recent flooding events pose to the city? Are there any specific challenges faced by Miami Beach's local building types — such as urban cottages and art-deco hotels, as characterized in the *Buoyant City* guidelines?

Debbie Tackett: We have actually been very lucky with major hurricanes. Hurricane Irma of 2017 went through Miami Beach, but didn't cause much flood or damage. More serious flooding is caused when king tide and major rain event happen at the same time — this "perfect storm" typically leads to both coastal flooding and standing water coming from underneath buildings. In the past two or three years, I've probably seen such combined flooding events around a dozen times. The multiple and interconnected causes of flooding remind us that it's not enough to only look at sea level rise projections, and that our local resilience strategies should always take a wider range of climate risks into account.

Like New York City, Miami Beach has many unique urban building types. And yes, it can be hard to find existing flood adaptation guidelines that are tailor-made for historic neighborhoods with dense urban fabric. So we are on our feet to develop localized design strategies — and clearly, with such a great diversity in building types and styles, **there are no one-size-fits-all solutions.** The 1930s Art-Deco hotels are built before air conditioning became common, so they tend to have high ceilings and first floors above street level — which give them a head start and more flexibility in flood adaptation; without these features, flood adaptation may be trickier for buildings built after air conditioning became standard. Topology is another factor at play: The city's section is in the shape of a bowl, with historic hotels along Ocean Drive residing on higher grounds, and those in the city center sitting a little bit lower.

Echoing your research, I would also say that streetscape is one of the most critical issues in the flood adaptation of historic urban built environment. In the making of *Buoyant City*, we studied a number of existing flood adaptation guidelines from other municipalities, which are mostly developed for detached houses on a building-to-building scale. However, **in an urban historic district, the most significant impact brought by flood adaptation on local urban experience may not lie in architecture at all. More often, it lies in a building's relationship with the ground — in other words, how it interacts with the sidewalk, planters, patios, and other elements within the public realm.** So in our local design reviews, we've been paying much attention to these issues, which may come down to small but important details such as railing design; in the *Buoyant City* project, there are studies on how side yards may be adapted along with buildings, to continue to serve as semi-publics spaces that promote social interaction.

Ziming Wang: In the face of rising waters, how many historic buildings in Miami Beach have been rehabilitated for flood resilience?

Debbie Tackett: There are a total of around 2,600 buildings in our historic districts, and in Florida, we have relatively strict codes for flood resistance. According to the State Building Code, buildings are required to comply with current flood-resistant construction standards when they go through substantial improvements (any renovation that costs 50% of the building's market value or more) — **and this rule applies to historic buildings as well.** Typically, the Building Code would require a residential building's finished floor level to be located above 9ft NGVD, and a non-residential building's finished floor level to be above 8ft NGVD; **historic building owners may file for waivers on floor elevation requirements so they don't necessarily have to raise their buildings, but up-to-code floodproofing treatments must be done.**

Besides floodproofing measures that are universally carried out under the Building Code, in the past, we've seen a few applications on physical elevation. Some historic building owners chose to raise their interior finished floor, and some else would lift their buildings by a mild height (say, 3 feet). There are probably less than 10 physical elevation cases in total, but they are actually happening here.

Ziming Wang: Miami Beach is regarded as a national leader in climate resiliency policy-making and resilience infrastructure construction — and I noticed that there have been a great number of plans and studies done on the local and county level as well as on the GM&B scale. So how does your position fit in the city's framework for climate resilience?

Debbie Tackett: My role as the Chief Historic Preservation and Architecture Officer is nested under the city's Planning Department — which is one of the major actors in the city's climate resilience initiatives, and has been involved in the development of the city's Resiliency Code and 2040 Comp Plan. City officials are pretty collaborative here: we at the Planning Department are in constant connection with our Chief Resilience Officer Amy Knowles, and I'm fully aware that **while historic preservation can't be the full solution to climate resilience, it can be part of it.**

One interesting project that I'd like to let you know is that echoing the city's large-scaled street elevation efforts in Sunset Harbor, Palm Island and Hibiscus Island, there is one street section in a historic district that has been raised: 11th Street from the west of Jefferson Avenue to the east of Euclid Avenue in the locally designated Flamingo Park Historic District. If you check it out on Google Street View, you'll see that building entrances are now several steps of stairs below sidewalk level. While raising the streets, the city is also installing new drainage and pump systems; so we really look to it as a potential long-term solution.

Another aspect of my work connects with local residents, who may reach out to us and the city's Historic Preservation Board to express opinions on things like new pump stations in historic districts.

Ziming Wang: The *Buoyant City* guidelines stemmed from a collaboration between local planning, preservation and resilience officials, architects, and consulting engineers; in the "2100 and the Buoyant City" panel conversation, you also had a university professor join the conversation. I think the project has showcased a quite unique and diverse coalition of local professionals towards heritage resilience — and I wonder how did that kind of coalition come into place?

Debbie Tackett: Well, speaking of the *Buoyant City* project, we had Allan Shulman as our head consultant. He's both a practicing architect and a professor at University of Miami's School of Architecture, and has an extensive experience researching and designing Miami Beach's architecture. He assembled the whole project team after winning the governmental RFQ, and the city helped coordinate public outreach for the project. One impressive thing about *Buoyant City* is that it won unanimous support from local residents, developers, and historic preservation organizations — which is a quite rare achievement.

Flood adaptation and climate resilience are heated design and research topics in local architecture schools. I don't teach at university, but I've spoken to students at Florida International University and University of Miami many times. There is a design studio at Florida International University's School of Architecture, where students take a block in Miami Beach every semester and propose its resilient future — it has been really fun to see these projects. It's exciting to see Miami Beach as a lab for innovations in resilience, and I always tell students that there is no wrong answer. We also have to keep an eye on advancements in technology — maybe hydraulic lift systems and floating houses will be able to enter into mass production and application in the future.

Ziming Wang: In the panel conversation, you mentioned that Miami Beach accounts for more than half of all Federal historic preservation tax credits received in Florida. How have these tax credits — as well as other financial incentives — helped the flood adaptation of historic resources?

Debbie Tackett: The Federal historic tax credit program helped tremendously in the preservation of historic buildings in the private sector; and with our Building Code, flood resilience is normally a part of substantial improvement projects. One case that I can think of is Fontainebleau Hotel: its multi-million renovation in 2009 generated a substantial amount of tax credit incentives, and that project also spurred other investments in its immediate vicinity. Increased property values in historic districts would also increase our tax base, which may indirectly benefit local residents.

Ziming Wang: There are of course many things revolutionary about the *Buoyant City* guidelines — from creative building-scaled adaptation solutions to extensive design studies on urban form change and zoning incentives. In your eyes, what's the most unique thing about *Buoyant City* that other municipalities and policy-makers may learn from?

Debbie Tackett: *Buoyant City* is indeed a guideline first of its kind; and I believe its uniqueness lies in the fact that it wasn't fearful to propose changes. We value our historic built environment, but we never wanted to turn Miami Beach into an outdoor museum that looks frozen in time. As a city, we have always embraced changes and flexibility; with that mindset, we have adopted a preservation strategy that welcomes contemporary infill developments in historic districts.

Why do we tolerate formal and physical changes so much? Because heritage tourism has always been an important component of the local economy, and the city's financial values grew primarily because of built environment changes that happened over the years. For example, the mid-century Fontainebleau Hotel that I just mentioned was developed on the site of Firestone Mansion built in 1916; it is because of the successive flow of new developments and new architectural styles that we now have a rich collection of historic resources from single-family mansions to art-deco hotels and Mimo (Miami Modern) buildings. Now, it may be time to see even more changes — **we'll allow for the flexibility, but also approach our historic built environment with sensitivity.**

I believe that flood adaptation interventions on local historic buildings will eventually become a critical part of the understanding of their historic significance; as we add, alter, or modify our historic buildings, these interventions will also be a valuable resource for public education on climate resilience.

Ziming Wang: How would you image Miami Beach's future waterfront historic streetscape?

Debbie Tackett: That depends on how you would define *future* — there are a lot being proposed, and only time will be able to tell how our city will be transformed. Miami Beach has a great number of climate resilience initiatives going on that range from recycling and intermodal transit to green & blue infrastructure and living seawalls; you may check them out at Miami Beach Rising Above, the city's portal for its climate initiatives.

Ziming Wang: And it comes to our final question — could you give me some idea on the next steps that the city is taking at the intersection of historic preservation and flood adaptation?

Debbie Tackett: There has been a recent discussion on heightening the seawall by Collins Canal for Palm View historic district — by engaging in that conversation, we are trying to think more proactively and work more closely with infrastructure projects as preservationists. Another issue that the city has been facing is that after streets were raised in Sunset Harbor, street-level businesses are recategorized as "basements" by FEMA because they now reside slightly lower than sidewalks. This re-categorization gives FEMA the right to reject flood insurance claims; the city is actively working with FEMA in the hope of developing solutions to set this issue straight.

* This interview text has been transcribed and edited based on the interviewer's notes.

Julia F. Martin & Erin Lanier | Julia F. Martin Architects

Left: Photograph of 1 Water Street Residence after elevation.
Right: Streetscape change diagram for 1 Water Street, with another historic house (3 Water Street) built with the same design on its side.
Source: Julia F. Martin Architects.

Julia F. Martin Architects is an architectural firm located in Charleston, South Carolina. Specialized in residential, commercial, and preservation design projects, it designed 1 Water Street — a structurally elevated historic residence in Charleston's waterfront that sensitively responds to local historic environment and historic architectural forms. As the first historic brick structure that was structurally raised in Charleston, the residence now resides above a full-story concrete foundation cladded in matching light blue stucco, and embellished by a pair of elegant L-shaped stairs leading to the elevated main entrance; arched door openings are made on the new ground floor, with restrained forms that reference the building's original design. Overall, 1 Water Street's elevation design integrates a number of streetscape mitigation strategies that add to the symmetry and character of the historic residence. As a successfully designed elevation project, it was featured in the Elevated Buildings Walking Tour offered by Keeping History Above Water 2021 Conference in Charleston.

This interview was carried out on Feb. 6, 2023 over Zoom, with Ms. Julia F. Martin, AIA, principal of Julia F. Martin Architects, who also serves on the City of Charleston's Board of Architectural Review (BAR-S); and Ms. Erin Lanier, Preservation Professional at Julia F. Martin Architects. In this interview, they shared insights on Charleston's building elevation practice from the architect's perspective, and envisioned further changes in local historic

urban forms as well as heritage resilience planning and policy-making. For more information on the 1 Water Street project, please watch this timelapse video of its structural elevation process.

> *"We've been thinking of appropriate elevation design strategies for local historic buildings for years, and we're confident that local historic buildings are able to be designed for flood resilience in a way that respects their historic characters."*

Ziming Wang: It seems that in Charleston, flood adaptation and building elevation are becoming increasingly popular among historic homeowners, and are potentially changing the preservation design market. How many historic buildings are flood adapted in Charleston's historic districts? Besides 1 Water Street, how many flood adaptation commissions have come to you?

Julia Martin & Erin Lanier: Hundreds of buildings, probably — if you take any form of flood adaptation into account, and also consider the historic building stock outside historic districts. We believe that more than 100 adaptation projects within historic districts have been designed and approved, but not all of them got built. After flood impacts or due to dilapidation, many homeowners would have to rebuild the foundation anyways; and that is a good opportunity for them to lift their houses by a few feet.

We ourselves have done several designs for the elevation of historic residences — but the actual construction of elevation projects remains pretty cost-prohibitive, so whether these designs are going to be built depends on whether or when our clients choose to commit the financial resources.

Ziming Wang: Speaking of the cost of elevation projects — to what extent would financial incentives such as FEMA grants or National Park Service grants be helpful to property owners?

Julia Martin & Erin Lanier: These financial incentives may seem like an opportunity, but we haven't personally seen any project funded under government grants or subsidies yet. **There seems to be a long application cycle and considerable amounts of bureaucracy associated with these programs, which may hamper homeowners' willingness to participate.** Also, some FEMA grants require properties to have had severe repetitive loss (SRL); but since property prices are becoming higher and higher in Charleston's historic downtown, it's generally hard for homes to meet the bar, which requires either 4 or more separate flood insurance claim payments, or 2 or more payments of which the combined value exceeds the property's value. Furthermore, many of the more upscaled historic residences in Charleston are self-insured; and with the high cost of flood adaptation, homeowners don't necessarily have the sense of urgency to retrofit just for lowered premium rates.

Ziming Wang: The design of 1 Water Street is highly laudable. The collection of streetscape design treatments you've adopted made the new foundation and stairs an integral part of the historic residence; and I also like the arched doors on the ground floor which both clearly reference historic forms and achieve identifiability through restrained forms. How did these creative design solutions come into place? How have your familiarity with local historic buildings translated into flood adaptation projects?

Julia Martin & Erin Lanier: We've been thinking of appropriate elevation design strategies for local historic buildings for years — even before structural elevation became a permitted and recommended treatment by local Board of Architectural Review (BAR). You know, BAR historically rejected elevation proposals for historic buildings; but after the back-to-back hurricanes that happened between 2015 and 2017, they started to change their mindset and began producing design and policy guidance for elevation projects. Julia was there back in the day for BAR's workshops where architects, preservationists and other stakeholders voted for recommended design treatments in the elevation of historic buildings; these workshops led to the production of Charleston's *Design Guidelines for Elevating Historic Buildings* published in 2019. Full-floor addition when significant height changes are planned is actually one of the things that are recommended by the guidelines. (Note: For more details on the making of the Charleston guidelines, see the interview with Ms. Erin Minnigan conducted as part of this project's interview series).

Speaking of the 1 Water Street project itself, we had a checklist of priorities — **goals listed on the top are functionality, FEMA regulation compliance, and historic integrity and character.** These goals helped us to rule out unsuitable design strategies, and finally reach a logical and graceful solution. Also, many of Charleston's residences are historically built on raised foundations or basements, which served as a template for our design.

Ziming Wang: I learned that besides practicing as an architect, you also serve on the Board of Architectural Review; so how has the close connection between preservation policy-makers and architects in Charleston helped guide the transformation of historic buildings towards flood resilience?

Julia Martin & Erin Lanier: Charleston actually has a "City Architect" position, and there has been a close relationship and mutual respect between architects and city officials who review preservation design projects. The joint effort between architects, city officials, and other stakeholders was crucial in the development of the *Design Guidelines for Elevating Historic Buildings* that we just mentioned; informal discussions with BAR staff also helped us navigate details in our project design. Let's take 1 Water Street for example — the city has a 1 ft freeboard height requirement for substantial improvement projects, as compared to 2 ft for new construction projects. This might not seem significant, but it was important for us to get the standards right. Due to the tight space of the site, the project would not happen as it is if any additional freeboard height was required.

Furthermore, Charleston has a major section of population that are passionate about climate resilience and

historic preservation — which leads to a strong public awareness about the city's climate resilience initiatives and guideline-making processes.

Ziming Wang: And 1 Water Street was the first brick structure ever structurally raised in Charleston, right? Any technical challenges associated with elevating a masonry — instead of wood-frame — structure?

Julia Martin & Erin Lanier: Yes, it was incredibly complicated indeed. We actually had three teams of engineers on site — besides the contractor responsible for elevating the building, there was a team of geotechnical engineers that worked on stabilizing the ground for the temporary support system, and another team that worked on the new foundation structure, which was built in concrete masonry units (CMUs). As a result, this project would cost 3-4 times more than a typical elevation project for wood-frame houses. Besides the engineering teams, We also have to give credit to our clients, who are brave and evermore committed to this project; as well as to our building elevation contractor, who has extensive experience in elevating and moving large-scaled, masonry buildings.

Ziming Wang: In parallel with flood adaptation interventions on buildings, there has been a rising discussion on resilient landscape design — elements such as planting, rain gardens, and pervious surfaces, etc. How do you evaluate the prospect of these landscape features in Charleston's historic urban environment?

Julia Martin & Erin Lanier: Of course, these landscape features would enhance the resilience of urban lots and sites — however, the problem seems to be that there hasn't been any design code and enforcement mechanism established. Since BAR's purview is largely limited to historic structures themselves, the enforcement of resilient landscape design and permeable surfaces will need to involve other city agencies such as the Building Department, Department of Public Service, and Department of Stormwater Management. We are eager to see more initiatives and regulations made on this front. In the Dutch Dialogue held by the city in 2019, experts discussed the prospect of strategically allowing the water to flow into tidal wetlands and barrier islands on the coast, and more comprehensively redesigning the city's relationship with water; such large-scale proposals on landscape adaptation may also be relevant to your question, and contribute to the city and region's flood resilience.

Ziming Wang: With hundreds of flood adaptation projects going on, how would you imagine Charleston's future historic streetscape?

Julia Martin & Erin Lanier: Well, there might short-term changes as well as long-term changes. If you come back in 40-50 years, you'll probably see more historic buildings elevated, and possibly the construction of the seawall currently proposed by US Army Corps of Engineers; if you are thinking of 100 years from now, then even more significant changes may have happened. We certainly hope that besides the city's large-scale infrastructural and landscape solutions, more people could get on board to adapt their homes for flood resilience; but the reality is that some are still waiting to see what the government or city could do, before they are willing to commit their own financial resource. The BAR saw a flurry of application after the major hurricane events several years ago; **these storm and flood events are — in some senses — wake-up calls for homeowners, preservationists and architects.**

Ziming Wang: And it comes to our final question — from the architect's perspective, what is the biggest challenge in the flood adaptation of Charleston's historic buildings? What changes would you like to see in the field of heritage resilience?

Julia Martin & Erin Lanier: The first thing we can think of is that more financial incentives from FEMA or other governmental agencies would certainly be of great help, since the high price of building elevation has prohibited some homeowners from undertaking flood adaptation interventions. Speaking of design guidelines and design strategies for historic buildings, there has been a large amount of thought put into local policy-making, and we're confident that local historic buildings are now able to be designed for flood resilience in a way that respects their historic characters. Finally, we'd be excited to see the emergence of local house movers and lifters that are able to perform complicated elevation projects — like 1 Water Street.

This interview text has been transcribed and edited based on the interviewer's notes.

Jonathan Boulware | South Street Seaport Museum

The historic Schermerhorn Row at 2-18 Fulton Street that houses South Street Seaport Museum's main building (on the lower left) and a number of retail businesses. Photograph by Ziming Wang, 2021.

Capt. Jonathan Boulware is the President and CEO of South Street Seaport Museum. In 2012, Hurricane Sandy brought more than six feet of surging water into the entrance of the museum's Fulton Street building, destroying the museum's cafe, admission desk, gift shop, computer system, and electrical systems; at Bowne & Co. Stationers — a nearby printing shop owned by the museum, more than 200 drawers of antique wood and metal type were drenched. As flood water rose up to eight feet in the South Street Seaport neighborhood, many other retail businesses and historic buildings (such as Fraunces Tavern) were also inundated.

Leveraging funding from multiple resources including FEMA and the Lower Manhattan Development Corporation, South Street Seaport Museum has repaired and renovated its buildings for higher flood resilience, and planned for new exhibition and educational spaces. In this interview, Capt. Boulware — both as the museum's president and as a resident of the neighborhood — shares the museum's recovery and revitalization process post Hurricane Sandy, and expresses his views on the neighborhood's more recent flood protection and resilience planning efforts.

This interview was conducted on Feb. 13, 2023, at South Street Seaport Museum.

"Long-term and short-term strategies at different scales should be developed hand-in-hand to ensure us a resilient future."

Ziming Wang: I learned from a *New York Times* report back in 2012 that Hurricane Sandy caused substantial damage to the museum: it inundated the Fulton Street building's whole basement, surged to 6 feet above ground, and destroyed collections at Bowne & Co. Stationers. Could you give me some more ideas on the losses that Hurricane caused?

Jonathan Boulware: Yes, we had a flood that was over our heads pouring into the lobby — and I had a picture where one of my colleagues was standing at the entrance beside flood marks. The high flood mark was five or six inches above his head, so we estimate that the museum actually had around 6.5 ft of flooding. The sidewalks have been raised since Hurricane Sandy, so the flood marks would seem even higher back then as compared to today. As for Bowne & Co., the flood impact was not as severe: things did get wet, but they were soon restored.

Ziming Wang: Has the museum been impacted by more recent flooding events, such as Hurricane Ida?

Jonathan Boulware: No. Luckily, we didn't have any flooding within our premises since Hurricane Sandy.

Ziming Wang: I noticed that the recovery of South Street Seaport Museum was supported by funding from FEMA as well as the Lower Manhattan Development Corporation (LMDC). Are there any other funding or grants that helped the museum's revitalization? How important are these funds to the museum?

Jonathan Boulware: Our recovery work hasn't finished yet — it's still ongoing! We're in a multi-phase process of revitalizing our museum, which faced not only impacts from Sandy but also other financial struggles. We've already secured $7.9 million under the FEMA funding announced in 2015; another $5 million came from city-level, non-FEMA grants. Institutions such as LMDC helped us with ongoing capital projects — with the LMDC funding, we are currently renovating the 1868 Thomson & Co. Warehouse at 213-215 Water Street into spaces for exhibition, education and community use.

These funds have just been critical to us. Without them, we wouldn't have been able to reopen and recover.

Ziming Wang: Speaking of the museum's main building at Fulton Street, what repairs and interventions have been made? Are there any concerns, challenges or difficulties encountered in the process? Is the building prepared for potential floods in the future?

Jonathan Boulware: We were not opportunistic at all in recovering our building from flood impacts. The historic warehouses of the Schermerhorn Row that house our museum remained largely intact after Hurricane Sandy; the challenge we had was to effectively modernize the building's mechanical systems, upgrading electrical, heating, plumbing, vertical transportation, and information infrastructure. When we upgraded these systems, we were not dependent on potential community-level adaptation strategies that might be implemented by the city; in contrast, we wanted the building to be ***floodable***, in the sense that it won't have its vulnerable infrastructure destroyed by the next major hurricane. Today, most of our building's mechanical systems are located on the second floor; and our HVAC equipment has been relocated onto the roof.

One thing that remains a challenge is the land that our building sits on — one of the lowest and oldest parts of the city, the Seaport was built right at sea level through landfills. Therefore, the land that we currently sit on as we talk is very porous, and can pose potential flooding threat to underground utilities such as elevator shaftways during flood events. Given the material and construction of historic landfills, hardening the land in this neighborhood would be particularly difficult.

Ziming Wang: With all these undertakings, how long did the museum stay closed after Hurricane Sandy?

Jonathan Boulware: We were closed for a number of months right after Hurricane Sandy. Our internal operation restarted in 2013, and the museum was open to the public in the latter part of that year. We have never closed again since our reopening ten years ago.

Ziming Wang: In your earlier responses, you mentioned community-level flood resilience plans and flood prevention measures in South Street Seaport that were implemented by the city in recent years. How much are you aware of these plans and projects — such as the Financial District and Seaport Climate Resilience Master Plan that proposes an extension of the East River shoreline which will accommodate large-scale resilience infrastructure and public esplanades, or, temporary flood barriers placed as interim flood protection measures under the FDR Drive?

Jonathan Boulware: Yes, I've been following these efforts quite closely, not only as the president of South Street Seaport Museum, but also as a resident of the neighborhood. I do believe that issues of climate and flood resilience could and should be discussed on many scales — and we should get on our feet to adapt for the increasing threat of Sandy-like events. In some senses, I think we are lucky because we got an early warning shot back in 2012; the hurricanes that impact us in the future will likely be more frequent and even more powerful. However, I do have some critiques regarding the ongoing FiDi-Seaport Resilience Master Plan, and the interim flood protection measures adopted in the neighborhood:

First of all, it is not enough to talk only about in-situ adaptation. The "pernicious" aspect of framing resilience as a result of adaptation is that we sometimes tend to overlook long-term sea level rise, an issue that no amount of concrete and rebars can fix. In the short term, city-level investment and infrastructural upgrades may help us better bounce back after hurricane impacts; but we cannot solely rely on them because in 100 or even 500 years of time, **we may have to retreat. My stance on managed retreat is that we can either walk away in a way that we've planned for, or we'll be forced to run away.** It'll be a serious challenge for us as a species. Now, managed retreat might not seem to be a politically popular idea because there are just too many short-term goals and challenges competing for resources with such long-term planning efforts, but I do hope that we can see more city-level planning made on this front.

Speaking of the interim flood protection measures, I've seen the water-filled tiger dams deployed once — possibly before Hurricane Isaias. I think one challenge tied to this strategy has to do with the accuracy of weather forecasts — how right or how wrong can you get in certain advance? As a captain, I always follow hurricane tracking data from NOAA's National Hurricane Center in order to ensure the safety of my crew members and passengers during cruise events. But hurricane forecasts always have a margin of error, which can be pretty significant when they're projecting impacts that will happen several days in the future. So let's say these deployable dams need 30 hours to be installed; then the emergency managers in charge must make the call around 36 hours before the hurricane arrives, or they'll be missing out the window for interventions. And in fact, they may make mistakes in two ways: although Hurricane Ida hit us hard, there were no barriers set up; and before Isaias, the city set up the barriers, but only to find out that weather conditions were actually mild. Now, those people who had to change their commute plans and walk extra blocks to their workplaces weren't too satisfied — it's similar to the situation where schools get a number of angry parents when a "snowstorm" was forecast but never came. When such mispredictions happen, they may hamper the trust and relationship between the community and municipal emergency management agencies.

A rendering for the resilience infrastructure proposed in the city's newly published *FiDi-Seaport Climate Resilience Master Plan*.

Now, let's get to the FiDi-Seaport Master Plan. It's great to see that New York City is developing urban-scaled infrastructural solutions under the Lower Manhattan Coastal Resiliency (LMCR) initiative, and that FiDi-Seaport will serve as a section of the continuous flood defense infrastructure that is being constructed in Lower Manhattan. I must say it's a fancy design; however, I do feel that emergency evacuation shall be better considered in the plan, and that the quality of landscapes could be further enhanced. Furthermore, like I said earlier, it would be great to see more diverse and long-term strategies besides shoreline hardening to be considered and studied in the neighborhood-level resilience master plan. **Long-term and short-term strategies at different scales should be developed hand-in-hand to ensure us a resilient future.**

Ziming Wang: You clearly saw the images and renderings published in the FiDi-Seaport Master Plan. How different is your vision of the future Seaport waterfront from the official design published in the master plan?

Jonathan Boulware: Well, the current design is still pretty much a sketch — it's still a long way to go for it to be brought into reality. These curving walkways are pretty, and architecturally appealing; but my comments have remained centered on the accessibility and visibility of the Lower Manhattan waterfront. Back in 2001, Lower Manhattan witnessed the largest water evacuation in history; and that evacuation was only able to happen because the waterfront had the open space capable of accommodating hundreds of vessels that answered the call. So if you think of that, you'll understand that access to water is an important part of urban design. **While we focus on visual and spatial attractiveness, let's not forget to retain the evacuation capabilities of the waterfront.**

Ziming Wang: Have you been able to speak out your opinions in the public engagement sessions held during the making of the master plan?

Jonathan Boulware: Yes, I have. And when I have the opportunity, I'll continue to make these comments in the future.

Ziming Wang: I know that Hurricane Sandy also caused significant impacts to other stores, restaurants and cultural institutions in South Street Seaport. How long did it take for them to recover? Were they supported by similar funding opportunities, or adapted for future flood events like the museum did?

Jonathan Boulware: The whole neighborhood was impacted by Hurricane Sandy, and some businesses did not ever recover. The favorite restaurant of mine left, and never came back; some coffee shops were also caught in great difficulty.

I would say that various retail businesses, restaurants, and cultural institutions in the neighborhood did not

receive the same support after Hurricane Sandy. **Very often, small-scaled institutions or establishments tend to be put lower on the list and receive less attention in the distribution of disaster recovery funding.** Think about this — we fought for more than two years to secure the FEMA funding; and we are even one of the larger institutions in the neighborhood!

Another issue about FEMA funding is that it's not essentially a grant; it's an eligibility for reimbursement — which means that you have to make expenditures first. With the FEMA funding we've got, we may spend $1 million out of our pocket, and ask FEMA for reimbursement; and then, we may spend another $1 million. But the problem is that we need to have $1 million in the first place — it could be a great challenge for businesses and cultural institutions to gather a significant amount of cash available in hand after being impacted by a hurricane. And also, you typically only get 90% of the announced grant.

Ziming Wang: Which governmental or non-governmental agencies did you work with in the renovation process? Did you work with LPC quite a bit?

Jonathan Boulware: We work with LPC regularly — but not that much during our renovation process, since much of the work was non-structural or happened inside the building. The Lower Manhattan Development Corporation remains one of our major partners, supporting our recovery, renovation, and exhibition programs.

Ziming Wang: In my previous interviews, some have stated that the LPC should take more lead in guiding the flood adaptation of New York City's historic buildings. Would you agree with this statement?

Jonathan Boulware: I certainly won't make a charge against LPC — in a city with tens of thousands of locally designated buildings, LPC is already having its hands full. However, the idea of developing a guideline for the flood adaptation of historic buildings sounds pretty worthy and promising — that's something that the city should potentially allocate funding and resources for. If I was in charge of such a project, I would try my best to have the Mayor's Office of Climate and Environmental Justice (MOCEJ), the City Council, preservation design firms, museums, and the National Trust for Historic Preservation at the table. You know, New York City has a number of the world's best preservation design firms; I'm sure that'll be an unparalleled resource.

Ziming Wang: Actually, there is a flood adaptation guideline for historic buildings just made on the national level — in 2021, National Park Service published its illustrated *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings,* a document that has gathered extensive attention from preservationists across the country.

Jonathan Boulware: Good to hear that! National Park Service also has a set of guidelines on the application of the

Secretary of the Interior's Standards for Historic Vessel Preservation — you may check that out if you're interested.

* This interview text has been transcribed and edited based on the interviewer's notes. For more information on Hurricane Sandy's impacts on South Street Seaport, please see this project's Digital Report 01: Flood Risk of New York City's Historic Built Environment.

Robert Sauder | Wolfe House & Building Movers

The limestone Orchard Beach Shelter House was relocated in 2020 from the eroding Lake Michigan shoreline by Wolfe House Movers. This project was awarded the Governor's Award for Historic Preservation in May 2022 by Michigan's State Historic Preservation Office.
Image source: Wolfe House Movers.

Based in Bernville, PA and providing services throughout the country, Wolfe House & Building Movers is a leading contractor in the industry of building elevation and relocation. While flood adaptation and flood regulation compliance provide a valid rationale to lift or move a building, property owners also lift or move buildings for a myriad of other reasons — for example, to repair and reconstruct deteriorated foundations; to save a building from redevelopment and demolition; to repurpose a building into commercial or public use at a new location; or, to make way for railway construction. Currently, Wolfe House Movers deals with up to 500 elevation and relocation projects a year, covering buildings of different construction types (brick, stone, terracotta/concrete masonry and wood frame) and various scales (ranging from single-family homes to a 156' wide, five-story hotel) — many of which are historic structures.

Wolfe House Movers has helped to adapt a number of historic or existing buildings for flood resilience through elevation or relocation interventions. Among their flood adaptation projects are the elevation of the Greek Revival residence at 260 Main Street in Owego, NY (see here for an interview with its homeowners); the elevation of 1 Water Street residence in Charleston, SC (see here for an interview with the project's preservation architects); the elevation of 42 Rutledge Avenue in Charleston, SC (the first historic home lifted in Charleston); the elevation of a

single-family home in Carolina Beach, NC; the relocation of Orchard Beach Shelter House in Manistee, MI from the Lake Michigan shoreline; and the relocation of The Pollocksville Depot in Pollocksville, NC. The company was also responsible for the 2008 relocation of the Hamilton Grange mansion in New York City into St. Nicholas Park.

In this interview, Mr. Robert Sauder from Wolfe House Movers discusses how the company's expertise informs solutions for the flood adaptation of historic properties, as well as how flood-related elevation and relocation demands are influencing the building lifting & moving industry. This interview was carried out on Feb. 15, 2023 over Zoom.

> ***"Historic buildings and residences often bear great emotional and heritage values, which serve as a rationale for property owners to seek elevation or relocation."***

Ziming Wang: How many building lifting/moving projects do you carry out each year? Among the buildings lifted or moved, how many are designated historic properties, and how many are lifted or moved for flood resilience? How have flood-related elevation and relocation demands evolved in recent years?

Robert Sauder: We typically deal with a couple hundred projects each year. Among them, a significant portion are the elevation or relocation of historic buildings — although not all of them are Federally or locally designated. **Historic buildings and residences often bear emotional values or heritage values that are far greater than their material values, which serve as a rationale for property owners to seek elevation or relocation.** Many homeowners that come to us would display a strong sentimental connection to their historic homes.

Flood-related elevation and relocation demands really fluctuate with region and time. For several years, flood-related projects may account for 50%-75% of all projects carried out in some of our regional branches; after a major flood event, we typically have a greater amount of people calling in for inquiries. Many flood-threatened homes have repetitive flooding issues — most homeowners that made up their minds for elevation or relocation hadW already experienced multiple flood impacts.

Ziming Wang: And for those buildings elevated or moved for flood-related reasons, how many are residential homes, versus structures of commercial or community use?

Robert Sauder: The majority of structures we deal with are residential homes. Very often, homeowners are seeking FEMA compliance through elevation; and a decision they have to make is how much additional freeboard height they would need above local BFE (Base Flood Elevation) or DFE (Design Flood Elevation).

Ziming Wang: In my previous interviews, many preservationists and homeowners have stressed the importance of financial incentives from FEMA or National Park Service in bringing their flood adaptation projects into fruition. How often are your clients able to secure these incentives?

Robert Sauder: As a contractor, our work is largely focused on the design and execution of elevation and relocation projects. However, we do advise our clients to speak with State and local preservation agencies, in order to acquire information on necessary review processes and available financial resources.

Ziming Wang: Speaking of real-world projects, what's the typical cost of elevating a detached residential house, of wood-frame and masonry construction, respectively? How long will it take?

Robert Sauder: Well, building lifting is not a cheap and inexpensive process. **There are many factors — such as foundation type, building size, the height of elevation — that may significantly influence the cost of elevation projects. When houses are elevated for flood resilience, flood zone designation also matters: for example, buildings in the V Zone may face stricter foundation requirements than those in the AE Zone.** Masonry buildings are of course trickier than typical wood-frame buildings — they are both heavier, and more fragile. **So in general, an elevation project can range from two days to several weeks to complete, and may cost anywhere between tens of thousand to hundreds of thousand dollars.**

Ziming Wang: I noticed that you've successfully moved and lifted a great number of historic buildings built of timber frame, stone, and bricks. Could you give me some more ideas on the technical challenges associated with elevating or relocating a masonry building?

Robert Sauder: It has to do with how deflections created in the elevation or relocation process are translated within different structural systems. Wood frames are pretty forgiving, as they are able to re-adjust themselves for deflections, and relay these deflections among posts and beams through the building fasteners. Masonry buildings don't have such ability, so if proper care is not taken some damage may happen when they are lifted or moved. To restrict deflections, shimming treatments are necessary for brick buildings; stone buildings tend to be even more technically challenging, so we sometimes need to grout their joints, beams and lintels. Also, the irregularity of stones may make stone buildings more susceptible to damage — that's why I said that masonry buildings are not only heavier, but also more fragile.

Ziming Wang: As an elevation and relocation contractor, what are your major considerations when carrying out elevation or relocation projects on historic properties?

Robert Sauder: First of all, it's important for us and other parties involved to get the basic information right: we need to know which era the structure was built in, as well as the building's construction type and material. **We then try to decide the "carry line" with property owners and preservationists — in other words, the height at which the structure will be cut through and lifted or moved.** It has to do with what parts of the building are considered *historic* — if a building's foundation is deemed historic, we'll lift it with its original foundation; if its floor system is historically significant, we'll make sure to keep the original floors. For elevation projects, the aesthetics of transitional materials between the lifted building and the new foundation also matters a lot.

Ziming Wang: With more and more buildings being elevated or relocated for flood resilience, how would you imagine future urban form changes?

Robert Sauder: Echoing your research, I believe that one of the challenges would lie in the flood adaptation of attached buildings in urban settings. In theory, it's possible to lift a city block as a whole; however, such urban-scaled intervention will need to be built on more creative design and engineering strategies, as well as more innovative policy-making. There might be other alternatives as well — it'll be great if policy-makers in different cities can objectively evaluate available flood adaptation strategies versus what is deemed historically significant in the local urban environment, so we may have a better idea on how to adapt historic buildings while preserving their heritage values.

Ziming Wang: And it comes to our final question — what changes would you like to see in the fields of flood regulation and preservation standards, in order to make the flood adaptation of historic properties more common and affordable?

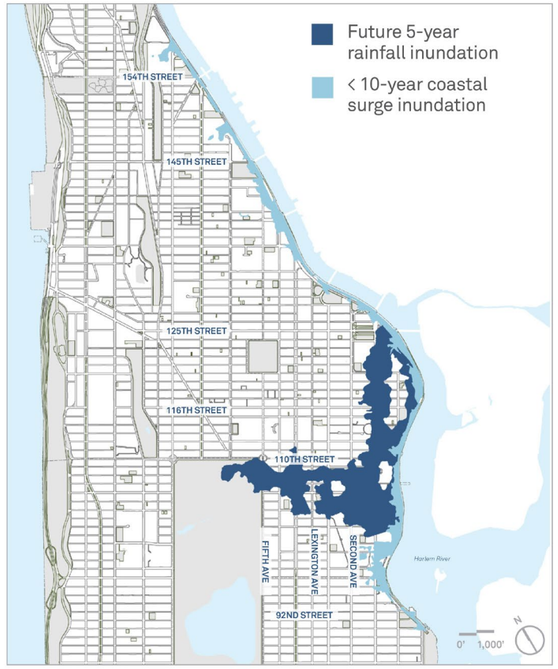
Robert Sauder: I would say more clearly-stated standards, and more streamlined permit and review processes. Every time you add a procedural burden to the elevation or relocation project, it's going to become a deterrent to prospective property owners.

Ziming Wang: Thank you for providing interesting insights from the perspective of those who actually lift and move historic buildings!

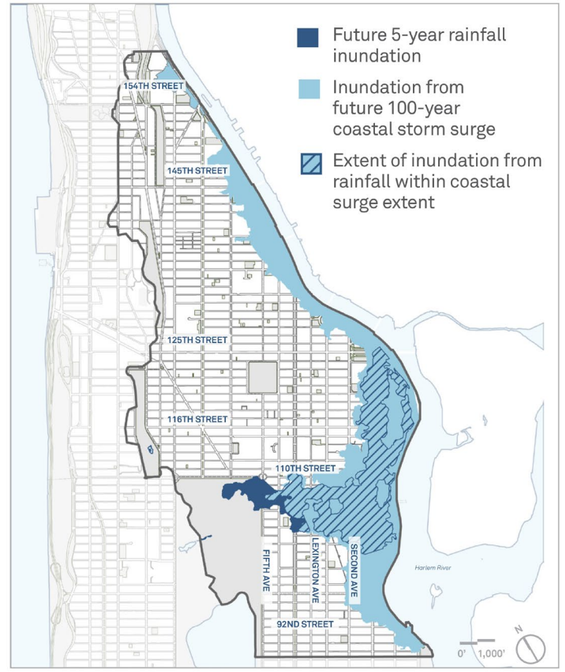
* This interview text has been transcribed and edited based on the interviewer's notes.

Marie Winfield | A'Lelia Bundles Community Scholar, Columbia University

Future 5-Year Rain and Future 10-Year Coastal Surge Event*



Future 5-Year Rain and Future 100-Year Coastal Surge Event*



SOURCES: NPCC, Langan Engineering Modeling
*Future 5-year rain event = 5.88" rain in 24 hours)

Flood risk in East Harlem identified in the published summary of *Vision Plan for a Resilient East Harlem*.

Ms. Marie Winfield is an attorney and freelance consultant on land use, zoning and community planning issues, with a focus on environmental review. As an advocate in the East Harlem community, she served as a member of Community Board 11 in Manhattan, numerous neighborhood plan committees, the Department of Sanitation Community Advisory Group for the M11 Sanitation Garage, and Metropolitan Hospital and Mount Sinai Hospital and Icahn School of Medicine Community Advisory Boards. She also served as the Deputy Director of Fair Housing Justice Center, and the President of the East Harlem/El Barrio Community Land Trust nonprofit. In 2021, she joined Columbia University's 9th class of A'Lelia Bundles Community Scholars.

Located in upper Manhattan along East River, a significant portion of East Harlem lies within the 1% floodplain as

outlined in New York City's PFIRM maps. The neighborhood luckily dodged the full impact of Hurricane Sandy, as the storm hit a low tide when it arrived; however, recent research has found that a six-hour difference in Sandy's landfall would have easily brought severe flooding into the neighborhood.

In 2017, NYC Parks and Mayor's Office of Resiliency started to produce a community-scaled resilience plan for East Harlem named *Vision Plan for a Resilient East Harlem*. However, until today, only a 25-page summary of the plan has been released. The lack of transparency in resilience planning has led to questions raised regarding the city's oversight of a neighborhood with significant flood risk, which also suffers other challenges including infrastructural disinvestment.

Digital news platform *The CITY* has published a series of articles (respectively in January 2021 and October 2022) following up on resilience planning in East Harlem as well as the community's fraught fight to access the *Vision Plan*; Ms. Winfield, along with other CB11 staff, expressed opinions on local resilience planning in these articles. In this interview, Ms. Winfield shares further observations on the environmental justice implications of challenges faced by the East Harlem community, and envisions community-level resilience planning as a valuable opportunity to reach integrated land-use decisions and develop localized environmental education programs.

This interview was carried out on Feb. 20, 2023 over Zoom.

> ***"Community-level resilience planning can be a valuable opportunity for integrated land-use decisions and localized environmental education programs."***

Ziming Wang: We know that although a significant portion of East Harlem is situated in the 1% floodplain, the neighborhood was spared from the full impact of Hurricane Sandy. But how has the neighborhood suffered from other forms of floods — such as storm surges — in recent years? And what's the public perception of flood risk in East Harlem?

Marie Winfield: Well, I'm not an expert on flood risks; however, based on what I've heard in the community, people who live along 1st and 2nd Avenues often had flooding problems during Sandy and other storms — there were cars that submerged under flood water. East Harlem is also home to a great number of NYCHA campuses; some of them are vulnerable to flooding as well. Along 116th and 117th Streets, people may have felt lucky for being spared by Hurricane Sandy. However, the community's concern revived when Metropolitan Hospital announced last year that a "FEMA wall" (the Metropolitan Hospital Flood Wall Resiliency Project funded by FEMA) would be placed around its perimeter. It's a Federally funded project, which didn't have to go through city-level land use procedures; and when we got to know it, it had already passed environmental reviews. **You see, sometimes we have these piecemeal interventions and adaptation projects; however, we don't really have a comprehensive understanding of the neighborhood's flood risk, or an integrated agenda to adapt for resilience.**

Ziming Wang: I think this echoes a point you made in the *CITY* article, that the lack of community-level resilience planning was not only a problem by itself, but is also connected to other challenges such as the infrastructural disinvestment that we see on Pier 107. So could you give me some more details on the implications of the lack and intransparency of community-level resilience planning?

Marie Winfield: First of all, I always believed that a comprehensive neighborhood resilience plan could serve as an opportunity to solve infrastructural issues in East Harlem. The Pier 107 near 110th Street is literally falling into the East River; and sinkholes have appeared on the East River Esplanade. If elevating low-lying sections of the waterfront is something considered in the *Vision Plan*, then it would reasonably create a chance to upgrade and repair our esplanade. However, we haven't seen much progress in either infrastructural upgrades or resilience planning yet.

The problem of the piecemeal solutions that have been given to us is that they are not coordinated with each other, and they're often not able to address the pre-existing infrastructural and land use issues in the community as I just mentioned. In around 2017, the city announced the Harlem River waterfront park project as part of the Manhattan Greenway that loops the island; at roughly the same time, the *Vision Plan* was also introduced by NYC Parks and the Mayor's Office of Resiliency. I was like "Wait — don't they potentially contradict each other?" They are essentially disparate planning processes happening at the same time, and may likely end up with different recommendations for the esplanade and piers. Meanwhile, we also have other individual projects that we've committed resources and money to — such as the FEMA wall around the Metropolitan Hospital, and capital projects under the NYC Community Parks Initiative. Furthermore, East Harlem has recently been through a rezoning process, and there's the creation of the East Harlem Historic District — a quite new historic district that resulted from the advocacy of local organizations such as East Harlem Preservation and Ascendant Neighborhood Development. All these efforts and new changes are calling for a more unified and consolidated strategic planning process. During my time as a member of CB11's Environment, Open Space & Parks Committee, I worked with NYC Parks to advocate for flood resilience measures such as bioswales and porous landscape materials in the renovation of local parks and playgrounds; but again, that's only a piece of the whole picture that should be established.

Ziming Wang: Would you say that these challenges have demonstrated a case of environmental injustice against the East Harlem community? I noticed that the Harlem River waterfront park was only proposed because East Harlem was one of the several gaps in Manhattan where waterfront access was still missing.

Marie Winfield: Yes, this is a case of environmental injustice. We've seen governmental neglect on a neighborhood with environmental risks; we've seen mismatched priorities in land use and resilience planning. There are many things that we've been promised that don't seem to pan out: repairs to the pier and the esplanade, as well as the M11 Sanitation Garage. I moved into East Harlem when my daughter was two years old; and as we walked along the esplanade recently, I noticed the same sinkholes that I found when we just moved here — my daughter is 16 now.

Speaking of the community resilience plan, it was launched in parallel with other resilience plans in downtown areas — such as the East Side Coastal Resiliency Plan and the Lower Manhattan Coastal Resiliency (LMCR) initiative. However, the East Harlem resilience plan didn't receive quite as much attention and investment: it was overseen by the city's Department of Parks, which seemed abnormal in the first place. The city did send someone from the Mayor's Office of Climate Resiliency (MOCR) to CB11; but without giving an explanation, they just said that the project was "going to be done well." **Resilience planning should be an action where government agencies at different levels, community members, and consultants get together to find solutions;** especially in our case, where taxpayers' money went into the project. However, in reality, after the *Vision Plan* was made, city officials would again propose pilot projects in their own ways. I believe that part of the problem really had to do with the stewardship of planning processes and capital projects: the Community Parks Initiative has been more successful, because it allowed influential community organizations to steer the money and projects, and thus boosted the democratic participation of local residents. The James Weldon Johnson Park was reconstructed within 18 months — a reminder that infrastructural upgrades don't always need to take a generation to be done.

Ziming Wang: Community engagement and participation are of course the key to success for every planning project. So if the city government and CB11 are to restart the making of a community resilience plan for East Harlem today, which governmental or non-governmental organizations would you like to have at the table?

Marie Winfield: The short answer is Any and Every. Past planning projects such as the East Harlem Neighborhood Plan had identified specific organizations to engage; however, I feel that it may work better if policy-makers keep their doors open for any community organization or individual to come in, and that incentives are provided for those who come to share opinions. I sometimes feel that local schools which have already established extensive social networks are not well-used in planning projects. Also, it's important for city agencies to take community inputs and translate them into part of the outcome of planning projects: in other words, community inputs have to mean something. As a Community Board member, I used to receive a lot of requests saying "I need to speak with you by tomorrow to have this community engagement task checked off." **But we shouldn't be "pawns" of planning processes; community input is meant to really inform policy-making.**

Ziming Wang: Another issue identified by community leaders in articles published by *the CITY* is that without a resilience plan, it's hard for a community to apply for Federal and municipal funding to carry out adaptation projects. Do you know of any Federal or municipal grant that has been spent in East Harlem in support of resilience planning and flood adaptation? Are there buildings elevated, retrofitted, or bought out in Harlem following Hurricane Sandy?

Marie Winfield: There are projects that were carried out under Federal or municipal support from time to time — the *Vision Plan* and the Metropolitan Hospital Flood Wall project both used Federal funds, and some of the NYCHA campuses in the neighborhood have been selected for pilot projects on flood mitigation by the city. However, overall speaking, Federal and municipal funding is still drastically lacking in East Harlem, in terms of resilience planning and climate adaptation.

Speaking of building-scaled retrofitting interventions, I can't think of any case in East Harlem. However, at CB11, we were well aware of New York City's recently published Zoning for Coastal Flood Resiliency (ZCFR); and, besides building-scaled adaptation policy-making, I personally hope that the city pays more attention to the development of complex-scaled strategies for NYCHA campuses.

Ziming Wang: The *Vision Plan* recommended a number of large-scale flood resilience strategies, such as rebuilding the 106th Street — the historic waterway of Harlem River — into a "green corridor" with mid-road streams or ditches. In your imagination, what will East Harlem look like when it's properly adapted for flood resilience? What features would you like to see in the community's resilience plan?

Marie Winfield: I actually haven't ever imagined that — however, I have perused every single resilience proposal that's been made for East Harlem in the last 12 or 16 years. Very often, in these studies, planners and consultants would say "Let's look at what they've done in Amsterdam, and take those strategies here!" However, the real challenge lies in bringing these strategies into reality. I believe that we have plenty of successful cases to learn from — other areas of New York City are already benefiting from initiatives such as the Billion Oyster Project and the Solar One Green Energy Education Center.

As for East Harlem, one thing I've wanted in the neighborhood's resilience plan is the creation of an environmental education center where intergeneration knowledge exchange can be made on the environmental history of the neighborhood. Many older East Harlemites used to fish or crab along East River; but nobody is going there anymore — people are afraid that their children may fall into the sinkholes. It's important that the local history of human interaction with nature is made known to our younger generations.

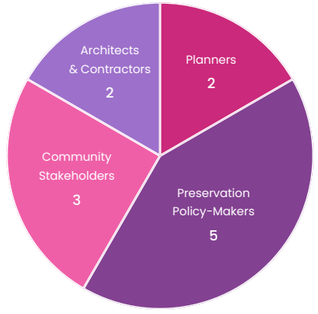
And also, East Harlem has a number of diaspora groups — such as Puerto Ricans and Mexicans — that have environmental practices historically connected to the water. These communities are usually very creative in

arranging native plants in their community gardens; so it would be great if their knowledge on climate and environment were also given a chance to be communicated and heard across the neighborhood.

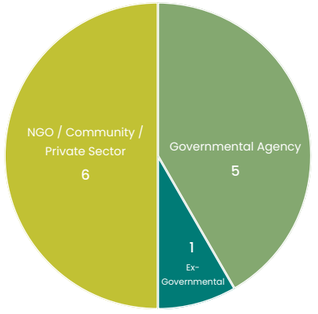
* This interview text has been transcribed and edited based on the interviewer's notes.

Summary of Findings

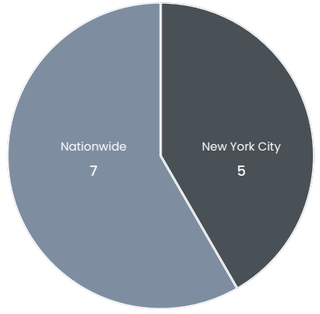
Profiles of Interviewees



by Focus Group



by Background



by Location

This interview series features the author's conversations with policy-makers and stakeholders from diverse backgrounds based in both New York City and other parts of the country. Preservation Policy-Makers are the most represented focus group in the series, with 5 interviews conducted; other interviews are relatively evenly shared by the focus groups of Urban Planners, Architects & Contractors, and Community Stakeholders. Among the (groups of) interviewees, half currently hold or have held policy-making positions at governmental agencies on Federal, State or local level; the other half work in NGOs, local communities, or the private sector. 5 (groups of) interviewees are based in New York City, while 7 are based nationwide outside New York City.

The engagement with multiple focus groups facilitates a lively exchange of knowledge, perspectives, and information both among different professions and between professional practitioners and the public. While preservation policy-makers weigh in on the heritage value implications of flood adaptation interventions, urban planners have informed us of New York City's latest resilience planning progress; architects and contractors have provided first-hand design and engineering considerations on flood adaptation projects, and community stakeholders have shared local practices, and identified challenges and concerns faced in the real world. Similarly, conversations with leading figures in heritage resilience policy-making help decipher the intentions behind cutting-edge policy documents and design guidelines for the flood adaptation of historic properties, while on-the-ground voices from local communities reveal the procedural and regulatory reforms that need to be carried out in the future. A balanced selection of interviewees based in and outside New York City ensures an understanding of the heritage resilience framework within New York City's context — especially with regard to the project's design study areas (South Street Seaport and East Harlem) — along with a nationwide scope that touches on successful theory and practice which may serve as a valuable reference to New York City.

Keywords and Common Observations

The word cloud above visualizes keywords mentioned in the interviews as identified by the author and sorted by number of mentions. A total of 5 keywords have been emphasized by at least 5 (groups of) interviewees: **Direct Investment & Financial Incentives** (7 mentions), **Innovative Design Strategies & Regulatory Reforms** (7 mentions), **Consolidated Public Outreach and Information-Sharing Mechanism** (5 mentions), **Integrated Land-use Planning** (5 mentions), and **Interdisciplinary Collaboration** (5 mentions). While flood adaptation design strategies for historic built environment and associated policy reform agendas are key focus areas of the whole research project by design, other keywords may reveal pressing needs, future potentials and real-world challenges commonly agreed-upon by various stakeholders in today's heritage resilience practice. The common observations, as represented by frequently mentioned keywords, are listed as follows:

- **Direct investment (e.g. grant programs and reimbursements) and financial incentives (e.g. tax credits, lowered flood insurance premium) from both historic preservation and emergency management agencies on Federal, State and local levels are urgently needed to bring flood adaptation projects on historic properties into reality.** Flood retrofitting is not an easy and inexpensive process, and the high cost of retrofitting projects have in some cases prohibited heritage resilience undertakings. Given the limited scope of historic preservation grants and tax credits (which are typically distributed post disasters, targeted at income-producing structures, and without a specific heritage resilience focus), historic homeowners and property owners often need to resort to FEMA grant programs for their adaptation projects. However, as FEMA grants are often funneled through municipalities or local communities, it may take individual property owners a long period of time and a considerable amount of bureaucracy to secure these resources. It is recommended that historic preservation agencies further develop grants and incentives that are targeted at heritage resilience undertakings and benefit residential property owners, and that emergency management agencies and local governments expand the scale and simplify the application process of existing hazard mitigation grant programs. Furthermore, property owners would typically favor direct financial investment (e.g. grants) over reimbursement allowance or tax credits; NFIP policies shall also be designed to further reward flood adaptation on historic properties.

- **Innovative flood adaptation design strategies and guidelines for historic built environment shall be developed hand-in-hand with necessary reforms in floodplain management regulations and historic preservation standards.** It is commonly acknowledged that one of the key tensions caused by flood adaptation interventions on historic properties lies in potential adverse impacts on historic character and negative streetscape change. While flood retrofitting design guidelines have been more widely developed for the structural elevation of historic detached single homes, adaptation strategies targeted at high-density **urban building types** (4 mentions) and historic urban fabrics remain scarce. Design guidelines that serve to steward high-density historic urban forms towards flood resilience shall be more actively developed by local preservation and planning agencies, with a more **holistic approach** (3 mentions) that takes street space and urban design elements into account, and a **change in preservation philosophy** (3 mentions) that embraces spatial changes as interpretable layers of historic significance. Historic preservation standards, floodplain management regulations, and flood insurance policies shall be updated in accordance to accommodate flood retrofitting on historic properties and retrofitting strategies beyond structural elevation.

- **Both professional practitioners and the public will benefit from a public-facing information-sharing platform that consolidates policy, design, technical and financial resources on heritage resilience.** Since heritage resilience is an inherently complicated and interdisciplinary discourse, preservationists and homeowners interviewed in this project have both identified the need for an information-sharing mechanism that would contribute to the knowledge exchange between the preservation profession and other related fields (e.g. urban planning and floodplain management), and inform historic property owners of flood-resistant construction standards, project review processes, funding opportunities, as well as available design and technical guidance. Online platforms and social media are among the effective means of heritage resilience knowledge exchange; on this front, the Interactive Map launched as part of this project may be seen as an experimental attempt.

- **Heritage resilience shall be incorporated into local land-use planning strategies that manage climate resilience with a broader scope and a more comprehensive approach.** In recent years, the urban flood resilience planning practice has evolved from merely fortifying buildings and deploying protective infrastructure into a more comprehensive approach that manages water by setting up land use and urban development parameters, designating ecological restoration areas and flexible floodways, and envisioning resilience infrastructure that may combine with existing road systems or provide new landscape and public space. By actively engaging in neighborhood and city-level resilience planning processes, preservationists may leverage large-scaled resilience projects for the protection of significant historic resources, and further align urban resilience plans with historic preservation interests. With more land-use and zoning rules being made on the climate resilience front, an integrated framework of planning policies that address multiple climate risks (e.g. sea level rise, storm surges and hurricanes) and resilience agendas (zero carbon, energy retrofitting and green retrofitting) may be established; neighborhood-scaled resilience plans shall also incorporate considerations that address underlying environmental justice and infrastructural issues. This observation is connected to other keywords such as **Multi-Hazard Mitigation Planning** (4 mentions), **Neighborhood-Scaled Strategies** (3 mentions), **Social & Environmental Equality** (3 mentions), and **Streamlined Review Processes** (2 mentions).

- **Interdisciplinary collaboration is critical for the making of heritage resilience plans and design guidelines.** Almost all cutting-edge heritage resilience design guidelines published in recent years — from National Park Service's *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (2021), to Charleston, SC's *Design Guidelines for Elevating Historic Buildings* (2019), and Miami Beach, FL's *Buoyant City* (2020) — stemmed from an interdisciplinary policy-making dialogue involving architects, preservationists, planners, emergency managers, contractors and the public, which is very often led by governmental preservation agencies or city governments. Mirroring these successful practices, local preservation agencies in waterfront cities should be more proactive in leading an inter-agency and interdisciplinary policy-making effort to produce a design and regulatory framework that transforms local historic resources towards flood resilience.

These observations reveal the challenges and opportunities commonly identified on a nationwide scope and within different local contexts, and are therefore to a great extent applicable to New York City's heritage resilience policy-making. The recommendations summarized in this section will be integrated into the policy reform and policy-making agendas raised by the author for New York City in Digital Report 06: Policy & Procedural Recommendations.

Part III

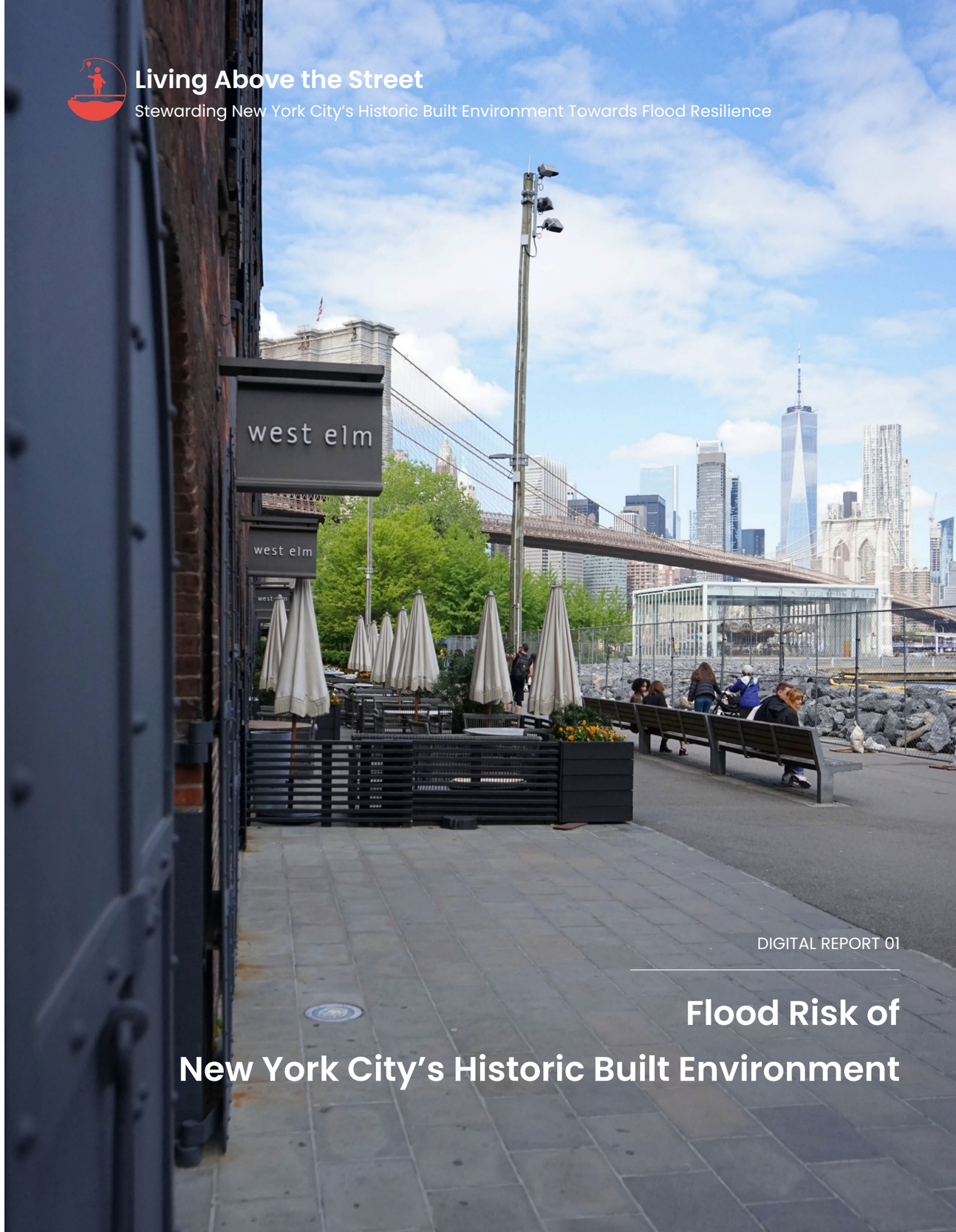
Policy & Design Reports

Introduction

This part features the author's original research that seeks to develop design and policy tools to address flood adaptation and historic urban form change in New York City's context, and fill in the missing pieces that lie within the city's heritage resilience framework. Specifically:

- Digital Report 01 - Flood Risk of New York City's Historic Built Environment demonstrates the physical flood risk faced by New York City's urban historic resources, which is compounded by uncontrolled streetscape changes brought by adaptation interventions, and the city's insufficient heritage resilience policy-making.
- Identifying streetscape change as the key area of tension in the flood adaptation of historic built environment, Digital Report 02 - Adaptive Streetscape: Concept & Framework proposes an "Adaptive Streetscape" framework and a set of evaluation metrics that serve to understand and measure the various values involved in the transformation of historic streetscapes towards flood resilience.
- Addressing the absence of streetscape-sensitive flood retrofitting design strategies targeted at New York City's historic buildings and neighborhoods, Digital Report 03 - Streetscape-Sensitive Design Strategies seeks to explore such strategies based on nationwide flood retrofitting regulations and guidelines, successful built cases, together with the author's own illustrative input.
- Applying the Adaptive Streetscape framework and streetscape-sensitive design strategies to New York City's real-world historic urban environment, Digital Reports 04 and 05 feature two street-scaled adaptation design studies respectively investigating a historic mixed-use/commercial corridor (Front Street in South Street Seaport) and a historic residential corridor (East 118th Street in East Harlem).
- As a conclusion to the whole research project, in Digital Report 06 - Policy & Procedural Recommendations, the author summarizes findings made in the previous Digital Reports, generalizes a "planning — design — review" procedure for the flood adaptation of historic street corridors, and synthesizes all needs for policy reform and policy-making identified throughout the project into 9 policy-making agendas.
- Supplementing Digital Reports 01-06, Digital Report 07 - Terms & Full Bibliography provides a concise glossary of terms and acronyms used in this project, and a compiled full bibliography.

These reports are expanded upon the author's M.S. Historic Preservation thesis "Living Above the Street: Flood Retrofitting and Adaptive Streetscape of New York City's Historic Districts"; a more detailed executive summary is also available at the beginning of each Digital Report. Two sets of page numbers are provided for the compiled Digital Reports: for example, 252 (III-6) denotes page 252 of the final report, which corresponds to page 6 in the compiled Digital Report 03.



Livingabovethestreet.nyc

About

This report is part of the independent research project "Living Above the Street: Stewarding New York City's Historic Built Environment Towards Flood Resilience," which is supported by Onera Foundation under 2022 Onera Prize for Historic Preservation.

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Further Readings

To view and download the whole series of policy & design reports, please visit:
https://www.livingabovethestreet.nyc/reports.

This Onera Prize research project is developed upon the author's M.S. Historic Preservation thesis:
Wang, Ziming. 2022. "Living Above the Street: Flood Retrofitting and Adaptive Streetscape of New York City's Historic Districts." M.S. Historic Preservation Thesis, Columbia University.
https://doi.org/10.7916/fn43-vb19.

Cover Image:
The Empire Stores in Brooklyn with Jane's Carousel in the background, which were both inundated by Hurricane Sandy in 2012. Photograph taken by the author.

"Like much of NYC, the Wyckoff House Museum experienced flooding last night due to extremely heavy rains. This is following on the footsteps of another record rainfall last week.

Climate change is very real and historic structures are especially vulnerable to increased rainfall and serious flooding. The flooding impacted our root cellar, which housed farm tools and mechanical equipment."

Facebook Posting from Wyckoff Farmhouse Museum after Hurricane Ida, Sep. 2, 2021.

ABC7NY. "Historic House in NYC Severely Damaged by Flooding from Ida." Sep. 4, 2021.

Contents

01

Executive Summary

Executive Summary

Flooding and sea level rise are threatening the integrity of New York City's historic built environment. Currently, 31 locally designated Landmarks Preservation Commission (LPC) historic districts and 33 National Register historic districts intersect with New York City's floodplain, representing respectively **20.0%** and **24.6%** of the whole city's historic district designations. As extreme storms repeat and the floodplain expands, a larger proportion of New York City's historic urban fabric is expected to be under imminent flood risk in the near future.

Although the intersection between historic districts and floodplain might be the most intuitive indicator of the flood risk faced by New York City's historic built environment, it's important to acknowledge **the diverse body of historic assets** that are exposed to flood impact. In the floodplain, we are not only able to find designated historic districts, but also individual landmarks, undesignated historic neighborhoods, and intact historic streetscapes; beyond individual buildings with historic significance, we must take various historic urban forms into consideration, and actively plan for their transformation towards flood resilience.

The physical flood risk faced by New York City's historic built environment is further compounded by the **lack of innovative design strategies as well as systematic construction standards and review procedures** necessary for its flood adaptation. After Hurricane Sandy, New York City's Building and Zoning Codes started to require the eventual elevation of all habitable spaces of structures within the city's 1% floodplain to the Design Flood Elevation (DFE); under this regulation, efforts to lift living spaces above street level have caused uncontrolled streetscape change in New York City's waterfront communities. Meanwhile, historic structures, neighborhoods and districts have been to a considerable extent left out of the city's flood resilience discourse, as there hasn't been any comprehensive city-level retrofitting design guidelines for historic properties, nor neighborhood-scaled flood resilience study featuring historic communities made in recent years. In addition, historic structures are often exempted from both Federal and city-level retrofitting mandates, and their retrofitting is often not financially incentivized. The combined effect of these blank spots in flood adaptation and historic preservation policy-making cause New York City's historic built environment to be **even more vulnerable to both physical flood threat and potential adverse impacts brought by retrofitting interventions.**

In this report, the author discusses how physical flood risk and insufficient adaptation and preservation policy-making leave the future of New York City's historic built environment at high stakes. At the end of this report, several case studies are made to help us better conceptualize real-world impacts of floodwater and sea level rise on urban built heritage.

02

Physical Flood Risk of New York City's Historic Built Environment

2.1

Mapping Historic Districts, Landmarks and Neighborhoods in New York City's Floodplain

It's empirically known that various historic resources in New York City are under high risk of flood impact. For example, during Hurricane Sandy of 2012, floodwater inundated the South Street Seaport area, "rising in some areas to eight feet in depth" and causing ground-floor businesses to close for months; during Hurricane Ida of 2021, the Wyckoff House in Brooklyn — the oldest structure in New York City — witnessed up to seven feet of inundation in its root cellar, damaging farm tools and mechanical equipment (The City of New York 2013, 374-375; ABC7NY 2021).

Flood damage on heritage sites may be viewed as part of the broader flood risk faced by New York City's whole waterfront built environment. In 2012, Hurricane Sandy inundated an area of 51 square miles in New York City, containing approximately 88,700 buildings; the area and number of properties at risk of flooding are anticipated to continue to increase through the 2050s, as sea level rises, extreme hurricanes and storms repeat, and the floodplain expands (The City of New York 2013, 13, 85).

Despite the frequent reports of historic neighborhoods and properties being flooded in New York City, there doesn't seem to be a comprehensive survey of historic resources under flood risk. To build a better understanding of the flood risk faced by New York City's historic built environment, this section seeks to locate historic resources at risk by **mapping historic districts, landmarks, and neighborhoods in New York City's floodplain** using GIS-based spatial analysis.

Data Sources

To analyze the flood risk faced by New York City's historic resources, this project uses the following spatial data:

FEMA's PFIRM geodatabase. FIRM (Flood Insurance Rate Maps) and PFIRM (Preliminary Flood Insurance Maps) are FEMA's official nationwide map series showing floodplain boundaries, Base Flood Elevations and floodways. New York City's effective FIRM maps are most recently revised in 2007, incorporating a stock of approximately 35,500 buildings in its 1% floodplain (The City of New York 2013, 23); on the other hand, PFIRMs are FEMA's updated, non-final flood maps issued in December 2013, encompassing a stock of 71,500 buildings in New York City's 1% floodplain (NYCDCP 2014, 16). To keep on track with most recent flood map revisions, this project uses New York City's PFIRM geodatabase acquired from FEMA's Flood Map Service Center in August 2022.[1]

NYC Landmarks Preservation Commission's Historic District and Individual Landmark shapefiles. These shapefiles — available on NYC Open Data — provide geographical information of NYC's locally designated LPC historic districts and individual landmarks. This project uses the Feb. 28, 2023 revision of LPC's historic district database and individual landmark site database (excluding non-building listings such as bridges, lampposts and sidewalk clocks).

New York State Historic Preservation Office's Cultural Resource Information System (CRIS) data. The GIS-based CRIS system lists National Register historic resources across the State. This project uses New York City's CRIS data requested by the author from New York State Historic Preservation Office in April 2023, which the author then processed to separate building assets and historic districts.

Mapping Method

Intersection calculation is executed in ArcMap to find historic resources that overlap New York City's 1% or 0.2% floodplain. In accordance with the data structure of LPC and New York SHPO's shapefiles, **subsequent extensions are mapped and counted as individual historic districts.** Only currently listed National Register Historic Districts are mapped and counted, excluding those with eligible or undetermined status.

Findings: Flood Risk on Neighborhood Level

As maps and diagrams on pages 10-14 have shown, a considerable portion of New York City's neighborhood-level historic fabrics are currently under imminent flood risk. Specifically:

31 locally designated **LPC Historic Districts** intersect with New York City's current floodplain, accounting for **20.0%** of all such designations across the city (see pages 10-11 for details);

33 National Register Historic Districts intersect with New York City's current floodplain, accounting for **24.6%** of all such designations across the city (see pages 12-13 for details).

These results reveal that about **one in every five designated historic districts in New York City will likely be inundated by floods reaching 1-in-100-year magnitude — such as those created by the likes of Hurricane Sandy or Hurricane Ida.**[2]

1 For further explanation of terms related FEMA's Flood Maps, please refer to *Digital Report 07: Terms & Full Bibliography*.

2 According to New York City's Post-Sandy report, "Sandy's storm tide caused flooding that exceeded the 100-year floodplain

LPC Historic Districts Under Flood Risk

31 locally designated LPC Historic Districts intersect with New York City's current floodplain, accounting for **20.0%** of all such designations across the city.

Boerum Hill Historic District & Extension;
Chelsea Historic District & Extension;
Cobble Hill Historic District;
DUMBO Historic District;
East 10th Street Historic District;
Eberhard Faber Pencil Company Historic District;
Ellis Island Historic District.
Fraunces Tavern Block Historic District;
Fulton Ferry Historic District;
Gansevoort Market Historic District;
Governors Island Historic District;
Greenpoint Historic District;
Greenwich Village Historic District;
SoHo-Cast Iron Historic District & Extension;
South Street Seaport Historic District & Extension;
Stone Street Historic District;
Sullivan-Thompson Historic District;
Tribeca East Historic District;
Tribeca North Historic District;
Tribeca South Historic District;
Tribeca West Historic District;
Weehawken Street Historic District;
West Chelsea Historic District.

Hunters Point Historic District

Fort Totten Historic District

Douglaston Historic District

New York City Farm Colony - Seaview Hospital Historic District

Atlantic Ocean
Hudson River
Eastchester Bay
Little Neck Bay
Upper New York Bay
NEW JERSEY
Lower New York Bay
Raritan Bay

N
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FEMA PFIRM Floodplain

1% Annual Chance Floodplain (SHFA) Including Zones A, AE, AO, VE

0.2% Annual Chance Floodplain

LPC Historic Districts

LPC Historic Districts Intersecting 1%/0.2% Annual Chance Floodplain

LPC Historic Districts Outside Floodplain

Data Sources: FEMA Map Service Center (2022); NYC Open Data (2023). Mapped by Ziming Wang, Apr. 2023.

National Register Historic Districts Under Flood Risk

33 National Register Historic Districts intersect with New York City's current floodplain, accounting for **24.6%** of all such designations across the city.

Boerum Hill Historic District;
Brooklyn Navy Yard Historic District;
Chelsea Historic District & Extension;
Cobble Hill Historic District;
DUMBO Industrial Historic District;
Fulton Ferry Historic District;
Gansevoort Market Historic District;
Gowanis Canal Historic District;
Greenpoint Historic District;
Greenwich Village Historic District;
Rockwood Chocolate Factory Historic District;
SoHo Historic District (NR+NHL);
South Street Seaport Historic District & Extension;
South Village Historic District;
Stone Street Historic District;
Two Bridges Historic District;
Wall Street Historic District;
Wallabout Industrial Historic District.

Sailors' Snug Harbor District
Bennett, Floyd, Field Historic District
Fort Wadsworth Historic District
Jacob Riis Park Historic District
Fort Tilden Historic District
Richmond Town Historic District
Miller Army Air Field Historic District

East Harlem Historic District
Sutton Place Historic District
Hunters Point Historic District
Douglaston Historic District

Far Rockaway Beach Bungalow Historic District

Atlantic Ocean
Hudson River
NEW YORK
Eastchester Bay
Little Neck Bay
Upper New York Bay
NEW JERSEY
STATEN ISLAND
Lower New York Bay
Raritan Bay

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FEMA PFIRM Floodplain

1% Annual Chance Floodplain (SHFA) Including Zones A, AE, AO, VE

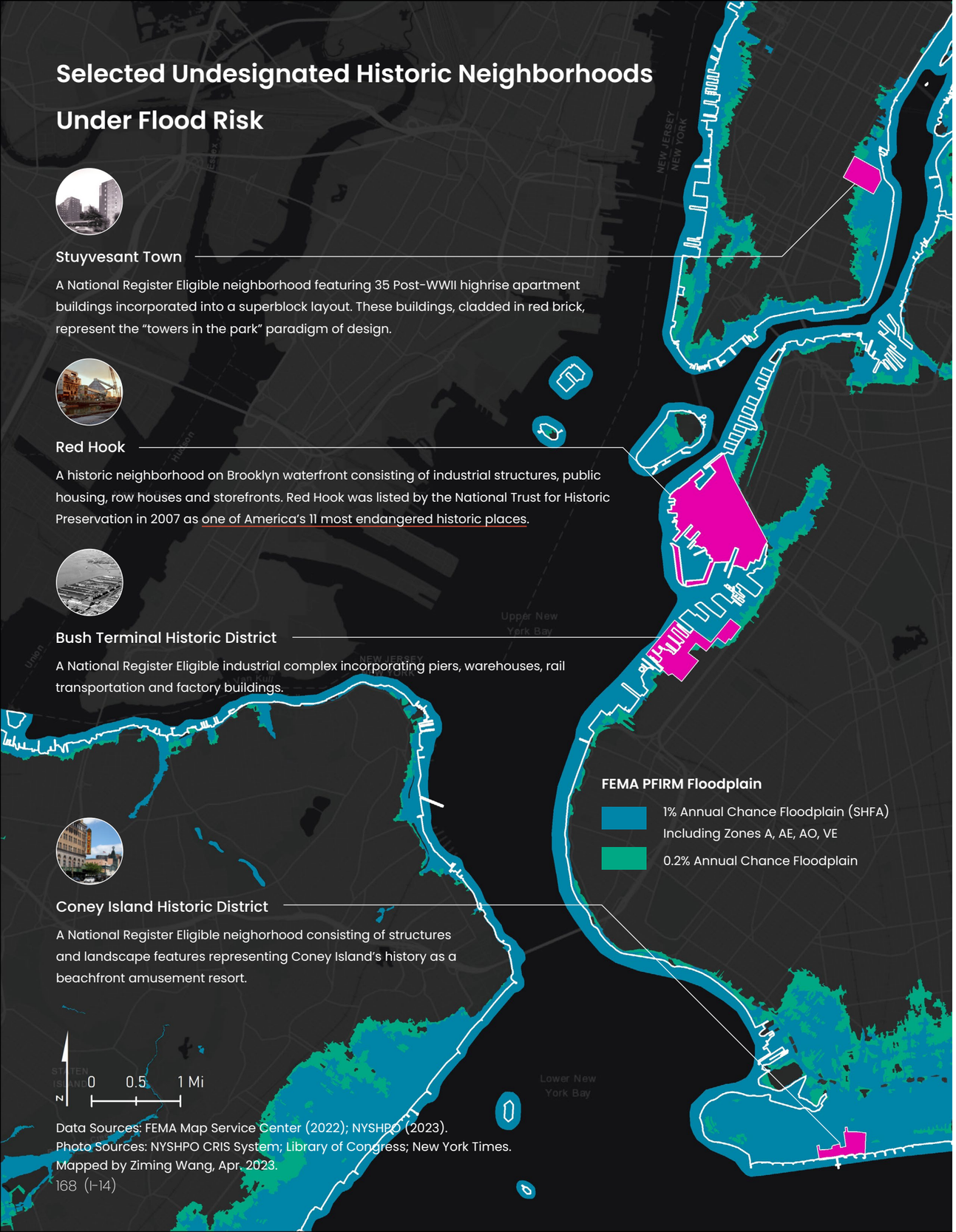
0.2% Annual Chance Floodplain

National Register Historic Districts

NR Historic Districts Intersecting 1%/0.2% Annual Chance Floodplain

NR Historic Districts Outside Floodplain

Data Sources: FEMA Map Service Center (2022); NYSHPO (2023); NYC Open Data (2022). Mapped by Ziming Wang, Apr. 2023.



Most of these flood-threatened historic districts cluster around Downtown Manhattan and Downtown Brooklyn, which corresponds to the overall distribution of all LPC and National Register historic districts in New York City.

Additionally, multiple historic neighborhoods not yet recognized by Federal or local designation are also sitting in the floodplain — such as Stuyvesant Town, Red Hook, Bush Terminal, or Coney Island (see page 14). Lacking the protection of local Landmark Law and Federal historic preservation regulation, these neighborhoods are likely to be more susceptible to redevelopment or adverse impacts brought by flood retrofitting interventions.[3]

Findings: Flood Risk on Building Level

As maps on pages 16-19 have shown, **182 LPC Individual Landmark Buildings** are located partially or fully within New York City's current floodplain, accounting for **13.2%** of all such designations across the city; **99 National Register historic buildings** are located partially or fully in the floodplain, accounting for **12.8%** of all such designations across the city.

Overall speaking, **one in every ten designated historic buildings in New York City is subject to imminent flood risk.** Furthermore, extreme floods and storm surges can also impact historic properties located outside the floodplain. For example, the Wyckoff House Museum inundated by Ida is only adjacent to FEMA's PFIRM floodplain, but not located within it.

The designated historic buildings in New York City's floodplain represent a great diversity in scale and characteristics. They range from detached houses in Staten Island and Bronx, to attached row houses in South Street Seaport and Chelsea, to large-scale civic structures such as the U.S. Custom House and Marine Air Terminal, and to various commercial buildings including the Hanover Bank and the Barclay-Vesey Building. There are also religious structures (e.g. St. Cecilia Church and Convent) and industrial structures (e.g. Sohmer Piano Factory) identified in the floodplain. These buildings have together constituted a diverse flood risk portfolio, and thus call for flexible and customized strategies in flood adaptation.

Based on observations made from the mapping of historic resources in New York City's floodplain, in the next section, the author will further discuss the diversities that lie within the city's flood-threatened historic resources. In addition, non-building assets such as bridges, subway stations, memorials, forts and cemeteries are also found in or near the city's floodplain, which may be worthy of further research in the future.

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boundaries by 53 percent citywide" (The City of New York 2013, 13). Similarly, NOAA's forecast predicted that Hurricane Ida could potentially cause 1-in-100-year rainfall for some areas.

3 Further discussions will be made in Section 3.2 and *Digital Report 02 - Adaptive Streetscape: Concept & Framework* regarding the adverse streetscape impacts brought by flood retrofitting interventions.

LPC Individual Landmark Buildings Under Flood Risk

182 LPC Individual Landmark Buildings intersect with New York City's current floodplain, accounting for **13.2%** of all such designations across the city.


27-41 Harrison Street


2-18 Fulton Street


Barclay-Vesey Building


United States Custom House


Hanover Bank


Kreischerville Workers' Houses


Samuel Pell House


Marine Air Terminal

0 1 2 Mi

Data Sources: FEMA Map Service Center (2022); NYC Open Data (2023).
Photo Sources: NYCLPC; NYC-Landmarks.com; Wikimedia Commons.
Mapped by Ziming Wang, Apr. 2023.

FEMA PFIRM Floodplain

1% Annual Chance Floodplain (SHFA) Including Zones A, AE, AO, VE

0.2% Annual Chance Floodplain

LPC Individual Landmark Buildings

LPC Landmark Buildings Intersecting 1%/0.2% Annual Chance Floodplain

LPC Landmark Buildings Outside Floodplain

National Register Historic Buildings Under Flood Risk

99 National Register historic buildings intersect with New York City's current floodplain, accounting for **12.8%** of all such designations across the city.


Sohmer Piano Factory


Long Island City Post Office


Fraunces Tavern


Charlie Parker House


Reformed Church on Staten Island


TWA Air Terminal

Atlantic Ocean
Eastchester Bay
Little Neck Bay
Hudson River
NEW YORK
NEW JERSEY
Newark Bay
Upper New York Bay
Lower New York Bay
STATEN ISLAND
Raritan Bay

N
0 1 2 Mi

FEMA PFIRM Floodplain

1% Annual Chance Floodplain (SHFA) Including Zones A, AE, AO, VE

0.2% Annual Chance Floodplain

National Register Historic Buildings

NR Historic Buildings Intersecting 1%/0.2% Annual Chance Floodplain

NR Historic Buildings Outside Floodplain

Data Sources: FEMA Map Service Center (2022); NYSHPO (2023).
Photo Sources: Wikimedia Commons; Untapped New York; Charlie Parker Residence.
Mapped by Ziming Wang, Apr. 2023.

2.2

Characterizing New York City's Flood-Threatened Historic Built Environment

The historic resources in New York City's floodplain represent a wide range of historic periods, structural types, construction methods, styles and characters. To better understand how diversities within New York City's flood-threatened historic built environment would influence its flood adaptation, this section summarizes key factors on neighborhood and building level that create varieties in historic characters and affect adaptation planning decisions.

Neighborhood-Level Varieties

Designation Status. Designated historic districts are generally better researched and protected than undesignated historic neighborhoods. According to the *Rules of New York City Landmark Preservation Commission* ("Title 63"), all alterations of historic district buildings and new constructions in selected historic districts are subject to an application—review process; preservation master plans have also been made by LPC for several local historic districts. On the Federal level, the designation of a National Register historic district requires an owner consent process, and may thus represent local property owners' collective acknowledgment of its historic significance (see NPS n.d.). For both LPC and National Register historic districts, designation reports tend to provide a comprehensive understanding of a historic district's history, significance, formal features, and current condition.

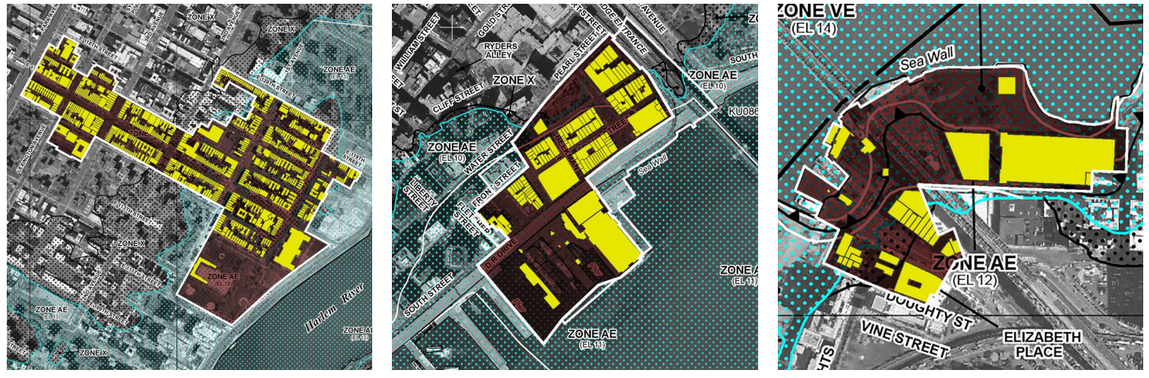
Street Corridor Function. Street corridor function is a deciding factor for both the character of a historic neighborhood characteristics and its flood adaptation options. Different street-level uses (Residential, Commercial or Mixed-Use) not only create different formal qualities and spatial compositions, but also define pedestrians' behavioral patterns as they interact with the streetscape. For example, as compared to a residential corridor, a commercial corridor tends to have greater street-level transparency, more street furniture, awnings and signage, and better accessibility to streetfront structures; it may attract a more diverse body of visitors, who will likely perform a variety of activities along the street. **More importantly, commercial and residential first-floors are subject to separate flood-resistant construction standards in New York City's Building Code, and thus involve different available options of retrofitting strategies.**[4]

4 More detailed discussion on New York City's regulation framework on floodplain buildings will be made in Chapter 3 and *Digital Report 02 - Adaptive Streetscape: Concept and Framework*.

Lot Size. Lot size plays a significant role as it defines the scale and influences the human experience of historic urban environment; moreover, lot size may also be able to reflect a historic neighborhood's predominant building type(s). A historic neighborhood may primarily consist of **small lots**, which are typically around 25 ft in frontage, accommodating row houses or similar low-to-mid-rise structures; **mid-sized lots**, where lot mergers have occurred to accommodate mid-rise apartment/mixed-use buildings with a larger footprint than row houses; or **large lots**, which often incorporate a frontage larger than 50 ft and house large-scale industrial and commercial buildings.

Predominant Building Type(s). Many historic districts and neighborhoods are known for the stylistic features and spatial layouts of buildings commonly found within them — for example, cast-iron commercial structures are associated with SoHo; mixed-use, mid-rise apartments and storefronts are associated with South Street Seaport; and brownstone row houses may be associated with Central & East Harlem. Building typology not only defines a historic neighborhood's character, but is also connected to decisions on what flood-resistant standards are applicable and what flood retrofitting interventions are appropriate.

Based on the key factors identified above, the illustration below examines three historic districts with distinct characters through a comparison of their site plans.



East Harlem / 116th St Corridor	South Street Seaport / Front St Corridor	Fulton Ferry / Water St Corridor
National Register	LPC + National Register	LPC + National Register
Small Lot	Mid-Sized Lot	Large Lot
Residential Use	Mixed Use	Commercial Use
Low-Rise Row Houses	Mid-Rise Apartments & Storefronts	Former Industrial Structures

Various physical characters of New York City's flood-threatened historic neighborhoods.
Data Sources: FEMA (2015); NYCLPC (2023); NYSHPO (2023); NYCDCP (2022). Mapped by Ziming Wang.

Building-Level Varieties

As revealed in the mapping process, great diversities lie within the flood-threatened historic building stock of New York City. These historic buildings incorporate various structural, formal and historic features that define their significance, and call for more customized retrofitting solutions and more detailed classifications as compared to those targeted at the general existing building stock. While New York City Department of City Planning's *Retrofitting Buildings for Flood Risk* report (2014) characterizes New York City's residential-related floodplain building stock into 6 major categories (Bungalow, Detached, Semi-Detached, Mid-Rise Walk-up, and Mid-Rise Elevator) and identifies key issues and retrofitting design strategies based on each category (NYCDCP 2014, 20; 32-36), a more case-by-case approach may be necessary to form strategies for historic buildings in New York City's floodplain. Below are several key factors that should be considered when plans to mitigate the flood hazard of historic structures are made.

Structural Type, Construction and Scale. New York City's waterfront historic buildings incorporate a wide range of structural types, from wood-framed houses to masonry, concrete and steel-framed structures. Many of them also have specific, character-defining materials and constructions (for example, the shared party walls between speculative row houses, and the cast-iron facades used in SoHo's commercial storefronts). Furthermore, the structural type of a building may to a considerable extent define its scale: for example, wood frames are generally used for small, low-rise structures, while concrete and steel frame may support large commercial and civil structures. **The question of structural type is important, because it defines what retrofitting strategies are feasible** — for example, it would be possible to structurally elevate a detached single-family house onto a new foundation, but such intervention would be impractical for mid-rise masonry apartments and row houses with shared party walls.

Function & Use. Whether a building is residential, commercial or mixed-use (which typically means first-floor commercial use and upper-floor residential use) is a key factor that shapes historic characters, because **it defines what flood-resistant construction standard a building is subject to, and which retrofitting strategies are recognized by the Building Code.** New York City's Post-Sandy Building Code requires residential structures in floodplain to have their habitable use relocated above the Design Flood Elevation (DFE); while commercial storefronts on street level may just be dry-floodproofed (see New York City's 2014 Building Code, Appendix G, Section G304.1).

Character-Defining Features and Spatial Layouts with Historic Significance. Historic properties often incorporate architectural, spatial and decorative features that demonstrate their historic significance and reflect historic social-spatial relationships. **Understanding these character-defining features and layouts may help us choose appropriate retrofitting strategies that best preserve a building's historic significance.** For example, it would be inappropriate to elevate detached single homes by a great height over exposed concrete piles, as it significantly damages the building's historic form, proportion, entrance context and streetscape relationship; it would also be unfavorable to directly relocate retail storefronts in a historic main street to above street level without sufficient streetscape mitigation design, since this intervention alters the historic social-spatial relationship where pedestrians and residents interact with transparent, human-scaled retail spaces as they walk along the street. Important interior spaces (e.g. lobbies or entrance halls) and decorative features (such as historic signage and wall finishing materials) should also be preserved during retrofitting intervention. Since character-defining features vary from one building to another, a **case-by-case evaluation** may be needed to select the retrofitting strategy that best preserves a building's historic characters.

Streetscape Expression, Basement & Access. As was just discussed, street-level entrances of detached houses, stoops and yards in front of row houses, transparent storefronts on commercial corridors, commercial spaces in cellars, signage, awnings and other forms street-level expression often serve as a defining feature for the characters of New York City's historic neighborhoods. Many retrofitting interventions — such as structural elevation, implementation of new exterior stairs, and filling basements or cellars — will inevitably damage a historic building's human-scaled and vigorous streetscape expressions by changing how building uses are located or accessed. **Therefore, streetscape change is the key area of tension in the flood retrofitting of historic structures, and has become the focusing point of multiple flood retrofitting design guidelines on local and state level.** The streetscape issues brought by flood retrofitting interventions will continue to be further explored in the upcoming reports.

Critical Systems. Building systems — including Mechanical, Electrical, Plumbing (MEP) and Elevators — are essential for a building's daily functioning, and can be easily inundated by flood (NYCDCP 2014, 33). Historic buildings may have critical systems built or installed in different historic periods and located at different heights. To ensure the normal operation of a building under flood impact, the floodproofing, relocation or replacement of critical systems should also be considered in flood retrofitting design.

03

Flood Risk Compounded by Adaptation & Preservation Policies

New York City's historic built environment is not only threatened by physical flood risk represented by floodplain designation, but also by flood retrofitting interventions under the current regulation framework that may bring adverse impact to the characters of historic urban fabric, as well as historic preservation policies that don't sufficiently support the flood adaptation of historic districts, neighborhoods and buildings. Specifically, the following policy-related issues have been observed:

- **New York City's Post-Sandy Building Code and Flood Zoning require the gradual elevation of all habitable spaces of structures within the 1% floodplain to above Design Flood Elevation (DFE), which has in turn caused various uncontrolled streetscape changes in the city's waterfront neighborhoods;**

- **Historic districts, neighborhoods and buildings have been to a considerable extent left out of New York City's discourse on flood adaptation. As the policy-making process lags behind, there has been a lack of innovative retrofitting design strategies and design-review mechanism targeted at the flood retrofitting of historic structures;**

- **As designated historic buildings are largely exempted from New York City's flood-resistant construction standards and NFIP's floodplain management regulations, they are more likely to be left flood-prone due to the lack of retrofitting mandate and incentives.**

These conditions have together posed compound policy challenges and further complexified the flood adaptation of New York City's historic built environment. By analyzing key flood adaptation policies and regulations relevant to New York City's context — namely **New York City's Building Code, New York City's Flood Zoning, National Flood Insurance Program (NFIP)'s floodplain management regulations, and LPC's design review standards** — this section examines the limitations within New York City's flood adaptation and historic preservation standards, and discusses how they impact the stewardship of New York City's historic built environment towards flood resilience.

3.1
New York City's Flood-Resistant Construction Standard & Flood Zoning

New York City's Post-Sandy Building and Zoning policy-making started as early as in 2013. Currently, New York City's Building Code (2014) implements a mandate for 1% floodplain buildings to eventually elevate habitable

spaces; meanwhile, the City's two Flood Zoning Amendments provide zoning-level support to the Post-Sandy Building Code, and lay out exemptions and incentives to expedite flood-resistant construction and reconstruction in the floodplain.

NYC Building Code Appendix G: Flood-Resistant Construction Standard

In January 2013, shortly after Hurricane Sandy stroke United States' Northeast coast, an emergency executive order was adopted by New York City's Office of the Mayor, requesting flood reconstruction projects to raise their first floors and incorporate floodproofing treatments (NYCDCP 2013a). This policy is refined and solidified in the current (2014) version of New York City's *Building Code* (NYCDOB 2014), which explicitly requires in its Appendix G – "Flood-resistant Construction" – that **"all habitable spaces of new construction, and existing buildings that were substantially damaged or are undertaking substantial improvements" within the 1% floodplain "to be raised above the Design Flood Elevation (DFE)," with additional floodproofing requirements** (NYCDOB 2014; NYCDCP 2019b, 2).

Specific provisions on how floodplain buildings shall be elevated and floodproofed are then provided for flood zones subdivided within the floodplain, such as A Zone, V Zone and Coastal A Zone.[5] Since 97% of New York City's 1% floodplain building stock is located in the A Zone (NYCDCP 2014, 16), A Zone provisions are applicable to most structures regulated by Appendix G. In this project's design studies, **A Zone provisions** are always used to evaluate Building Code compliance. Details of the A Zone provisions are listed as follows:

· **Flood-Resistant Standards for Residential Structures (for flood zone purpose).** All new buildings and substantial improvements shall: 1) Raise the lowest floor, including the basement, to at or above the Design Floor Elevation (DFE); 2) restrict uses in enclosed spaces below DFE solely to parking, access, storage, or crawlspace; 3) wet-floodproof enclosed spaces under DFE (see *Appendix G*, Section 304.1.1).

· **Flood-Resistant Standards for Non-Residential Structures (for flood zone purpose).** New buildings and substantial improvements have two options: **A) Elevation Option**, as is applicable to residential structures; **B) Dry Floodproofing option.** Requirements for the Dry Floodproofing option are as follows: 1) The structure should be dry floodproofed to at or above DFE; 2) All dwelling units and sleeping areas should be located at or above DFE (see *Appendix G*, Section 304.1.2).

It can be clearly seen from New York City's current Building Code that a building's use — especially **first-floor function** — is of key importance in the discussion regarding its flood retrofitting, as residential first-floors must be elevated above DFE, while commercial first-floors are granted more flexibility and can stay on street level as long as dry floodproofed.

Although Appendix G explicitly requires residential spaces to be elevated, it doesn't necessarily mean that whole structures have to be raised upon new foundations. Compliance with Appendix G can be either achieved by **Structural Elevation**, where buildings are physically lifted on a new or extended foundation; or **Non-Structural Elevation**, where active uses are relocated and the interior program is altered, while a building's structure largely remains in the same place (see FEMA 2014, 5-1; NYCDCP 2016b, 34).[6]

New York City's Building Code Appendix G is made in accordance with NFIP's floodplain management regulations, which took effect in New York City after the City joined NFIP in 1983 (NYCDCP 2019b, 2). Therefore, streetscape impacts caused by building elevation is not merely a New York-specific issue, but faced by multiple local communities across the country.

Instances of Structural Elevation and Non-Structural Elevation.
Source: NYCDCP 2014, 43; 73.

In New York City, Base Flood Elevation (BFE) — the elevation of surface water created by a 1% annual chance flood — may reach 12-13 ft above sea level in Manhattan's waterfront area, which could roughly mean 6-7 feet above street level. In Appendix G, Design Flood Elevation (DFE) is defined by local BFE plus an additional freeboard height — typically 1 or 2 ft — based on building use (see *Appendix G*, Table 2-1). **For a simplified calculation, in this project, local DFEs will always be estimated as local DFE plus 1 ft.**

In Appendix G, "substantial improvement" is defined as any repair or improvement of the structure that costs more than 50% of its market value before the project. The "substantial improvement" threshold is used as a tool to gradually require the elevation of habitable spaces, along with the implementation of required floodproofing measures on waterfront structures.

5 For explanation on flood zone terms, please refer to *Digital Report 07: Terms & Full Bibliography*.

6 NPS's *Guidelines on Flood Adaptation* (2021) calls the Non-Structural Elevation method "Elevate the Interior Structure." Under the Non-Structural Elevation scenario, some alteration to the existing structure may still be needed, such as constructing an elevated floor plate above the original first floor, or taking out the second-floor's floor plate to create a double-height space.

New York City's Flood Zoning

To better support the elevation mandates set out in New York City's Post-Sandy Building Code and to remove zoning-level policy barriers, a series of citywide zoning amendments have come into place.

In October 2013, a temporary Flood Zoning Text Amendment was adopted, proposing new baselines for building height measurement within the 1% floodplain, and providing updated provisions for building envelope, access, floor area calculation, streetscape, building equipment, among other issues (NYCDCP 2013a; 2013b).

The 2013 Flood Zoning Amendment was further upgraded in 2019 into the report ***Zoning for Coastal Flood Resiliency: Planning for Resilient Neighborhoods***, which was in turn adopted in May 2021 as the current Flood Zoning of New York City (NYCDCP 2019a; 2019b; 2019c; 2019d). Besides making previous rules permanent and refining regulation provisions, this new flood zoning text is made applicable to the City's 0.2% annual chance floodplain – where Appendix G standards are not required – to further encourage flood-resistant construction and incremental building retrofitting.

Beyond coordinating changes brought by the Flood-Resistant Construction Standard to zoning parameters, New York City's Flood Zoning also seeks to incentivize flood retrofitting and flood-resilient new construction through zoning bonuses and floor area exemptions.

Moreover, **streetscape change** has also become a key consideration in New York City's Flood Zoning. The 2013 Flood Zoning Text Amendment developed streetscape design options for two typical rebuilding scenarios — the structural elevation of a 1-2 family detached home, and the new construction of a relatively large-scaled multi-family and community facility building (NYCDCP 2013b, 29-34). In the 2019-2021 Flood Zoning Amendment, **a point system** is introduced, requiring all buildings to incorporate a set of streetscape mitigation design features regarding building access and street-level expression when they are constructed or elevated. Although New York City's most recent Flood Zoning provides a greater variety of design options on streetscape mitigation, New York City's flood adaptation regulations still remain relatively preliminary in terms of streetscape control. **Especially, there haven't been any systematic streetscape design guidelines for historic structures, and design strategies developed for general construction or reconstruction projects seem to be far from adequate to deal with the flood retrofitting of historic buildings in historic urban context.** The tension between New York City's current streetscape mitigation regulation and waterfront streetscape changes will be further discussed in the next section; illustrations of streetscape mitigation guidelines in 2013 & 2019-2021 Flood Zoning Amendments may be found in *Digital Report 02 - Adaptive Streetscape: Concept & Framework*.

3.2 Streetscape Change as an Outcome

New York City's Post-Sandy Building Code and Flood Zoning have to a great extent redefined what neighborhoods look like in the City's floodplain. Accompanying the rapid execution of thousands of retrofit and new construction projects under Post-Sandy regulations, New York City's "floor-raising" strategy based on individual building retrofitting has caused various streetscape changes in multiple waterfront neighborhoods (e.g. Red Hook, Brooklyn and Breezy Point, Queens), where structures are often elevated or built upon concrete piles or blank street walls and accessed by out-of-context stairs, creating a passive and alienating streetscape.

These uncontrolled streetscape changes speak for the urgent need to develop flood retrofitting and streetscape mitigation strategies suitable for historic buildings and neighborhoods. As many waterfront historic properties are facing imminent flood threat, they will possibly experience major spatial interventions for flood resilience in the foreseeable future; with a lack of innovative design and policy solutions on the flood retrofitting of historic buildings and streetscapes, New York City's historic waterfront urban forms are being left at high stakes.

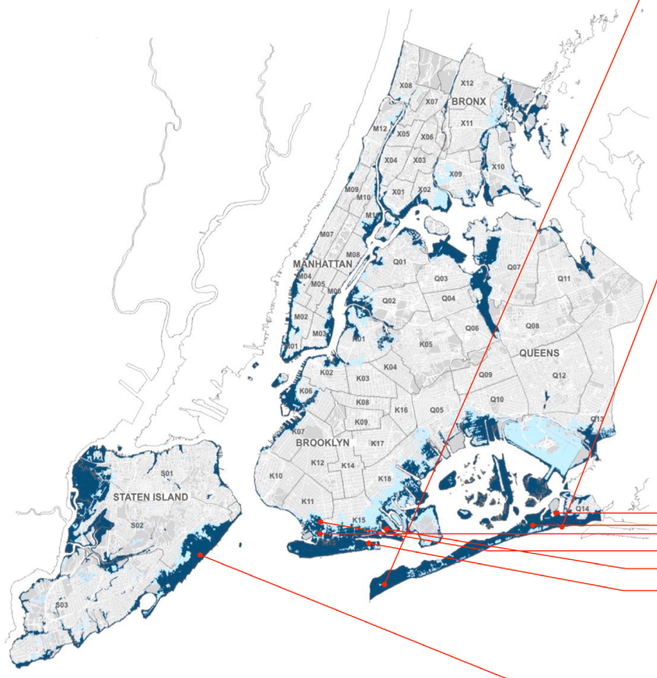
With local Post-Sandy built projects selected and illustrated on pages 30-31, this section examines the streetscape change brought by New York City's Post-Sandy flood regulation through several case studies.

Post-Sandy Retrofitting & Reconstruction Projects

- **Breezy Point Streetscape, 2021.** The structures along Rockaway Point Boulevard in Breezy Point, Queens are elevated onto exposed concrete pile foundations, and accessed by out-of-context stairs. Some foundations are covered by blank concrete walls or lattices on street front, while structures not yet elevated and those elevated to slightly different heights form an inconsistent, alternating pattern ("the lollipopping effect"). These conditions to a great extent diminish the streetscape's visual and experiential qualities, altering the proportion and context of the original urban fabrics.

- **NYC Build It Back Projects, 2016-2019.** Since its start from 2013, NYC Mayor's Office of Housing Recovery Operations (HRO)'s Build It Back program has provided assistance to around 32,000 households impacted by Hurricane Sandy as of 2021, and "has rebuilt and elevated over 1,300 homes to today's stringent regulations for flood compliance" (NYC Recovery 2021; NYC Mayor's Office of Housing Recovery Operations n.d.). These up-to-standard rebuilt projects are often elevated on concrete foundations up to 10 to 14 ft above sea level — an exorbitant height that may bring significant negative streetscape impacts without adequate mitigation. Similar to houses in Breezy Point, the blank concrete walls or piles diminish the vigor, intimacy and human scale of street

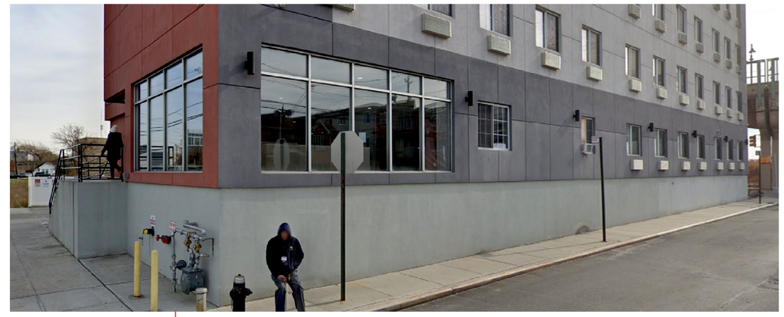
Post-Sandy Built Projects & Associated Streetscape Change



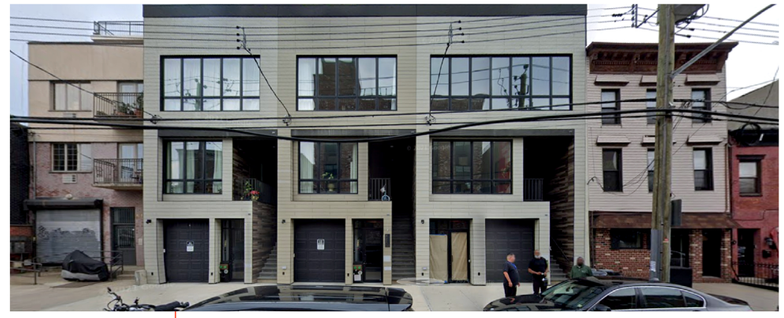
New York City's 1% Floodplain

(2007 FIRM & 2015 PFIRM Combined)

Breezy Point Streetscape, 2021

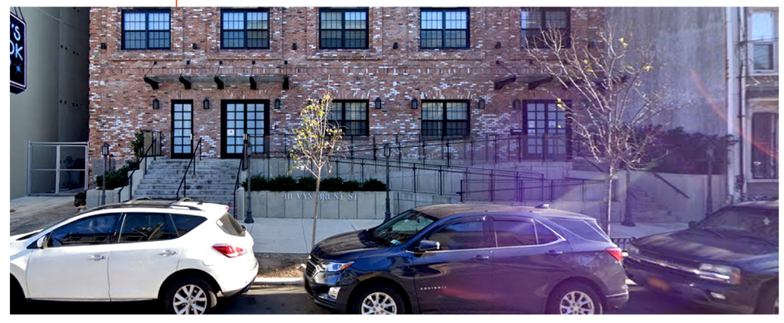


Hotel, 2013, Far Rockaway



Walk-Up Residential Houses, 2018, Red Hook

Selected NYC *Build It Back* Projects, 2016-2019



Community Facility, 2017, Red Hook

Post-Sandy Retrofitting and Reconstructions

Post-Sandy New Constructions

Image Sources: NYCDCP 2019d, 4 (floodplain map); Instagram @nycbuilditback; Google Maps.
Compiled by Ziming Wang, Aug. 2022.

interface, creating a passive streetscape where pedestrians are flanked by open foundations, blank street walls and inactive uses (such as storage and parking).

Post-Sandy New Construction Projects

- **A Hotel Built in Far Rockaway, Queens, 2013.** To elevate all interior spaces above flood elevation, the building encompasses a solid, blank wall all around its parameters on street level. As this is a block-scaled development, such treatment has led to a block-long unfriendly and alienating streetscape.

- **A Set of Walk-Up Residential Houses Built in Red Hook, Brooklyn, 2018.** To accommodate Building Code regulations, all residential spaces have been located on or above the second floor. Although this project has incorporated some of the streetscape mitigation treatments encouraged by New York City's Flood Zoning (recessed stairs and covered parking, etc.), the out-of-context form of stairs and the existence of non-transparent parking function on street level have still created streetscape changes incompatible with the neighborhood's historic urban characteristics. These incompatible streetscape expressions showcase further potentials in the project's streetscape design, which would be an even more important issue for the retrofitting of historic structures or constructions in historic districts.

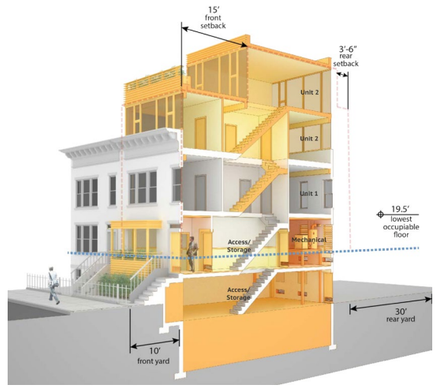
- **A Community Facility Built in Red Hook, Brooklyn, 2017.** This project was praised as a successful example in terms of streetscape mitigation in New York City's 2019 *Zoning for Coastal Flood Resiliency* study (NYCDCP 2019c, 57). Although the project has created a smooth access from street level by incorporating a comprehensively designed stair and ramp system with plantings, the street wall is offset, and the interface between street space and the building's interior is still interrupted by the massive access system. In historic neighborhoods and districts with continuous street walls and intimate streetscapes, stairs and ramps may be placed within the building, if possible, to better preserve the street relationship.

The cases selected and discussed above reveal how passive and alienating streetscape may result from flood retrofitting interventions and the implementation of flood-resistant building standards. Although these cases aren't necessarily retrofitting projects on historic buildings or within historic districts, since not much resilience policy-making has been made for New York City's historic fabric, the City doesn't seem to have a plan to bring its historic resources to flood resilience, while avoiding some of the negative streetscape changes currently present in the city's waterfront neighborhoods.

3.3
Lack of Flood Adaptation Design & Policy Guidelines on Historic Properties

As discussed in Section 3.2, thousands of structures in New York City's waterfront areas have been elevated and retrofitted under the City's Post-Sandy flood regulation framework, causing uncontrolled streetscape changes in waterfront communities. Nevertheless, historic districts, neighborhoods and structures have been to a great extent left out of the flood resilience discourse: **there haven't been any systematic design guidelines for the flood retrofitting of the city's historic structures, nor neighborhood-level flood resilience studies targeted at the city's historic built environment.**

Targeted at the general building stock in New York City's floodplain, New York City's Department of City Planning (DCP) has published a series of retrofitting design guidelines and resilience planning studies, including the 2014 *Retrofitting Buildings for Flood Risk* report. The *Retrofitting* report serves as a key document for property owners to plan for appropriate retrofitting interventions on various properties, as well as for planners and researchers to envision future waterfront urban form change. Although the *Retrofitting* report has successfully put forward 10 real-world flood retrofitting design case studies that cover New York City's floodplain building types and a wide range of considerations (Use, Access, Structural Systems, Critical Systems, Parking, and Streetscape & Visual Connectivity; see NYCDCP 2014, 32-36), **its streetscape design schemes seem insufficient for the flood retrofitting of historic structures.** For example, interventions such as elevating detached houses on latticed pile foundations and new, out-of-context additions atop row houses may not seem to be a big deal for general existing buildings, but could cause significant damage to the characters of historic buildings. Without design guidelines dedicated to historic structures, unplanned and uncontrolled adverse impact may happen when historic structures undergo physical interventions within the flood retrofitting process.



Retrofitting Guidelines for General Building Stock May Not Be Appropriate for Historic Buildings.
Source: NYCDCP 2014, 67.

Similarly, since 2013, DCP has published a series of neighborhood-level resilience studies under its "Climate Resiliency" Initiative, each focusing on a type of urban space (e.g. *Resilient Art Spaces*, 2015; *Resilient Retail*, 2016; and *Resilient Industry*, 2018) or a specific neighborhood (e.g. West Chelsea, 2016; East Village, 2016; and Canarsie, 2017). Nevertheless, in this series, there hasn't been a study dedicated to the preservation and adaptation of a

historic neighborhood.[7] **Without neighborhood-level adaptation studies, preservationists and planners will be unable to develop strategies that coordinate streetscape change across multiple properties, or envision urban form change on neighborhood scale beyond a building-by-building approach.**

The Landmarks Preservation Commission (LPC) is New York City's municipal agency responsible for safeguarding the city's historic landmarks and historic districts. **Although LPC has recognized the need for flood retrofitting historic properties, its policy and guideline-making remains largely preliminary.** Currently, LPC has published two technical memos on relocating mechanical equipment from below BFE to the roof, and installing flood shields on building openings. These interventions have also been incorporated into LPC's current (2019) version of *Permit Guidebook*; but beyond these piecemeal treatments, no further design and policy guidelines are found towards the comprehensive retrofitting of historic buildings for flood resilience.

To steward New York City's historic built environment towards flood resilience, we need not only building and neighborhood-scaled design guidelines, but also reforms in preservation policies and procedures. In New York City, alterations to all locally designated historic buildings are subject to LPC's design review process. Since major retrofitting interventions — such as structural elevation and non-structural elevation — may involve substantial reworking on a building's historic fabrics, they are not likely to be able to pass the design review under current standards. New York City's landmark design review standards may need to be further updated to facilitate the systematic flood retrofitting of historic buildings, just like how New York City's zoning regulation has been revised to accommodate the Post-Sandy Building Code. Furthermore, financial incentives such as historic preservation tax credits shall be explored as a means to stimulate the flood retrofitting of historic structures, and neighborhood-level preservation plan systems (such as LPC's historic district master plans) may adopt policies to encourage flood adaptation and coordinate streetscape change.

Luckily, although New York City's design and policy framework on the flood retrofitting of historic structures and neighborhoods remains preliminary, in recent years, flood retrofitting and streetscape mitigation strategies have been actively developed by various policy-making entities on local, state and Federal levels across the United States. Some local municipalities such as Charleston, SC have published design guidelines for the elevation of historic detached homes, identifying streetscape change as a core issue and developing localized design strategies to ensure human-scaled and context-sensitive streetscape expression; New Jersey and Maryland's State Historic Preservation Offices (SHPOs) have developed guiding documents on the flood mitigation of historic structures, listing different retrofitting options and exploring retrofit outcomes through illustrative design studies; on the Federal level, National Park Service has published *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (2nd ed., 2021), which provides comprehensive guidance on a wide range of temporal and permanent flood adaptation treatments on historic properties. All these research and policy-making efforts may serve as a valuable reference for New York City's future flood adaptation and historic preservation standards, and inform how the City's historic buildings and neighborhoods may be transformed towards flood resilience.

Synthesizing issues and resources identified in this section, *Digital Report 03: Streetscape-Sensitive Design Strategies* will further develop retrofitting design tools responsive to historic streetscapes based on New York City's floodplain building stock, and *Digital Report 06: Policy & Procedural Recommendations* will further discuss key policy agendas that help bridge the discourses of flood adaptation and historic preservation in New York City's context.

3.4
Lack of Incentives & Exemption from Retrofitting Mandates

Beyond the lack of design guidelines and policy procedures as analyzed in Section 3.3, historic property owners may also be less motivated to flood retrofit their historic structures due to the lack of financial incentives and the exemption of historic structures from retrofitting mandates. **Both NFIP's floodplain management standard and New York City's Building Code provide pathways through which designated historic structures may be exempted from the "substantial improvement" regulation, which means that property owners don't have to elevate or retrofit even when they carry out extensive renovation on their historic properties.** Furthermore, unelevated historic structures may continue to secure subsidized flood insurance premium, which may make historic property owners feel less financially compelled to flood retrofit their historic structures.

New York City's Building Code Appendix G is made in accordance with requirements from NFIP's floodplain management standards, since New York City is a participating community of the NFIP program (NYCDCP 2019b, 2). **Although NFIP requires local communities to elevate residential spaces up to BFE when buildings are constructed or renovated, it also provides two pathways through which such mandate may be exempted or variable for structures** listed on National Register, eligible to be listed on National Register, or determined as a contributing structure to a National Register historic district — These structures may either be totally exempted from the "substantial improvement" provision and the associated elevation mandate, or they may be included under the provision, while permitted to gain FEMA variances that serve to loosen the rules on a case-by-case basis (FEMA 2008, 4). Both pathways are based on the condition that the proposed renovation project will not result in the delisting of the historic structure; **among these two pathways, New York City has chosen to exempt properties with either the National Register or LPC designation from the "substantial improvement" provision,**

7 Although some of the neighborhoods covered in DCP's study series (such as West Chelsea) are historic neighborhoods or overlap with designated historic districts, not much discussion has been made on historic preservation considerations.

without providing an alternative local framework that regulates the resilience of historic structures (see Appendix G, Section G201).[8] By exempting designated historic structures from flood retrofitting mandates, thorny issues regarding flood resilience and historic characters may be avoided; nevertheless, it only adds up to the long-term flood risk of historic buildings and neighborhoods, as these historic resources are now left exposed to increasing flood risk without a framework of solutions towards flood resilience.

As the nationwide property flood insurance administered by FEMA, the National Flood Insurance Program (NFIP) is currently required only for properties in the 1% floodplain which have Federally-backed mortgages or received Federal assistance for acquisition or construction; it can also be voluntarily purchased by owners of flood-threatened residential or non-residential properties (FEMA 2021, 1-1; NYCDCP 2016a). **Since a building's flood insurance premium is generally determined by the height difference between BFE and the level of its lowest floor, property owners will likely receive a significantly lower insurance premium after flood retrofitting. On the other hand, buildings not properly elevated will be charged a much higher premium** (NYCDCP 2014, 11; FEMA 2014, 3-5; FEMA 2008, 8).[9] Therefore, many property owners are incentivized to retrofit for the potential decline in flood insurance rates, and whether a retrofitting strategy qualifies for "NFIP Premium Full Reduction" has become one of the key considerations in New York City's flood adaptation planning studies such as DCP's *Retrofitting Buildings for Flood Risk* (2014) and *Resilient Retail* (2016).

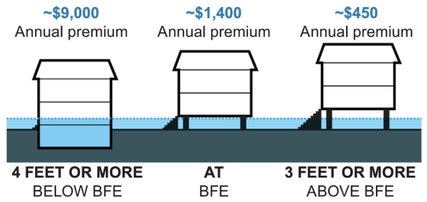


Diagram Showing the Relationship between NFIP Premium and Lowest Floor Elevation.
Source: NYCDCP 2016a.

Nevertheless, under this framework, **NFIP has made subsidized flood insurance rates available to all Federally designated historic structures, whether they are elevated or not** (FEMA 2008, 8-9). This policy is originally designed to encourage historic property owners to retain the National Register status of their properties; but in fact, it may disincentivize property owners to flood retrofit their properties even when they carry out major renovations, as they won't lose the benefit of subsidized insurance rates anyways (see NPS 2021, 22).

The lack of flood retrofitting mandates (from local Building Code) and financial incentives (from insurance policies) may be part of the reason why there haven't been systematic retrofitting design guidelines and policy procedures for historic structures in New York City. If the aforementioned mandates and incentives are adopted, they may encourage historic property owners to flood retrofit, and even push local planning and preservation agencies to put forward design and policy guidelines that help regulate retrofitting projects.

8 Although New York City's Building Code exempts all designated historic buildings from the "substantial improvement" provision, it nevertheless includes a variance-granting mechanism (see Section G107.2.1). However, if historic property owners choose to use the exemption, then no resilience measures will be compulsory.

9 FEMA's *Homeowner's Guide to Retrofitting* states that if homeowners elevate a certain structure to 2 feet higher than BFE, the premium would be 70% lower than if they elevate the structure exactly at BFE (FEMA 2014, 3-5).

04

Case Studies:

Heritage Under Water

In the previous chapters, the author has mapped the physical flood risk faced by New York City's historic built environment, and analyzed how such physical risk is compounded by underdeveloped flood adaptation and historic preservation policies. To supplement these findings, this chapter features several real-world cases and visualization projects that help us better conceptualize the impact of sea level rise and floodwater on historic buildings, neighborhoods, and streetscapes.

Empire Stores, Brooklyn

Situated within Brooklyn's Fulton Ferry Historic District only 20 feet away from East River, the Empire Stores overlooks the Brooklyn Bridge Park and is considered a jewel in the neighborhood. A warehouse complex built on landfill consisting of seven adjacent brick buildings built in circa 1870, the Empire Stores was originally used for "general storage of raw materials" such as sugar and coffee beans, and is renowned for the rows of massive round-arched windows and gates along its facade, covered with operable iron shutters (Dunlap 2017; Laslow 2016; ULI n.d.; NYCLPC 1977a).

When **Hurricane Sandy hit in 2012**, Brooklyn Bridge Park Development Corporation — the owner of Empire Stores — was in the process of calling for proposals to rehabilitate the complex. Local residents in the DUMBO area recalled a flood elevation of 4 to 5 feet inside waterfront buildings resulting from storm surge brought by Sandy; flood also inundated the nearby Jane's Carousel in Brooklyn Bridge Park. (Dunlap 2017; Frost 2012a; Frost 2012b). Flood in Empire Stores was said to "come up to the scaffolding," while photographic evidence shows that the shutters were torn from their hinges after Hurricane Sandy (Frost 2012a; Frost 2012b).

In 2013, Midtown Equities joined force with HK Organization to redevelop the site, with architectural firm Studio V working on building and landscape design. Learning lessons from Hurricane Sandy, the redesigned Empire Stores features a new concrete foundation, and a 1100-foot-long deployable flood shield system which will be transported to the site and installed before anticipated

From Top to Bottom:

Location of Empire Stores.
Source: Author's Illustration.

Berenice Abbott, "Warehouse at Water Street and Dock Street, May 22, 1936."
Source: Brooklyn Historical Society.

The Empire Stores in Novermber 2012 after Hurricane Sandy.
Source: Frost 2012b.

extreme flood events. Some tenants also chose to relocate electrical systems and locate storage and office spaces on higher floors, leaving the street floor to less critical uses (Dunlap 2017; ULI n.d.). The renovated Empire Stores opened in 2017, providing 36,000 square feet of restaurant, retail, office, and event space (Empire Stores n.d.). Its retrofitting strategy demonstrates the possibility of using dry-floodproofing measures to provide a flexible layer of protection to mixed-use buildings, without jeopardizing critical storefront spaces.

The Deployable Flood Shield System Protecting the Empire Stores.
Source: Twitter Posting of AquaFence.

Wyckoff Farmhouse Museum, Brooklyn

Built before 1641, the Wyckoff House is found to be the oldest building in New York City and State; in 1965, it became the subject of NYC Landmarks Preservation Commission's first landmark designation. The single-story farmhouse, standing on its original site, is a rare example of "the Flemish Medieval Survival and the Dutch Colonial styles of architecture" (LPC 1965; Wyckoff House Museum n.d.).

Upper:
Location of Wyckoff House Museum.
Source: Author's Illustration.

Lower:
The Wyckoff House in 2017.
Source: Lore Croghan for *Brooklyn Daily Eagle*.

The Wyckoff Farmhouse Museum is located in the southeast corner of East Flatbush, beside the neighborhood of Canarsie. **Although it is technically outside New York City's current (PFIRM) 1% and 0.2% floodplains, the structure was severely impacted by Hurricane Ida in 2021.** According to the museum's online postings and news report by ABC7NY, the historic house's sub celler witnessed as much as seven feet of water, while the upper cellar was inundated by about five feet of water. Flood water in the cellars completely submerged the museum's HVAC and water heater systems, and ruined a great amount of farm equipment stored underground worthing several thousand dollars (ABC7NY 2021; Wyckoff House Museum 2021a; 2021b). The extent of structural damage was unclear; but observing from pictures posted by the museum on Facebook, flood water had inundated the historic rubble walls of the building's cellars, and reached a height only several feet away from the wood beams underneath the cellar's ceiling. To make things worse, it was reported that most of the flood water was sewage water, thus causing the inundated area to be "contaminated with a toxic film" (ABC7NY 2021).

The management team of the Wyckoff House Museum attributed the severe flood impact partly to the "back-to-back" storms that the site faced in the week of Hurricane Ida (Wyckoff House Museum 2021b). Shortly after the hurricane, a matching fund campaign was set up on IOBY, a Brooklyn-based non-profit platform (ABC7NY 2021). **As of Jun. 1, 2022, the Wyckoff House remains closed for public tours, as its HVAC and electrical systems have to be repaired or replaced** (Wyckoff House Museum 2022).

The damages happened at Wyckoff House Museum reflect some intricate challenges posed by flood on historic properties. First of all, although new construction codes can easily ban basements or cellars in flood-prone areas, in many cases, the basements and cellars of historic properties may still need to remain, as they serve as an integral part of a structure's historic fabrics and contribute to its historic significance. Moreover, the construction of historic structures may to a considerable extent limit the floodproofing options available — for example, wood-frame buildings are generally excluded from the dry-floodproofing option as wooden walls tend to be neither strong enough nor watertight enough to hold off flood water (MDSHPO 2018, 3.29). Under these unique challenges, Intensive research and policy-making are needed to develop design solutions and permit procedures that help retrofit historic structures towards flood resilience.

Inundation in Wyckoff House's cellars caused by Hurricane Ida.
Source: Wyckoff House Museum 2021b.

According to ABC's news report, the management team of the Wyckoff House Museum expressed their awareness of the necessity of "more aggressive preventive measures," as well as a better understanding of "flood abatement options" as flood risks increase. Reporting its flood damage to the public, the Wyckoff House Museum wrote on Facebook that "climate change is very real, and historic structures are especially vulnerable to increased rainfall and serious flooding" (Wyckoff House Museum 2021a; ABC 2021).

South Street Seaport, Manhattan

South Street Seaport is a commercial historic district in Lower Manhattan's waterfront featuring warehouses, stores and mid-rise buildings commonly built with red or yellow bricks in the first half of the 19th Century. Known as one of the first commercial blocks in New York City, South Street Seaport represents the rise of New York City as it grew from "a small cluster of wharves" to "an important part of the leading port of the nation," all upon successive landfills (NYCLPC 1977b). The South Street Seaport area remains as a vibrant tourist attraction today with museums, restaurants, markets, retail stores, and nightlife.

Hurricane Sandy of 2012 hit the South Street Seaport area hard. According to New York City's Post-Sandy report, "waters flowed directly off of the East River and into the South Street Seaport area," "rising in some areas to eight feet in depth" (The City of New York 2013, 374). The local South Street Seaport Museum reports a water surge up to six feet in its lobby, with flood carrying "debris and signs and barricades and pieces of timber and in some cases vehicles along"; flooding in the museum also drenched more than 200 drawers of antique wood and metal type (Pogrebin 2012). Near the museum, eleven feet of water entered the historic Fraunces Tavern cafe, a New York City landmark (Pearson 2013).

Since many retail storefronts were located on street level and had low-lying storage, kitchen or electrical systems, the impact of Hurricane Sandy was detrimental. Most ground-floor businesses were still closed months after the storm, and many of them had yet reopened nearly one year after Hurricane Sandy (The City of New York 2013, 375; New York Curbed 2013). Nevertheless, the flood impact on South Street Seaport has aroused a wide attention, and stimulated governmental actions on multiple levels: As of 2015, the South Street Seaport Museum had acquired a funding of $10.4 million from Federal government to recover from Hurricane Sandy; in 2021, NYCEDC and Mayor's Office of Climate Resiliency (MOCR) published the *Financial District and Seaport Climate Resilience Master Plan*, which was reported to be "a blueprint for comprehensive flood defense infrastructure"; in recent years, temporary flood barriers are also seen in the area as a form of

On Left Page:

Location of South Street Seaport Historic District.
Source: Author's Illustration.

From Top to Bottom:

South Street Seaport Streetscape in 2012, before Hurricane Sandy.
Source: Harvey Barrison; *New York Business Journal*.

Inundation and Flooding of South Street Seaport during Hurricane Sandy.
Source: BrooklynVegan.

Closed Stores in South Street Seaport, Feb. 2013.
Source: Tina Fineberg for the Associated Press.

"interim protection measures" provided by the city (Arnott 2015; NYC Lower Manhattan Coastal Resiliency n.d.; NYCEDC, MOCR, and Arcadis 2021; Glassman 2019; Marsh, Mongelli, and Steinbuch 2020). As a historic neighborhood selected for this project's retrofitting design studies, the flood adaptation of South Street Seaport's historic streetscape will be further discussed in Digital Report 04 - *Adaptation Design Study: South Street Seaport*.

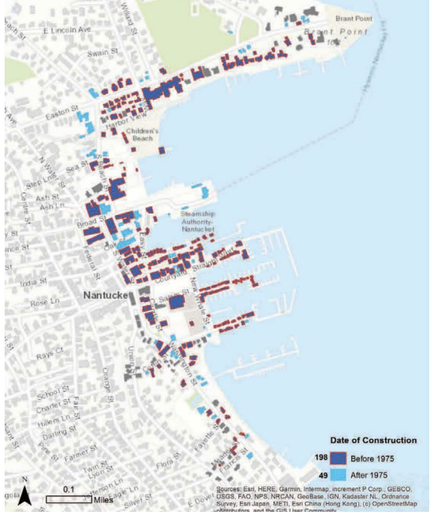
Temporary Flood Barriers in South Street Seaport Area, Jun. 2022. Source: Photograph by the Author.

Resilient Nantucket: Sea Level Rise Visualization

Resilient Nantucket: 3D Digital Documentation and Sea Level Rise Visualization is a project published in 2019 under the Resilient Nantucket Initiative, as a collaboration between the Town of Nantucket, Nantucket Preservation Trust, and University of Florida Preservation Institute Nantucket (University of Florida 2019; McGrath n.d.; UF Historic Preservation Program n.d.; Town & County of Nantucket n.d.). Combining 3D laser scanning, GIS and digital visualization techniques, this project was able to achieve several goals towards resilience planning and public education:

- By scanning around 300 buildings in Nantucket's historic Downtown and Brant Point areas and collecting essential attribute data including historic status and elevation measurements, a database was constructed for the purposes of resilience planning, vulnerability analysis and heritage monitoring.

- Point cloud data produced by laser scanning were then related to ground elevation data acquired from the state, and unified under the NAVD88 elevation datum. This allows researchers to visualize inundation scenarios based on NOAA's sea level rise projections, and to create public education materials consisting of photorealistic images of historic Nantucket under future seawater.



GIS Mapping of Buildings Impacted by Flooding by the Year 2100, under NOAA's Intermediate High Scenario. Source: University of Florida 2019.

- The GIS database created from local heritage survey was used to perform spatial analysis and vulnerability assessment, to help planners identify structures impacted by sea level rise by the years of 2040, 2060, 2080, and 2100 (see University of Florida 2019).

This project is an excellent example of how digital methods may be used to visualize built heritage under flooding and sea level rise, and thus raising the public awareness on historic preservation and resilience planning. Besides being featured at multiple conferences, the project was also presented in a public-facing workshop in Newport, RI in 2019 under the Keeping History Above Water initiative (Newport Restoration Foundation 2019).

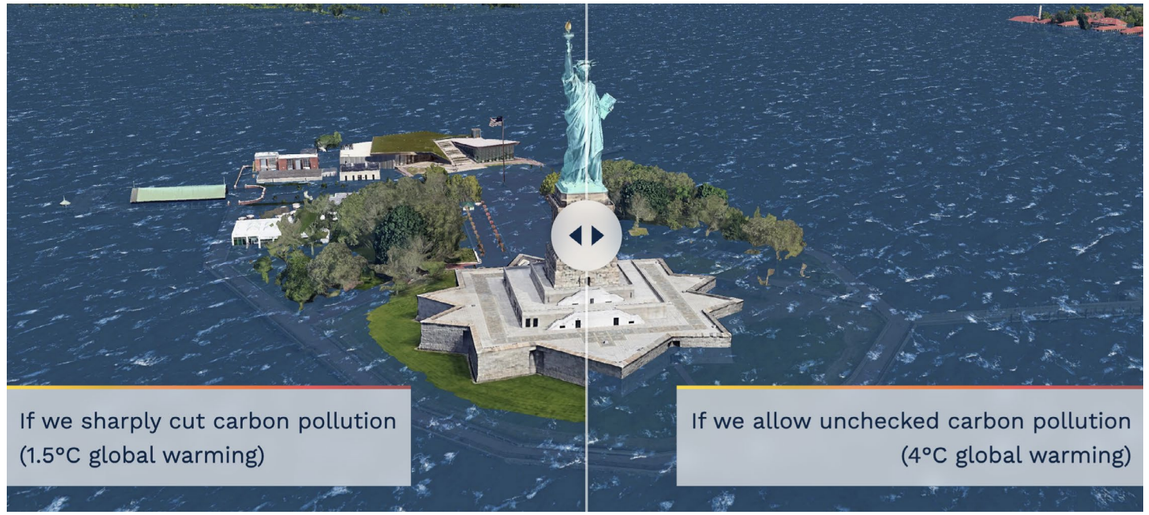
Digital Visualization of Old North Wharf, Nantucket under Sea Level Rise in 2080. Sea Level was Estimated under NOAA's Intermediate-High Projection, which Establishes 2080 Sea Level at 6.14 ft above NAVD88 datum.
Source: University of Florida 2019.

Speculative Renderings: New York City Under Rising Sea & Floodwater

Some renderings similar to the *Resilient Nantucket* project introduced above have also been made in New York City's context. In *New York Magazine*'s 2016 article "This is New York in the Not-so-distant Future," several renderings made by MDI Digital were featured, depicting the flooding scenario caused by both sea level rise and a hundred-year storm "decades from now." The Meatpacking District and Calatrava's Oculus were selected as subjects of visualization, accompanying warnings from Klaus Jacob — a professor at Columbia University's Lamont-Doherty Earth Observatory — that routine inundation and flash floods will become far more likely to happen in New York City as global warming and sea level rise continue (Rice 2016). Although the data baselines behind these visualizations remain not fully clear, they provide us with a visual understanding of what could happen when our heritage — and the whole waterfront urban space — becomes under water.

Also of interest is "Picturing Our Future," an online sea level rise visualization project made by Climate Central that covers 189 locations across the world — including heritage sites, city landmarks, airports and stadiums. In each

visualization, the project interface enables visitors to toggle the value of global temperature rise, and examine how these sites are inundated by higher seawater as global warming gets more severe. The project has featured the Statue of Liberty as a representative of New York City, and depicts the sea level rise brought by a 4°C global warming to almost inundate Fort Wood — the 11-point-star shaped fort which serves as the Statue's foundation (Climate Central n.d.).



Upper:
"A speculative rendering showing what a hundred-year storm could briefly do to the Meatpacking District decades from now, when sea levels have risen several feet."
Photo-illustration: MDI Digital/Jonny Maxfield/Cultura Exclusive/Getty Images. Source: *New York Magazine*.

Lower:
Renderings of the Statue of Liberty under Two Sea Level Rise Scenarios brought by Different Extents of Global Warming.
Source: Climate Central.

05

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Living Above the Street
Stewarding New York City's Historic Built Environment Towards Flood Resilience

An Onera Prize in Historic Preservation Project

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Living Above the Street

Stewarding New York City's Historic Built Environment Towards Flood Resilience

DIGITAL REPORT 02

Adaptive Streetscape: Concept & Framework

Livingabovethestreet.nyc

About

This report is part of the independent research project "Living Above the Street: Stewarding New York City's Historic Built Environment Towards Flood Resilience," which is supported by Onera Foundation under 2022 Onera Prize for Historic Preservation.

Columbia GSAPP M.S. Historic Preservation '22

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Further Readings

To view and download the whole series of policy & design reports, please visit:
https://www.livingabovethestreet.nyc/reports.

This Onera Prize research project is developed upon the author's M.S. Historic Preservation thesis:
Wang, Ziming. 2022. "Living Above the Street: Flood Retrofitting and Adaptive Streetscape of New York City's Historic Districts." M.S. Historic Preservation Thesis, Columbia University.
https://doi.org/10.7916/fn43-vb19.

Cover Image:
Different Goals of Adaptive Streetscape Transformation, Visualized on the Elevation of Front Street in South Street Seaport.
Illustration by the Author.

"We nod; we each glance quickly up and down the street, then look back to each other and smile. We have done this many a morning for ten years, and we both know what it means: All is well."

Jane Jacobs,
The Death and Life of Great American Cities (1961)

Harlem Tenement in Summer, c. 1935-39.
New York Public Library Digital Collections.

Contents

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Executive Summary

Executive Summary

Among the multiple complications brought by flood adaptation on historic built environment as identified in Digital Report 01, **streetscape change** is the key area of tension. Typical flood retrofitting interventions such as structural elevation and wet-floodproofing directly diminish the visual and experiential qualities of historic streetscapes, which would potentially result in a significant loss of historic values embedded in New York City's human-scaled, vigorous and intimate historic streets.

Severe streetscape changes brought by flood retrofitting projects in New York City's waterfront communities are reminders of the fact that **flood resistance is not the only goal in the adaptation of New York City's historic structures, neighborhoods and districts, and that we must take a broader scope of heritage values into consideration**. As New York City's existing streetscape mitigation design guidelines are targeted at general existing structures, they often fail to address specific historic preservation concerns — such as visual consistency, historic authenticity and social-spatial relationship — in their design recommendations. To explore policy and design guidelines suitable for New York City's historic built environment, we must first develop a more comprehensive understanding of the goals and values involved in its transformation towards flood resilience.

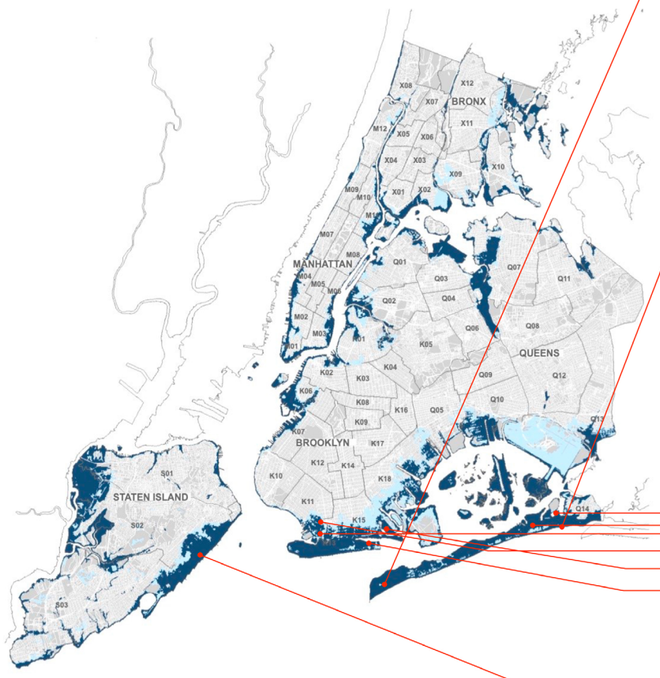
In response to the problem stated above, this report puts forward a framework for the understanding and evaluation of historic streetscape change under flood adaptation. Under the **"Adaptive Streetscape" concept**, key adaptation and preservation goals including **Flood Resilience, Building Integrity & Visual Consistency, Streetscape Experience & Social-Spatial Relationship, and Floor Area Transfer** are identified; a set of **semi-quantitative evaluation metrics** are then developed to facilitate a more accurate comparison of streetscape qualities before and after planned adaptation interventions.

It's also important to acknowledge that **intricate tradeoffs and conflicts exist among the multiple goals identified in the flood adaptation of historic streetscapes, and that different goals will likely lead to different retrofitting treatments and design choices.** In other words, a specific retrofitting treatment (such as structural elevation) may have positive effect on some goals (e.g. flood resilience), but negative impacts on others (e.g. streetscape quality). **These tensions speak for the meaning of the Adaptive Streetscape framework in producing balanced solutions acknowledging multiple values and conflicting goals.** The Adaptive Streetscape concept and metrics constructed in this report will be actively referenced in the literature review, design study and policy analysis featured in upcoming reports, serving as a foundation for this project's exploration of design and policy tools.

02

Key Issue: Streetscape Change

Post-Sandy Built Projects & Associated Streetscape Change



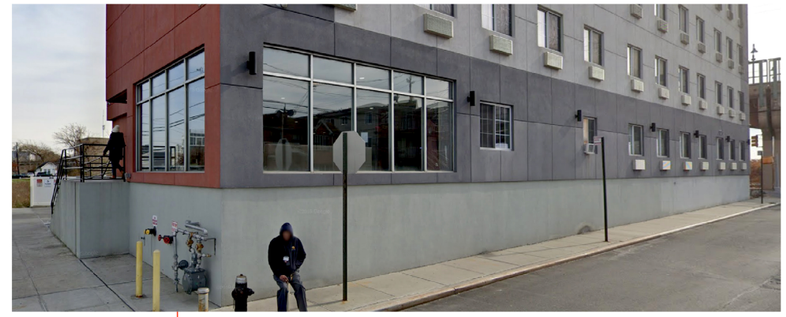
New York City's 1% Floodplain

(2007 FIRM & 2015 PFIRM Combined)

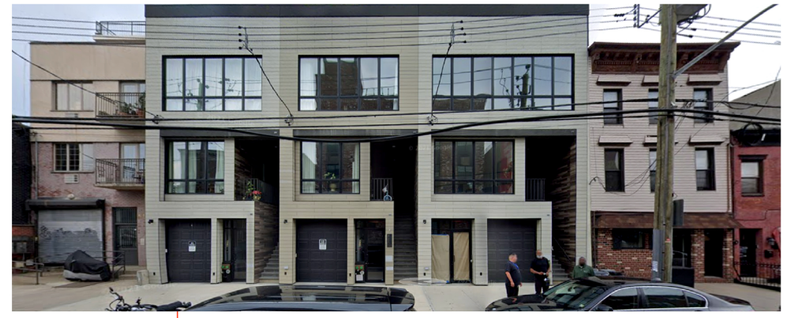
Breezy Point Streetscape, 2021

Selected NYC *Build It Back* Projects, 2016-2019

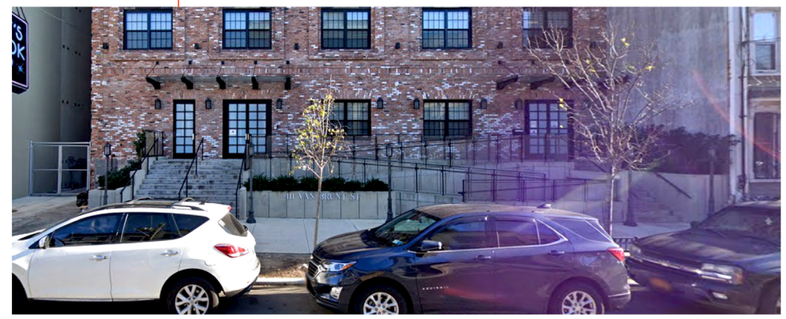
Post-Sandy Retrofitting and Reconstructions



Hotel, 2013, Far Rockaway



Walk-Up Residential Houses, 2018, Red Hook



Community Facility, 2017, Red Hook

Post-Sandy New Constructions

Image Sources: NYCDCP 2019d, 4 (floodplain map); Instagram @nycbuilditback; Google Maps.
Compiled by Ziming Wang, Aug. 2022.
For full analysis, see Digital Report 01: *Flood Risk of New York City's Historic Built Environment*, Chapter 3.

2.1
Streetscape Tensions in Flood Adaptation

Streetscape Tensions in Flood Adaptation

In Digital Report 01, the author has raised several conflicts and challenges that flood adaptation interventions pose on historic built environment, including the lack of innovative design strategies and systematic policy mechanism, the exemption of designated historic buildings from retrofitting mandates, as well as the lack of financial incentives. Among the multiple complications brought by the underdeveloped design and policy framework at the intersection of flood adaptation and historic preservation, **streetscape change** seems to be the key area of tension. Typical retrofitting interventions — including structural elevation and wet-floodproofing — immediately and directly diminish the visual and experiential qualities of historic streetscapes, which would potentially result in a significant loss of historic values embedded in New York City's human-scaled, vigorous and intimate historic streets. Specifically, the streetscape discourse is of key importance for the following reasons:

- **Streetscape Change is the Most Significant Impact Brought by Flood Adaptation.** Compared to relatively minor interventions such as the relocation of critical systems and the installation of dry-floodproofing anchors, streetscape changes brought by the elevation of habitable spaces (as required by New York City's Post-Sandy Building and Zoning Codes) often result in a complete alteration of historic characters including style, proportion and street relationship, as well as significant reworking on historic fabrics. These interventions tend to create completely new, out-of-context and sometimes alienating urban forms, and are often far beyond the acceptance of New York City's local design review standards which are strictly based on formal quality and material authenticity.

- **Streetscape Tensions Involve Multiple Forms of Heritage Values.** Beyond the formal quality and material authenticity stressed by local Landmark Law and preservation standards, historic street spaces actually represent a broader range of heritage values. For example, intimate historic streets often house a variety of functions and activities including window-shopping, dining, plantation, and resting; they may also serve as a vehicle of community connections, as demonstrated by the "sidewalk ballet" recorded by Jane Jacobs.[1] Furthermore, these functions and activities are often paired with specific types of physical spaces along the street: for example, the retail storefronts at street-level or in cellars, the row house lobbies above street level accessed by a stoop, and storage space in the cellar accessed by an alleyway. If all these functions and activities are removed, the characters of a historic streetscape would be significantly reduced even if all its visual and spatial qualities have largely remained. All these examples speak for the value of the vigor, interactivity and social-spatial relationships embedded in historic streets.

- **Streetscape Change is a Unique Challenge Faced by the Preservation Enterprise.** Given the acute tensions between flood adaptation interventions and the potential loss of heritage values, streetscape change has become a thorny issue peculiar to the preservation enterprise. As new adaptation designs and projects are proposed, architects and planners are creating drastically new urban forms to incorporate flood resilience; since retrofitting guidelines made for general existing structures typically don't identify historic preservation as an aim, design recommendations promoted in these guidelines won't be sufficient to address the loss of streetscape values in the context of historic built environment. Therefore, it's ultimately the preservation enterprise's responsibility to develop innovative design and policy solutions to steward our historic streetscapes towards flood resilience while retaining their visual, material, and social-spatial qualities.

Building on New York City's Post-Sandy building and zoning policy framework and associated streetscape change outcomes analyzed in Digital Report 01, this section seeks to elaborate the vital importance of streetscape preservation in the flood adaptation of historic built environment. For a full analysis on streetscape change brought by New York City's Post-Sandy Building and Zoning Codes, please refer to Chapter 3 of *Digital Report 01: Flood Risk of New York City's Historic Built Environment*.

The importance of the streetscape discourse can also be demonstrated by existing nationwide design guidelines on the flood retrofitting of historic structures, which more than often identify streetscape mitigation strategies as a key focus area. For example, Charleston, SC's *Design Guidelines for Elevating Historic Buildings* (2019) has adopted streetscape design as its key consideration, promoting detailed site, entrance and foundation design recommendations and successful local practices to help facilitate an appropriate transformation of historic urban forms; similarly, New Jersey and Newport's design guidelines on the elevation of historic buildings have also identified streetscape change as a key preservation challenge, and have both put forward design and zoning recommendations that help to preserve the streetscape expression of historic structures (see NJSHPO 2019a, 9-4, 9-5, 3-10; NJSHPO 2019b, 21, 26; Newport HDC 2020). These existing design solutions may serve as a valuable reference for New York City's flood adaptation and historic preservation policy-making, and will be further synthesized in *Digital Report 03: Streetscape-Sensitive Design Strategies*.

Streetscape-Friendly Elevation Design of a Historic Home in Charleston, SC.
Source: Photograph by the Author.

1 For "Sidewalk Ballet," see Jacobs 1961, 50-51.

Context of the Streetscape Discourse

As this project focuses its lens on the streetscape changes of historic built environment brought by flood adaptation, it would be important to locate the streetscape discourse in the broader realm of flood adaptation and historic preservation fields; by doing so, this project's findings will be able to better connect with and more effectively contribute to the larger picture of heritage resilience planning and policy-making. From macro to micro scale, this section briefly examines the context of the streetscape change discourse pursed by this project.

Flood Hazard Mitigation: Managed Retreat, Relocation and In-Situ Adaptation

The top-level decision making regarding flood risk involves a choice whether to move people and buildings away from flood-prone areas, or adapt the existing flood-threatened built environment *in-situ*. As a community-level collective action, **managed retreat** means "the strategic relocation of structures or abandonment of land"; on single-building or single-site scale, **relocation** means a strategy where historic properties and cultural resources are moved to new sites with low flood risk (Hino, Field, and Mach 2017, 364; FEMA 2005, 3-17). Although experimental projects of managed retreat and relocation have both been carried out, **in-situ adaptation** is still today's mainstream strategy; in recent years, U.S. cities have built or proposed levees and sea walls, elevated streets and buildings, and implemented building floodproofing treatments to facilitate flood-resilient, in-situ development into the future.[2]

In-Situ Flood Adaptation: Strategies under Different Scales

In-situ adaptation strategies incorporate a wide range of solutions from city scale to building/lot scale. As one of the most densely populated and developed coastal city in the world, New York City has thus far engaged with adaptation projects and proposals of almost all different scales. Notable Post-Sandy adaptation projects in New York City include:

- The **city-scaled** *New York-New Jersey Harbor and Tributaries Coastal Storm Risk Management* study (2019) by U.S. Army Corps of Engineers, which proposes an up-to-6-mile long seawall that protects the city's waterfront area under extreme stormwater events (see Barnard 2020);
- The **neighborhood-scaled** East Side Coastal Resiliency Plan designed by architectural firm BIG in 2014, which features a landscaped levee that spans over 2.5 miles on Manhattan's Lower East Side shoreline and serves as part of the continuous flood protection infrastructure (along with the Lower Manhattan Coastal Resiliency Plan, LMCR) that surrounds lower Manhattan (Bjarke Ingels Group n.d.);
- NYC Department of City Planning's **neighborhood and street-scaled** flood adaptation planning studies, such as *Resilient Neighborhoods: West Chelsea* (2016) and *Resilient Retail* (2016);
- The **building-scaled** NYC Build It Back program carried out by NYC Mayor's Office of Housing Recovery Operations (HRO) since 2013, which has provided assistance to around 32,000 households impacted by Sandy as of 2021 (NYC Recovery 2021), and "has rebuilt and elevated over 1,300 homes to today's stringent regulations for flood compliance," often elevating homes to 10 to 14 feet above sea level (NYC Mayor's Office of Housing Recovery Operations n.d.).

Among the multiple solutions discussed above, individual-building retrofitting is by far the most widely carried out adaptation method. Under NFIP's floodplain management regulations, local municipalities have enforced flood-resistant building standards in their Building Codes; building elevation and retrofitting are also given a central place in NFIP's insurance policies, as well as FEMA's guidelines for homeowners and planners (see for example, FEMA 2014; FEMA 2008).

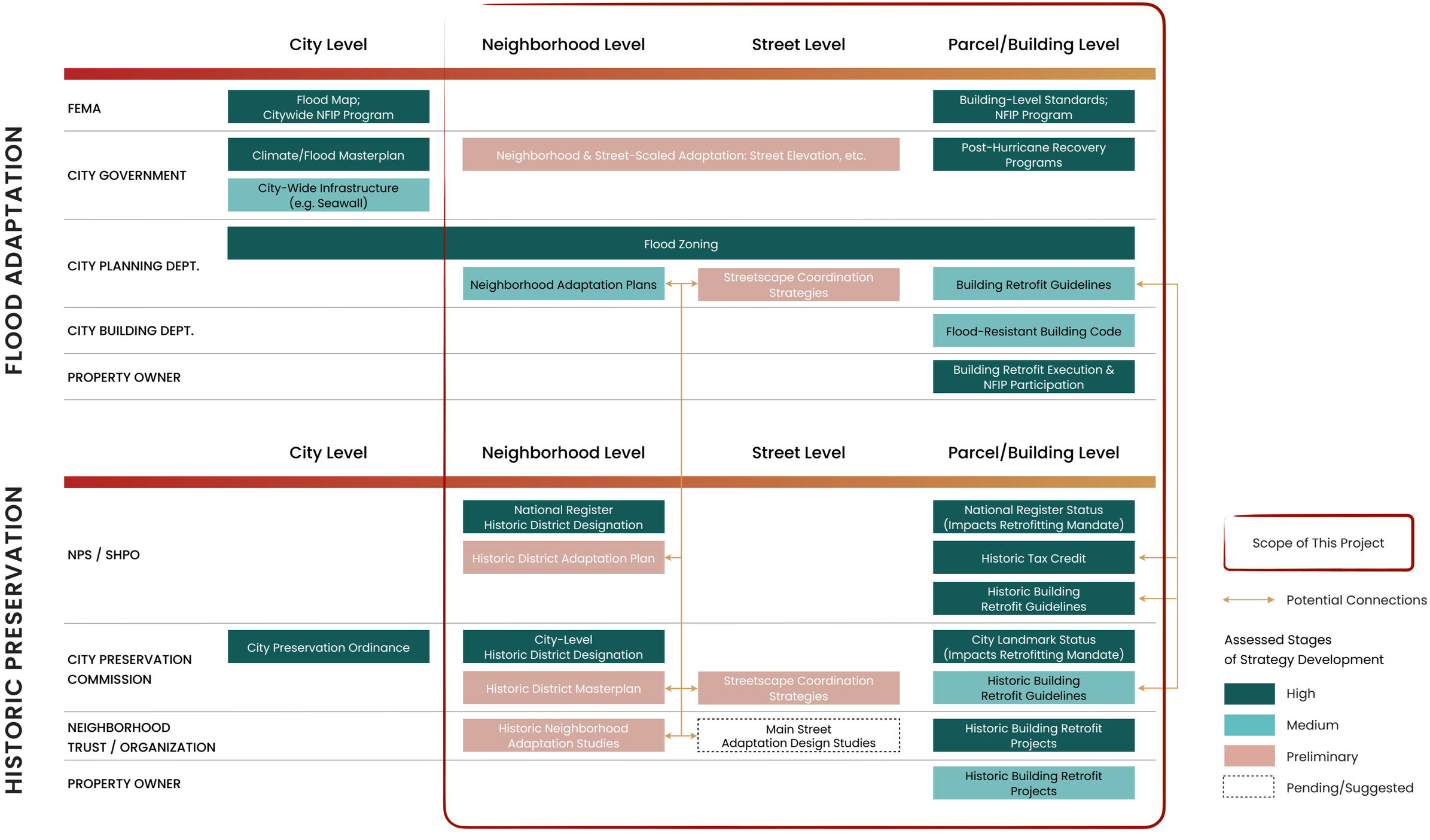
The Role of Historic Preservation

Multiple cities and communities in the United States (such as Newport, RI, Charleston, SC, St. Augustine, FL and Nantucket, MA) have their historic downtowns within flood-threatened areas, and have thus seen flood retrofitting projects launched on structures with historic significance or landmark status. These retrofitting projects, along with associated policy-making and research efforts, have created some connections between the discourses of flood adaptation and historic preservation.

In recent years, historic preservation agencies from Federal to local level have published a variety of **flood retrofitting design guidelines for historic structures** — including National Park Service's recently updated *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (2nd ed., NPS 2021); historic building retrofitting guidelines made by New Jersey (2019), Maryland (2018), and Louisiana (2015) SHPOs; local design and review standards published in cities such as Boston (2018), Charleston (2019), Newport (2020), and St. Augustine (2021). Summarizing successful local practices and putting forward recommended design treatments, these guidelines have provided insight on how historic buildings may be retrofitted for flood resilience; nevertheless, given the building stock in local communities, most of these guidelines are focused on detached single homes.

Meanwhile, homeowners of historic structures and local preservation organizations have played an active role in carrying out **real-world retrofitting projects**. Successful elevation and retrofitting projects on historic structures include the Greek-Revival house in Owego, NY raised by homeowner Julie Nucci (NPS 2021, 88; Roby 2015); Newport Restoration Foundation's experimental projects on retrofitting and elevating Colonial homes (NRF 2016;

2 For an example of managed retreat, see Acquisition and Buyout Program under NYC Build It Back (Maldonado 2021; NYC Mayor's Office of Housing Recovery Operations n.d.); for an example of relocation, see the relocation of the Bachman Wilson House designed by Frank Lloyd Wright (Florida Department of Economic Opportunity 2015, 63).



Context of the Streetscape Discourse.
Source: Author's Illustration.

Dean 2019); and the 113 Calhoun Street retrofitting project in Charleston, carried out by a collaboration between the City of Charleston, Clemson University, and South Carolina Sea Grant Consortium (FEMA 2008, 14). Cities previously hit by hurricanes — such as New Orleans and Charleston — have seen more retrofitting projects on historic buildings.[3]

Although most of the current research and practice are concentrated on building scale, there have been some recent studies seeking to **incorporate neighborhood-scale strategies** into the flood adaptation of historic built environment. For example, the *Manayunk Main Street Historic District Flood Guide* (2020) commissioned by the Pennsylvania SHPO has adopted a neighborhood-scaled perspective targeting at the major building types within Philadelphia's Manayunk Main Street Historic District; Newport Restoration Foundation's *74 Bridge Street* study (2016) advocates for elevating the street together with buildings as a strategy to ensure long-term resilience and protect historic characters; the City of Miami Beach's Buoyant City guideline (2020) addresses urban form change and streetscape change through extensive neighborhood and street-scaled design illustrations. In addition, **conferences** such as Keeping History Above Water (nationwide) and Preservation in a Changing Climate (Salem, MA) are also being held to exchange knowledge on the flood adaptation of historic built environment.

The Context of the Streetscape Discourse

Among the flood adaptation strategies of different scales, **individual-building based retrofitting is mostly likely to cause drastic streetscape changes**. Coordinating retrofitting design options of individual buildings, street and neighborhood scaled strategies are also closely related to the issue of streetscape change. Therefore, this project focuses its lens on streetscape changes associated with building, street and neighborhood-level flood adaptation treatments, and engages New York City's historic buildings, neighborhoods and districts as its subject.

The diagram on pages 14-15 graphically examines this project's scope, and maps it within projects and policies implemented by major stakeholders in the realms of flood adaptation and historic preservation. The diagram also reveals opportunities for further connection between the two fields, as well as the fact that street and neighborhood-scaled heritage resilience research and policy-making have been relatively scarce. **Engaging both building and street/neighborhood-scaled perspectives**, this project seeks to make design and policy inquiries towards the potential streetscape changes in New York City's historic built environment brought by flood adaptation, and develop design and policy tools that facilitate an adaptive transformation of New York City's historic streetscape towards flood resilience.

3 For examples of elevation projects in New Orleans, see project gallery of local contractor Roubion Elevation + Shoring; for an example of historic building retrofitting in Charleston, see the timelapse of 1 Water Street in Charleston (which will be further discussed as a case study in Digital Report 03).

2.2
New York City's Existing Regulations & Guidelines on Streetscape Mitigation

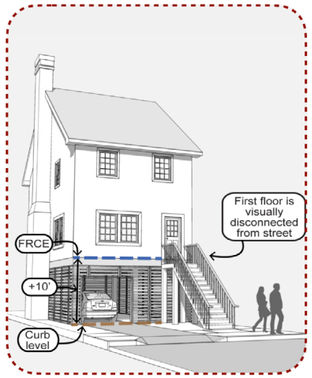
Although this project seeks to leverage nationwide regulations, guidelines and built projects to develop flood adaptation strategies for New York City's historic built environment, New York City's local regulations and guidelines remain as a keystone for the project's research and findings. Building on New York City's Post-Sandy flood regulation framework elaborated in Section 3.1 of Digital Report 01, this section briefly examines the specific streetscape design provisions in New York City's two **Flood Zonings** (which are currently mandatory for all projects in the city's floodplain), and streetscape **design guidelines** promoted in NYCDCP's 2014 *Retrofitting Buildings for Flood Risk* report. These regulations and guidelines represent New York City's most comprehensive and up-to-date policy-making at the intersection of flood adaptation and streetscape change.

Streetscape Provisions in the 2013 Flood Zoning Amendment

As a temporary Zoning Amendment put forward to support Post-Sandy development and reconstruction, New York City's 2013 Flood Zoning Text Amendment didn't fail to notice potential negative streetscape impacts brought by the city's new flood-resistant Building Code. In fact, it provided several streetscape design recommendations for **two typical building/rebuilding scenarios** — the structural elevation of a 1-2 family detached home, and the new construction of a relatively large-scaled multi-family building and community facility building (NYCDCP 2013b, 29-34). In the detached home scenario, treatments such as planting, stair turn, new porch, and raised yard are listed as recognized streetscape mitigation strategies, and homeowners are required to choose 1 or 2 of these strategies while elevating their homes; in the new construction scenario, planting, streetfront transparency, and screened parking are required (see figures on page 18). Although these regulations only respond to a very limited number of scenarios, they nevertheless serve as a starting point for New York City's streetscape mitigation regulation, and were also designed with different heights of first-floor elevation in mind (for example, a detached home raised by 10 feet need to incorporate more mitigation treatments than it would if raised by 5 feet).

Streetscape Provisions in the 2019-21 Zoning for Coastal Flood Resiliency (ZCFR)

In its campaign to produce the updated Zoning for Coastal Flood Resiliency (ZCFR, 2019-2021), NYCDCP evaluated its 2013 streetscape design menu and called it "laudable," but nevertheless "rather limited" (NYCDCP 2019b, 13). In New York City's current flood zoning, a **point system** is used to ensure adequate streetscape mitigation treatment. A larger variety of design features — including "Wide Stairs," "Entrance Close to the Grade," "Recessed



Elevated Situation
(Without Streetscape Mitigation)

Planting

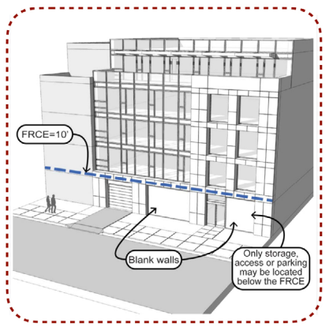
Stair Turn

Unenclosed Porch

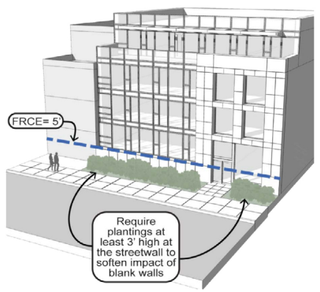
Roofed Porch

Raised Yard

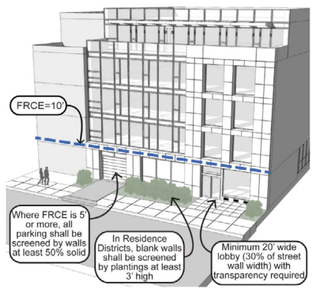
Streetscape Mitigation Design Menu for the Structural Elevation of Detached Homes in New York City's 2013 Zoning Text Amendment.
Source: NYCDCP 2013b, 31.



Elevated Situation
(Without Streetscape Mitigation)



Mitigation Design for
A 5' Elevation



Mitigation Design for
A 10' Elevation

Streetscape Mitigation Design Menu for the New Construction of a Multi-Family and Community Facility Building in New York City's 2013 Zoning Text Amendment. Source: NYCDCP 2013b, 33-34.

Access," "Multiple Entrances," "Terraced Yard," "Wall Treatment," "Additional Fenestration," and "Accessory Residential Use" — have become recognized by the Flood Zoning and are added to the design menu, with each feature worthing 1-2 points. Projects with the level of first story above flood elevation (FSAFE) below 5 feet are required to score at least 1 point, while projects with an FSAFE of 5 feet or more are required to score at least 3 points contributed by design features under both the "Access" category and the "Ground Floor Level" category (see figure below). According to the final adopted zoning text, these streetscape regulations apply to "all zoning lots containing flood-resistant buildings" (NYCDCP 2021, Section 64-50).

Access:

Ground Floor Level:

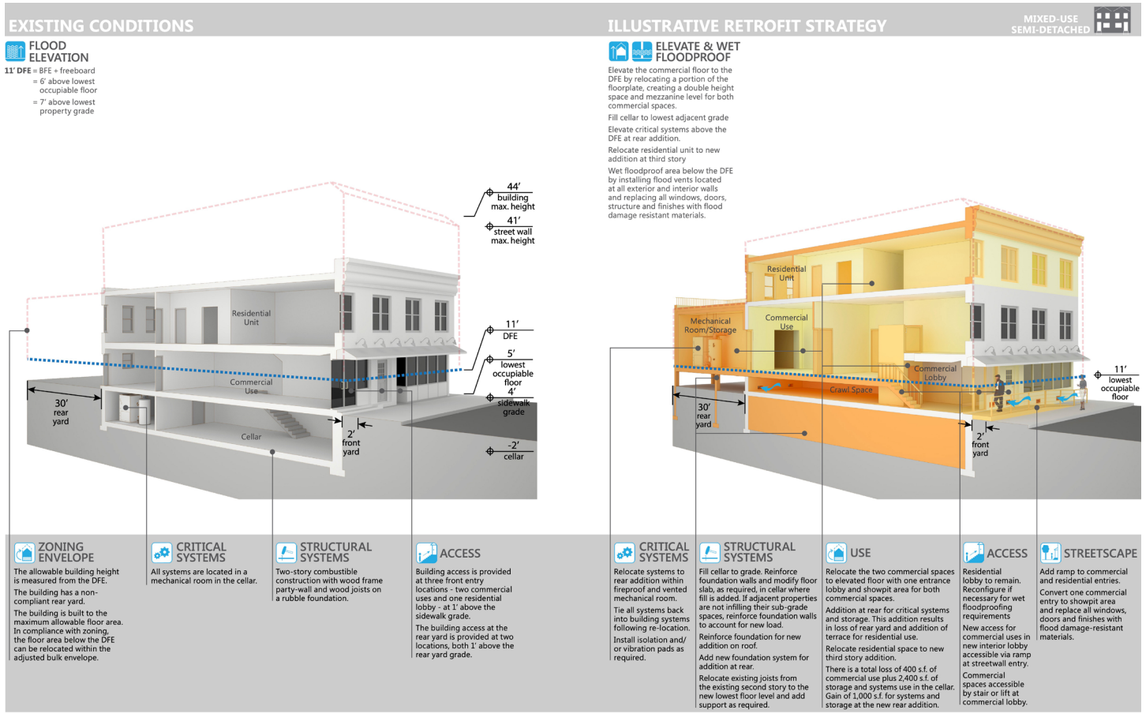
Level of the *first story above the flood elevation*	Streetscape Requirements		Total Points
	Access	Ground Floor	
Below 5'			1
5' or above	✓	✓	3

New Design Options in the 2019-2021 Flood Zoning

Updated Streetscape Design Menu in New York City's 2019–2021 Flood Zoning for Coastal Flood Resiliency (ZCFR).
Source: NYCDCP 2019c, 60-61.

Streetscape Guidelines in NYCDCP's Retrofitting Buildings for Flood Risk Report (2014)

As introduced in Digital Report 01, NYCDCP's *Retrofitting* report (2014) is the most comprehensive flood retrofitting design guideline to date targeted at New York City's floodplain building stock. Despite being only a design study with no legal effect, the report successfully put forward 10 real-world flood retrofitting design case studies that cover different floodplain building types and a wide range of considerations (Use, Access, Structural Systems, Critical Systems, Parking, and Streetscape & Visual Connectivity; see NYCDCP 2014, 32-36). The report also features statistic data that describe the profile of New York City's floodplain building stock, and discussions on alternative adaptation strategies for each case study.



A Flood Retrofitting Design Case Study ("Mixed-Use Semi-Detached") in New York City's 2014 *Retrofitting Buildings for Flood Risk* Report.
Source: NYCDCP 2014, 84-85.

Although New York City is regarded as having "the most progressive climate resiliency-focused land-use proposal" of any city in the U.S. (see Grace and Marvilli 2021), its streetscape mitigation provisions and guidelines — which are targeted at general existing structures and new constructions in the floodplain — may still be insufficient for the flood adaptation of the city's historic built environment. On the one hand, the city's Flood Zonings are designed as general rules offering great flexibility to individual projects, and are therefore unable to indicate specific challenges and strategies in the retrofitting design of different types of historic structures; on the other hand, many innovative design treatments in the *Retrofitting* report are creating new, out-of-context urban forms, as it doesn't aim at any historic preservation goals. Building on New York City's current policy-making efforts and learning from nationwide resources, *Digital Report 03: Streetscape-Sensitive Design Strategies* will develop **a streetscape design toolbox** applicable to New York City's floodplain building stock prioritizing preservation and streetscape considerations.

03

Adaptive Streetscape:

Concept and Framework

3.1
Valorizing Historic Streetscape

Extensive streetscape changes in New York City's waterfront communities are reminders of the fact that **flood resilience is not the only goal in the adaptation of New York City's historic built environment.** Retrofitting strategies used in projects like *NYC Build It Back* are not suitable for historic buildings, neighborhoods and districts, although they may be able to achieve high flood resilience. Instead, **we must take a broader scope of heritage values into consideration**; as architects and planners strive to create new urban forms that accommodate flood resilience, it's the task of preservationists to justify the significance of historic urban forms.

To answer this question, this Chapter raises an "Adaptive Streetscape" framework that lays out different values and goals in the adaptation of historic streetscapes towards flood resilience. To start the discussion, this section examines the heritage value of historic streetscapes through policy and literature review and a critical analysis.

Formal and Material-Based Values

Formal and material-based values have long been given a central place in heritage value assessment. Formal qualities such as style, proportion, site relationship (or street relationship) and character-defining features distinguish historic districts and neighborhoods from contemporary urban forms, and reflect the architectural significance of historic buildings. Original material and construction of historic buildings demonstrate the concept of authenticity and integrity, both of which are key aspects of heritage value traditionally held dear by the historic preservation profession.

Formal and material-based values are explicitly protected by Federal and local-level preservation laws and regulations. The designation criteria of National Register of Historic Places and LPC Individual Landmarks have stressed the importance of "distinctive characteristics" and "aesthetic value," as well as the concept of "integrity" (National Park Service 1997, 2; NYCLPC n.d.). Meanwhile, LPC's design review standards are strictly based on an intention to preserve formal and material-based qualities: as a general rule, repair is preferred over replacement, and any replacement "must match the physical and aesthetic characteristics of the original or historic materials and features," in terms of "design, detail, texture, tooling, dressing, color, and finish" (NYCLPC 2019, 1.6).

A historic district or neighborhood is not merely a collection of historic buildings. Therefore, formal and material-based values don't only exist in individual buildings, and can be extended to urban forms and streetscapes. The formal values of historic streetscapes are also acknowledged in today's historic preservation regulation, mostly through rules for historic district designations; in fact, the concept of historic district itself implies that there are specific importances associated with built elements outside, surrounding, or found commonly among the designated buildings. Specifically, The designation criteria for LPC historic districts stress the necessity of "a distinct sense of place" and "a coherent streetscape"; similarly, New York SHPO explains National Register historic district as a group of properties that "are not usually significant individually, but gain meaning from their proximity and association with each other" (NYCLPC n.d.; NYSHPO n.d.). The acknowledgement of formal and material-based values of individual buildings and historic streetscapes is central to the evaluation of streetscape impacts brought by flood retrofitting intervention.

Experiential and Social-Spatial Values

Significant as formal and material-based values are, they don't represent the whole range of values associated with historic streetscapes. In fact, much significance of historic streetscapes is connected to the experience of people (both visitors and residents), and the pairing of human activities with physical spaces. These experiential and social-spatial values parallel the formal and physical values discussed above, and to a great extent contribute to the vigor and charm of historic streetscapes.

Intimate, human-scaled historic streets corridors are often known for housing a wide variety of functions and activities, and serving as a vehicle of community connections. Activities such as window-shopping, outdoor dining, and recreation associated with neighborhood commercial corridors and the interaction between residents along residential streets are not only valuable qualities by themselves, but also reflect a unique sense of place and even valuable historic lifestyle. These social-spatial significances have been well documented by urban researchers such as Jane Jacobs and Mindy Fullilove: Fulliove, in her *Main Street* (2020) study, recorded a myriad of activities in the often historic main streets (Fullilove 2020, 45); Jacobs, in her account of "Sidewalk Ballet," recalled how residents of different age, occupation and origin greeted each other on the street every morning, demonstrating the role of street space as a tie connecting community members (Jacobs 1961, 50-51; see also Fullilove 2016, 20). If all these functions and activities are removed, the characters of a historic streetscape would be significantly reduced even if all its visual and spatial qualities have largely remained.

Acknowledging the vigor and interactivity embedded in historic street space may **not only supplement** the understanding of formal and material-based values, **but also challenge it** — for example, flood retrofitting strategies aimed at preserving streetscape vigor and interactivity may to a larger extent modify the spatial layout of historic buildings and sacrifice their material authenticity. The tensions and tradeoffs among different forms of streetscape values will be further discussed in the next section, as the author attempts to establish a framework balancing different goals in the flood adaptation of historic streetscapes.

3.2

Adaptive Streetscape: Concept and Framework

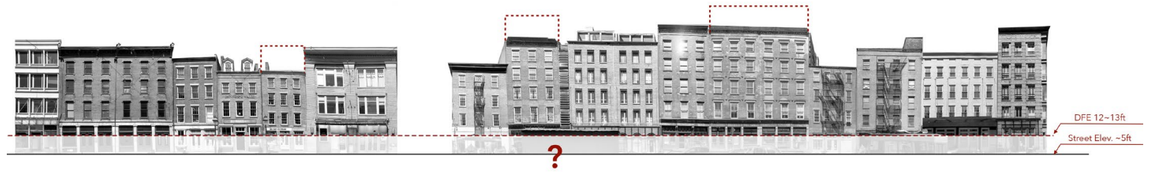
Discussions in Section 3.1 have revealed that beyond flood resilience, there are multiple heritage values associated with historic streetscapes that must be taken into account in their flood adaptation; in other words, the flood adaptation of historic streetscapes is ultimately a multi-criteria decision-making process. Synthesizing findings from both flood adaptation and historic preservation discourses, this section raises the concept of "Adaptive Streetscape" and establishes a framework that lays out different values and goals in the adaptive transformation of historic streetscapes towards flood resilience.

Upon reviewing existing flood adaptation and retrofitting guidelines as well as the examination of streetscape theory in the historic preservation realm, the author has identified four key goals in the "Adaptive Streetscape" transformation: **Flood Resilience; Building Integrity and Visual Consistency; Streetscape Experience and Social-Spatial Relationship; and Floor Area Transfer.** As each of these goals represents distinct resilience or heritage values, there are **intricate tradeoffs and conflicts** between them; moreover, **different goals are likely to lead to different retrofitting treatments and design choices.** In this section, the intentions, design outcomes and tradeoffs associated with each Adaptive Streetscape goal are laid out in detail; the Adaptive Streetscape framework will also serve as a foundation for streetscape quality evaluation and flood adaptation decision-making in the whole project's exploration of design and policy tools.

Goal No. 1: Flood Resilience

Flood Resilience is the key target of all flood adaptation interventions. Typical flood retrofitting treatments recognized by Federal and New York City-level regulation often involve structural elevation, the elimination of active uses and residential uses on street level, basement fill, and wet or dry floodproofing.

Outcomes, Tradeoffs and Mitigation Strategies: As demonstrated by many Post-Sandy built projects in New York City's floodplain, the application of flood resistant construction standard may bring about significant negative impacts to the character of historic streetscapes and individual buildings. For example, exorbitant heights of structural elevation may inevitably undermine the quality of a building's streetscape expression by impacting its scale and the transparency, accessibility and interactivity of its street floor (NJSHPO 2019b, 17, 26); the elimination of active uses on street floor or in cellars may bring about considerable challenges to the social-spatial relationship between pedestrians and retail storefronts, and thus diminish the vigor of commercial corridors. Generally speaking, retrofitting strategies that focus excessively on flood resistance may cause **significant**



Goal 1

Flood Resilience

Intention: Implement Retrofitting Treatments Recognized by Federal/Local Regulations; Eliminate High Risk/Active Use under DFE.

Tradeoffs: Building Integrity & Visual Consistency; Streetscape Experience & Social-Spatial Relationship.

Goal 2

Building Integrity & Visual Consistency

Intention: Apply Streetscape Mitigation Design Treatments; Preserve the Formal and Material-Based Values of Historic Buildings & Streetscape.

Tradeoffs: Streetscape Experience & Social-Spatial Relationship; Floor Area Transfer.

Goal 3

Streetscape Experience & Social-Spatial Relationship

Intention: Prioritize Street-Level Interactivity and Accessibility Over Building Integrity; Allow Necessary Modifications to Streetfront Structures.

Tradeoffs: Flood Resilience; Building Integrity & Visual Consistency; Floor Area Transfer

Goal 4

Floor Area Transfer

Intention: Minimize Floor Area Loss Caused by Flood Retrofitting, and Mitigate Such Loss Through the Execution of Rooftop Additions.

Tradeoffs: Building Integrity & Visual Consistency; Streetscape Experience & Social-Spatial Relationship.

Multiple Goals of the Adaptive Streetscape, Illustrated on the Elevation of Front Street in South Street Seaport Historic District.
Source: Illustration by the Author.

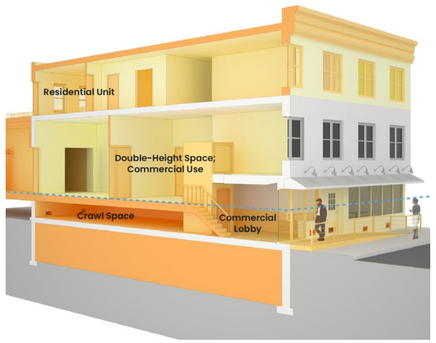
tradeoffs in the goals of Building Integrity & Visual Consistency, and Streetscape Experience & Social-Spatial Relationship.

To address these challenges, elevated buildings or buildings with elevated interior space should be carefully designed for streetscape mitigation treatments; in mixed-use and commercial corridors, incremental and partial retrofitting as well as design features adding to the interactivity of streetscape (e.g. transparent display windows on street level) shall be considered as preferable strategies (see NYCDCP 2016b, 38-39; 77-80).

Goal No. 2: Building Integrity & Visual Consistency

This goal ties to the most widely acknowledged concerns in building-scale flood retrofitting — blank street walls, out-of-context piers and exterior stairs, the "lollipopping effect" among elevated and un-elevated buildings, etc. Focusing on the formal and material-based values of historic streetscape, this goal seeks to apply streetscape mitigation design treatments to retain historic structures' human scale, street relationship, visual consistency, spatial layout, and material integrity. On street and neighborhood scale, this goal asks for the coordination of streetscape expressions among similar structures along a street corridor or in the same historic neighborhood through creative planning and policy tools. Specific design treatments that create friendly streetscape expressions compatible with historic urban context will be further discussed in Digital Report 03: *Streetscape-Sensitive Design Strategies*.

Outcomes, Tradeoffs and Mitigation Strategies: The Building Integrity & Visual Consistency goal prioritizes flood retrofitting strategies that preserve a building's spatial layout, material integrity and architectural significance, **which may cause potential tradeoffs with the goals of Streetscape Experience & Social-Spatial Relationship and Floor Area Transfer.** For example, the abandonment of a whole floor may be prioritized over extensively reworking a building's interior floor plates and non-structurally raising its interior program, even if the latter brings about more vigor and interactivity on street level (see figure on this page); meanwhile, rooftop additions — which are considered as an important way to mitigate floor area loss — may also be discouraged, as they are changing historic buildings' original fabric, proportion and style.



A design scheme in NYCDCP's 2014 *Retrofitting* report that achieved streetscape friendliness at the cost of extensive formal and structural changes, revealing the tension between Integrity & Streetscape goals.

Source: NYCDCP 2014, 85.

To balance these conflicts, retrofitting treatments that to a certain extent help retain historic structures' architectural characters may be considered as preferable strategies; such treatments include building additions executed in compatible style, or the reconstruction or preservation of key character-defining features.

Goal No. 3: Streetscape Experience & Social-Spatial Relationship

Contrary to the Building Integrity & Visual Consistency goal discussed above, the Streetscape Experience & Social-Spatial Relationship goal focuses on the preservation of experiential and social-spatial values associated with historic streetscapes. This means that active uses should be visually and experientially as close to the street level as possible to facilitate street-level activities such as window-shopping, recreation and daily interaction, and that these uses should be physically accessible from street level (for example, through street-level lobbies and ADA-compliant access).

Outcomes, Tradeoffs and Mitigation Strategies: The Streetscape Experience & Social-Spatial Relationship goal may in some cases **conflict with the Building Integrity & Visual Consistency goal.** Let's reexamine the case study discussed in Goal No. 2: under a streetscape-oriented scenario, streetscape-friendly strategies that involve extensive interior space alteration may be favored, even if they create significant impact on building's historic fabric and architectural layout; since streetscape-friendly retrofitting strategies such as interior elevation often requires creating double-height spaces or incorporating interior stairs and ramps (see figure on page 26), they may also result in the **loss of active floor area.** To mitigate these issues, spatial alterations shall be made with respect to the original architectural style and layout, and rooftop additions may be considered when possible.

Furthermore, the principle that active uses should be as close to the street level as possible brings conflict with **the flood resilience goal.** As discussed in Goal No. 1: Flood Resilience, the height to which structures or uses are elevated should always be decided under careful consideration.

Goal No. 4: Floor Area Transfer

As basements are filled, spaces under DFE are elevated or abandoned, double-height spaces are created, and new egress or access systems are introduced within existing structures, flood retrofitting interventions often result in the loss of active or usable floor area. The loss of active floor area may make retrofitting projects even less feasible in financial terms, and discourage property owners to carry out retrofitting undertakings. To address this issue, the Floor Area Transfer goal seeks to minimize floor area loss created by retrofitting treatments, and to mitigate such loss through physical additions within a building's zoning parcel.

As a key financial factor, floor area has been given much attention in New York City's flood adaptation policy-making. For example, NYCDCP's 2014 *Retrofitting* report has provided detailed floor area change calculation for each design scenario, where rooftop addition is often adopted as a solution; New York City's Flood Zoning Amendments also offer some flexible rules regarding building height and floor area calculation, exempting street-floor areas that are floodproofed or occupied by access use, and allowing floor areas to be transferred through additions (NYCDCP 2019c, 42-43, 50-54).

Outcomes, Tradeoffs and Mitigation Strategies: The design schemes in DCP's *Retrofitting* report sometimes feature rooftop additions as much as two stories tall (NYCDCP 2014, 66-67), causing vast changes in the building's characters; the potential of out-of-context and out-of-scale additions indicates **tradeoffs with the Building Integrity & Visual Consistency goal.** Nevertheless, those negative impacts may be to a considerable extent mitigated through thoughtfully designed additions that are either invisible from street level or compatible with the original style of historic structures (see Digital Report 03 for further discussions). On the other hand, since many streetscape-friendly retrofitting strategies often operate on the cost of active floor area, **conflicts may also emerge between the goals of Floor Area Transfer and Streetscape Experience & Social-Spatial Relationship.**

Discussions above reveal the resilience, heritage and economic values represented by each goal listed under the Adaptive Streetscape framework, as well as the outcomes, conflicts and tradeoffs between different goals. In the next section, the author will continue to develop the conceptual Adaptive Streetscape framework into a set of semi-quantitative metrics, which can be used to measure the quality change of New York City's historic streetscapes before versus after flood adaptation.

3.3

Adaptive Streetscape: Evaluation Metrics

Given the multiple conflicting goals in the flood adaptation of historic built environment, tradeoffs and tensions among different goals must be carefully examined and evaluated in order to produce balanced solutions that both achieve flood resilience and respect heritage values. Building on the *qualitative* discussions made in Section 3.2, this section develops the multiple goals of Adaptive Streetscape into a rating scale consisting of ***semi-quantitative metrics***, so that the quality of historic streetscapes before and after flood adaptation may be numerically measured. The rating system will be used in this project's upcoming neighborhood design studies, serving as a foundation for the evaluation of proposed design schemes.

The concept of a *measurable* system that evaluates the quality of urban space is inspired by Ewing and Clemente's *Measuring Urban Design* (2013) study. In this study, Ewing and Clemente established correlation between experiential features of streetscapes (e.g. "imageability" or "complexity," which are rated by invited urban design experts on a 1-5 scale) with physical and countable characters (e.g. proportion of historic buildings, proportion of first floor with windows, and the number of street furniture), and used statistic measures to prove such correlation. They found that the overall walkability of urban streetscape is predominantly decided by five experiential features: imageability, enclosure, human scale, transparency, and complexity; each feature was then correlated with multiple physical characters, each numerically measurable and has a particular coefficient value.

The Ewing and Clemente model has provided much insight for this project's effort to establish Adaptive Streetscape metrics, as they demonstrated that the desired visual and experiential impressions of urban streetscape can be quantitatively measured through a statistic regression of countable, physical features. Following this path, this research puts forward 24 individual metrics that contribute to the quality of historic streetscape under the 4 Adaptive Streetscape goals: **Flood Resilience, Building Integrity & Visual Consistency, Streetscape Experience & Social-Spatial Relationship, and Floor Area Transfer.** Each individual metric is classified with a 5-point rating scale, where 1 point means least desirable, and 5 points means most desirable; the score of each Adaptive Streetscape goal will be the unweighted average of all individual metrics falling under it.

It should be noted that as a semi-quantitative, preliminary evaluation system, the streetscape scale developed in this project doesn't have as much statistical foundation as the Ewing and Clemente model has. First of all, not all individual metrics are numerically countable; instead, some of them may be quantified based on empirical assessments (for example, 1 point could mean "very low," 5 points could mean "high," "extensive," or "abundant"). Meanwhile, the correlation between individual metrics and the final streetscape qualities are not statistically tested, although further discussion will be made in this section regarding how individual metrics are established.

Flood Resilience

Provide rating (in 5-point system) for both the original streetscape and the retrofitted streetscape.
Overall rating is calculated through an unweighted average of individual metrics below.

Average lowest residential floor elevation as compared to BFE & DFE*	1 < BFE – 4ft	2 ≥ BFE – 4ft	3 ≥ BFE	4 ≥ DFE	5 ≥ DFE+1ft
Percentage of areas with active use (except for storage, parking and access) on street level	1 ≥ 80%	2 80 – 60%	3 60 – 40%	4 40 – 20%	5 < 20%
Percentage of flood-proofed area on street level	1 < 20%	2 20 – 40%	3 40 – 60%	4 60 – 80%	5 ≥ 80%
Percentage of basement area as compared to street-floor building floor area	1 ≥ 80%	2 80 – 60%	3 60 – 40%	4 40 – 20%	5 < 20%

* Recall that for easier evaluation, DFE is always estimated as BFE + 1ft in this research.

Building Integrity & Visual Consistency

Provide rating (in 5-point system) for both the original streetscape and the retrofitted streetscape.
Overall rating is calculated through an unweighted average of individual metrics below.

Percentage of identifiable historic structures along both sides of the street corridor	1 < 20%	2 20 – 40%	3 40 – 60%	4 60 – 80%	5 ≥ 80%
Current condition of historic structures	1 Poor	2 Fair	3 Average	4 Good	5 Excellent
Extent of existing modification to historic facades	1 Extensive	2 High	3 Medium	4 Low	5 Very Low
Number of identifiable historic architectural elements and ornaments on street level	1 Scarce	2 Few	3 Moderate	4 Frequent	5 Abundant
Permanent material impact brought by flood retrofitting (for retrofitted streetscape only)	1 Extensive	2 High	3 Medium	4 Low	5 Very Low
Permanent visual impact on street level brought by flood retrofitting (for retrofitted streetscape only)	1 Extensive	2 High	3 Medium	4 Low	5 Very Low
Permanent visual impact on rooftops brought by flood retrofitting (for retrofitted streetscape only)	1 Extensive	2 High	3 Medium	4 Compatible	5 Invisible
Permanent physical impact on street space brought by flood retrofitting (for retrofitted streetscape only)	1 Extensive	2 High	3 Medium	4 Compatible	5 Invisible

Evaluation Metrics of the Adaptive Streetscape Framework.
Source: Illustration by the Author.

Streetscape Experience & Social-Spatial Relationship

Provide rating (in 5-point system) for both the original streetscape and the retrofitted streetscape.
Overall rating is calculated through an unweighted average of individual metrics below.

Percentage of continuous street wall along both sides of the street corridor*	1 < 20%	2 20 – 40%	3 40 – 60%	4 60 – 80%	5 ≥ 80%
Percentage of street-level transparency (for mixed-use/commercial corridor only)	1 < 20%	2 20 – 40%	3 40 – 60%	4 60 – 80%	5 ≥ 80%
Percentage of active use (except for storage, parking and access) along both sides of the street*	1 < 20%	2 20 – 40%	3 40 – 60%	4 60 – 80%	5 ≥ 80%
Percentage of storefronts with outdoor dining/seating (for mixed-use/commercial corridor only)	1 < 20%	2 20 – 40%	3 40 – 60%	4 60 – 80%	5 ≥ 80%
Average main entrance elevation of structures on both sides of the street as compared to street level	1 ≥ 4ft	2 3–4ft	3 2–3ft	4 1–2ft	5 < 1ft
Identifiable architectural patterns (fenestration, pilasters, etc.) on street level	1 Scarce	2 Few	3 Moderate	4 Frequent	5 Abundant
Number of storefronts, awnings, canopies and signages (for mixed-use/commercial corridor only)	1 Scarce	2 Few	3 Moderate	4 Frequent	5 Abundant
Liminal space for pedestrian passage/ Ability to walk along the sidewalk	1 Very Low	2 Low	3 Acceptable	4 Good	5 High
Permanent visual impact on rooftops brought by flood retrofitting (for retrofitted streetscape only)	1 Extensive	2 High	3 Medium	4 Compatible	5 Invisible
Estimated pedestrian behavioral change/mind map change brought by flood retrofitting (for retrofitted streetscape only)	1 Extensive	2 High	3 Medium	4 Low	5 Very Low

* “Continuous Street Wall” means a solid street wall composed of individual structures with each facade offset by less than 2 ft from the primary street wall plane, disqualifying structures with recessed facades and ramps in front of them.
* For “Active Use” to be counted, the actively used space must have a floor elevation of less than 3 ft from the street level.

Floor Area

Provide estimated values of the following indicators for both the original streetscape and the retrofitted streetscape.

Average FAR of structures on both sides of the street corridor	(value)
Estimated overall floor area, and floor area gain/loss through flood retrofitting	(value in sq.ft)

The table on pages 30-31 shows individual metrics and quantification parameters developed in this project to evaluate streetscape change brought by flood adaptation under the Adaptive Streetscape framework. Besides adopting metrics established and tested in the Ewing and Clemente model, the metrics listed in the table also incorporated observations and findings made in the previous discussion regarding flood adaptation policy-making and the values of historic streetscapes:

- The Flood Resilience metrics have referenced the flood insurance premium model in New York City's Zoning for Coastal Flood Resiliency of 2019-2021 (NYCDCP 2019c, 20), as well as several key principles of New York City's current flood-retrofitting regulatory framework (eliminating active functions on street level, implementing floodproofing treatments, and filling basements or cellars).

- The Building Integrity and Visual Consistency metrics are designed to evaluate the abundance and physical condition of historic buildings and street-level architectural features within the original streetscape, as well as to evaluate impacts brought by flood retrofitting on key areas such as a building's street level, rooftop and street space.

- The Streetscape Experience and Social-Spatial Relationship metrics incorporate several criteria from the Ewing and Clemente model; key streetscape features (awnings, signages, storefronts, etc.) defined in NYCLPC's *Permit Guidebook* (2019) are also adopted, together with key elements of street relationship that are highlighted in NYCDCP (2019c) and Crankshaw (2009)'s studies. Metrics for the cognitive and social-spatial aspects of streetscape quality are inspired by Fullilove's *Main Street* (2020) study.

- The Floor Area metrics are built upon the building addition strategies and floor area transfer discussions in NYCDCP's *Retrofitting* report (2014) and Flood Zoning amendments (2013 & 2019–2021).

Metric:
Percentage of areas with active use on street level

Goal 1: Flood Resilience	1 ≥ 80%	2 80 – 60%	3 60 – 40%	4 40 – 20%	5 < 20%	↓
Goal 3: Streetscape Experience & Social-Spatial Relationship	1 < 20%	2 20 – 40%	3 40 – 60%	4 60 – 80%	5 ≥ 80%	↑

Metric:
Permanent visual impact on rooftops brought by flood retrofitting

Goal 2: Building Integrity & Visual Consistency	1 Extensive	2 High	3 Medium	4 Compatible	5 Invisible	↑
Goal 3: Streetscape Experience & Social-Spatial Relationship	1 Extensive	2 High	3 Medium	4 Compatible	5 Invisible	↑

Correlation and Contradiction Between Different Goals Demonstrated by Evaluation Metrics.
Source: Illustration by the Author.

The semi-quantitative metrics established in the table are able to directly demonstrate the correlation and contradiction between different Adaptive Streetscape goals, as previously analyzed in Section 3.2.
For example, the Flood Resilience goal asks to limit active use on street level below DFE, while the Streetscape Experience goal encourages as much active use on street level as possible; in another case, the Building Integrity goal and the Streetscape Experience goal may both benefit from rooftop additions executed in compatible style with little visual impacts (see figure on page 32). The Adaptive Streetscape framework and metrics will be used throughout this project, to produce balanced design solutions that acknowledge multiple values and conflicting goals.

04

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Living Above the Street
Stewarding New York City's Historic Built Environment Towards Flood Resilience

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DIGITAL REPORT 03

Streetscape-Sensitive Design Strategies

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About

This report is part of the independent research project “Living Above the Street: Stewarding New York City’s Historic Built Environment Towards Flood Resilience,” which is supported by Onera Foundation under 2022 Onera Prize for Historic Preservation.

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Further Readings

To view and download the whole series of policy & design reports, please visit:

https://www.livingabovethestreet.nyc/reports.

This Onera Prize research project is developed upon the author’s M.S. Historic Preservation thesis:

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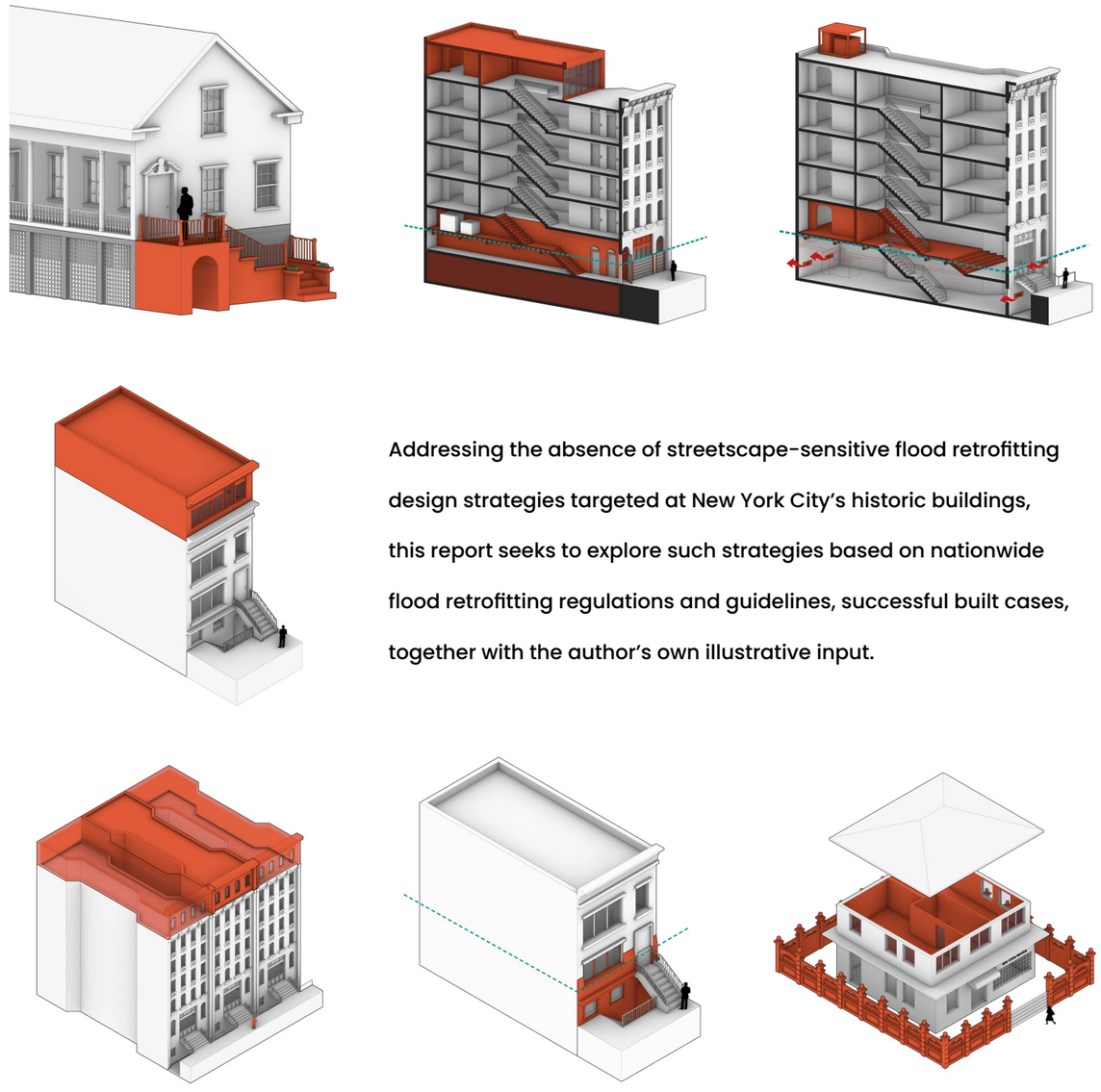
Cover Image:
Streetscape features of a dry-floodproofed retail storefront in a mid-rise mixed-use building.
Illustration by the author.



Addressing the absence of streetscape-sensitive flood retrofitting design strategies targeted at New York City’s historic buildings, this report seeks to explore such strategies based on nationwide flood retrofitting regulations and guidelines, successful built cases, together with the author’s own illustrative input.

Contents

01

Executive Summary

Executive Summary

The extensive streetscape changes brought by flood adaptation interventions in New York City's waterfront and the multiple goals and values involved in the transformation of historic built environment towards flood resilience call for innovative design strategies on historic buildings and neighborhoods that balance flood resilience and heritage values. In recent years, flood retrofitting and streetscape mitigation strategies on historic or existing buildings have been actively developed by various policy-making entities on different levels. In 2021, the National Park Service published the illustrated *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*; this nationwide guideline paralleled the emergence of a number of similar guidelines and policy documents on state and city level, such as Miami Beach, FL's *Buoyant City* (2020); Charleston, SC's *Design Guidelines for Elevating Historic Buildings* (2019); Boston, MA's (2018) *Resilient, Historic Buildings Design Guide* (2018); and New York City's own *Retrofitting Buildings for Flood Risk* report (2014), *Zoning for Coastal Flood Resiliency* (2019), and the LPC technical guidelines on equipment relocation and flood shield installation.

Although these nationwide guidelines may serve as a valuable reference to New York City's flood adaptation policy-making, they may not be suitable to be directly applied on New York City's flood-threatened historic buildings. First of all, most nationwide flood adaptation policies and design guidelines are made for detached single-family homes, while New York City has a variety of high-density urban building types that involve mixed uses, multiple tenants, and shared party walls; on the other hand, although New York City's own flood retrofitting guidelines have managed to address these building types, their streetscape provisions are still relatively preliminary, and lack specific considerations for historic buildings, neighborhoods or districts. **Addressing the absence of streetscape-sensitive flood retrofitting design strategies targeted at New York City's historic buildings, this report seeks to explore such strategies through a comprehensive review of nationwide guidelines and regulations, successful built cases, together with the author's own illustrative input.** In this report, the author characterizes New York City's floodplain building stock into six major categories based on NYCDCP's 2014 *Retrofitting* report, pairs each building type with one or two overall adaptation methods (e.g. structural elevation and in-place dry-floodproofing), lists major streetscape and preservation considerations under each adaptation scheme, and maps design treatments that help address these considerations. To reveal potential tensions between streetscape-sensitive design strategies and New York City's current flood regulation framework, local Building Code and Flood Zoning compliance of each proposed design strategy is also examined.

Besides the flood adaptation discourse on individual building scale, several neighborhood-scaled adaptation models — such as elevating streets in low-lying urban sections — have also been recently executed or proposed in cities across the US. In addition to building-scaled strategies, the author briefly lists these large-scale adaptation models, and discusses their streetscape implications as well as historic preservation relevance.

With the exploration of streetscape-sensitive flood adaptation design strategies comes the need for policy reforms in flood regulation and preservation standards. Building upon the design studies carried out in this report, the author finds that a considerable number of streetscape-sensitive design strategies identified for New York City's flood-threatened historic buildings and neighborhoods are either incompliant with the city's current Building Code, or not acknowledged, regulated and supported by the city's flood regulation framework at all. While New York City's Building Code and Flood Zoning shall be further reformed to better accommodate the characters of urban building types and regulate streetscape changes, extensive preservation policy-making is urgently needed as well in order to establish more comprehensive flood adaptation solutions targeted at the city's historic built environment.

At the end of this report, all the streetscape-sensitive flood adaptation design strategies identified on building and neighborhood scales are summarized into a ***streetscape-sensitive design toolbox*** — an illustrated glossary of recommended design treatments listed in tabular form. This graphic toolbox may be seen as a preliminary design guideline for the flood adaptation of New York City's historic buildings, and will be applied to real-world historic environment in the adaptation design studies featured in Digital Report 04 (South Street Seaport) and Digital Report 05 (East Harlem).

02

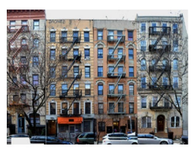
Characterizing New York City's Floodplain Building Stock

As Digital Report 01 has revealed, a various collection of historic assets are situated within New York City's current floodplain. Within the floodplain, we may find buildings that range from wood-frame houses to high-rise towers and airport terminals; and historic districts and neighborhoods with different designation statuses, functions, scales, and predominant building types. To navigate such complexity, a typological characterization of New York City's floodplain building stock becomes necessary. An understanding of major building types in the city's floodplain will not only facilitate the development of typified flood adaptation design strategies, but also help us better apprehend the characters of local historic districts.

Leveraging the city's PLUTO database and Mass Appraisal System, New York City Department of City Planning (NYCDCP)'s 2014 *Retrofitting Buildings for Flood Risk* report featured a count of all residential related-buildings in the city's 1% PFIRM floodplain. Based on this count, the *Retrofitting* report categorized New York City's floodplain building stock into 6 major types: **"Bungalow," "Detached," "Semi-Detached," "Attached," Mid-Rise Walk-Up," and "Mid-Rise Elevator,"** with the percentage of mixed-use buildings calculated for each building type (NYCDCP 2014, 16-21). This count and characterization was only carried out for buildings with residential units because according to New York City's current building code, only residential spaces are required to be raised up to DFE; purely commercial structures can be just dry-floodproofed in-place, which involves significantly less physical intervention and urban form change. Furthermore, this characterization also excluded multi-family high-rise structures (more than 6 stories) which constitute less than 2% of the floodplain building stock, and have more retrofitting options and flexibility.

The data and characterization published in DCP's *Retrofitting* report provide a critical understanding on the profiles of New York City's flood-threatened building stock, which may serve as a starting point for the inquiries carried out in this project. **However, as a characterization based on general planning metrics, the DCP categorization has downplayed an important factor with substantial streetscape implications: a building's street-level use.** A multi-family apartment with a street-level residential lobby and a mixed-use structure with a street-level storefront are not only different in terms of use, characters, social-spatial relationship, and visual appearance; more importantly, they are subject to different floodproofing standards and options (as residential and non-residential structure, respectively) under Appendix G of New York City's current Building Code. **Therefore, a re-characterization of the DCP data that emphasizes the difference between residential and mixed-use structures is needed in order to establish a basis for the development of streetscape-sensitive flood adaptation design strategies.**

For this study, the author separates residential and mixed-use structures under each building type established in the DCP report; meanwhile, instead of merely doubling 6 building types into 12, the author also merges DCP's original building types that have little difference in construction type and streetscape implications. Specifically, the original "Bungalow" and "Detached" types — which are similar in scale and construction method — are

Original Building Types		New Building Types for Streetscape Purpose	Number of Buildings	Building Characters
 Bungalow	Residential 6,350 Buildings	Detached Residential	**29,883 Buildings**	**Construction:** Wood Frame on Masonry, or in some cases Masonry. **Basement:** With or Without Basement. **Party Wall:** None. **Height:** 1-2 Story. **Function:** Residential.
	Mixed-Use 0 Building			
 Detached	Residential 23,533 Buildings	Detached Mixed-Use	**2,327 Buildings**	**Construction, Basement, Party Wall, and Height:** Same with Detached Residential. **Function:** 1st Floor Commercial, Upper Floor Residential.
	Mixed-Use 2,327 Buildings			
 Semi-Detached	Residential 12,321 Buildings	Semi-Attached/Attached Residential	**20,616 Buildings**	**Construction:** Wood Frame or Masonry with Wood Joints, on Masonry/Concrete Foundation. **Basement:** With Basement or Cellar. **Party Wall:** Yes. **Height:** 1-3 Story. **Function:** Residential.
	Mixed-Use 1,369 Buildings			
 Attached	Residential 8,295 Buildings	Semi-Attached/Attached Mixed-Use	**2,394 Buildings**	**Construction, Basement, Party Wall, and Height:** Same with Semi-Attached/Attached Residential. **Function:** 1st Floor Commercial, Upper Floor(s) Residential.
	Mixed-Use 1,025 Buildings			
 Mid-Rise Walk-Up	Residential 2,540 Buildings	Mid-Rise Residential	**3,188 Buildings**	**Construction:** Masonry, Steel or Concrete, on Masonry/Concrete Foundation. **Basement:** With Basement or Cellar. **Party Wall:** Yes. **Height:** 4-6 Story. **Function:** Residential.
	Mixed-Use 940 Buildings			
 Mid-Rise Elevator	Residential 648 Buildings	Mid-Rise Mixed-Use	**982 Buildings**	**Construction, Basement, Party Wall, and Height:** Same with Mid-Rise Residential. **Function:** 1st Floor Commercial, Upper Floors Residential.
	Mixed-Use 42 Buildings			

Re-categorizing New York City's floodplain building types for streetscape purpose. Data processed based on NYCDCP's 2014 *Retrofitting Buildings for Flood Risk* report.

merged into the new “Detached” type, and then divided into “Detached Residential” and “Detached Mixed-Use.” The original “Semi-Detached” and “Attached” types — which both have party walls on at least one side that serve as a key restriction to applicable retrofitting strategies — are merged into the new “Semi-Attached/Attached” type, and then divided into “Semi-Detached/Attached Residential” and “Semi-Attached/Attached Mixed-Use.” The original “Mid-Rise Walk-Up” and “Mid-Rise Elevator” types — which share great overall resemblance — are merged into the new “Mid-Rise” type, and then divided into “Mid-Rise Residential” and “Mid-Rise Mixed-Use.”

Recalculating data published in the DCP report, this process produces 6 new building types for flood adaptation and streetscape purposes: Detached Residential, Detached Mixed-Use, Semi-Attached/Attached Residential, Semi-Attached/Attached Mixed-Use, Mid-Rise Residential, and Mid-Rise Mixed-Use. The illustration on p. 10-11 visualizes the re-categorization process described above. As a preliminary attempt to establish streetscape-sensitive flood adaptation design strategies for New York City’s flood-threatened historic building stock, in the following chapters, the author will attempt to gather and propose design solutions based on these six new building types; more in-depth studies in the future may be required to further explore detailed strategies for the broader and more specific types of historic buildings in the floodplain. Detailed profiles of New York City’s 6 floodplain building types established in this study are listed as follows:

- **Detached Residential. Construction:** Wood Frame on Masonry, or in some cases Masonry. **Basement:** With or Without Basement. **Party Wall:** None. **Height:** 1-2 Story. **Function:** Residential. **Count:** 29,883 Buildings.

- **Detached Mixed-Use. Construction, Basement, Party Wall, and Height:** Same with Detached Residential **Function:** First Floor Commercial, Upper Floor Residential. **Count:** 2,327 Buildings.

- **Semi-Attached/Attached Residential. Construction:** Wood Frame or Masonry with Wood Joints, on Masonry/Concrete Foundation. **Basement:** With Basement or Cellar. **Party Wall:** Yes. **Height:** 1-3 Story. **Function:** Residential. **Count:** 20,616 Buildings.

- **Semi-Attached/Attached Mixed-Use. Construction, Basement, Party Wall, and Height:** Same with Semi-Attached/Attached Residential. **Function:** First Floor Commercial, Upper Floor(s) Residential. **Count:** 2,394 Buildings.

- **Mid-Rise Residential. Construction:** Masonry, Steel or Concrete, on Masonry/Concrete Foundation. **Basement:** With Basement or Cellar. **Party Wall:** Yes. **Height:** 4-6 Story. **Function:** Residential. **Count:** 3,188 Buildings.

- **Mid-Rise Mixed-Use. Construction, Basement, Party Wall, and Height:** Same with Mid-Rise Residential. **Function:** First Floor Commercial, Upper Floors Residential. **Count:** 982 Buildings.

03

Existing Design Guidelines and Other Data Sources

The extensive streetscape changes brought by flood adaptation interventions in New York City's waterfront and the multiple goals and values involved in the transformation of historic built environment towards flood resilience call for innovative design strategies on historic buildings and neighborhoods that balance flood resilience and heritage values. Nevertheless, flood adaptation and streetscape change is far beyond a New York City-specific challenge; in recent years, flood retrofitting and streetscape mitigation strategies on historic or existing buildings have been actively developed by various policy-making entities on different levels. In 2021, the National Park Service published the illustrated *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings*; this nationwide guideline paralleled the emergence of a number of similar guidelines and policy documents on state and city level, such as Miami Beach, FL's *Buoyant City* (2020); Charleston, SC's *Design Guidelines for Elevating Historic Buildings* (2019); Boston, MA's (2018) *Resilient, Historic Buildings Design Guide* (2018); and New York City's own *Retrofitting Buildings for Flood Risk* report (2014), *Zoning for Coastal Flood Resiliency* (2019), and the LPC technical guidelines on equipment relocation and flood shield installation. Since the streetscape provisions in New York City's flood adaptation guidelines still remain relatively preliminary and especially lack specific considerations for historic buildings and neighborhoods, these nationwide guidelines and policy documents may serve as valuable references to New York City's flood adaptation policy-making.

However, in spite of their ingenuity, these nationwide guidelines may not be suitable to be directly applied on New York City's historic buildings. This is primarily because most nationwide flood adaptation policies and design guidelines are made for detached single-family homes, which constitute the most commonly found residential building type in the U.S.; while New York City has a variety of high-density urban building types — such as row houses, mixed-use mid-rise apartments, etc. — that involve mixed uses, multiple tenants, and shared party walls. **The specific building types inside New York City's floodplain have led to an absence of streetscape-sensitive flood retrofitting design strategies targeted at New York City's historic buildings.** To address such absence and develop New York City-oriented streetscape-sensitive retrofitting design strategies, the author seeks to leverage the following sources and inputs:

- **Successful streetscape design strategies identified in existing flood adaptation guidelines and policy documents, that are transferrable to New York City's floodplain building types;**
- **Successful flood retrofitting built cases across the country;**
- **The author's own design input, for building types not effectively addressed by existing guidelines or built cases.**

The following chapters will provide a brief introduction to these sources and inputs, which serve as a basis for design strategies proposed in Chapter 04.

3.1
Key Existing Design Guidelines on the Streetscape-Sensitive Flood Adaptation of Historic Buildings

Although most of them are focused on single-family homes and not targeted at New York City's historic built environment, the existing nationwide flood adaptation guidelines — which represent the current knowledge body on streetscape-sensitive flood retrofitting — are still able to provide many ingenious and innovative streetscape design strategies that may be mirrored in New York City's policy-making. However, these successful strategies are scattered among different publications under various regulation systems, and have not yet been systematically reviewed and summarized. In this project, the author selects and reviews 27 nationwide flood adaptation design guidelines and policy documents, and uses them to develop flood adaptation design strategies for New York City's flood-threatened historic building stock. The guidelines and policy documents are selected based on the following criteria:

- They should provide strategies for the flood adaptation of historic or existing built environment;
- They should directly contain design strategies and treatments that address streetscape changes brought by flood adaptation interventions; or
- They should lay out key flood regulations or historic preservation standards that regulate the permitted flood adaptation options for historic buildings.

These 27 guidelines and documents shall be considered as core samples of nationwide flood adaptation policy-making, as many of them cite each other as key references or case studies; they also represent a wide variety of regulatory levels (from Federal to State and municipal), policy-making interests (flood resistance, design quality, vis a vis historic preservation), and scopes (historic structure vs. general existing structure). Many of them — including Charleston, SC's *Design Guidelines for Elevating Historic Buildings*, Miami Beach's *Buoyant City*, Louisiana's *Elevation Design Guidelines for Historic Buildings in the Louisiana GO Zone*, and New York City's *Zoning for Coastal Flood Resiliency* — identify streetscape change as a key focus area and feature illustrated recommendations or detailed streetscape provisions; however, most streetscape mitigation strategies readily available for historic structures are oriented towards the structural elevation of detached houses.

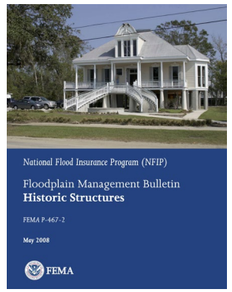
It should also be noted that with only a few exceptions, most guidelines are primarily focused on flood adaptation interventions on building or site scale — paralleling the fact that the current discourse on flood adaptation in the U.S. weighs largely on building or site-scaled retrofitting carried out by individual homeowners. However, a number of neighborhood-scaled adaptation models that aim to take whole neighborhoods out of floodplain

Guideline / Regulation	Policy-Making Interest	Regulatory Level			Scope	
		Federal	State	Municipal	General Buildings	Historic Structures
FEMA, 2008 Floodplain Management Bulletin: Historic Structures (P-467-2)	Historic Preservation Flood Resistance Regulation	●				●
FEMA, 2014 Homeowner's Guide to Retrofitting (P-312, 3rd Edition)	Flood Resistance Regulation	●			●	
National Park Service, 2021 Guidelines on Flood Adaptation for Rehabilitating Historic Buildings	Historic Preservation	●				●
Louisiana SHPO, 2015 Elevation Design Guidelines for Historic Buildings in the Louisiana GO Zone	Design Quality Historic Preservation		●			●
Maryland SHPO, 2018 Flood Mitigation Guide: Maryland's Historic Buildings	Historic Preservation		●			●
Mississippi Development Authority, n.d. Elevation Design Guidelines for Historic Homes in the Mississippi Gulf Coast Region	Design Quality Historic Preservation		●			●
New Jersey SHPO, 2019 Flood Mitigation Guide for Historic Properties	Historic Preservation Flood Resistance Regulation		●			●
New Jersey SHPO, 2019 Elevation Design Guidelines for Historic Properties	Design Quality Historic Preservation		●			●
Boston Environment Department, 2018 Boston: Resilient, Historic Buildings Design Guide	Design Quality Historic Preservation			●		●
Boston Planning & Development Agency (BPDA), 2016 Retrofitting Boston Buildings for Flooding: Potential Strategies	Design Quality			●	●	
Boston Planning & Development Agency (BPDA), 2019 Coastal Flood Resilience Design Guidelines	Design Quality			●	●	
Charleston Board of Architectural Review (BAR), 2019 Design Guidelines for Elevating Historic Buildings	Design Quality Historic Preservation			●		●
City of Miami Beach, 2020 Buoyant City: Historic District Resiliency & Adaptation Guidelines	Design Quality Historic Preservation			●		●
Miami-Dade County, 2021 Resilient Rehab: A Guide for Historic Buildings in Miami-Dade County	Design Quality Historic Preservation			●		●
Town of Nantucket, 2021 Resilient Nantucket: Flooding Adaptation & Building Elevation Design Guidelines	Design Quality Historic Preservation			●		●
FEMA, 2012 The History of Building Elevation in New Orleans	Design Quality Historic Preservation			●		●
NYC Department of Buildings (DOB), 2014 Building Code Appendix G	Flood Resistance Regulation			●	●	
NYC Department of City Planning (DCP), 2013 Flood Resilience Zoning Amendment	Design Quality Flood Resistance Regulation			●	●	
NYC Department of City Planning (DCP), 2019-2021 Zoning for Coastal Flood Resiliency	Design Quality Flood Resistance Regulation			●	●	
NYC Department of City Planning (DCP), 2013 Coastal Climate Resilience: Designing for Flood Risk	Design Quality			●	●	
NYC Department of City Planning (DCP), 2014 Retrofitting Buildings for Flood Risk	Design Quality Flood Resistance Regulation			●	●	
NYC Department of City Planning (DCP), 2016 Coastal Climate Resiliency: Resilient Retail	Design Quality Flood Resistance Regulation			●	●	
NYC Landmarks Preservation Commission (LPC), 2019 LPC Permit Guidebook (2019 Edition)	Design Quality Historic Preservation			●		●
NYC Landmarks Preservation Commission (LPC), n.d. Technical Guides on Equipment Relocation and Flood Shield Installation	Historic Preservation			●		●
Newport Historic District Commission (HDC), 2020 Policy Statement and Design Guidelines for Elevating Historic Buildings	Design Quality Historic Preservation			●		●
City of St. Augustine, 2021 Flood Mitigation Design Guidance for Historic Residences	Design Quality Historic Preservation			●		●
City of St. Augustine, 2021 Flood Mitigation Design Guidance for Historic Coquina Buildings	Design Quality Historic Preservation			●		●

Guidelines and policy documents studied in this project.

through infrastructural interventions have also been made in municipalities such as New York City and Miami Beach in recent years. As a supplement to building-scaled strategies, these neighborhood-scaled models will be discussed in Chapter 05.

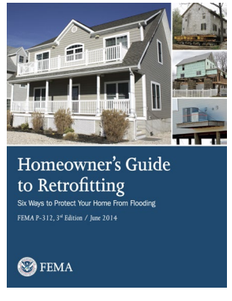
The table on p. 16 lists the guidelines and policy documents studied in this project. The rest of this section provides a brief review and introduction to these guidelines, ranking them alphabetically by geography from Federal to local level. Specific design solutions extracted from these documents will also be individually referenced in the discussion of building-scaled design strategies carried out in Chapter 04.



FEMA, 2008

***Floodplain Management Bulletin: Historic Structures* (P-467-2)**

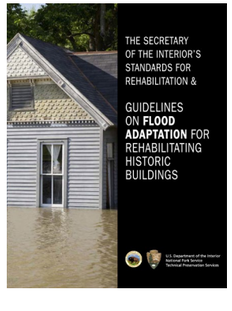
This brochure lays out NFIP's *substantial improvement* provision that has been adopted in the building codes of all participating communities including New York City, and introduces two options that may be chosen by local communities to relieve historic structures (on National or State Register) from the mandate: exempting historic structures from the definition of "substantial improvement," or requiring historic structures to acquire FEMA variances when they are substantially renovated. Information was also provided on NFIP's flood insurance policy on historic structures, as well as on cases where historic structures were retrofitted (through structural or non-structural elevation, equipment relocation and floodproofing, etc.) for flood resilience.



FEMA, 2014

***Homeowner's Guide to Retrofitting* (P-312, 3rd Edition)**

Aimed at general homeowners, this document lists common types of flood adaptation strategies (elevation, relocation and demolition) and floodproofing treatments (wet floodproofing, dry floodproofing and barrier systems). Although not directly related to streetscape design solutions, it provides a concise and typological review of the current toolbox on building-scaled flood retrofitting.



National Park Service, 2021

***Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (2nd Edition)**

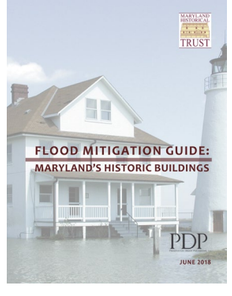
This illustrated guideline provides a comprehensive review and visualization of flood adaptation interventions that may be applied to historic structures and sites, ranging from temporary measures and floodproofing treatments to basement fill and structural or non-structural elevation. Using diagrams, photographs, lists of recommended practices and case studies, it also lays out ways in which these flood adaptation

strategies — which often involve more extensive spatial changes than normally acceptable — will be able to retain historic characters and meet *The Secretary of the Interior's Standards for Rehabilitation*.

URS for Louisiana Division of Historic Preservation (LASHPO), 2015

Elevation Design Guidelines for Historic Buildings in the Louisiana GO Zone

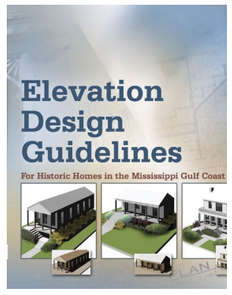
Targeted at the structural elevation of local detached homes, this guideline uses successful built cases to lay out recommended practices in the design of site features, building facade, foundation, fence and stairs — areas closely related to historic characters and streetscape change. A particular emphasis is given to stair and landing areas in this guideline, with case studies provided for a number of different stair layouts.



PDP Architects for Maryland Historical Trust (MDSHPO), 2018

Flood Mitigation Guide: Maryland's Historic Buildings

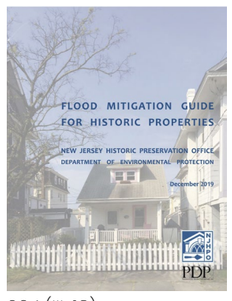
Designed to help local governments form community-level flood resilience strategies for historic properties, this guideline explains the key concepts of flood adaptation, and addresses the whole cycle of emergency management (planning & preparedness — response & recovery — mitigation — adaptation) with a focus on its preservation relevance. Matrices are provided to illustrate the pool of available community-wide and property-specific flood adaptation options; a number of the state's historic communities were surveyed, with possible flood adaptation strategies identified.



URS for Mississippi Development Authority, c. 2008

Elevation Design Guidelines for Historic Homes in the Mississippi Gulf Coast Region

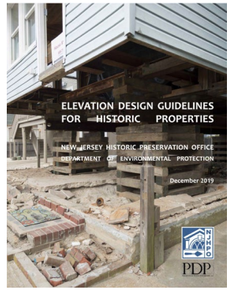
Developed after Hurricane Katrina, this document serves to guide elevation projects on historic homes carried out in the disaster recovery process. Featuring recommendations for site, architecture and foundation, this guideline advocates for elevation designs that complement and match historic facade composition, and mitigate streetscape changes through treatments such as planting, screening, and grade change of the site.



PDP Architects for New Jersey Historic Preservation Office (NJSHPO), 2019

Flood Mitigation Guide for Historic Properties

Similar to the Maryland guideline introduced above, this document situates New Jersey's historic built environment into the flood adaptation and emergency management cycle. This guideline further stresses the policy-making actions that local community can take to encourage the sensitive flood adaptation of historic properties, such as modifying zoning ordinance or building code, developing financial incentives, and creating streamlined review processes.



PDP Architects for New Jersey Historic Preservation Office (NJSHPO), 2019

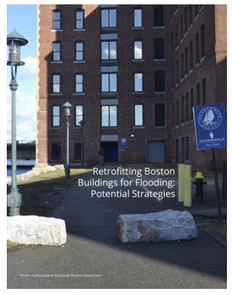
Elevation Design Guidelines for Historic Properties

As a companion to the state's *Flood Mitigation Guide for Historic Properties*, this guideline lays out considerations on neighborhood, site and building scales for the structural elevation of historic houses. Most of these considerations are related to the mitigation of changes in proportion, historic character, and streetscape; illustrated case studies are provided for local building types such as row house, duplex, and detached home.

Bella Purdy for Boston Environment Department, 2018

Boston: Resilient, Historic Buildings Design Guide

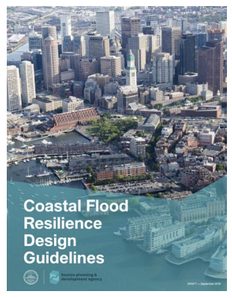
This guideline positions flood adaptation under a larger framework of resilience, which also includes climate mitigation measures such as solar panels, and climate resilience measures such as rain gardens. Illustrated design studies are provided where strategies under all three lenses are proposed for local historic building types that range from row houses to industrial lofts; for streetscape considerations, non-structural elevation is favored over structural elevation, with options to locate access stairs either outside or inside the entrance.



Adria Boynton for Boston Planning & Development Agency (BPDA), 2016

Retrofitting Boston Buildings for Flooding: Potential Strategies

As an exploratory guideline designed for Boston's general existing building stock, this document uses the concept of "Retrofi+" to illustrate additional design recommendations beyond FEMA's minimum requirements. Illustrated case studies are provided for a greater variety of building types, including mixed-use wharf buildings and high rises. For streetscape and urban design considerations, a range of design solutions are proposed, including front porch, raised yard, landscaping, foundation screening, interior elevation with vestibule, temporary programming in abandoned first floor, and rooftop addition set back from the original facade.

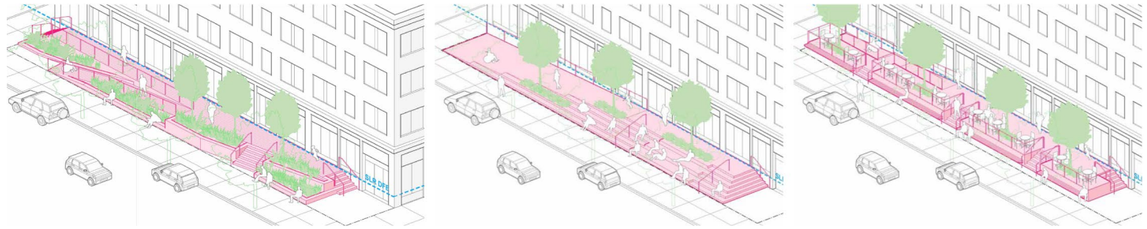


Boston Planning & Development Agency (BPDA), 2019

Coastal Flood Resilience Design Guidelines

An expansion to the *Retrofitting Boston Buildings for Flooding* report, this guideline establishes six major building types in Boston's floodplain — which are somewhat similar, but slightly lower in density than the building types identified in New York City's *Retrofitting Buildings for Flood Risk* report. Illustrated design studies are carried out for

each building type, and general adaptation strategies that may be applied across the board are visualized as well. One of the principles of this guideline is that building-scale resilience solutions should contribute to an overall enhancement of the public realm; accordingly, public realm implications are discussed for each design strategy, and streetscape and urban environment friendly design solutions — such as exterior circulation systems combined with plantation, seating areas and outdoor dining — are proposed.

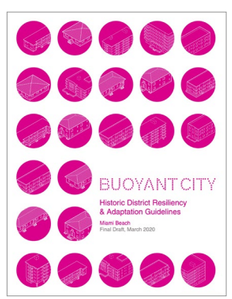


Exterior circulation system designs proposed in Boston's Coastal *Flood Resilience Design Guidelines*.
Source: BPDA 2019, 41-42.

Charleston Board of Architectural Review (BAR), 2019

Design Guidelines for Elevating Historic Buildings

An innovative design guidance and review standard published to support the elevation of historic homes in Charleston's peninsula-shaped downtown, this guideline provides recommendations under the focus areas of streetscape/context, site design, foundation design, and architecture/preservation. Stressing streetscape quality and visual consistency across all of its four focus areas, this guideline promotes a number of creative design solutions based on successful local practice, including "piazza screening" (where the entrance of a house is retained at street level, and stairs are put behind it leading to an elevated side porch), articulated and fenestrated foundation design, and detailed landscaping and fence recommendations. The creation of a fenestrated and architecturally compatible full story is recommended when significant elevation change is involved; and a procedure is established to ensure that the elevation designs of "sister houses" will follow the first elevated instance in the group.



Shulman+Associates et al. for City of Miami Beach, 2020

Buoyant City: Historic District Resiliency and Adaptation Guidelines

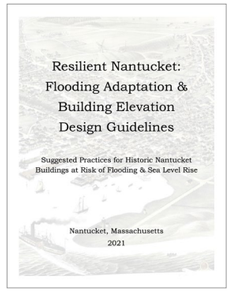
Buoyant City is arguably one of the most audacious and comprehensive design guidelines published for the flood adaptation of historic built environment across U.S. cities. Through richly illustrated and intense design studies, the guideline surveys the building typology, morphology and typical landscape features in Miami Beach's historic districts, and proposes creative design strategies on building/site scale that include the "building in a building" approach and the elevation of buildings together with lots. It further considers the process of elevating buildings with lots (through individual projects or through a combined approach on block or district scale), as well as financial incentives and development bonuses — such as TDRs and rooftop additions in different forms — that may stimulate adaptation undertakings. The philosophy that embraces change as an interpretable layer of history is showcased throughout the guideline; and changes in streetscape, public spaces, and urban forms are at the very heart of its design considerations. Street view renderings, street sections and urban design diagrams are made for many adaptation options proposed in the guideline, which involve spatial strategies not only on buildings and their lots, but also on sidewalks, alleys and street space. As an experimental design study that thinks beyond today's typical preservation standards and flood regulations, this guideline provides a diverse collection of creative alternatives for the future of urban historic districts.

Streetscape and urban design schemes in *Buoyant City*.
Source: Miami Beach 2020, 274-289.

Shulman+Associates for Miami-Dade County, 2021

Resilient Rehab: A Guide for Historic Buildings in Miami-Dade County

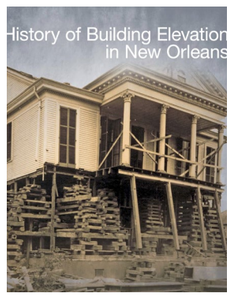
Contrasting to *Buoyant City* where bold and forward-looking adaptation strategies are proposed in a non-compulsory manner, *Resilient Rehab* is an attempt to incorporate practical resilience considerations into county-level preservation design review standards. Stemmed from the typical structure of preservation design guidelines, this document surveys predominant historic architectural styles in Miami-Dade, while providing an analysis on resilience challenges for each building type. Resilience actions and considerations can also be found as part of the recommendations for each architectural element discussed in the document; additionally, there's an independent section that lays out general flood adaptation interventions that are applicable to historic buildings and sites. This guideline provides an example on how resilience strategies can be blended into local preservation design standards, encouraging not only purposeful flood adaptation projects, but also a wider range of renovation and rehabilitation actions with incremental resilience measures.



Thomason & Associates for Town of Nantucket, 2021

Resilient Nantucket: Flooding Adaptation & Building Elevation Design Guidelines

This guideline discusses how key flood adaptation strategies for historic buildings may be appropriately applied to Nantucket's sensitive historic built environment, which features freestanding commercial or residential houses built mostly in wood frame that can be traced back to the 1700s. As is the case for many other historic towns, the design of foundation, stair, and landscape features as well as the choice of finishing materials are critical for the retaining of detached houses' historic characters under flood adaptation and elevation.



URS for FEMA, 2012

The History of Building Elevation in New Orleans

Due to recurring flood risks, houses in the New Orleans area have been historically elevated or built with principal living areas above the ground. This report traces the history of building elevation in New Orleans, and surveys the historic raised house types that resulted from local construction and elevation practice. These house types may provide traditional wisdoms that aid the design of contemporary elevation projects.

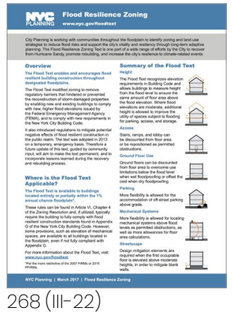

APPENDIX G

FLOOD-RESISTANT CONSTRUCTION

NYC Department of Buildings (DOB), 2014

NYC Building Code (2014) Appendix G: Flood-Resistant Construction

In compliance with FEMA's floodplain management requirements, NYC Building Code's *Appendix G* lays out floodproofing options for structures within the 1% floodplain when they are substantially improved: all residential structures (for flood zone purpose) shall have their habitable spaces elevated above DFE, and accessory spaces below DFE wet-floodproofed; mixed-use or non-residential structures have the option to either elevate, or dry-floodproof in-place. However, instead of requiring all designated properties to acquire FEMA variances, the Building Code offers a pathway for historic buildings to be just exempted from the substantial improvement provision (see the definition of "substantial improvement," section G201). A more detailed analysis on *Appendix G* can be found in Digital Report 01: Flood Risk of New York City's Historic Built Environment.

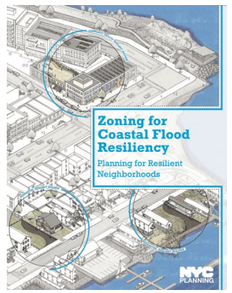


NYC Department of City Planning (DCP), 2013

Flood Resilience Zoning Amendment

This temporary flood zoning amendment was adopted in October 2013 to support New York City's emergency Building Code changes proposed as an executive order from the Office of Mayor right after Hurricane Sandy. The amendment proposes new baselines for building height measurement within the 1% floodplain, and provides updated provisions

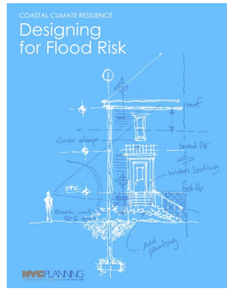
for building envelope, access, floor area calculation, streetscape, and building equipment, among other issues. It contains a set of preliminary streetscape design recommendations targeted respectively at the structural elevation of detached homes, and the new construction of large-scaled mixed-use buildings; a detailed analysis of this design menu can be found in Digital Report 02.



NYC Department of City Planning (DCP), 2019-2021

Zoning for Coastal Flood Resiliency (ZCFR)

NYCDCP's 2013 Flood Zoning Amendment was further updated in 2019 into the report *Zoning for Coastal Flood Resiliency: Planning for Resilient Neighborhoods*, which was in turn adopted in May 2021 as New York City's current flood zoning. Besides making previous rules permanent and refining flood zoning provisions, this new flood zoning is made applicable to both the city's 1% and 0.2% floodplains. Streetscape design standard is among the key areas of changes introduced by this new amendment: a point system is featured in the current flood zoning, requiring all buildings to incorporate a collection of streetscape mitigation design features totaling a certain number of points under the categories of access and street-level expression when they are constructed or adapted for flood resilience. Digital Report 02 provides a detailed introduction and analysis of the currently effective streetscape design point system.



NYC Department of City Planning (DCP), 2013

Coastal Climate Resilience: Designing for Flood Risk

An early post-Sandy design study aimed at identifying urban design principles to guide new construction projects under flood resistance standards, this report highlights four key design considerations: visual connectivity, facade articulation, inviting access, and neighborhood character — all of which are closely related to the tensions between flood regulations and the vigor and visual quality of urban streetscape. Specific design solutions recommended include human-scaled architectural elements on street level, articulated and transparent facades, and access systems integrated into site design; although originally developed for new constructions, these principles are also very relevant to the flood adaptation of existing or historic structures.

NYC Department of City Planning (DCP), 2014

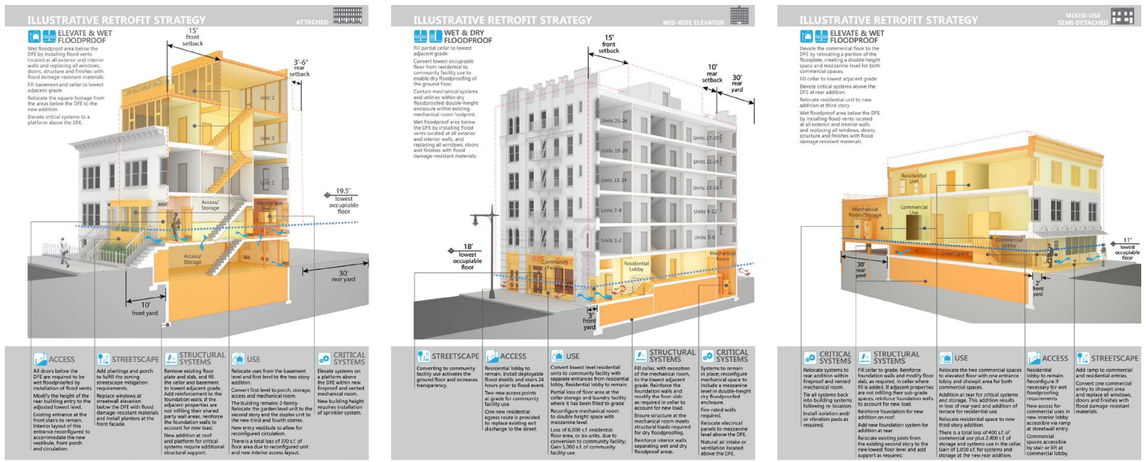
Retrofitting Buildings for Flood Risk

A comprehensive and intense building-scaled flood adaptation design study, the *Retrofitting* report sets the stage for the understanding of retrofitting strategies suitable for specific building types found in New York City's floodplain. Leveraging New York City's PLUTO database and Mass Appraisal System, the report provides a characterization

and count of New York City's floodplain building stock; it also features 10 real-world adaptation design studies that cover major building types (such as row houses, mixed-use mid-rise buildings, and mid-rise apartments) identified in the floodplain. Each design study incorporates a design scheme that is fully compliant with applicable regulations, featuring considerations under key focus areas such as use, access, structural systems, critical systems, parking, and streetscape & visual connectivity; alternative strategies that are incremental and not fully compliant with the substantial improvement provision are also provided.

This report may be regarded as the most in-depth flood adaptation design study dedicated to New York City's floodplain building types so far, as it envisions creative retrofitting strategies — such as interior elevation, optional rooftop addition, street-level functional conversion and the creation of double-height spaces — that are targeted at high-density urban fabrics and framed beyond structural elevation.

In many ways, the *Retrofitting* report serves as a basis for the inquiries of this project. The floodplain building types adopted in this study stem from data provided by the *Retrofitting* report; this study also references many overall retrofitting strategies established by the report for individual building types. The building-scaled streetscape-sensitive design strategies proposed in the next chapter may be seen as a critique and further development of the *Retrofitting* report, which proposes innovative spatial solutions, but still lacks preservation considerations.



Flood retrofitting case studies carried out in the *Retrofitting* report.
Source: NYCDCP 2014, 67; 79; 85.

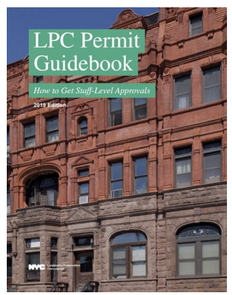
NYC Department of City Planning (DCP), 2016

Coastal Climate Resiliency: Resilient Retail

As part of DCP's series of citywide resilience studies that seek to understand resilience challenges for art, commercial and industrial areas, the *Resilient Retail* report focuses on New York City's neighborhood retail corridors. In some ways, this report is positioned as a critique of existing Federal flood regulations, such as FEMA's floodplain management standards that require dry-floodproofing or elevation for commercial areas, and wet-floodproofing for residential lobbies; and the NFIP premium reduction standard that requires basements to be filled. These regulations may cause challenges to the operation of streetfront retail businesses, because many businesses rely on basement or cellar spaces for business and storage, and the implementation of two separate floodproofing systems based on different uses may be technically impractical for mixed-use buildings developed on narrow lots. Fundamentally, these stringent and impractical regulations may imply large-scale redevelopments that jeopardize the vibrancy of neighborhood retail corridors. Responding to these challenges, the *Resilient Retail* report argues for additional flexibility to be provided for retail, office and community facility spaces, so that different areas can be floodproofed in different ways according to their vulnerability; and that NFIP should recognize partial mitigation investments besides incentivizing wholesale retrofitting projects that bring buildings totally up to code.

The *Resilient Retail* report is much relevant to the flood adaptation of historic buildings in New York City's context. First of all, many neighborhood commercial corridors — such as Front Street in South Street Seaport studied in Digital Report 04 — are also important historic corridors; secondly, historic neighborhoods generally share many traits — such as high-density, mixed use, and high walkability — with neighborhood commercial corridors. Therefore, the policy reforms proposed in *Resilient Retail* are also largely applicable to New York City's historic buildings. The report also incorporates street-scaled thinking in resilience planning, as it considers building groups along street sections when envisioning resilience challenges and mapping flood adaptation strategies.

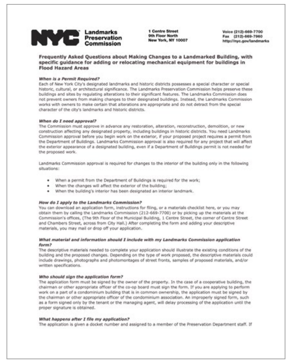
Flexible combination of partial mitigation strategies envisioned in the *Resilient Retail* report.
Source: NYCDCP 2016, 39; 69-70.



NYC Landmarks Preservation Commission (LPC), 2019

LPC Permit Guidebook (2019 Edition)

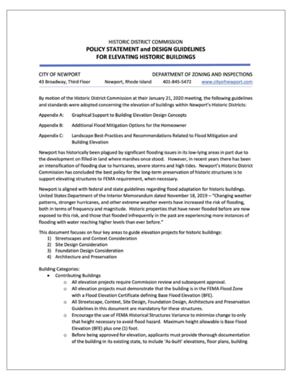
Accompanying the Rules of the Landmarks Preservation Commission, this guidebook shows how works on locally designated structures may meet the LPC rules and therefore get staff-level approvals. Although not directly aimed at flood adaptation interventions, this guidebook reveals the key areas — such as storefronts, awning, and signage — that have impact on a building's historic characters and streetscape relationship, as well as the general renovation considerations that would help preserve the characters of these architectural elements.



NYC Landmarks Preservation Commission (LPC), n.d.

Technical Guides on Equipment Relocation and Flood Shield Installation

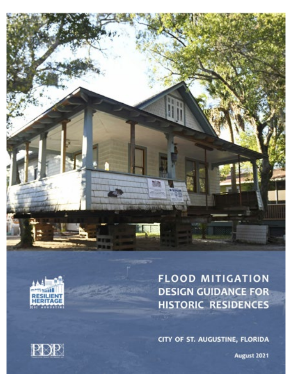
LPC's flood adaptation policy-making can be found in two technical guides published on its website, respectively on equipment relocation and flood shield and barrier installation. The equipment relocation guide reiterates LPC's existing rules and procedures for mechanical rooftop additions, and the flood shields and barriers guide confirms that their installation is subject to LPC review. Generally, these guides serve as procedural notices to property owners; some more specific design recommendations on flood shields may also be found on page 11.9 of the *LPC Guidebook*. With limited available policy and design guidance, there's still a lack of flood adaptation regulation for New York City's locally designated historic buildings; extensive policy-making is needed by LPC to address a broader range of floodproofing interventions, guide the whole process of flood retrofitting, and regulate potential contradictions between preservation standards and general flood regulations.



Newport Historic District Commission (HDC), 2020

Policy Statement and Design Guidelines for Elevating Historic Buildings

This guideline provides recommendations for the structural elevation of historic buildings under four key areas: streetscape and context, site design, foundation design, and architecture and preservation; its structure and provisions mirror Charleston's 2019 *Design Guidelines for Elevating Historic Buildings*. Different from the Charleston guideline, the Newport guideline also applies to non-contributing buildings in historic districts.



PDP Architects for the City of St. Augustine, 2021

Flood Mitigation Design Guidance for Historic Residences

Developed in response to recent hurricanes, this guideline identifies basic improvements, building elevation, and wet floodproofing as suitable flood mitigation strategies for the largely wood-frame residential building stock in St. Augustine's historic districts. Design studies are provided to envision the elevation of local historic buildings, where designs for new foundation and stairs are informed by historic architectural styles and layouts.

Sarah Ryan Architects et al. for the City of St. Augustine, 2021

Flood Mitigation Design Guidance for Historic Coquina Buildings

Paralleling the *Historic Residences* guideline that deals with a largely wood-frame building stock, this document identifies temporary measures, dry floodproofing, wet floodproofing and site floodproofing as recommended flood adaptation strategies for St. Augustine's historic buildings that are built partially or entirely of natural coquina. Due to the soft and heavy nature of coquina masonry construction, elevation is deemed as impractical and potentially destructive; suitable strategies are identified for 31 pre-1820 coquina structures located in the St. Augustine Town Plan National Historic Landmark District.

3.2 Other Data Sources: Built Cases and the Author's Input

The guidelines and policy documents reviewed in Chapter 3.1 serve as an important source of existing knowledge on the streetscape-sensitive flood adaptation of historic buildings. Many of the design strategies proposed in these guidelines will be referenced and transferred onto New York City's historic building stock in the building-scaled strategies developed in the next chapter. However, in view that none of these guidelines address flood adaptation strategies for historic building types peculiar to New York City, some other data sources are still needed. In this study, the author also uses a combination of successful built cases and original design input to inform design strategies that suit New York City's unique historic built environment.

- **Successful Built Cases**

Historic buildings that have been successfully adapted for flood resilience can be found across the country, especially in cities with extensive flood adaptation and historic preservation policy-making. These projects often incorporate a number of different streetscape design strategies, that can be referenced for the flood adaptation design of New York City's historic buildings. Some of these successful projects (such as 1 Water Street in Charleston, SC and 260 Main Street in Owego, NY) are analyzed in the next chapter in support of the author's development of streetscape-sensitive flood adaptation design strategies.

- **The Author's Design Input**

Despite a number of existing guidelines and built cases as introduced above, there are still many blank spots where streetscape-sensitive flood adaptation strategies haven't yet been made available for certain historic building types (especially high-density building types such as row houses, apartments and mixed-use mid-rise buildings) commonly found in New York City. In these cases, the author will step in to propose overall retrofitting methods and streetscape design strategies, referencing the focus areas and design studies featured in nationwide regulations and guidelines.

04

Building-Scaled Strategies

Drawing solutions from existing design guidelines and regulations, successful built cases, and the author's own illustrative input, this chapter proposes design treatments sensitive to streetscape values and historic preservation considerations for New York City's six major floodplain historic building types as established in Chapter 02.

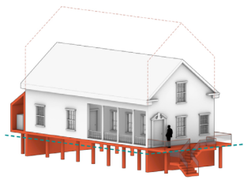
Acknowledging that structural elevation — a somewhat default method adopted by FEMA and many municipalities in their flood adaptation policy-making — may not be applicable to New York City's attached, high-density urban building types, Section 4.1 first matches each building type with one or two suitable overall retrofitting method(s) based on suggestions made in NYCDCP's 2014 *Retrofitting* report (for example, structural elevation for Detached Residential buildings; in-place dry-floodproofing or non-structural elevation for Mid-rise Mixed-use buildings). Based on such pairing, Sections 4.2 — 4.7 make detailed discussions for each building type: under each identified overall retrofitting method, the author first lists major streetscape and preservation challenges, and then maps design treatments that help address these challenges. To reveal potential tensions between streetscape-sensitive design strategies and New York City's current flood regulation framework, local Building Code and Flood Zoning compliance of each proposed design strategy is also analyzed.

Given the fact that existing streetscape design strategies and guidelines don't evenly address New York City's six floodplain building types discussed in this study, the author introduces an estimated Level of Retrofitting Strategy Development in the analysis for each building type:

- A "■ High" level of development (e.g. Detached Residential) means that the overall retrofitting method(s), streetscape and preservation considerations, and streetscape-sensitive design treatments have all been well-discussed in existing theory and practice for a certain building type, and that the design strategies proposed in this study are largely gathered from existing publications and cases.
- A "■ Medium" level of development (e.g. Semi-Attached/Attached Residential; Semi-Attached/Attached Mixed-Use) means that only the overall retrofitting method(s) have been established for a certain building type by existing research (such as DCP's 2014 *Retrofitting* report), while the streetscape impacts and mitigation solutions associated with these retrofitting method(s) have not yet been discussed. In this study, the author will identify key streetscape and preservation considerations based on the established retrofitting method(s), and propose design strategies that address these considerations.
- A "■ Preliminary" level of development (e.g. Detached Mixed-Use) means that existing research reckons the existence of such building type, but hasn't made specific discussions on its retrofitting. In such case, the author will be responsible for proposing suitable overall retrofitting methods, major preservation and streetscape considerations, as well as specific streetscape mitigation treatments.

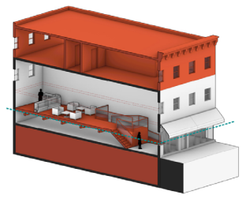
All illustrations in this Chapter, unless otherwise noted, are prepared by the author.

01
Detached Residential



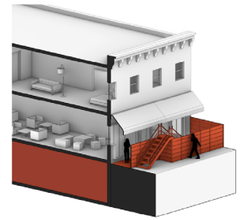
Structural Elevation

04
Semi-Attached/Attached Mixed-Use



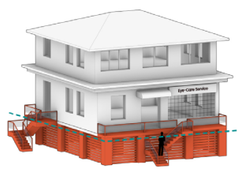
Interior Elevation
+ Rooftop Addition

Or



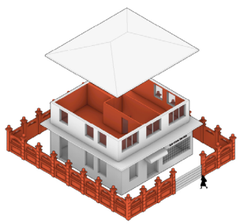
In-Place Dry-Floodproofing

02
Detached Mixed-Use



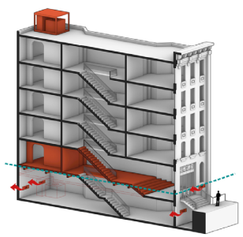
Structural Elevation

Or



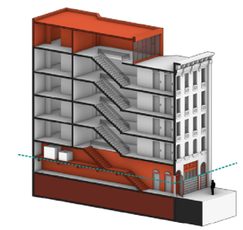
In-Place Dry-Floodproofing

05
Mid-Rise Residential

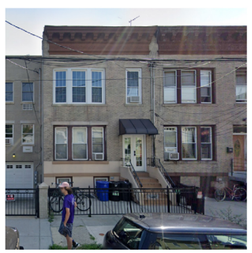


Interior Elevation
+ Optional Addition

Or



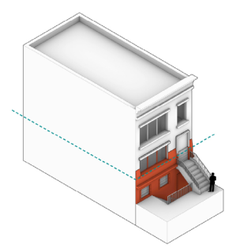
"Mix-and-Match"
of Wet and Dry-Floodproofing



03
Semi-Attached/Attached Residential

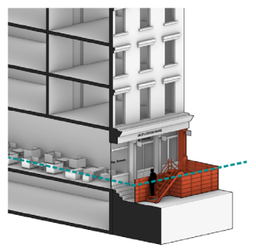
Non-Structural Elevation
+ Optional Addition

Or



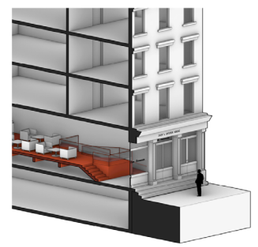
In-Place Dry-Floodproofing

06
Mid-Rise Mixed-Use



"Mix-and-Match"
of Wet and Dry-Floodproofing

Or



Interior Elevation

Overall retrofitting methods for each building type identified in this study.
Photo source: Google Street View.

4.1 Mapping Overall Retrofitting Methods

The illustration on pages 30-31 maps the 1-2 overall retrofitting method(s) recommended for each major building type in New York City's floodplain. Given the limited applicability of structural elevation (which is typically regarded as a suitable strategy for wood-frame detached homes, and in some cases, detached masonry houses), alternative strategies must be identified for New York City's high-density urban building types. On this front, DCP's 2014 *Retrofitting* report has provided a crucial ground through the development of real-world design studies, which have to a great extent informed the identification of suitable overall retrofitting methods in this study. In accordance with the illustration, recommended overall retrofitting method(s) for each building type are listed as follows, along with their origins in the DCP report and other nationwide guidelines, if applicable:

- **Building Type 1: Detached Residential.** Overall Retrofitting Method: Structural Elevation (see Case Study 01: "Bungalow" in the *Retrofitting* report, as well as nationwide guidelines on detached building elevation).
- **Building Type 2: Detached Mixed-Use.** Overall Retrofitting Method: Structural Elevation, or In-Place Floodproofing (identified by the author).
- **Building Type 3: Semi-Attached/Attached Residential.** Overall Retrofitting Method: Non-Structural Elevation with Optional Addition, or In-Place Dry-Floodproofing (see Case Study 05: "Attached" in the *Retrofitting* report, including alternative strategies proposed).
- **Building Type 4: Semi-Attached/Attached Mixed-Use.** Overall Retrofitting Method: Interior Elevation & Rooftop Addition, or In-Place Dry-Floodproofing (see Case Study 08: "Mixed-Use Semi-Detached" and Case Study 09: "Mixed-Use Attached" in the *Retrofitting* report.)
- **Building Type 5: Mid-Rise Residential.** Overall Retrofitting Method: Interior Elevation & Optional Addition (see Case Study 06: "Mid-Rise Walk-Up" and Case Study 07: "Mid-Rise Elevator" in the *Retrofitting* report.)
- **Building Type 6: Mid-Rise Mixed-Use.** Overall Retrofitting Method: In-Place Dry-Floodproofing (see Case Study 10: "Mixed-Use Mid-Rise Walk-up" in the *Retrofitting* report), or Interior Elevation (Identified by the author).

The applicability, advantage, and limitation of each overall retrofitting strategy will be further discussed along with specific streetscape mitigation design strategies throughout Sections 4.2 — 4.7.

4.2 Building Type 1: Detached Residential

General Information

Stock in New York City's Floodplain: 29,883 (buildings).

Characteristics: Wood frame on masonry, or in some cases masonry; with or without basement. 1-2 story; no party wall. Detached residential houses can be seen in New York City's lower-density historic neighborhoods, such as Coney Island and Sheepshead Bay; they also exist as individual landmarks, such as the Kreischer Mansion (National Register) and the Kreischerville Workers' Houses (LPC) in Staten Island.

New York City Building Code Classification: Residential (for flood purpose).

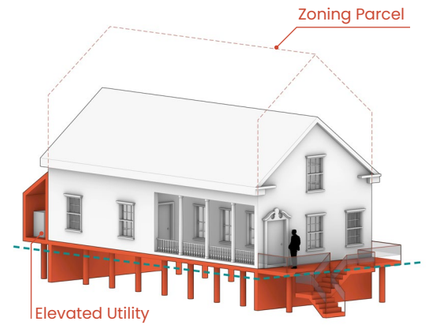
A Detached Residential House in Breezy Point, Queens. Source: Google Maps.

New York City Building Code Regulation (Residential): 1) All living space must be raised above DFE; 2) Uses below DFE are restricted to parking, storage and access; 3) Spaces below DFE should be wet-floodproofed (NYCDOB 2014 Building Code).

Level of Retrofitting Strategy Development: ■ **High.** Most nationwide guidelines and regulations in the existing flood policy landscape deal with detached residential structures, which have great prevalence across the country and also constitute the most major building type in New York City's floodplain.

Overall Retrofitting Method: Structural Elevation

Typical Retrofitting Method: Structural Elevation. The typically wood-framed, low-rise detached houses can be feasibly elevated onto a new (typically concrete) foundation for flood resilience. Structurally elevating detached residential structures (along with the construction of homes on high foundations) has been a common practice in many waterfront communities; in cities like New Orleans, due to repetitive flood impacts, the practice of house elevation may have more than 100 years' history (FEMA 2012).

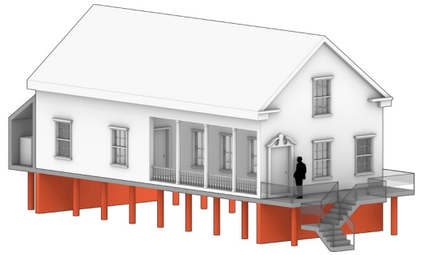


Overall retrofitting diagram for Detached Residential Structures. Based on NYCDCP 2014, 42-43.

NYC Building Code Compliance. This strategy complies with New York City's Building Code Appendix G regulation for the flood-resistant construction of residential structures.

Pros and Cons. The structural elevation of detached residential structure is a feasible, straightforward flood adaptation method with reliable resilience outcomes. Nevertheless, by physically segregating the first floor and the street space, it creates a passive street interface composed of blank foundation walls or piers, of which the formal, functional and accessibility issues must be mitigated through streetscape design strategies.

Preservation/Streetscape Consideration 1: Visual Consistency — Blank Street Wall and Piers. The structural elevation intervention will inevitably bring about a blank street wall or a set of piers readily visible from street level, the visual impact of which can be further worsened when a set of buildings are raised separately to different heights. This situation undermines the streetscape relationship of historic houses, as well as the visual consistency of a historic neighborhood.



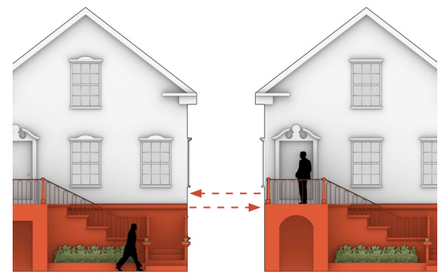
Solution 1 | Planting & Terraced Landscape. Many guidelines and local regulations recommend planters and terraced landscape as major means to cover foundation structure and provide transition between street space and the elevated first floor (NYCDCP 2013b, 31; 2019c, 61; Charleston BAR 2019, 3; Boston 2018, 16). In neighborhoods where stylistic front gardens exist as a historic character, a moderately raised front garden with context-appropriate decoration (for example, ironwork railings) may be desirable (Charleston BAR 2019, 3).

Solution 1 | Planting & Terraced Landscape.
Sources (from left to right): Charleston BAR 2019, 3; NPS 2021, 92; NPS 2021, 75.

Solution 2 | Adaptively Articulated, Solid Foundation Wall. Acknowledging that piers beside sidewalks may break the street wall and create significantly alienating visual implications, Charleston's local regulation permits only solid foundation walls at the street front (piers may be concealed behind, and "beachy" style slats and lattices are prohibited), and encourages the foundation wall to be laid in masonry while decorated with visual expressions (pilasters, fenestration, water tables, etc.) with reference to the original structure (Charleston BAR 2019, 5). Similar provisions are also incorporated in Newport and New Jersey's guidelines for elevating historic structures (Newport HDC 2020, 4; NJSHPO 2019a, 29). When the existing building is raised to a higher elevation, a full floor beneath the raised structure should be created; in such case, decorative window openings that help achieve better transparency and human scale may be considered. For side elevations, piers that align with the original structure and infill screening panels are recommended by several local and state guidelines (Louisiana SHPO 2015, 23; Charleston BAR 2019, 4; St. Augustine 2021, 4.12).

Solution 2 | Adaptively Articulated, Solid Foundation Walls.
Sources: Photograph taken by the author during Keeping History Above Water 2021 Conference; Charleston BAR 2019, 5.

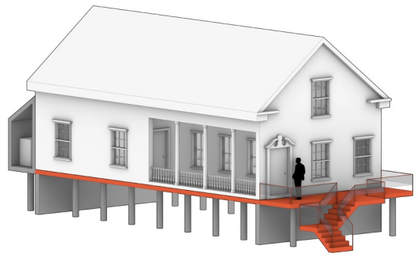
Solution 3 | Precedents and Coordinated Projects. Somewhat similar to attached row houses in New York City, rows of detached homes designed in the same style can be found in various cities across the country (e.g. "sister houses" in Charleston and Newport, and Creole cottage rows in New Orleans). Recognizing the reality that "building elevations occur over time, on a property-by-property basis," multiple guidelines call for later retrofit projects in a group of houses to follow the earliest precedent (which will be most rigorously reviewed) in order to ensure coordinated style, retrofitting treatment and height



of elevation (NJSHPO 2019a, 17; Charleston BAR 2019, 2; Louisiana SHPO 2015, 21). Retrofitting design precedents can be established among any group of structures with correlative massing or proportion (NPS 2021, 76). Furthermore, street/neighborhood-scaled parameters and guidelines may also be developed by local historic preservation agencies in the form of neighborhood preservation or flood resiliency master plan, which will be further discussed in Chapter 05: Neighborhood-Scaled Strategies.

Solution 3 | Precedents and Coordinated Projects.
Sources (from left to right): NJSHPO 2019, 17; Louisiana SHPO 2015, 21.

Preservation/Streetscape Consideration 2: Access and Sidewalk Relationship. Raised detached residential structures will most likely have a set of long, out-of-context stairs in their front yard. This necessary infrastructure for access may create streetscape expressions that are unfriendly and incompatible with historic urban forms. In New York City's 2013 flood zoning design menu, "turned stairs" are recommended as a streetscape mitigation strategy, which in the same time saves the front yard space needed to accommodate stairs (see Report 02 for details). However, given the drastic streetscape changes in New York City's waterfront communities brought by building elevation, more detailed considerations should be made when stairs and building access are designed in the elevation of detached residential houses.



Solution 1 | Stairs Within Context. Multiple design guidelines for historic structures recognize front stairs as "the single most dominant feature of an elevated building's exterior," stressing the importance of design, materials, and details (such as railings, posts, balustrades, and stair walls) in blending the stairs with the main body of the house (NJSHPO 2019a, 29; Louisiana SHPO 2015, 25, 29; Newport HDC 2020, 3). Successful stair designs often incorporate wall finishing and decorative motifs similar to the original historic structure, and encompass railings or balustrades appropriate in the historic urban context.

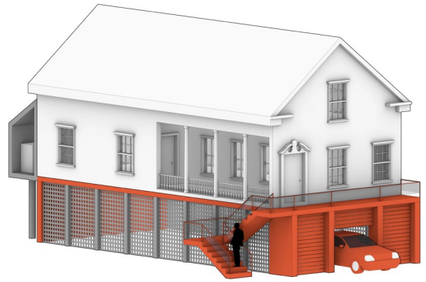
Solution 1 | Stairs Within Context.
Source: Louisiana SHPO 2015, 25, 26, 30.

Solution 2 | "Piazza Screens" and Other Ordinances on Retaining Entrance Context. The street-facing entrance of a detached residence serves as a key symbol of its relationship with the site and streetscape. Instead of putting a new set of stairs on the street front, Charleston's local practice retains the original entrance context by pinning the entrance opening (including the entrance door, door surroundings, stair steps and railing) at the original height while lifting every other part of the building, and placing stairs leading to the elevated first floor behind the entrance door. Since in Charleston's local building typology, the space behind the entrance door is typically a lengthy side porch ("piazza"), it would easily accommodate several steps of new stairs; the retained entrance is thus called "piazza screen" (Charleston BAR 2019, 7). Echoing this treatment, many other design guidelines also suggest retaining the entrance context and configuration to the greatest possible extent. For example, "entrance close to grade" earns 1 point in New York City's 2019 streetscape design point system (NYCDCP 2019c, 61); New Jersey's

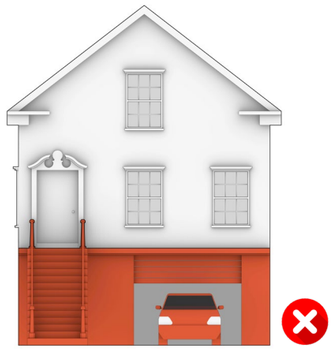
Solution 2 | Piazza Screens in Charleston.
Source: Photographs Taken by the Author During Keeping History Above Water 2021 Conference.

guidelines for elevating historic structures encourage retaining the original entrance orientation and configuration (NJSHPO 2019a, 29). Additionally, Charleston requires elevated homes to have exterior stairs built in masonry and connected to the sidewalk perpendicularly (Charleston BAR 2019, 3).

Preservation/Streetscape Consideration 3: Street-Level Parking Use. Through provisions that provide flexibility for parking use, New York City's current flood zoning encourages the crawl space under elevated buildings to be used as parking garages (NYCDCP 2013b, 24; NYCDCP 2019c, 69). On the contrary, aware of how much a garage gate changes the scale and visual consistency of historic streetscape, Charleston's regulation strongly discourages parking use underneath lifted historic houses, unless the garage is invisible from the pedestrian right of way (Charleston BAR 2019, 5). Similarly, New Jersey and Maryland's historic building retrofitting regulations also argue against additional garage gates, as a building typically need to be lifted considerably higher than the flood elevation to accommodate street-level parking space, which may "greatly impact a building's relationship to the ground" (MDSHPO 2018, 2.55, 3.24; NJSHPO 2019a, 21, 26).



Solution | Restricting Street-Level Parking in Historic Neighborhoods. Since parking use on street level may bring significant negative impacts on the pedestrian experience and visual consistency of historic urban streetscape, it is suggested that additional parking be restricted when the structural elevation of detached residence is carried out in historic neighborhoods with sensitive urban context. Such consideration may be potentially incorporated into New York City's future flood retrofitting design guidelines for historic structures, or the city's flood zoning.



The streetscape Impact of Street-Level Parking.
Source: NYC Build It Back (Instagram).

Historic House Elevation Cases That Incorporate Various Streetscape Design Strategies. The streetscape design strategies identified in this section are not mutually exclusive; in fact, a successfully designed elevation project for historic detached residence shall incorporate a number of streetscape mitigation strategies that help preserve the building's historic characters, human scale, and streetscape relationship. Below are two built cases that managed to achieve a delicate balance between flood resilience and heritage values through the ingenious combination of streetscape-sensitive design strategies.

· **1 Water Street, Charleston, SC.** The historic residence in Charleston's waterfront is elevated in a way that sensitively responds to local historic environment and architectural forms. A full-story concrete foundation cladded in matching light blue stucco was added to the residence, embellished by a pair of elegant L-shaped stairs leading to the elevated main entrance, as well as arched door openings and a central window on street level with restrained forms referencing the building's original design. The whole design complements the symmetry and characters of the historic residence; similar cases involving comprehensively designed stairs and porches can also be found in existing guidelines and publications (FEMA 2008, 13; FEMA 2014, 5-5).

1 Water Street, Charleston, SC.
Source: Photograph Taken by the Author
During Keeping History Above Water 2021 Conference.

· **260 Main Street, Owego, NY.** The 19th-century Greek Revival residence was substantially elevated, but with very little visual impacts. Successful streetscape treatments in this project include: 1) the entrance stairs that are broken into two materials, with the lower run made of stone that disguises itself in the landscape; 2) terraced front yard with plantings; 3) the new foundation coated in matching finishing, and the pilasters and flood vents on it that align with the historic house's three-bay elevation composition. This project is featured in NPS's retrofitting guidelines (NPS 2021, 88) as well as a number of local news media (e.g. Roby 2015; Owego Pennysaver 2015).

260 Main Street, Owego, NY.
Source: NPS 2021, 88.

Additional Considerations. The cases and strategies in this section are identified based on their applicability to New York City. In low-density settings with large lots, site-scaled strategies such as levees may also be applicable (see NPS 2021, 32-39).

4.3 Building Type 2: Detached Mixed-Use

General Information

Stock in New York City's Floodplain: 2,327 (buildings).

Characteristics: Wood frame on masonry, or in some cases masonry; with or without basement. 1-2 story; no party wall. While this building type is still residential-based, it incorporates an often family-operated business or professional service on street level.

New York City Building Code Classification: Residential (for flood purpose) with special regulation.

A Detached Mixed-Use house with an eye-care service in Rockaway Beach.
Source: Google Maps.

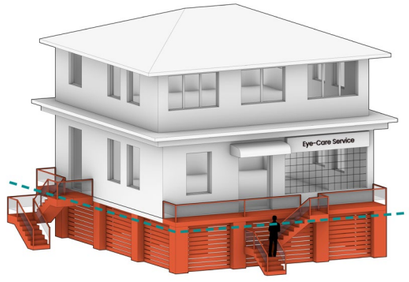
New York City Building Code Regulation: New York City's 2019–2021 Flood Zoning acknowledges the residential nature of this building type, and advocates for a special permit to allow "dry-floodproofed professional office space on the ground floor of buildings in Residence Districts" (NYCDCP 2019c, 76). Therefore, this type of structures has two retrofitting options: 1) Wet-floodproofing and structural elevation just like detached residential structures, and 2) In-place dry-floodproofing without elevation.

Level of Retrofitting Strategy Development: ■ **Preliminary.** New York City's planning reports recognize the existence of detached mixed-use structures, but there hasn't been much analysis on their retrofitting strategy. In this section, the author proposes suitable overall retrofitting methods, preservation & streetscape considerations, and streetscape design solutions for this building type.

Overall Retrofitting Method: Structural Elevation

Typical Retrofitting Method: Structural Elevation. Just like Detached Residential structures, the largely wood-frame construction of Detached Mixed-Use structures determines that structural elevation is the most reasonable retrofitting method.

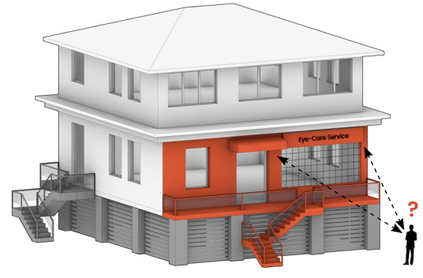
NYC Building Code Compliance. This strategy complies with New York City's Building Code Appendix G regulation for the flood-resistant construction of residential structures.



Overall retrofitting diagram for Detached Mixed-Use Structures.

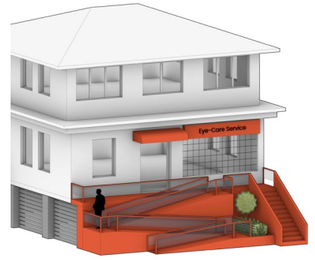
Pros & Cons. In addition to pros & cons covered in Section 4.2, the existence of commercial storefront poses new challenges to the structural elevation of detached mixed-use buildings: as the storefront is now hoisted above the street and thus loses accessibility to the sidewalk, design strategies that help promote accessibility and visual connection must be employed.

Preservation/Streetscape Consideration: Commercial Function and Accessibility. After structural elevation, the commercial storefront tends to lose visual connection and accessibility to pedestrians on street level.

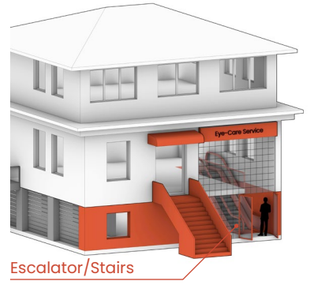


Solution 1 | Comprehensively Redesigned Stair & Entrance. To bring more accessibility to the elevated storefront, the entrance stairs should be designed with larger width and conspicuousness, and should be directly accessible from the sidewalk. For ADA compliance considerations, ramps shall be incorporated whenever possible, and may be designed together with stairs and landscape features. Design treatments on foundation facade discussed in Section 4.2 (Detached Residential) are also applicable to Detached Mixed-Use structures.

Solution 2 | Ground Floor Commercial Access. Alternatively, the storefront opening may be extended to the street level, creating a ground-floor entrance for the business; right inside the street-level entrance, interior stairs or escalator may lead customers to the raised commercial space. This strategy uses space below DFE solely for access, and is thus compliant with New York City's Building Code regulations. The access space below DFE should also be wet-floodproofed accordingly.



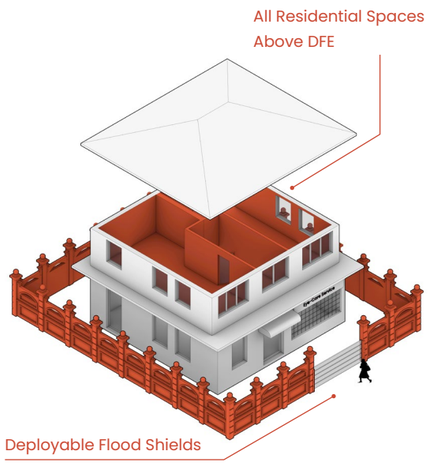
Solution 1 |
Comprehensively Redesigned Stair & Entrance



Solution 2 |
Street Level Commercial Access

Alternative Retrofitting Method: In-Place Dry-Floodproofing

Alternative Retrofitting Method: In-Place Dry-Floodproofing. New York City's current flood zoning allows dry-floodproofed office space on the ground floor, leading to an alternative solution for detached mixed-use structures: they can be dry-floodproofed in-place below DFE, on condition that all residential units are located on the upper floor(s). However, as wooden walls are neither strong enough to resist flood pressure nor watertight enough to keep floodwater outside the building envelope, wood frame buildings are generally excluded from the dry floodproofing option (MDSHPO 2018, 3.29). If dry-floodproofing treatment must be executed, a new, independent perimeter wall system needs to be established outside the existing exterior walls, or along the boundary of the building lot. This strategy may be costly and bring about further streetscape issues; its applicability may also be limited in New York City's urban setting where buildings have small lots and yards.



Alternative retrofitting diagram for Detached Mixed-Use Structures.

Nevertheless, such strategy may be found useful in some other urban settings. The picture on the right depicts a historic residence with flood-resistant perimeter walls in Charleston, SC: in this project, decorated perimeter walls are established around the lot of the detached residence; deployable flood shield anchors are installed at the main entrance, so that the whole site can be sealed before anticipated flood events. To mitigate streetscape impacts, the perimeter walls are decorated with design motifs that reference the historic residence such as balustrades, moldings, horizontal division and paneling, and are painted in pink stucco that matches the historic residence. However, the perimeter-wall strategy may only be appropriate for relatively mild flood elevations: when local flood elevation is very high, it becomes inevitable that the solid perimeter walls lose human scale and become a passive, segregating interface between the historic building and street space.

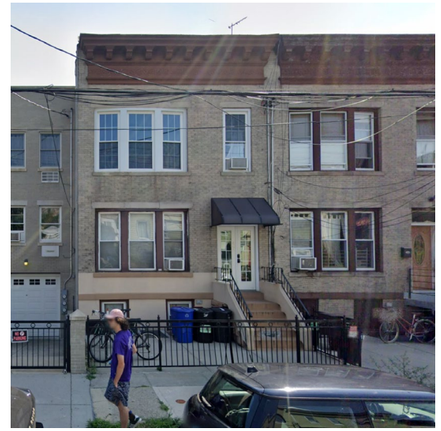
A detached residence with dry-floodproofing perimeter walls in Charleston, SC.
Source: Photograph taken by the author during the Keeping History Above Water 2021 Conference.

4.4 Building Type 3: Semi-Attached/Attached Residential

General Information

Stock in New York City's Floodplain: 20,616 (buildings).

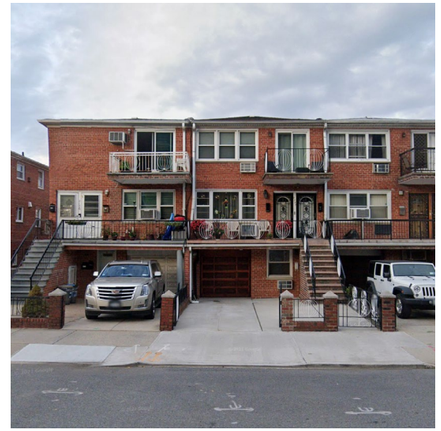
Characteristics: Wood frame or masonry with wood joints, on masonry/concrete foundation. 1-3 story; with party wall and basement or cellar. This type of structure makes up a major portion of New York City's floodplain building stock, encompassing multiple forms of low-rise "row houses" built in different eras with or without ground-level garage. Due to the project's preservation focus, discussions in this section will mainly focus on the brownstone-style row houses, which have a vast presence in the city and serve as an important icon of the city's historic architectural and urban forms.



A row of Attached Residential buildings in Red Hook, Brooklyn. Source: Google Maps.

New York City Building Code Classification: Residential (for flood purpose).

New York City Building Code Regulation (Residential): 1) All living space must be raised above DFE; 2) Uses below DFE are restricted to parking, storage and access; 3) Spaces below DFE should be wet-floodproofed (NYCDOB 2014 Building Code).

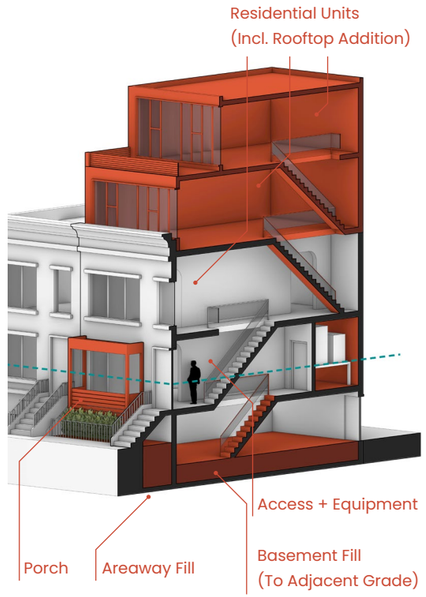


A row of Attached Residential buildings in Gravesend, Brooklyn. Source: Google Maps.

Level of Retrofitting Strategy Development: ■ Medium. NYCDCP's 2014 *Retrofitting* report acknowledges the prevalence of row houses in the city's floodplain, and briefly envisions their transformation by laying out two design case studies (NYCDCP 2014, 58-69). However, DCP's original studies are mostly focused on achieving the compliance of NFIP and city-level flood resistance standards, along with an intention to mitigate floor area loss through rooftop additions. As a result, the design schemes feature substantial additions that completely alter the street elevation with forms disconnected with the architectural and urban context. In a historic urban environment, flood retrofitting strategies must be revised to reflect considerations on historic urban forms and social-spatial relationships. Building upon DCP's original design schemes published in 2014, the author proposes specific streetscape/preservation considerations and mitigation solutions as an attempt to make these design schemes more applicable to New York City's historic row houses.

Overall Retrofitting Method:
Non-Structural Elevation with Optional Addition

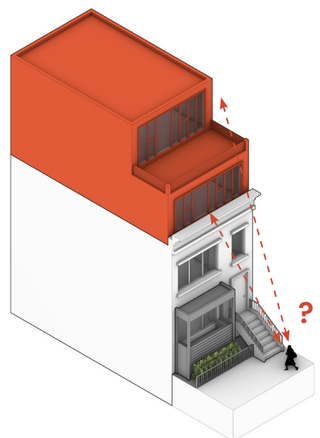
Typical Retrofitting Method: Non-Structural Elevation with Optional Addition. The "Semi-Attached/Attached Residential" building type is probably best represented by traditional brownstone-style row houses prevalent along New York City's historic residential streets. As shared bearing walls generally exclude the option of structural elevation (NYCDCP 2014, 58, 64), non-structural elevation — where the building's program (instead of the structure itself) adapts to flood risks — shall be carried out. The non-structural elevation intervention for Semi-Attached/Attached residential structures calls for: 1) filling the basement to lowest adjacent grade for Building Code compliance and NFIP premium reduction; 2) abandoning the first floor, and using it solely for access and storage; and 3) executing optional addition on top of the building (or in front/behind the building, in some cases) to compensate for the loss of first floor and basement/cellar area. Moreover, spaces below DFE shall be wet floodproofed, and street-level windows will be changed with those made of floor-resistant materials (see NYCDCP 2014, 64-69).



Overall retrofitting diagram for Detached Residential structures. Based on NYCDCP 2014, 42-43.

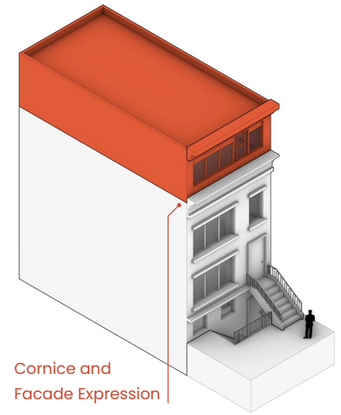
NYC Building Code Compliance. The non-structural elevation strategy will bring Semi-Attached/Attached Residential buildings up to Building Code compliance, on condition that basements or cellars are filled to equal or higher than the outside ground level on at least one site, and that first floors are abandoned.

Pros & Cons. The major advantage of non-structural elevation lies in that it's considerably more adaptive in nature than physically elevating a building; therefore, this method itself will not lend much direct change on historic streetscape. Nevertheless, the filling of basements and areaways (which constitute an iconic streetscape feature of New York City) and rooftop additions may pose challenges to historic streetscapes and neighborhood characters. Targeted at these challenges, the discussions below lay out streetscape/preservation considerations and mitigation strategies.



Preservation/Streetscape Consideration 1: Streetscape Change Brought by Building Addition (see illustration on p. 44). Through additions on top of the original building, losses in ground-floor and basement areas may be compensated; however, this strategy may also bring about visually incompatible new materials and forms, as well as undermine the continuity of the street wall. Streetscape impacts will be most substantial when additions are out-of-context, and set back from the street wall due to zoning parcel regulations.

Solution 1 | Additions Executed in Visually Compatible Architectural Style. When additional floors are built above the original structure, they should be executed in a visually compatible style with respect to the historic urban context. Incoherent and out-of-context additions without historic reference should be avoided, and the following features should be retained:

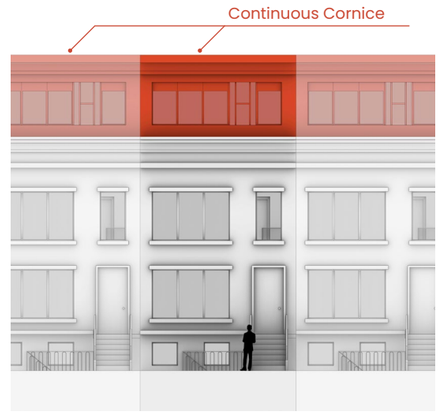


1) The Continuity of Street Wall. The front elevation of new rooftop addition should extend from the existing facade of the original building, instead of involving multiple setbacks. The achievement of this goal may require the flood zoning to reform accordingly.[1]

2) Character-Defining Features. The addition should embed typical character-defining features of row houses — such as the overhanging cornice, decorated lintels and window sills.

3) Bay and Elevation Expression. The bay, fenestration, and divisions on the added facade should make reference to the rhythms of the original structure, and adaptively use motifs informed by the original design.

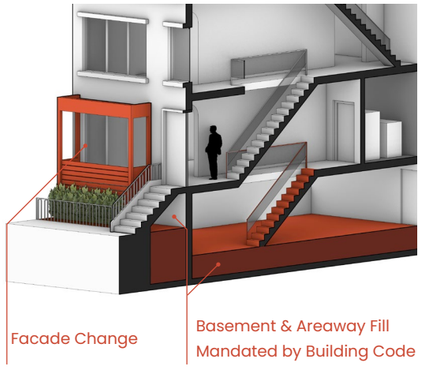
Solution 2 | Precedents and Coordinated Projects. When a street corridor made of row houses eventually gets flood retrofitted, the continuity of the street wall and key architectural elements (e.g. cornices) should be retained on a street or building group scale. Therefore, the retrofit design of a row house should set up a precedent for its neighbors; when possible, the precedent design as well as the following projects should be coordinated through local historic district master plan or historic preservation design review.



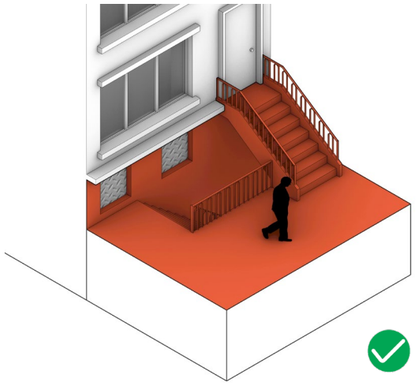
1 On this front, New York City's 2019-21 flood zoning allows the lot parcel to be calculated from the first floor above DFE, instead of DFE itself (NYCDCP 2019c, 42).

Preservation/Streetscape Consideration 2: Street-Level Facade Change and Loss of Historically Significant Street Relationship.

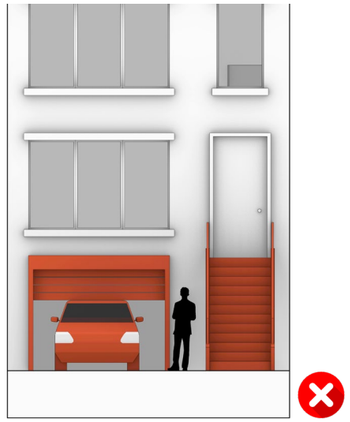
The non-structural elevation method calls for filling the basement/cellar to adjacent grade and abandoning the residential use of the first floor. These treatments may eliminate the significant street relationship of row houses where stairs from the street level lead to the basement, and bring about transparency changes in the street-level facade — as now street-level openings may be modified to accommodate access, storage & parking uses.



Solution 1 | Retaining Basement Areaways. New York City's current Building Code calls for filling basements and cellars and wet-floodproofing all spaces below DFE — a non-compromising rule which might bring about questions on feasibility as well as streetscape change. Therefore, several planning reports have advocated for more flexibility on the retrofitting strategy of basements/cellars, in other words, to allow the existence of below-grade spaces on condition that they're floodproofed (NYCDCP 2014, 69; NYCDCP 2016, 4; Boston 2018, 16). From a streetscape perspective, whether the basement is filled or not, the basement areaway should best be retained, and adaptively retrofitted with decorative fenestration or flood vents.[2]

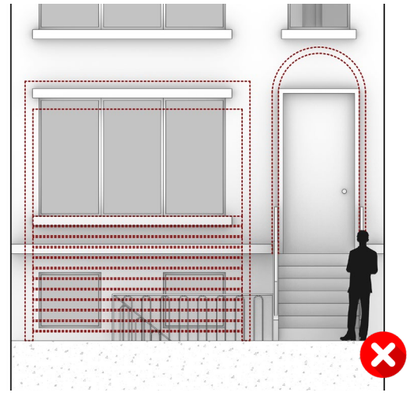


Solution 2 | Prohibiting New Street Front Parking Use. While some attached residences in New York City incorporate parking garage on street level, the historic "brownstone" type of row houses don't have parking function. Recognizing the negative impact of garage doors on human-scaled historic streetscape (see Chapter 4.2) and a building's street interface, new street-front parking use should be prohibited in the now abandoned/accessory first floor. In cases where street-level parking use — as a character of attached residences — is extant before retrofitting, this use shall be retained and continued.



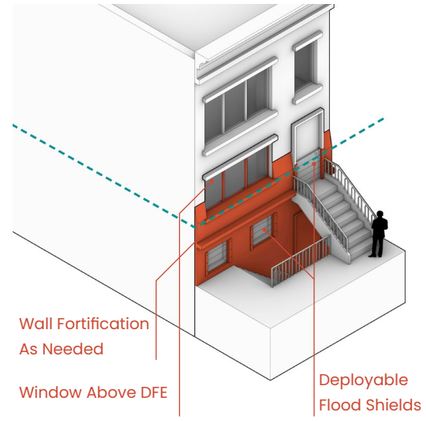
2 Retaining the basement areaway may be a treatment incompatible with the NFIP premium reduction standards, as the reduction standard mandates the whole structure to be filled to the adjacent grade (see NYCDCP 2014).

Solution 3 | Restricting Transparency & Facade Changes on Street Level. As the use of first floor changes and wet-floodproofing treatments get applied, potential transparency changes on the street-level facade — such as new/out-of-scale openings, fill of openings, or change of opening locations — may happen during retrofitting. From a preservation perspective, although the first floor is now no longer residential, the original window openings shall be retained at original locations and with the original size. For structures with landmark status, any reconfiguration of the front facade should refer to local preservation rules, such as LPC's *Permit Guidebook*.



Alternative Retrofitting Method: In-Place Dry-Floodproofing

Alternative Retrofitting Method: In-Place Dry-Floodproofing. Some existing research has noted that the NFIP full premium reduction standard together with New York City's Building Code may have led to too stringent and impractical requirements for the wet-floodproofing of attached residential structures, especially in terms of basement/cellar fill and the elimination of first-floor residential use (see NYCDCP 2014, 69; NYCDCP 2016, 4, 66).



New York City's 2014 *Retrofitting Buildings for Flood Risk* report thus puts forward an alternative strategy of **dry floodproofing all spaces below DFE (including basement) while retaining all current use**; first-floor windows may also be relocated above DFE, if such intervention doesn't result in substantial facade change. This strategy would be more feasible than the non-structural elevation scheme discussed above, as it doesn't involve substantial program changes or residential area loss; it would also be more friendly to the building's street relationship and streetscape expression. Nevertheless, for residential structures, this method neither receives full NFIP premium reduction, nor complies with Appendix G of the 2014 Building Code (as residential structures can't be dry-floodproofed). Therefore, under the current policy framework, this retrofit method may only be executed under "non-substantially improvement" situations. The streetscape and functional advantages of this strategy calls for policy reforms that better acknowledge partial retrofitting, or allow for the dry-floodproofing of residential structure; but since high-risk, residential spaces are now retained on street level, potential tradeoffs in flood resistance should be considered at the same time.

4.5 Building Type 4: Semi-Attached/Attached Mixed-Use

General Information

Stock in New York City's Floodplain: 2,394 (buildings).

Characteristics: Wood frame or masonry with wood joints, on masonry/concrete foundation. 1-3 story; with party wall and basement or cellar. First floor commercial, upper floor(s) residential. This building type can be commonly seen in New York City's community retail corridors, many of which are located in historic neighborhoods.

New York City Building Code Classification: Non-Residential (for flood purpose).

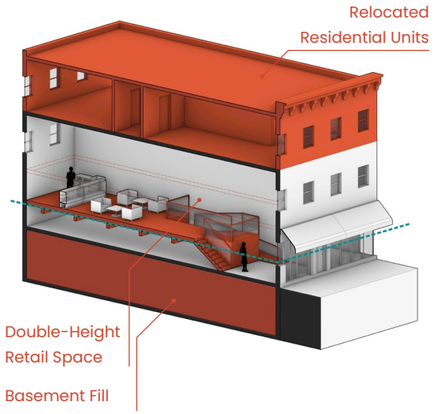
A row of Attached Mixed-Use buildings in Sheepshead Bay, Brooklyn. Source: Google Maps.

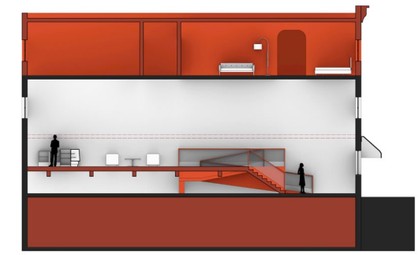
New York City Building Code Regulation (Non-Residential): 1) Elevation + Wet Floodproofing Option — structurally or non-structurally raise the structure and wet-floodproof it under the same standard as residential buildings; or 2) Dry Floodproofing Option — the structure stays at original elevation (with all dwelling units located above DFE) while being dry-floodproofed up to DFE (NYCDOB 2014 Building Code).

Level of Retrofitting Strategy Development: ■ **Medium.** Both NYCDCP's 2014 *Retrofitting* report and 2016 *Resilient Retail* report have developed some prototypes for the overall retrofitting methods of mixed-use low-rise structures, with a focus on the preservation of their street interface and commercial vigor (NYCDCP 2014, 82-93; 2016, 67-70); both have also urged NFIP policy reforms to better accommodate the needs of urban retail storefronts, for instance, by allowing a more flexible choice and combination of floodproofing treatments, or the continued existence of basements and cellars (NYCDCP 2014, 87; NYCDCP 2016, 4, 47-48, 66-67, 72-73). These discussions parallel the attention given to mixed-use structures and retail storefronts by other cities' flood retrofitting design guidelines (see for example, Nantucket 2021, 67). The prototypes and design schemes proposed in existing studies serve as an important basis for the author's discussion on street-sensitive design strategies.

Overall Retrofitting Method: Interior Elevation & Rooftop Addition

Typical Retrofitting Method: Interior Elevation & Rooftop Addition. Utilizing the "Elevation + Wet Floodproofing" option, this method calls for filling the basement or cellar and combining the existing first two floors into a double-height retail storefront. In the new double-height retail space, an elevated floor plate will be constructed above DFE, incorporating access systems (stairs and/or ramps) located inside the building; such treatments help retain the building's entrance strictly at the street level, along with display windows or other storefront design features. When zoning parcel permits, a new floor may be constructed on top of the original structure to compensate for the loss of residential units originally located on the second floor. Per New York City's Building Code, the retrofitted structure's commercial lobby (beneath the elevated first-floor) is restricted to access use, and therefore can't accommodate any seating or retail functions.



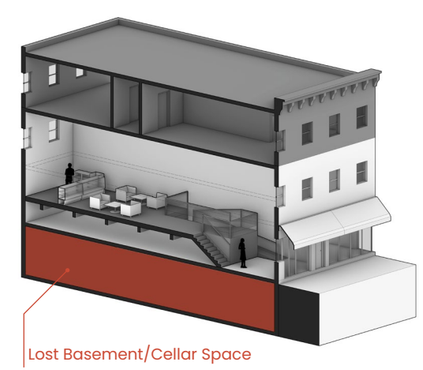


Overall retrofitting diagram for Semi-Attached/ Attached Mixed-Use Structures.
Based on NYCDCP 2014, 84-85; NYCDCP 2016, 34.

NYC Building Code Compliance. This strategy complies with New York City's Building Code under the "Elevation + Wet Floodproofing" option for non-residential structure.

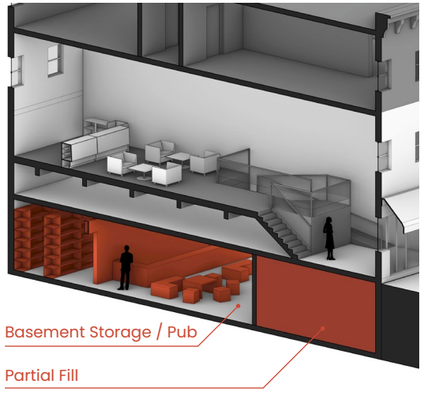
Pros & Cons. Featured in NYCDCP's *Retrofitting* (2014) and *Resilient Retail* (2016) reports, this method offers a highly streetscape-friendly solution to the 2-3 story mixed-use structures frequently found in New York City's neighborhood commercial corridors, comprehensively preserving their street interface and street-level transparency; meanwhile, it complies with New York City's regulations on flood resistant construction. Nevertheless, as existing research has noted, eliminating all basement/cellar space may have significant impacts on the daily operation of street-level businesses, as many businesses historically rely on sub-grade spaces for storage, kitchen, delivery, and office use; furthermore, limiting the commercial lobby to access use may undermine its potential as an active space for retail or seating (NYCDCP 2016, 34, 62, 79).

Preservation/Streetscape Consideration 1: Loss of Basement/Cellar Space. As just mentioned, New York City and NFIP's construction standards both require filling the whole basement/cellar when a building is elevated and wet floodproofed. Although this regulation directly diminishes an underground space of high flood risk, it creates operational problems for street-level retail stores and restaurants which often use the basement floor as accessory or storage space. Moreover, the elimination of basement/cellar may also directly eradicate underground commercial spaces

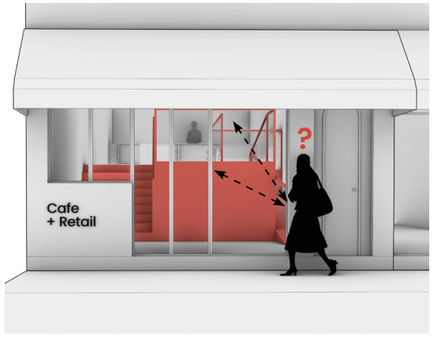


(such as bars and speakeasies). As many flood-threatened historic neighborhoods in New York City (e.g. South Street Seaport, Fulton Ferry and East Harlem) have historically significant strips of street-level or below-grade businesses, the complete loss of basement/cellars may bring substantial negative impacts to their historic streetscape and street vigor.

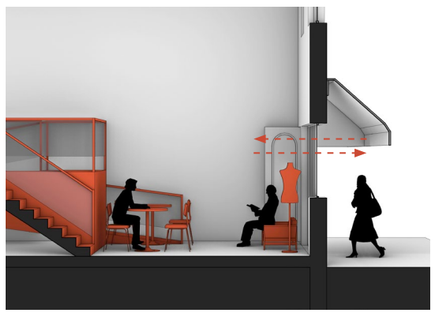
Solution | Loosening Basement/Cellar Fill Regulation in Urban Settings. NYCDCP's 2016 *Resilient Retail* report implies the prospect of allowing basement or cellar spaces to continue to exist on condition that they are properly drained and floodproofed (NYCDCP 2016, 62, 66); in fact, the challenges faced by sub-grade retail spaces discussed here reflect a broader mismatch between urban building types and flood resistance standards that are designed largely for detached residential homes. Loosening the basement/cellar fill regulation is not only helpful for the operation of street-level and underground retail businesses, but also beneficial for the preservation of historic streetscapes and social-spatial relationships in historic districts and neighborhoods.



Preservation/Streetscape Consideration 2: Undermined Commercial Lobby Activity. Under New York City's current regulation, the street-level commercial lobby of a non-structurally elevated mixed-use structure may only incorporate access function, or be used as a showpit area; therefore, although the entrance and display windows are retained on street level, the street interface will still be considerably diminished by the absence of any active use in the lobby space.



Solution | Allowing Limited Seating & Retail Function in Street-Level Retail Lobby. As New York City's several planning studies have argued, limited seating or retail function use be allowed in the wet-floodproofed street-level commercial lobby to better bridge the elevated first floor and the street-level entrance. These uses may be combined with other accessory functions (e.g. showpit areas) that are currently allowed to exist on street level, to better preserve a transparent and vigorous street interface.



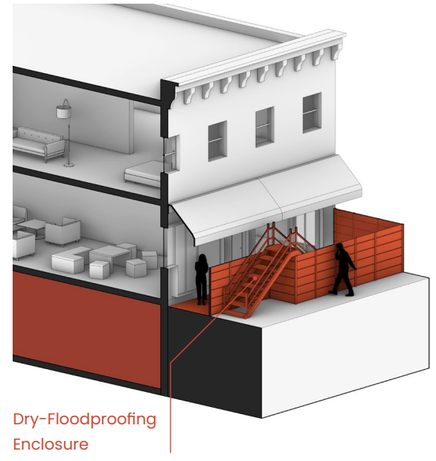
Seating & Retail Function in Street-Level Retail Lobby.
Based on NYCDCP 2014, 86.

Successful Case. Some existing publications have pointed to a successful case where commercial storefronts are flood retrofitted through the elevation of the interior first floors in Darlington, WI's downtown business district (FEMA 2008, 17; Nantucket 2021, 65-67). Due to the high ceilings typically seen in Darlington's historic storefronts, commercial first floors can be raised without affecting upper-floor spaces or leading to unusable ceiling height. After entering a business, customers may access elevated retail space by stairs or ADA-compliant ramps.

Successful Case: Non-structurally elevated storefronts in Darlington, WI.
Source: FEMA 2008, 17; Nantucket 2021, 65-67.

Alternative Retrofitting Method: In-Place Dry-Floodproofing

Alternative Retrofitting Method: In-Place Dry-Floodproofing. As New York City only requires elevating all residential spaces above DFE, retail storefronts may technically remain at the street level, while using the "Dry Floodproofing Option" in New York City's current Building Code. This in-place dry-floodproofing method calls for relocating all first-floor dwelling units (if any) to upper floors, and incorporating deployable dry-floodproofing shields in front of street-level openings. Since flood shields that directly seal windows and doors will likely block egress routes for street-level retail storefronts, a dry-floodproofing enclosure with temporary egress stairs shall be deployed (NYCDCP 2014, 31; 2016, 35). The in-place dry-floodproofing strategy may be considered as a streetscape-friendly solution, since it allows retail use to continue to survive at street level, and brings little change to a building's spatial layout; furthermore, dry-floodproofing has also been broadly applied in the flood adaptation of historic structures (see for example, NPS 2021, 45-55; Nantucket 2021, 63). Nevertheless, although this strategy fully complies with the NYC Building Code, it may not be eligible for NFIP premium reduction (NYCDCP 2014, 91).

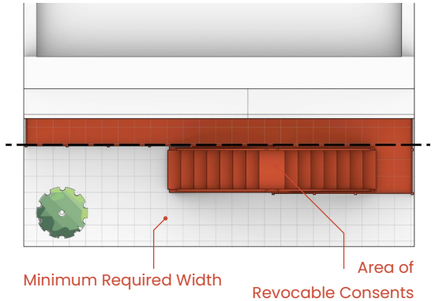


Alternative retrofitting diagram for Semi-Attached/ Attached Mixed-Use Structures.
Based on NYCDCP 2014, 90-91.

NYC Building Code Compliance. This strategy complies with New York City's Building Code under the "Dry Floodproofing" option for non-residential structure.

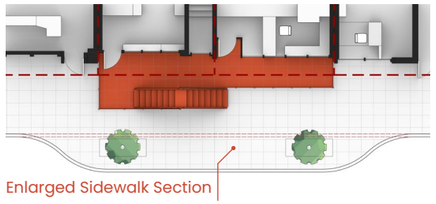
Pros & Cons. In-Place Dry-floodproofing is a streetscape-friendly strategy, and may bring about more feasibility for real-world application. However, the dry-floodproofing treatment has high technical requirements for a building's enclosure system, which may in some cases call for an extensive structural renovation. Meanwhile, as will be discussed later, the dry-floodproofing enclosure of semi-attached/attached mixed-use structures must in the meantime provide alternative egress routes (NYCDCP 2014, 31; 2016, 35), which may lead to temporary intrusion of the pedestrian right of way, and require more time, labor and cost in procurement and installation.

Preservation/Streetscape Consideration: Temporary Dry-Floodproofing Enclosures Occupying Sidewalk Space. When temporary dry-floodproofing shields are deployed, all means of egress (e.g. front entrance) that are blocked must be replaced with alternative egress routes above DFE (NYCDCP 2014, 31; 2016, 36). The typical solution to this challenge is a dry-floodproofing enclosure that incorporates a set of deployable stairs from ground level up to DFE that allows residents and customers cross over the flood barriers; these stairs will likely have to intrude the sidewalk space, and the frontage width they require may cause additional challenge for buildings built on narrow lots (NYCDCP 2014, 90-93).



Dry-floodproofing enclosure occupying sidewalk space. Based on NYCDCP 2014, 92.

Solution | Comprehensively Redesigned Sidewalk Space and Egress Routes. NYCDCP's *Retrofitting* report suggests the dry-floodproofing enclosure to be installed through a revocable consent from the city's Department of Transportation (NYCDCP 2014, 91); but in order to fully address limitations brought by narrow lots, limited sidewalk space and the potential coexistence of multiple sets of temporary egress stairs along a street, the dry-floodproofing measure shall be planned in coordination with neighboring buildings and with the sidewalk design. For storefronts with narrow frontage width, dry-floodproofing enclosures that cover two neighboring structures could be deployed; when the implementation of dry-floodproofing impacts the minimum required width of the sidewalk, the sidewalk could be locally widened to ensure the free passage of pedestrians. Additionally, a number of other strategies may be adopted as alternatives to providing egress routes:



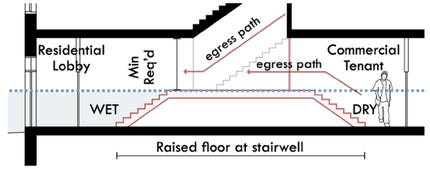
- When a building has high ground-floor ceilings and mild flood elevation, egress stairs may be deployed directly over dry-floodproofing shields that seal entrance doors. Another set of stairs should be deployed inside the building, in order for residents to reach the stair landing above DFE (NYCDCP 2016, 87).


Egress stairs deployed directly over dry-floodproofing shields. Source: NYDDCP 2016, 87.

- In waterfront areas with repeated flood risk, the temporary egress described above may be perpetuated by the construction of egress stairs both inside and outside the building in permanent materials. Local elevation rehabilitation may be needed to incorporate these stairs in a way that doesn't intrude sidewalk space and impact a building's historic integrity.


Permanent egress above DFE in a newly-built mixed-use building in Staten Island. Photograph taken by the author.

- For dry-floodproofed storefronts in mixed-use buildings, egress may also be provided internally: by connecting the retail space with the building's elevated and wet-floodproofed residential lobby, retail tenants and customers may leave the building through the residential lobby in emergency, instead of having to cross over the dry-floodproofing shields that have sealed the front entrance (NYCDCP 2016, 87).



Retail egress rerouted through wet-floodproofed and elevated residential lobby. Source: NYDDCP 2016, 87.

The treatments discussed above may be useful to mixed-use buildings in tightly-knit historic commercial corridors with relatively small and narrow lots; they'll be tested out in the project's Report 04 — a real-world adaptation design study on South Street Seaport historic district. However, it's important to acknowledge that all these treatments are still experimental in nature: due to the specificity of the semi-attached/attached mixed-use building type, there haven't been many built cases of dry-floodproofing enclosure or rerouted interior egress known by the author, nor are they recognized by New York City's current Building Code; furthermore, the NYC Building Code doesn't explicitly recognize the "mix-and-match" of floodproofing strategies where the commercial storefront is dry-floodproofed while the residential lobby is wet-floodproofed, either. These tensions open up further opportunities for flood policy-making and reform.

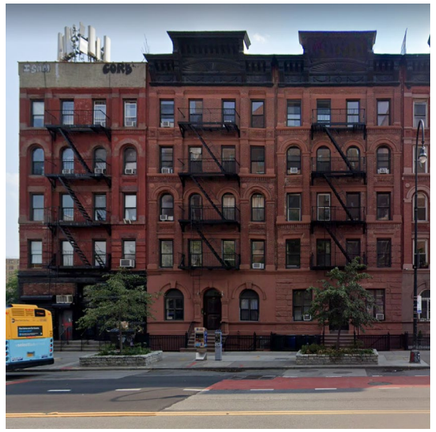
4.6 Building Type 5: Mid-Rise Residential

General Information

Stock in New York City's Floodplain: 3,188 (buildings).

Characteristics: Masonry, steel or concrete, on masonry/concrete foundation. 4-6 story; with party wall and basement or cellar. This building type is most commonly represented by mid-rise walk-up residential structures in the more densely developed areas within New York City's floodplain (e.g. part of East Village in Manhattan).

New York City Building Code Classification: Residential (for flood purpose).



A row of Mid-Rise Residential buildings in East Village, Manhattan. Source: Google Maps.

New York City Building Code Regulation (Residential): 1) All living space must be raised above DFE; 2) Uses below DFE are restricted to parking, storage and access; 3) Spaces below DFE should be wet-floodproofed (NYCDOB 2014 Building Code).

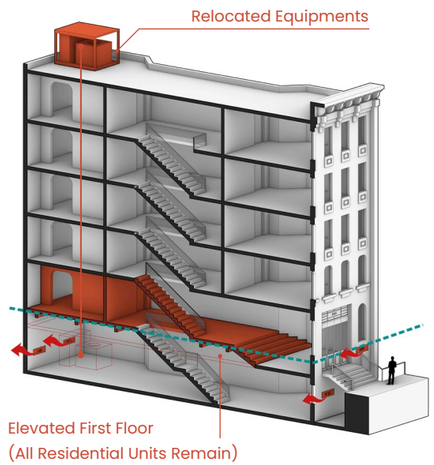
Level of Retrofitting Strategy Development: ■ **Medium.** As formally constructed masonry, concrete and steel structures are only to a limited extent affected by past hurricanes such as Sandy (The City of New York 2013, 14-15), existing research on this building type is so far only represented by two design case studies in NYCDCP's *Retrofitting* report (NYCDCP 2014, 70-81). As a precaution to potential streetscape changes brought by flood-retrofitting projects on mid-rise residential structures, in this section, the author develops preservation and streetscape considerations upon the overall retrofitting schemes advocated by DCP's planning study.

Overall Retrofitting Method: Interior Elevation with Optional Addition, or "Mix-and-Match" of Wet and Dry-Floodproofing

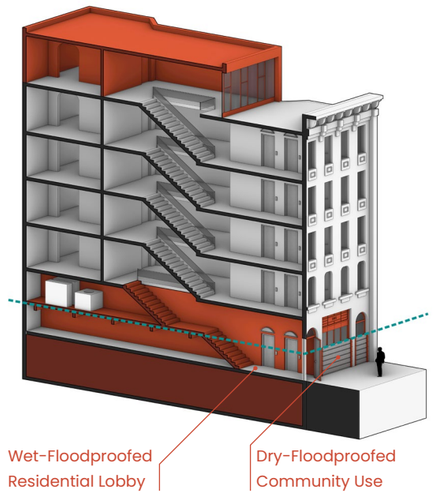
Typical Retrofitting Method: Interior Elevation with Optional Addition, or "Mix-and-Match" of Wet and Dry-Floodproofing. Similar to the case of row houses ("Semi-Attached/Attached Residential"), mid-rise walk-up apartments may be retrofitted by the non-structural elevation method. Based on the difference between a building's lobby elevation and the height of local DFE, two different strategies may be proposed:

- If a mid-rise residential building already has its lobby several stairs above street level, then local DFE is likely only slightly above the existing lobby elevation. In this case, a moderate elevation of the first floor's floor plate will suffice to bring all residential units above flood level. As the first floor's ceiling height is not significantly reduced, all residential units may remain at the original location. Spaces below DFE (including the basement) shall be wet-floodproofed, and critical equipments shall be relocated onto the rooftop (see NYCDCP 2014, 72-73).

- If a mid-rise residential building is directly accessed from the street level and has a relatively low lobby elevation, then local DFE is likely several feet higher than current lobby level. In this case, raising the first floor's floor plate may significantly reduce ceiling height and render the whole floor unusable. Therefore, it's recommended that most of the first floor space be converted into community or retail use, and be dry-floodproofed in-place; a residential lobby shall also remain on street level, and be wet-floodproofed. The loss of first-floor residential units may be compensated by rooftop addition; equipments may be relocated onto the rooftop, or into crawl spaces above DFE (see NYCDCP 2014, 78-79).



Overall retrofitting diagram for Mid-Rise Residential structures with high lobby elevation.
Based on NYCDCP 2014, 72-73.



Overall retrofitting diagram for Mid-Rise Residential structures with low lobby elevation.
Based on NYCDCP 2014, 78-79.

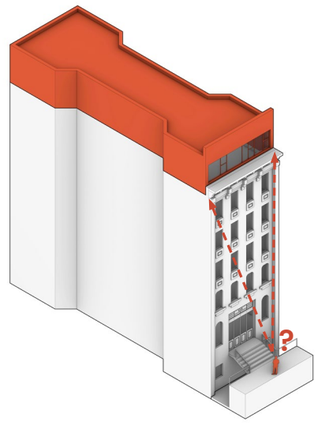
NYC Building Code Compliance. This strategy complies with the general principles set out in New York City's Building Code Appendix G (NYCDOB 2014 Building Code). Nevertheless, the mixed use of dry-floodproofing and wet-floodproofing on one structure — as seen in the "low lobby elevation" scenario discussed above — is not explicitly recognized by the city's Building Code.

Pros & Cons. The heavyweight, solid construction of masonry or steel frame leaves non-structural elevation as the only feasible retrofitting method for mid-rise structures. Luckily, non-structural elevation treatments will not significantly alter the streetscape relationship of mid-rise structures; due to the greater height of mid-rise buildings, additions on rooftop are also less visible from street level as compared to those above row houses (see Section 4.4). Similar to discussions made for Semi-Attached/Attached Residential structures in Section 4.4, preservation and streetscape considerations for mid-rise residential buildings are mostly concentrated on the entrance context/street interface and the potential streetscape changes brought by building addition.

Preservation/Streetscape Consideration 1: Entrance Context. Although the non-structural elevation method typically doesn't pose much change to a building's spatial layout and physical fabric, the retrofitting of the residential lobby and the change of first floor use still has the potential to alter a building's entrance context and diminish historically significant architectural forms and streetscape features. This would be a significant challenge especially when the use of first floor is changed from residential to retail or community facility — which may call for greater transparency, and altered elevation rhythms.

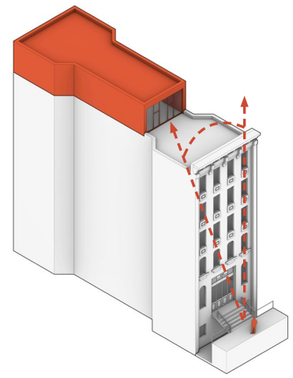
Solution | Retain Entrance Characters Under Local Preservation Regulations. In the retrofitting of historically significant mid-rise residential buildings, entrance context and street-level character-defining features shall be closely examined and retained. Historic architectural features around entrance gates should be salvaged, or replaced with flood-resistant materials bearing similar design and material texture. Elevation changes shall comply with the general standards laid out by local preservation design guidelines (such as NYCLPC's *Permit Guidebook*). If the use of first floor is altered (e.g. from residential to community facility), the street-level elevation's transparency and opening locations should be to the great extent retained.

Preservation/Streetscape Consideration 2: Changes Brought by Rooftop Addition. As is the case for row houses, rooftop additions that serve to compensate for residential floor area loss may pose negative streetscape impacts. As mid-rise structures have a greater height, their rooftop additions are generally less visible from street level, and may therefore be designed with more flexibility. Meanwhile, as New York City's mid-rise building stock features mostly walk-up building groups with a continuous street wall and repetitive architectural patterns, the flood retrofitting design should also incorporate considerations on adjacent buildings.

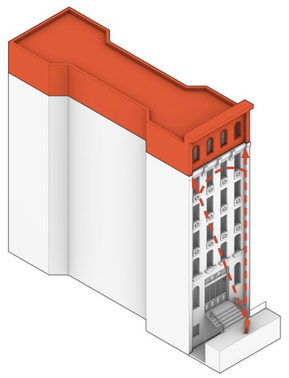


Solution 1 | Additions with Setback or Visually Compatible Elevation Design. When a rooftop addition is able to be seen from street level, it should embed a front elevation design that is architecturally compatible with the existing historic context and architectural fabric; alternatively, the addition may be set back substantially from the original street wall, in order to remain invisible from street level and avoid negative streetscape impacts.

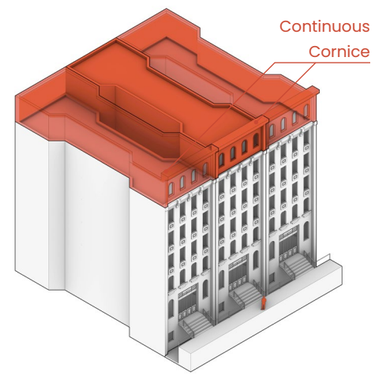
Solution 2 | Precedents and Coordinated Projects. Local preservation design review mechanisms should ensure that the flood retrofitting of walk-up mid-rise residential buildings are either coordinated on a group scale, or reference the earliest flood retrofitting instance within the group.



Addition with Setback



Addition in Compatible Style



Precedents & Coordinated Projects

4.7 Building Type 6: Mid-Rise Mixed-Use

General Information

Stock in New York City's Floodplain: 982 (buildings).

Characteristics: Masonry, steel or concrete, on masonry/concrete foundation. 4-6 story; with party wall and basement or cellar. First floor commercial, upper floor(s) residential. Similar to Mid-Rise Residential structures, this type of buildings typically exist in the more densely-developed areas of New York City's floodplain (e.g. South Street Seaport).

New York City Building Code Classification: Non-residential (for flood purpose).

A row of Mid-Rise Mixed-Use buildings in South Street Seaport, Manhattan. Source: Google Maps.

New York City Building Code Regulation (Non-Residential): 1) Elevation + Wet Floodproofing Option — structurally or non-structurally raise the structure and wet-floodproof it under the same standard as residential buildings; or 2) Dry Floodproofing Option — the structure stays at original elevation (with all dwelling units located above DFE) while being dry-floodproofed to DFE (NYCDOB 2014 Building Code).

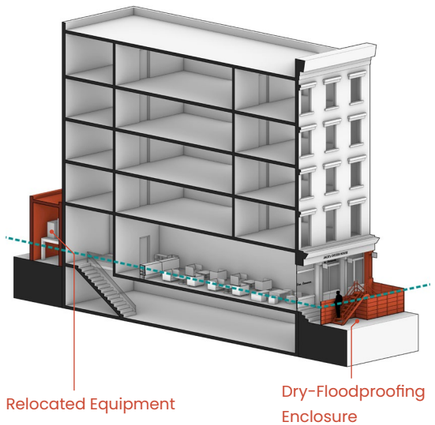
Level of Retrofitting Strategy Development: ■ **Medium.** Due to their formal construction and mixed-use nature, existing policy and design discussions on the flood-retrofitting of Mid-Rise Mixed-Use structures are limited, and most notably represented by a single case study in NYCDCP's *Retrofitting* report (NYCDCP 2014, 94-99). Referencing this design study as well as streetscape design strategies adopted in Post-Sandy mixed-use constructions in New York City's floodplain, in this section, the author explores streetscape and preservation considerations and streetscape design strategies applicable to New York City's historic Mid-Rise Mixed-Use structures.

Overall Retrofitting Method: "Mix-and-Match" of Wet and Dry-Floodproofing

Typical Retrofitting Method: "Mix-and-Match" of Wet and Dry-Floodproofing. As only living spaces are required to be physically elevated under New York City's current Building Code, mid-rise mixed-use buildings can simply be dry-floodproofed below DFE. All residential units shall be moved into or above the second floor; the ground-floor residential lobby shall be wet-floodproofed, pursuant to the principles set out by the city's Building Code; the basement shall be either filled, or dry-floodproofed.

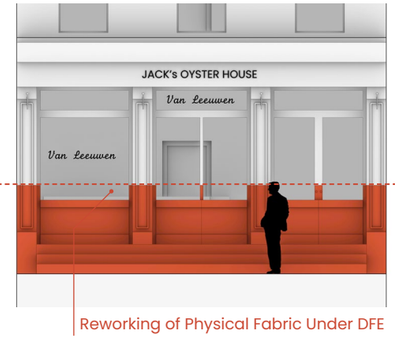
NYC Building Code Compliance. This strategy complies with New York City's Building Code under the "Dry Floodproofing" option for non-residential structure.

Pros & Cons. As discussed earlier, dry-floodproofing treatments on mixed-use structures typically don't pose much impact on a building's street interface and streetscape expression; furthermore, basements may remain in mixed-use buildings when the dry-floodproofing option is adopted and below-grade spaces are dry-floodproofed accordingly (see Appendix G Section G304.1.2). Overall, the streetscape and preservation considerations for Mid-Rise Mixed-use structures are of great similarity to those in the in-place dry-floodproofing of Semi-Attached/Attached Mixed-Use structures discussed in Section 4.5. In this section, the author will only raise one additional consideration regarding the multiple forms of human-scaled architectural elements (e.g. bulkheads, signage, and awning) closely associated with New York City's storefronts within mid-rise mixed-use buildings.

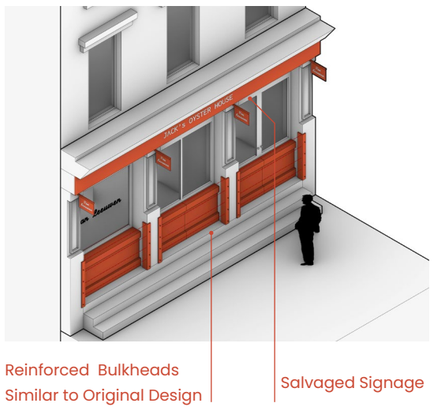


Overall retrofitting diagram for Mid-Rise Mixed-Use structures. Based on NYCDCP 2014, 96-97.

Preservation/Streetscape Consideration: Preservation of Human-Scaled Street Interface During Dry-Floodproofing Intervention. As a mid-rise mixed-use structure gets dry-floodproofed, its wall sections and physical fabric under DFE may have to be fortified, reworked, or reconstructed. When these alterations happen, key architectural elements with streetscape significance — such as bulkheads, awnings and signage as stressed in NYCLPC's *Permit Guidebook* (NYCLPC 2019) — shall be preserved or replaced with similar design.



Solution | Establish Design Guidelines to Retain Street-Level Character-Defining Features, and Encourage Decorative Architectural Elements in Retail Storefronts. New York City's future flood retrofitting design guidelines on historic structures should establish provisions on retaining the scale and transparency of storefronts during dry-floodproofing intervention, as well as preserving window, entrance, bulkhead and signage designs of historic significance; meanwhile, to achieve a vigorous streetscape, new signs

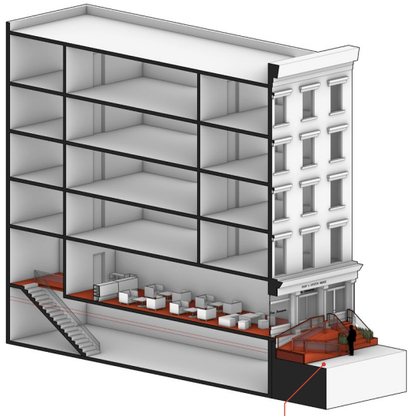


or awnings compatible with the context of historic neighborhoods shall be encouraged — for example, through the city's streetscape design point system — in the flood retrofitting of mid-rise mixed-use structures.

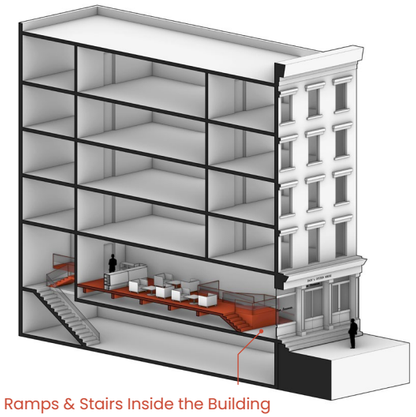
Alternative Retrofitting Method: Interior Elevation

Alternative Retrofitting Method: Interior Elevation and Wet-Floodproofing (for low DFE only). Although storefronts in mid-rise mixed-use structures have the feasible option of dry-floodproofing, in order to achieve higher flood resistance, the retail first floor may also be elevated and wet floodproofed. This scenario only applies to situations where DFEs are close to the street grade, so that the elevation won't create accessibility issues or result in the significant reduction of usable ceiling height.

When the retail first floors are raised, there are two options regarding the location of stairs and ramps leading to the elevated floor plate — they may be either placed outside the building (see for example, NYCDCP 2013b, 37), or in the interior (see for example, the non-structural elevation strategy discussed in Section 4.5 — Semi-Attached/Attached Mixed-Use). As New York City's 2013 flood zoning amendment and other policy documents have noted, long ramps required for ADA compliance and stairs outside the building may create an alienating streetscape, as it blocks the visual connection and direct pedestrian access from street level to retail storefronts, and breaks the continuous street wall. Therefore, in historic neighborhoods, stairs and ramps leading to elevated first-floor storefronts should always be located inside the structure when possible.



Ramps & Stairs Outside the Building



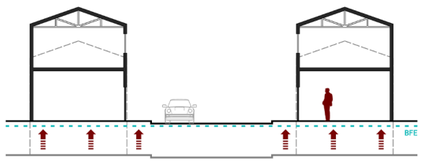
Ramps & Stairs Inside the Building

05

Neighborhood-Scaled Strategies

Besides building-scaled flood retrofitting strategies and streetscape design solutions central to the mainstream discourse on flood resilience, several neighborhood-scaled adaptation models — such as the elevation of low-lying streets and the construction of coastal resilience infrastructure — have also been carried out or proposed in cities across the U.S. Some of these strategies may in theory take a whole neighborhood out of the floodplain without introducing significant streetscape changes. However, these large-scaled interventions are greatly dependent on urban-scaled resilience pathways set out by city-level master plan, and generally have only been proposed as experimental strategies, or implemented in selected sections of a few coastal cities. While the overall intention of this project is to discuss flood adaptation and historic urban form changes on building and street scales (where retrofitting interventions are most likely to cause significant streetscape changes), this section provides a brief overview of the neighborhood-scaled adaptation tools that may offer supplemental information and provide a contextual understanding for discussions made in this project.

5.1 Elevating Streets with Buildings



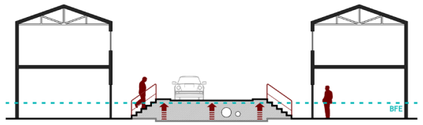
Since a great amount of streetscape change is caused by the increased height difference between building entrance and street level, elevating streets together with buildings may be a strategy that diminishes most streetscape issues while achieving flood resilience. The practice of elevating both buildings and streets can be traced back to the historic Raising of Chicago in the 1850s, following new drainage systems laid by the city which resulted in the elevation of the city's thoroughfares to increase by as much as eight feet. To address the height difference between grades of old buildings and new roads, "many Chicagoans built staircases from the street down to their front doors," but there were also hundreds of structures that were raised with jacks. Notable projects included the structural elevation of a whole row of mixed-use business structures on Lake Street, as well as the elevation of some other large-scale masonry structures (Salzmann 2018; Chicagology n.d.).

Building elevation on Lake Street, Chicago, 1857.
Source: Chicago Historic Society/Wiki Commons.

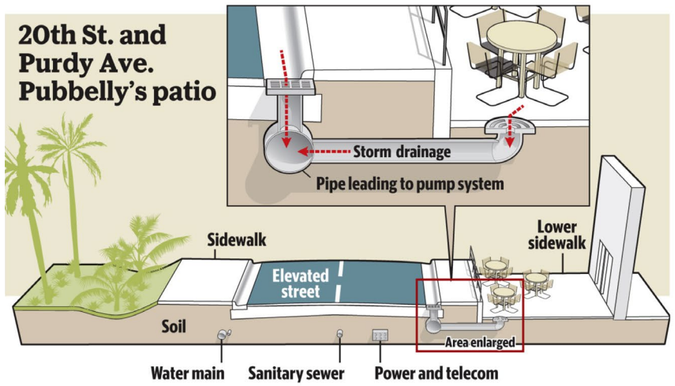
In recent years, the prospect of elevating streets together with buildings has reentered flood adaptation and historic preservation discourses as an alternative solution that would avoid the drastic proportion changes and historic integrity damages brought by structural elevation interventions. Newport Restoration Foundation's *74 Bridge Street* study identifies such strategy as the only alternative for the Point neighborhood — a local historic neighborhood featuring 18th-century timber-frame homes — that would simultaneously achieve flood regulation compliance, retain historic characters, and avoid the cost-prohibitive flood insurance rates for individual property owners. However, it is still uncertain how this community-scaled strategy would be agreed upon, funded, executed, and coordinated; and there hasn't been any recent built case of street and building elevation known to the author. Given the social justice and project coordination challenges present in existing community-level flood resilience programs (e.g. the "lollipop" effect of building elevation and the "checkerboard" effect in governmental buyout programs), the feasibility of this strategy is left to be further investigated and debated.

Analysis published by Newport Restoration Foundation supporting the elevation of streets together with buildings.
Source: Newport Restoration Foundation 2016, 26-27.

5.2 Elevating Streets without Elevating Buildings



While Newport is exploring the prospect of elevating both buildings and streets, Miami Beach, FL has since 2013 started an iconic stormwater management program experimenting the strategy of elevating roads and streets without elevating buildings. As an island city with 93% of its properties located within the 1% floodplain, the city has committed to investing nearly $ 600 million to raise at least 60% of the city-owned roads to 3.7 feet above sea level (Urban Land Institute 2018, 20-22; Harris 2020a). New stormwater drainage and pump systems are also envisioned in the plan, which are designed to collect stormwater and pump it back to Biscayne Bay through pipes under the elevated streets and one-way valves at the waterfront (Flechas and Staletovich 2015).

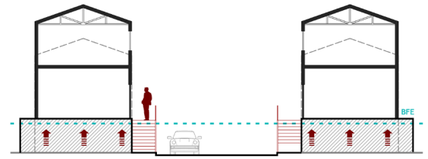


Road Elevation in Miami Beach: Street Section, Streetscape Change, and Proposed Project Areas.
Sources: Flechas and Staletovich 2015; Harris 2021; Campo-Flores 2020.

As of 2022, road elevation projects have been carried out in the city's several low-lying neighborhoods including Sunset Harbor and Palm and Hibiscus Islands (Flechas 2016; Harris 2021), sparking an extensive debate on the strategy's overall efficiency and its social justice implications on individual homeowners. As residences and businesses are now located several feet below the street level, flood has been found flowing into a street corner restaurant during a flood event in 2016 (Flechas 2016); in 2021, a group of homeowners sued the city for raising the road in front of their houses and thus flooding their properties (Harris 2021). Some discussion has been made to solve the issue where individual properties are no longer able to drain excess water to the street (Flechas 2017), and it has been found that while the road elevation projects have increased the value of 1,300 condominiums in Sunset Harbor by 11.9%, most complaints are coming from the single-family homes on Palm and Hibiscus Islands (Harris 2020b).

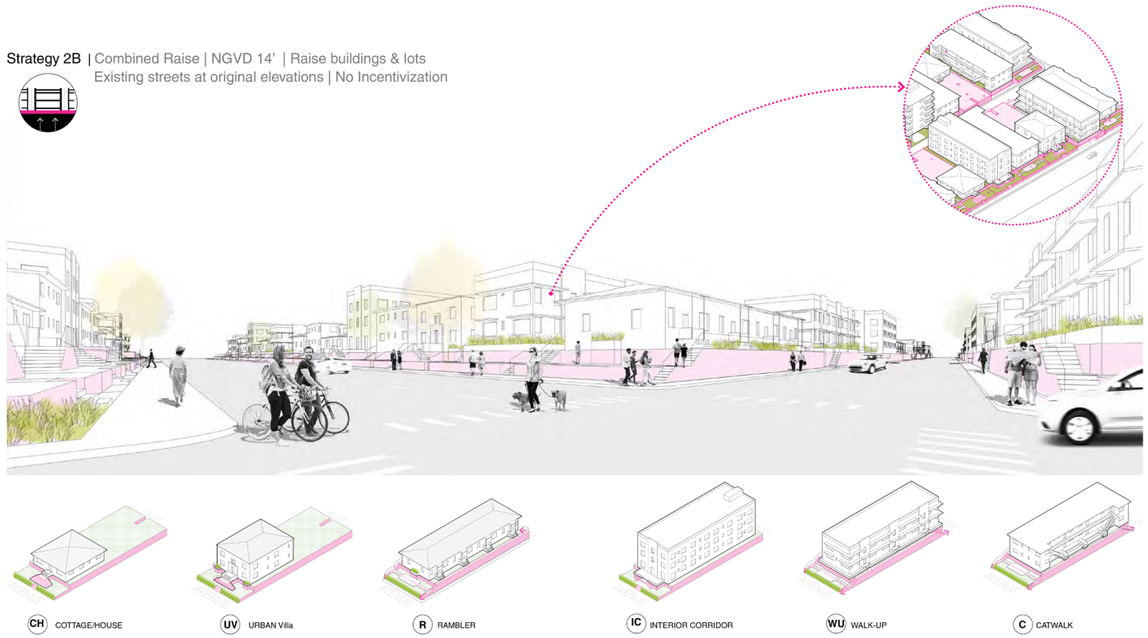
Not much unlike elevating single homes on poles or concrete foundations, the elevation of streets without elevating buildings — despite being a creative solution — will inevitably result in significant streetscape changes and loss of historic characters when applied to historic districts. On this front, Miami Beach's 2020 *Buoyant City* guideline provides several illustrations regarding the urban design strategies that may be adopted to mitigate the difference between raised roads and adjacent properties (see Miami Beach 2020, 278-279).

5.3 Elevating Buildings and Lots



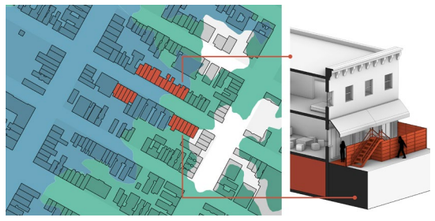
Several heritage resilience guidelines — such as Miami Beach's *Buoyant City* and Maryland's *Flood Mitigation Guide* — have proposed the possibility of raising buildings together with lots, creating a new ground plane above flood level (see Miami Beach 2020, 220-243; MDSHPO 2018, 3.39). Buildings and lots can either be elevated on a site-to-site basis as flood adaptation projects on individual properties, or be coordinated on a block scale. However, like the case for street and building elevation discussed in Section 5.1, the decision-making and project management mechanisms necessary for such elevation is not yet well-understood. However, it is claimed that both land filling and the coordinated approach to raising buildings have some precedents in North American urban history: Miami Beach was historically built upon landfills, and the town of Galveston, Texas was raised after a hurricane in 1900 (Miami Beach 2020, 222).

This strategy may be seen as a supplement to the elevation of streets alone discussed in Section 5.2; when these two strategies are implemented together, whole city sections will eventually be lifted with all streetscape relationships retained. The *Buoyant City* guideline provides some visualizations on the streetscape changes that may happen when buildings and lots are individually raised or raised in groups, while existing streets remain at the current level.



An illustration in the *Buoyant City* guideline laying out streetscape changes created when urban blocks and buildings are elevated, while streets remain at current level.
Source: Miami Beach 2020, 238-239.

5.4 Neighborhood-Scaled Adaptation Planning



Aiming at main streets and other forms of major street corridors, some local planning and historic preservation agencies have recognized the importance of coordinating retrofitting treatments and streetscape changes among a group of structures and their surrounding urban environment. This awareness is represented by several street and neighborhood-scaled flood adaptation planning studies published in recent years. For example, the *Manayunk Main Street Historic District Guide* (2020) commissioned by the Pennsylvania SHPO studied floodplain designations along the Main Street of Manayunk, Philadelphia, identified typical maintenance needs for historic structures along the street, and put forward two flood retrofitting design scenarios — wet-floodproofing and dry-floodproofing — applicable to predominant building types (Mid-rise Residential or Mixed-Use) along the Main Street. Similarly, the *Resilient Retail* study published by NYCDCP in 2016 mapped flood risk along New York City's selected community-level commercial corridors, and surveyed current street elevations; based on the understanding that the mix-and-match of flood retrofitting strategies are crucial to the provision of necessary retrofitting flexibility for retail storefronts, the study divided the street level of commercial corridors into three flood risk classes, and mapped the combination of different flood retrofitting strategies on street scale.

Bridging the street/neighborhood-level planning process and individual building retrofitting projects, these planning studies have demonstrated how street and neighborhood-scaled urban design approaches may help individual buildings to both achieve both higher flood resilience and contribute to a more consistent streetscape through the provision of technical information, design guidelines, and recommended practices.

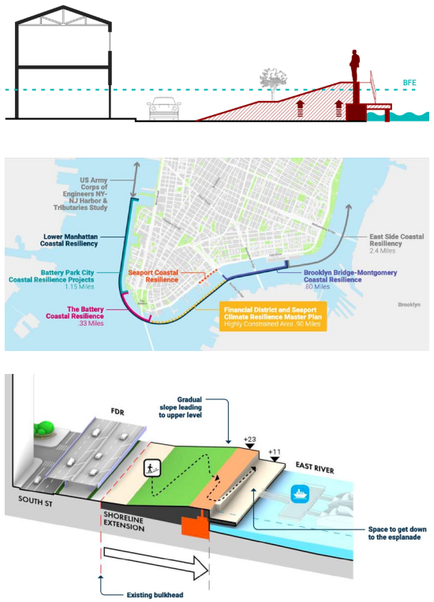
Unlike the more experimental and theoretical proposals discussed in the previous sections, the neighborhood-scaled adaptation planning approach is of particular relevance to the street and building-scaled flood adaptation solutions targeted by this study. Therefore, the process and methodology of this strategy will be actively referenced in the real-world adaptation design studies featured in Digital Reports 04 and 05.

Flood risk mapping, typological retrofitting strategies, and street-scaled retrofitting treatment coordination in existing neighborhood-scaled adaptation planning studies. Source: PDP Architects 2020, 27; NYCDCP 2016, 46, 69-70.

5.5 Resilience Infrastructure and Shoreline Extension

Besides raising sections of low-lying urban areas, another alternative would be constructing physical flood barriers such as seawalls that block coastal flood water and thus take communities out of the floodplain. Under this scenario, both existing buildings and streets may remain at the original location; no significant adverse impacts will be created in local streetscape relationships. While seawalls, levees and other forms of large-scaled infrastructural adaptation are typically understood as urban-level strategies, they often come into reality as community-scaled resilience infrastructure projects.

In the real world, this strategy is probably best represented by New York City's ongoing Lower Manhattan Coastal Resiliency (LMCR) initiative, a collection of neighborhood-scaled infrastructural adaptation projects that link with each other and seek to form a continuous flood barrier surrounding Lower Manhattan. Multiple forms of infrastructural interventions — including elevated wharfs, physical flood walls, deployable flood shields, and flood gates — are envisioned to comprise the flood barrier system; in most cases, these infrastructural constructions will be covered by new access and public recreation uses such as parks, green spaces, sports fields, esplanades, and bike paths, which can be reached by a sloped landscape that connects to the inland street level. Part of the project requires extending the existing Lower Manhattan shoreline into East River, in order to accommodate the flood defense barriers and the sloped landscape necessary for the public to reach recreational spaces on top of them. Specifically, the LMCR project is broken into the following components:



Plan of the LMCR initiative, and diagram of the sloped landscape that connects existing street level with new public uses on the flood barrier system.
Source: NYCEDC et al. 2021, 13, 71.

- Battery Park City Resilience Projects, a flood wall system accompanied with raised park spaces.
- The Battery Coastal Resilience Project, which seeks to rebuild the Battery Wharf and elevate it by 5 feet.
- Financial District and Seaport Resilience Master Plan, the combination of a waterfront esplanade system designed at 11 ft above sea level, and a raised landscape with buried flood walls designed at 23 to 26 ft above sea level. Flood gates are designed at select locations; both systems will be constructed as expansions of the existing shoreline.
- Brooklyn Bridge-Montgomery Coastal Resilience, a combination of flood walls and deployable flip-up barriers in the Two Bridges area.

The whole LMCR project connects to US Army Corps of Engineers' NY-NJ Harbor & Tributaries Study on the west end, as well as the East Side Coastal Resiliency project — a combination of flood walls and elevated landscape designed by Bjarke Ingels Group with a total span of over 2.5 miles — on the east end (Bjarke Ingels Group n.d.).

Some other cities have also developed resilience infrastructure master plans similar to New York City's LMCR initiative. For example, Boston's Resilient Boston Harbor initiative envisions waterfront infrastructural and building adaptation interventions for a number of waterfront areas across the city.

Renderings for community-scaled resilience infrastructure projects envisioned under the LMCR initiative.
Source: Battery Park City Authority; LMCR Official Website; NYCEDC et al. 2021, 72-73.

06

Flood Policy: Compliance and Tensions

In Chapter 4 and Chapter 5, the author analyzed the NYC Building Code compliance of each streetscape-sensitive flood retrofitting design solution identified for the city's historic built environment. These discussions reveal that although many design treatments identified or proposed in this study don't pose direct contradictions with the city's current flood policy framework, New York City's flood policy still sometimes prohibits the implementation of streetscape-friendly retrofitting design strategies on single building scale, and hasn't yet provided a solid framework for flood adaptation strategies and planning processes on street or neighborhood scale. These tensions and blank spots open up further possibilities for policy-making and reform in the fields of flood adaptation and historic preservation. Specifically, New York City's flood policy landscape shall be further developed in the following directions:

"Mix-and-Match" of
Wet & Dry Floodproofing

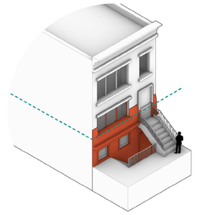
✕

Incompliant

Active Use in
Wet-Floodproofed Retail Lobby

✕

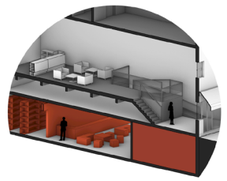
Incompliant



Dry-Floodproofing
Residential Structure

✕

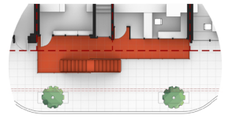
Incompliant



Storage/Retail/Accessory
Use in Basements

?

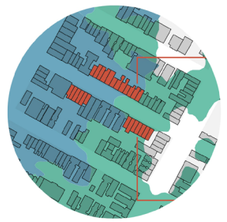
May Be Incompliant



Shared Dry-Floodproofing
Enclosure

?

No Framework



Neighborhood-Scaled
Adaptation Planning

?

No Framework

Tensions between streetscape-sensitive design strategies identified in this study and New York City's current Building Code and flood zoning.

- **National and city-level flood policy framework should further address the needs of urban building types.** It is observed throughout this study that NFIP's floodplain management requirements, premium reduction standards, state and local-level flood retrofitting guidelines and existing built cases are to a great extent concentrated on detached single homes. However, as the design studies in Chapter 4 along with a number of NYCDCP's planning studies (see for example, NYCDCP 2014; 2016) have revealed, the high density,

mixed-use, multi tenants, narrow lots, active basement use, and attached construction of New York City's floodplain building types call for floodproofing and flood retrofitting strategies that are not supported or acknowledged by the current Federal and local flood regulations. Strategies such as the "mix-and-match" of multiple floodproofing strategies, active wet-floodproofed retail lobbies on street level, the establishment of dry-floodproofing enclosures, and the continued use of floodproofed below-grade spaces are not only contributing to the streetscape expression of historic buildings, but also necessary for a greater stock of floodplain buildings to reach flood resistance. Therefore, Federal and city-level policy-making entities should further research the retrofitting challenges and strategies associated with high-density urban building types, and put forward construction standards, insurance policies, zoning rules and streetscape design guidelines that offer more flexibility and encourage streetscape-sensitive flood retrofitting projects on high-density urban building stock.

- **National and city-level flood policy framework should further acknowledge and incentivize partial and incremental retrofitting.** Flood resilience and regulation compliance isn't always achieved at once through total overhaul and large-scaled renovation; a more feasible approach for property owners would be to gradually incorporate flood resilience measures in a piecemeal manner. Furthermore, a number of streetscape-friendly design strategies identified in this study for New York City's historic buildings — such as dry-floodproofing attached residential structures and retaining basement areaways — are incompatible with the city's current Building Code or NFIP's premium reduction standards. These situations call for the recognition of partial and incremental retrofitting treatments by NFIP and local flood zoning (see NYCDCP 2016, 4). Financial and zoning incentives should continue to be developed, based on existing floor area and building height exemption provisions in New York City's 2019-21 Flood Zoning.

- **New York City's local preservation agency should produce design and policy guidelines on the flood retrofitting of historic structures, with an emphasis on urban form change and streetscape design.** Responding to the flood risks of New York City's locally designated historic buildings, LPC has published two technical guidelines on equipment relocation and flood shield installation, echoing this project's finding that dry floodproofing may be a strategy beneficial to the preservation of historic characters and streetscape relationships of certain building types (e.g. row houses and semi-attached/attached mixed-use structures). However, dry-floodproofing may not be the best solution for every building type, and the two interventions covered by existing policy-making are not sufficient for the diverse floodplain historic building types; therefore, it's important that more technical and design guidelines are made to cover a wide range of flood adaptation interventions as well as the resilience planning process for historic properties. Local guideline-making on heritage resilience will also help to clarify the review processes needed for flood retrofitting projects, and address potential contradictions between historic preservation standards and general Building Code regulations on flood adaptation.

- **Neighborhood-scaled flood adaptation planning should be incorporated into the city's existing resilience planning and historic preservation systems.** As is revealed in this study's examination of streetscape-sensitive design strategies, street and neighborhood-scaled coordination is critical in ensuring a consistent outcome of flood retrofitting projects on individual buildings, and retaining a building group or an urban historic neighborhood's urban forms, historic characters, and spatial relationships. In recent years, New York City's Department of City Planning has published a number of neighborhood-scaled planning studies under the Climate Resiliency initiative, and there are also several historic district masterplans issued by the city's Landmarks Preservation Commission. However, flood resilience discussions for historic districts and neighborhoods have been to a great extent left out from both systems, as DCP's neighborhood resiliency studies haven't covered the city's historic districts, and LPC's historic district masterplans haven't incorporated flood resilience provisions. The heritage significance, flood resilience parameters, and site-specific adaptation recommendations for historic neighborhoods and districts should be more closely incorporated into these existing policy-making systems, to better inform the adaptive and coordinated adaptation of New York City's historic built environment.

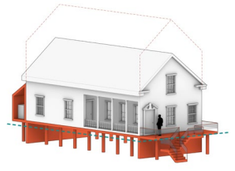
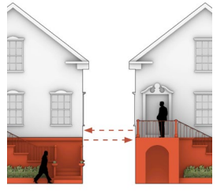
- **New York City's Building Code and Flood Zoning should better acknowledge the neighborhood-scaled resilience infrastructure projects taking place in the city's waterfront communities.** As discussed in Section 5.5, the city is executing a collection of neighborhood-scaled resilience infrastructure projects that seek to form a continuous flood barrier surrounding Lower Manhattan and take waterfront neighborhoods out of the floodplain. However, the city's current flood zoning and Building Code don't differentiate buildings in communities with neighborhood-scaled resilience measures in construction, against those located in the floodplain but will not be protected by neighborhood-scaled measures. More detailed policy-making would potentially relieve the burden of building-scaled flood retrofitting in Lower Manhattan neighborhoods protected with resilience infrastructure, and indirectly help preserve the fabrics of historic districts and neighborhoods in the area.

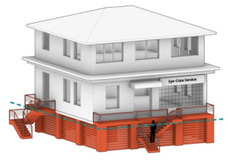
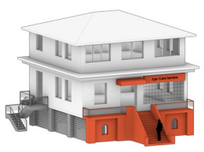
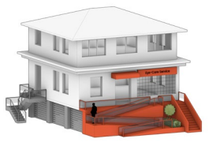
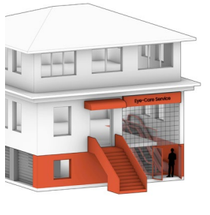
In Digital Report 06: Policy & Procedural Recommendations, the author will make a more comprehensive discussion on potential policy-making agendas targeted at flood adaptation and historic streetscape change based on findings identified in this report, along with other reports and components of the whole project.

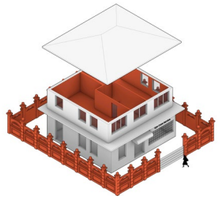
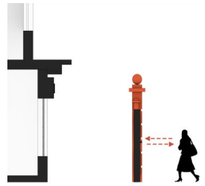
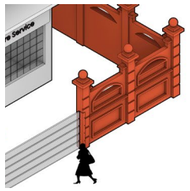
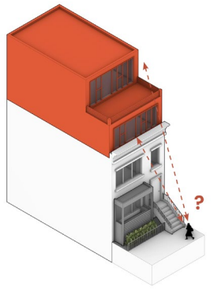
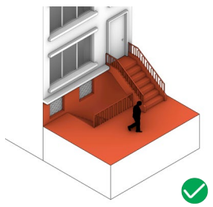
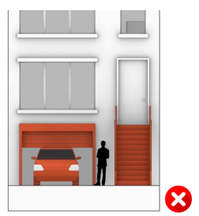
07

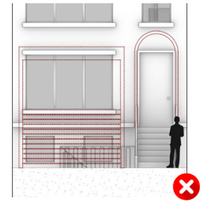
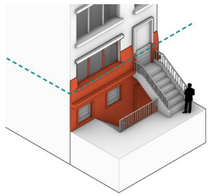
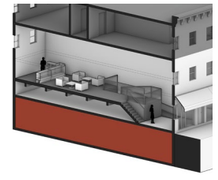
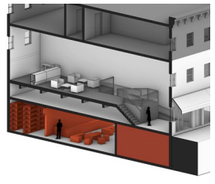
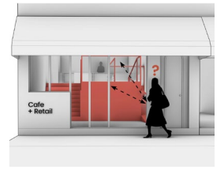
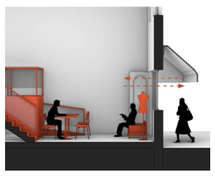
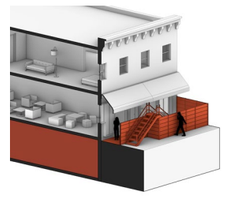
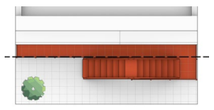
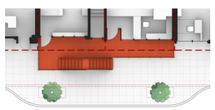
Appendices: Streetscape-Sensitive Design Toolbox

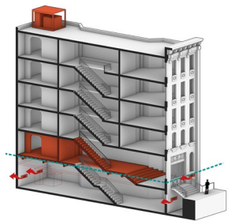
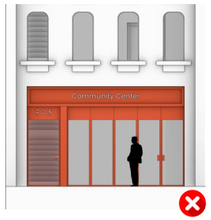
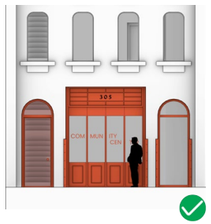
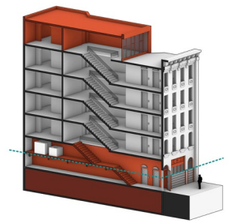
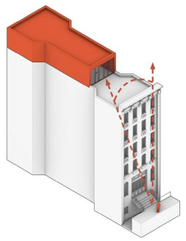
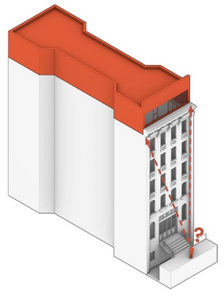
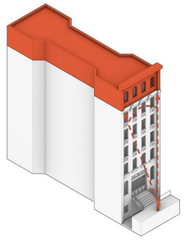
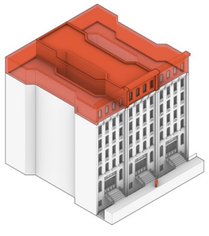
Appendix A: Building-Scaled Toolbox

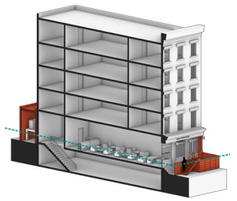
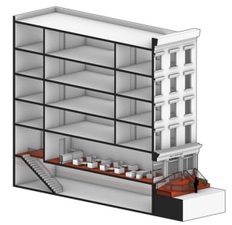
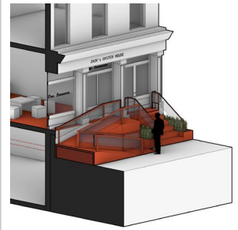
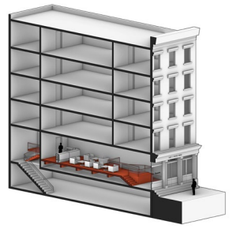
Building Type	Overall Retrofitting Method(s)	Preservation/ Streetscape Consideration	Solutions	NYC Building Code Compliance
 **Detached Residential** Stock: 29,883 Buildings	**Typical Method: Structural Elevation** 	 1 | Visual Consistency — Blank Street Wall & Piers	 Planting & Terraced Landscape	√
			 Articulated, Solid Foundation	√
			 Coordinated Projects	√
		 2 | Access & Sidewalk Relationship	 Stairs Within Context	√
			 "Piazza Screens," etc.	√

Building Type	Overall Retrofitting Method(s)	Preservation/ Streetscape Consideration	Solutions	NYC Building Code Compliance
Detached Residential *(continued)* Stock: 29,883 Buildings	**Typical Method: Structural Elevation** *(continued)*	 3 | Street-Level Parking Use	 Restrict Street-Level Parking	√
		4 | Comprehensive Use of Preservation & Streetscape-Sensitive Strategies	 Cases: 260 Main St, Owego, etc.	√
 **Detached Mixed-Use** Stock: 2,327 Buildings	**Typical Method: Structural Elevation** 	Commercial Function & Accessibility 	  Comprehensively Redesigned Stairs & Entrance (with Ramp when applicable)	√
			 Ground Floor Commercial Access	√

Building Type	Overall Retrofitting Method(s)	Preservation/ Streetscape Consideration	Solutions	NYC Building Code Compliance
Detached Mixed-Use *(continued)* Stock: 2,327 Buildings	 Alternative Method: In-Place Dry-Floodproofing	 Passive Street Interface	 Decorated Perimeter Walls in Compatible Style	√ (Under New Flood Zoning)
Semi-Attached/Attached Residential Stock: 20,616 Buildings	Typical Method: Non-Structural Elevation + Optional Addition	 1 | Streetscape Change Brought by Building Addition	 Addition in Compatible Style	√
			 Coordinated Projects	√
		 2 | Street Facade Change & Loss of Street Relationship	 Retain Basement Areaways	√
			 Prohibit New Parking Use	√

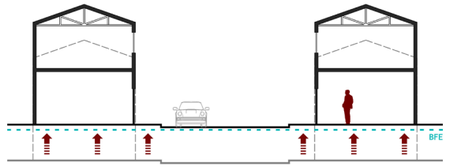
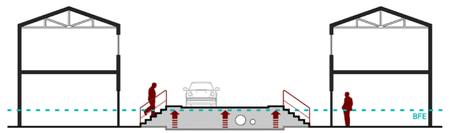
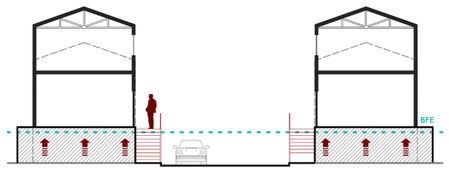
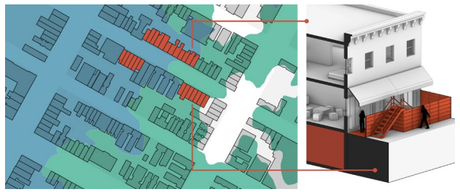
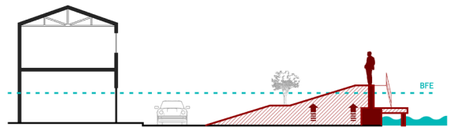
Building Type	Overall Retrofitting Method(s)	Preservation/ Streetscape Consideration	Solutions	NYC Building Code Compliance
Semi-Attached/Attached Residential *(continued)* Stock: 20,616 Buildings	Typical Method: Non-Structural Elevation + Optional Addition *(continued)*	2 | Street Facade Change & Loss of Street Relationship *(continued)*	 Restrict Street-Level Facade Change	√
	 Alternative Method: In-Place Dry-Floodproofing	/	/	× (Dry-Floodproofed Residential Space)
Semi-Attached/Attached Mixed-Use Stock: 2,394 Buildings	Typical Method: Interior Elevation + Optional Addition	 1 | Loss of Basement/Cellar Space	 Loosened Basement/Cellar Fill Regulation	× (Basement Fill)
		 2 | Undermined Commercial Lobby Activity	 Allowing Limited Seating & Retail	× (Active Use Below DFE)
	 Alternative Method: In-Place Dry-Floodproofing	 Floodproofing Enclosure Occupying Sidewalk Space	 Comprehensively Redesigned Sidewalk and Egress Routes	× ("Mix-and-Match" of Floodproofing) ? (No Framework for Shared Enclosures)

Building Type	Overall Retrofitting Method(s)	Preservation/ Streetscape Consideration	Solutions	NYC Building Code Compliance
 **Mid-Rise Residential** Stock: 3,188 Buildings	 **Typical Method:** **Interior Elevation + Optional Addition,** **Or Mix-and-Match of Wet and Dry-Floodproofing**	 1 | Entrance Context	 Retain Entrance Characters	√
				√
				√
		 2 | Streetscape Changes Brought by Rooftop Addition	 Addition with Setback or in Compatible Style	
			 Coordinated Projects	√

Building Type	Overall Retrofitting Method(s)	Preservation/ Streetscape Consideration	Solutions	NYC Building Code Compliance
 **Mid-Rise Mixed-Use** Stock: 982 Buildings	 **Typical Method:** **Mix-and-Match of Wet and Dry-Floodproofing**	 Preserving Human-Scaled Street Interface	 Retain & Encourage Street-Level Streetscape Features	√
	 **Alternative Method:** **Interior Elevation**	 Exterior Ramps/Stairs Diminishing Streetscape	 Ramps & Stairs Inside the Building	√

Appendix B:

Neighborhood-Scaled Toolbox

Neighborhood/Street-Scaled Strategy	Pros & Cons	NYC Building Code/Zoning Compliance
 Elevating Streets with Buildings	**Pros:** Achieves flood resistance and policy compliance with minimal streetscape change. **Cons:** Financial feasibility; Difficulties in community-level consensus and coordination.	? (No Framework)
 Elevating Streets without Elevating Buildings	**Pros:** Keeps road infrastructure usable during floods; Combination with new pumping/draining systems. **Cons:** Flooding redirected to nearby structures; Social justice concerns; Permanent, significant streetscape change.	× (Flood-Resistant Building Standards)
 Elevating Buildings and Lots	**Pros:** Keeps floodwater below the ground plane and away from all buildings; Potential combination with the elevation of streets. **Cons:** Lack of implementation mechanisms.	? (No Framework)
 Neighborhood-Scaled Adaptation Planning	**Pros:** Bridges neighborhood-scaled planning and individual building retrofitting; Coordinates flood adaptation strategies for higher resilience and more consistent streetscape. **Cons:** Existing guidelines are mostly advisory documents consisting of experimental design proposals.	√
 Resilience Infrastructure & Shoreline Extension	**Pros:** Achieves flood resilience without impacting the physical fabrics of existing communities; Potential combination with new public uses and green spaces. **Cons:** Financial feasibility; dependence on city-level masterplan.	√

08

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Living Above the Street
Stewarding New York City's Historic Built Environment Towards Flood Resilience

An Onera Prize in Historic Preservation Project

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DIGITAL REPORT 04

Adaptation Design Study: South Street Seaport

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About

This report is part of the independent research project “Living Above the Street: Stewarding New York City’s Historic Built Environment Towards Flood Resilience,” which is supported by Onera Foundation under 2022 Onera Prize for Historic Preservation.

Columbia GSAPP M.S. Historic Preservation ‘22

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Further Readings

To view and download the whole series of policy & design reports, please visit:
https://www.livingabovethestreet.nyc/reports.

This Onera Prize research project is developed upon the author’s M.S. Historic Preservation thesis:
Wang, Ziming. 2022. “Living Above the Street: Flood Retrofitting and Adaptive Streetscape of New York City’s Historic Districts.” M.S. Historic Preservation Thesis, Columbia University.
https://doi.org/10.7916/fn43-vb19.

Cover Image:
Flood Retrofitted Streetscape of Front Street in South Street Seaport During a Flood Event.
Rendering by the Author.

As one of the first commercial blocks in New York City, South Street Seaport developed from a small cluster of wharves into an important part of the leading port in 19th-Century United States. In the late 20th Century, it transformed into today’s mixed-use urban space with vibrant commercial atmosphere.

See Designation Report of South Street Seaport Historic District, NYCLPC, 1977.

Photograph Taken by Walter Smalling for HABS Survey NY-6368.
Source: Library of Congress.

Contents

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Executive Summary

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Following discussions made on flood risk, adaptive streetscape framework and streetscape-sensitive design strategies in the previous reports, Digital Reports 04 and 05 feature two real-world, street-scaled flood adaptation design studies within New York City's historic districts, exploring the prospect of adaptive historic urban form transformation towards flood resilience. Acknowledging building use as a key deciding factor of appropriate retrofitting strategies and applicable flood regulations (see Chapter 3.1, Digital Report 01), Digital Report 04 will investigate a **mixed-use street corridor** of vibrant retail atmosphere in **South Street Seaport**, while Digital Report 05 will investigate a brownstone **residential street corridor** in **East Harlem**. These two neighborhoods also represent different historic designation statuses (South Street Seaport as a LPC+National Register historic district; East Harlem as a National Register historic district only).

Both design studies start with a historic context study that facilitates the selection of a street corridor as focus area, of which a value-based assessment is carried out evaluating key streetscape characters. Utilizing findings established in this project, current conditions of the selected street corridor are then documented, and assessed under the **adaptive streetscape framework** (see Digital Report 02). Based on the profile (age, type, and use) of structures along the street corridor, the author groups them into several categories, and assigns an overall retrofitting strategy for each category. Key flood retrofitting treatments that balance multiple streetscape goals and respond to local streetscape characters are then developed based on the **streetscape-sensitive design toolbox** explored in Digital Report 03. Such street-scaled adaptation design leads to the rendering and evaluation of permanent streetscape changes after flood retrofitting, accompanied by an illustration of the retrofitted streetscape during flood events. To supplement the street-scaled design discourse and closely examine the impact of key retrofitting strategies and treatments on building scale, retrofitting case studies are carried out on real-world buildings along the street corridor. Finally, a discussion is made to evaluate the effectiveness of design strategies developed throughout the design study, as well as to analyze the needs for policy reform and design strategy development as revealed in the research process.

Overall, the South Street Seaport design study demonstrates that **although historic commercial corridors can be flood retrofitted while considerably retaining their streetscape quality, such retrofitting intervention will inevitably compromise other preservation and economic goals, and can only be achieved upon necessary regulation reforms and procedural establishments.**

02

Adaptation Design Study:

South Street Seaport

Designation, Streetscape Significance, and Street Corridor Selection

As one of the first commercial blocks in New York City, South Street Seaport developed from a "small cluster of wharves" into an important part of the leading port in 19th-Century United States, and in the late 20th Century transformed into today's mixed-use urban space with a vibrant commercial atmosphere. South Street Seaport has been designated both as a LPC Historic District (1977; 1989 extension) and a National Register Historic District (1972; 1978 extension). These two designations share similar boundaries, as they both incorporate an area of around 10 blocks from Fletcher Street to Dover Street, along with two piers at the East River waterfront (NYCLPC 1977; 1989; NPS 1978). According to FEMA's PFIRM map, almost the whole district is situated in New York City's 1% floodplain (see Site Map on the next page).

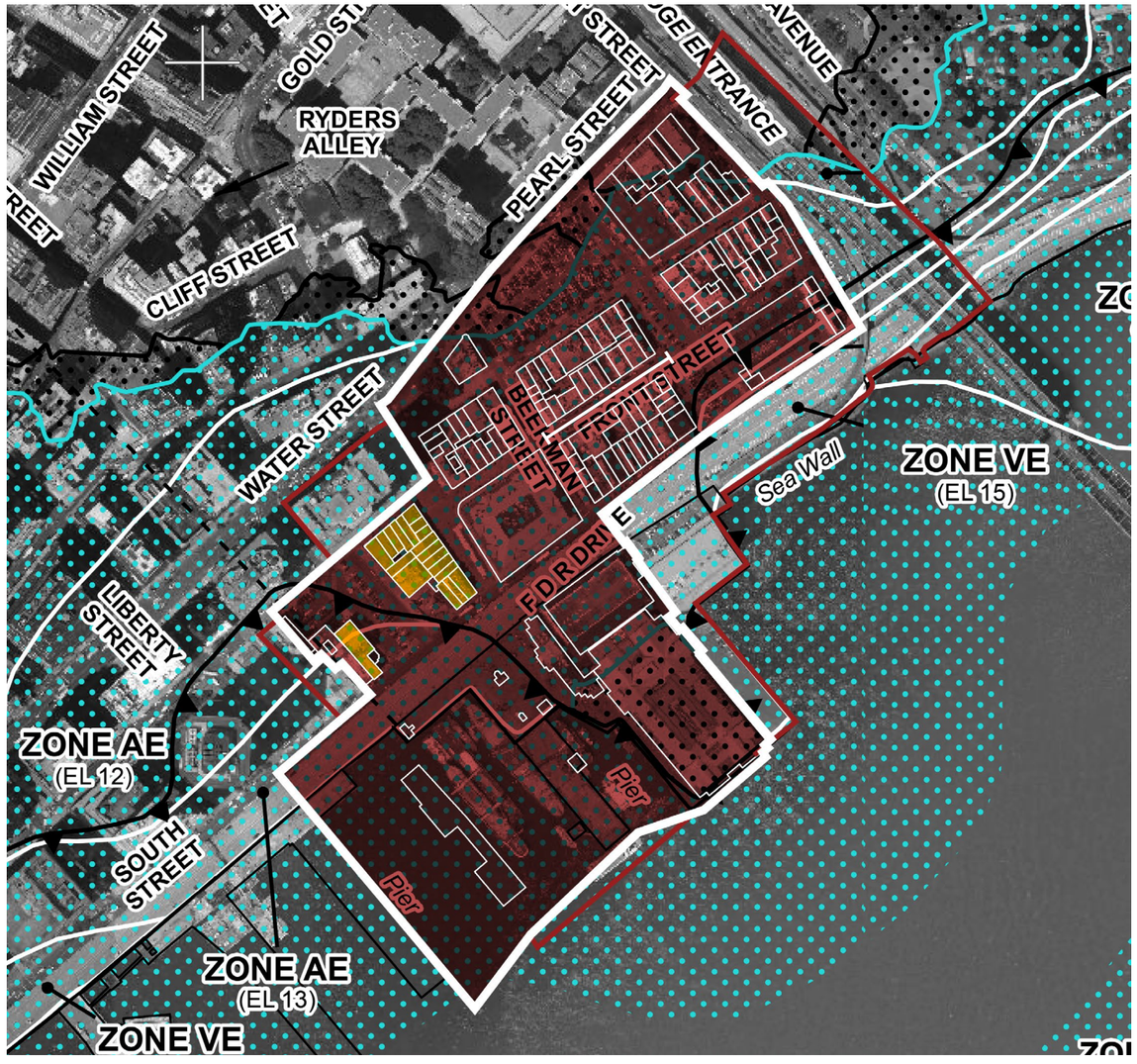
Structures standing in the neighborhood today are predominantly three-to-six story mercantile buildings built in the first half of the 19th Century. Cladded in red or yellow bricks, many of these commercial buildings have witnessed substantial alterations after construction. The most significant landmark in today's South Street Seaport is probably the Schermerhorn Row — a group of twelve red brick warehouses erected in 1811-1812 that currently houses South Street Seaport Museum and a number of retail businesses (NYCLPC 1968; 1977).

For the purpose of streetscape adaptation design study, a section of Front Street between Beekman Street and Peck Slip is selected. With an East-West layout and a closely knit streetscape, this street section primarily comprises 18-19th Century mid-rise brick buildings that once served for commercial or stable use, with sporadic recent constructions filling in between them. Currently, almost all structures within the street section fall under the "Mid-Rise Mixed-Use" typology (see Digital Report 03) — in other words, 4-6 story buildings with retail storefronts on street floor and residential units on upper floors.

The streetscape of Front Street is worth investigating both as an intact example of New York City's historic built environment, and as a typical mixed-use street corridor threatened by flood risk. From the historic preservation standpoint, this street section still retains its historic scale, function and vigor of a prosperous commercial district, featuring a very intact street wall. From the flood adaptation perspective, it echoes issues and solutions discussed in NYCDCP's 2014 *Retrofitting Buildings for Flood Risk* and 2016 *Resilient Retail* reports, while asking for additional policy and design strategy innovations given its formal, material, and experiential significance.

Also noteworthy is the fact that the whole South Street Seaport neighborhood is developed upon successive landfills executed since the 17th century; the original shoreline lies near today's Pearl Street (NPS 1978). According to New York City Open Data, Front Street has an elevation of around 4.5 ft above sea level, compared to a BFE of 11-12 ft prevalent in the area.

Site Map



LPC Historic District

National Register Historic District

1% Annual Chance Floodplain

0.2% Annual Chance Floodplain

LPC Individual Landmarks

Street Section for Design Study

0 500 ft

Historic Designation and Flood Risk.

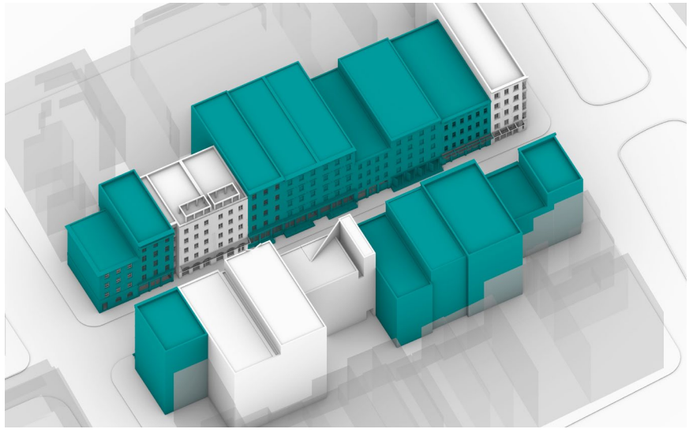
Base Map: FEMA PFIRM 2013, Panel 3604970184G;
Data Sources: CRIS/Map PLUTO/LPC Landmarks Map.

Existing Condition Documentation

Current Street Elevation with DFE & Building Lobby Elevations.

Street Elevation Data Source: NYC Open Data.

0 50 ft

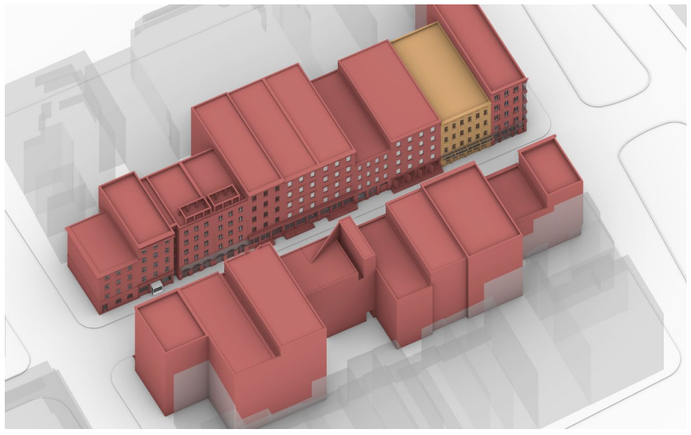


Building Age

Pre-1900 Buildings

Contemporary Developments

The majority of the building stock along the street corridor are Pre-1900 buildings of brick construction. Several contemporary developments also exist along the street, with scale and elevation expression compatible with the historic streetscape.

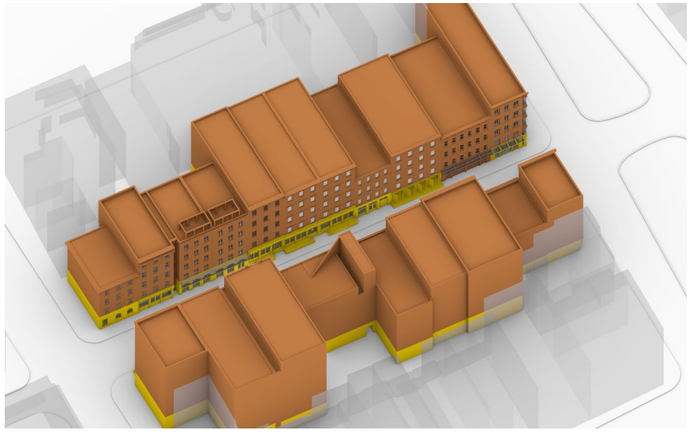


Building Type

Mid-Rise Mixed-Use (Up to 7 Floors)

Mid-Rise Residential

The Front Street corridor features a continuous street wall made up of mid-rise structures; almost all of them are Mid-Rise Mixed-Use, with the exeption of one Mid-Rise Residential structure near the east end.



Building Use by Floor

Retail

Residential

The function break-up by floor shows a clear division between street-level retail storefronts and upper-floor residential units. The street-level retail storefronts have to a great extent created the vigor of the street corridor, and defined its commercial characteristic.

Building Profile: Age, Type, and Use.

Existing Streetscape & Evaluation

Flood Resilience

2.00

Building Integrity & Visual Consistency

4.00

Streetscape Experience & Social-Spatial Relationship

4.38

Floor Area Transfer

Estimated Overall FAR: 4.35 ;

Estimated Total Usable Floor Area: 180,000 sqft.

Retrofitting Strategy Mapping

Streetscape Evaluation & Overall Intention

The key significance of the Front Street corridor lies in its human-scaled, intact retail interface that creates a vibrant commercial atmosphere and accommodates a variety of street activities (e.g. dining, rest, meandering, and window shopping). Although the physical fabrics of streetfront structures have gone through various alterations, the street's vigorous commercial scene has remained as a symbol of the neighborhood's spirit and history. Therefore, **the experiential and social-spatial values of the historic streetscape should be prioritized in its adaptation design** — specifically, some alterations to the historic mercantile buildings should be allowed in exchange for a more accessible and friendly street interface.

Given such assessment, the overall intentions of the street corridor's adaptation design are established as follows:

- **To keep the retail function, human scale, transparency and accessibility of the street interface as much as possible; while**
- **Retrofit buildings on both sides of the street corridor towards New York City flood regulation compliance.**

Building Retrofitting Strategies

In accordance with the intentions listed above, four overall flood retrofitting strategies are selected for buildings flanking the Front Street corridor, each targeted at a group of structures with similar characters:

A | Mid-Rise Mixed-Use Structure with Small Footprint/Retail Area

Strategy A1: Dry-floodproof the whole structure under DFE without elevation; or
Strategy A2: "Mix-and-Match" — Dry-floodproof retail space, and wet-floodproof residential lobby (see Mid-Rise Mixed-Use Section of Digital Report 03).

B | Mid-Rise Mixed-Use Structure with Larger Footprint/Retail Area

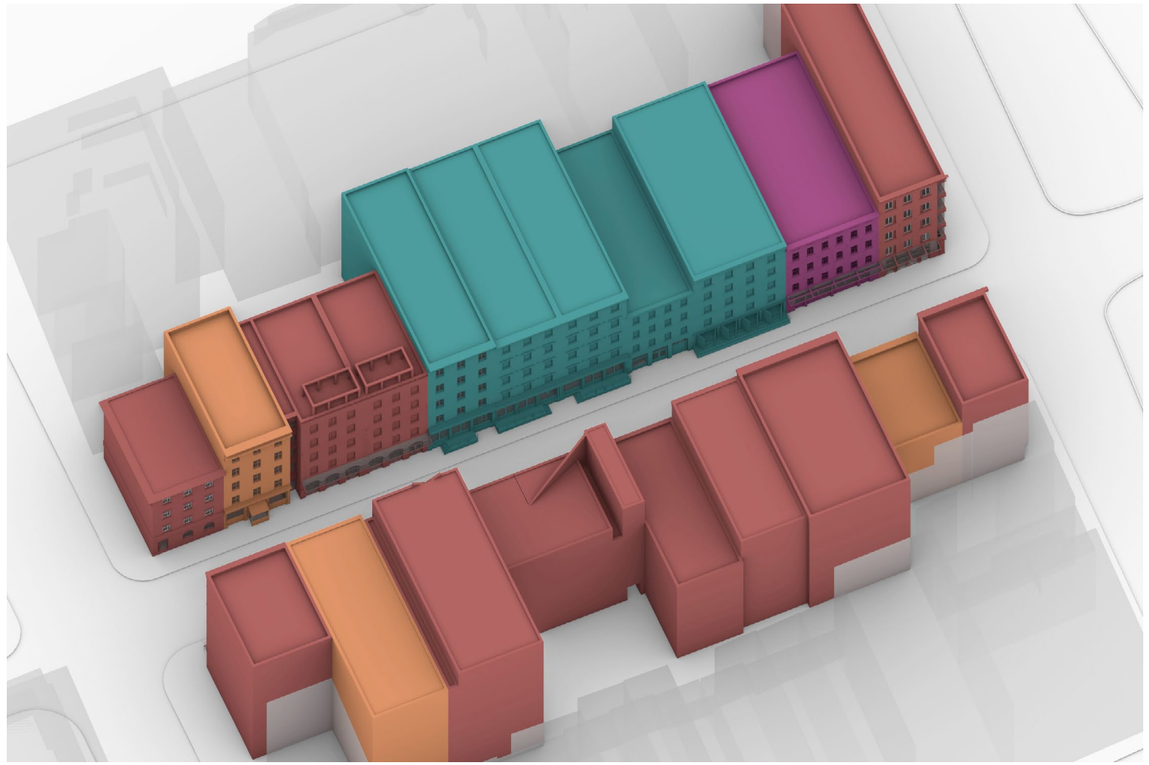
Strategy: Non-structural elevation with raised interior plate and double-height retail space (see Section 4.5 of Digital Report 03). This strategy is highly streetscape-friendly, but can only be applied when storefronts are large enough to accommodate interior ramps and stairs leading to the raised floor.

C | Mid-Rise Residential Structure

Strategy: Convert first-floor residential units to community use for enhanced streetscape, and execute the "Mix-and-Match" strategy (see Mid-Rise Residential Section of Digital Report 03).

Tradeoffs & Mitigation

As streetscape experience and social-spatial relationship become the priorities of the adaptation design, multiple tradeoffs may occur in other streetscape goals, such as impacts on building integrity (as a result of physical intervention and layout change) and floor area loss (brought by the creation of double-height spaces, the introduction of interior stairs and ramps, etc.). To mitigate potential floor area loss, rooftop additions will be allowed on buildings with significant retail or residential floor area loss, provided that these additions are either non-visible from street level or executed with compatible architectural style.



A1 Mid-Rise Mixed-Use, Small Footprint | Dry-floodproof Whole Structure

A2 Mid-Rise Mixed-Use, Small Footprint | "Mix-and-Match"

B Mid-Rise Mixed-Use, Larger Footprint | Non-Structural Elevation

C Mid-Rise Residential | Function Conversion + "Mix-and-Match"

Diagram of Overall Retrofitting Strategies.

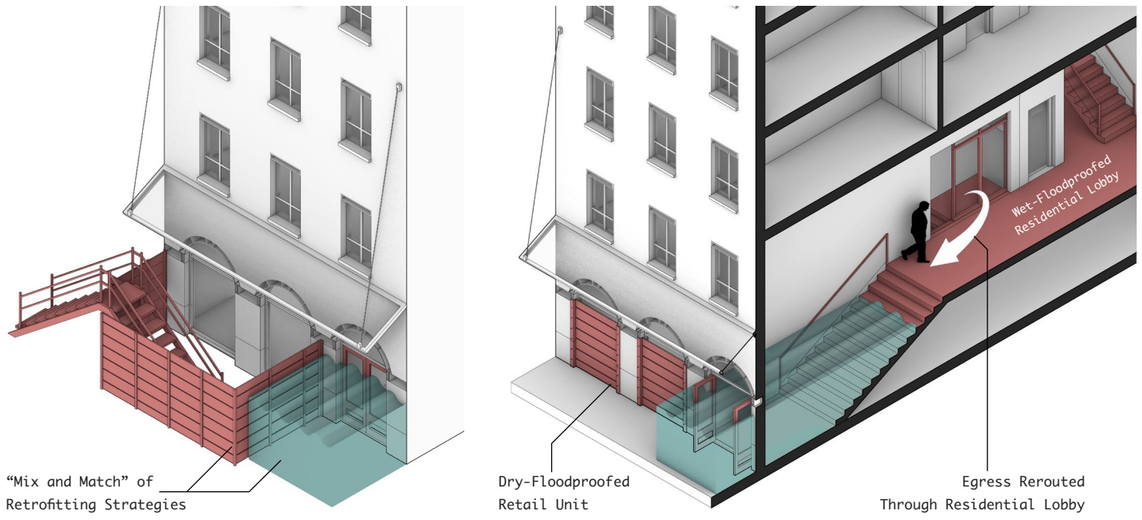
Key Retrofitting Treatments

Under the retrofitting priorities set in the previous section, this section explores building-level flood retrofitting design treatments that help provide an interactive, transparent, and accessible street interface. Utilizing successful strategies developed in Digital Report 03, the key treatments identified in this section will be applied to Front Street's streetfront structures wherever possible; nevertheless, these streetscape-friendly strategies are more than often beyond the permission of New York City's current flood regulation framework.

· "Mix-and-Match" of Dry Floodproofing and Wet Floodproofing.

For mixed-use structures, allowing dry-floodproofed and wet-floodproofed spaces to co-exist on street level may bring about more flexibility in flood retrofitting: on the one hand, this combination enables spaces of higher risk to be elevated or dry-floodproofed, and spaces of lower risk to be just wet-floodproofed (NYCDCP 2016, 66-71); on the other hand, when the egress of dry-floodproofed retail unit is able to be rerouted into the wet-floodproofed residential lobby next to it, the emergency egress and dry-floodproofing enclosure on sidewalk will no longer be necessary — which significantly reduces the physical impact on sidewalk space brought by flood retrofitting (NYCDCP 2014, 78-79; 2016, 87; see also Section 4.5 of Digital Report 03).

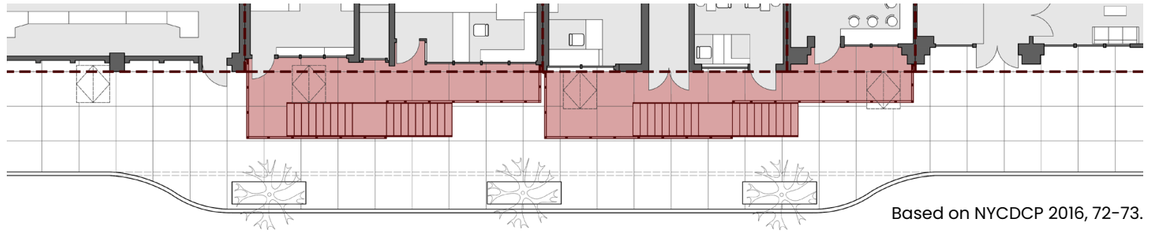
Acknowledging these advantages, all buildings under Retrofitting Strategy A2 will adopt the "mix-and-match" model. Nevertheless, although dry-floodproofing commercial areas and wet-floodproofing residential areas comply with the general principles of New York City's flood regulations, mixing these two strategies in a single structure is currently not recognized by the city's Building Code.



· Sidewalk Redesign & Shared Dry-Floodproofing Enclosure.

A key concern regarding dry-floodproofing commercial storefronts is that dry-floodproofing enclosures with egress exit stairs would often obscure the pedestrian right-of-way, and are difficult to deploy on narrow lots. To address this issue, this study proposes that two neighboring commercial storefronts share a dry-floodproofing enclosure when necessary, and that the sidewalk be locally widened to accommodate the minimum required width for pedestrian passage when floodproofing enclosures are deployed.

This strategy is developed based on findings in Digital Report 03 (see Mid-Rise Mixed-Use section), and will be applied to structures under Retrofitting Strategy A1. Currently, no regulation has been made regarding the application of shared dry-floodproofing enclosure; further policy and technical research are needed to prove the feasibility of such treatment.

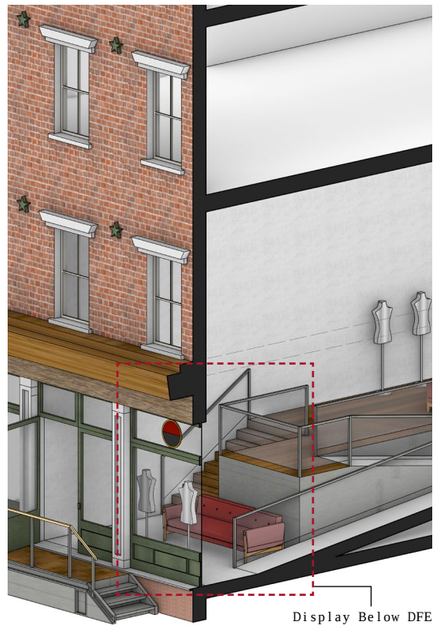


Based on NYCDCP 2016, 72-73.

· Wet-Floodproofed Commercial Lobby with Display & Limited Seating.

For mixed-use structures, New York City's 2014 *Retrofitting* report has promoted a highly streetscape-friendly solution, where retail units are non-structurally elevated and converted into double-height spaces with raised interior floor plates. This strategy retains the commercial lobby and entrance on street level, and thus preserves human scale, street transparency and accessibility; nevertheless, the wet-floodproofed commercial lobby can be only used for access (see Section 4.5 of Digital Report 03).

In this study, to provide better interactivity for the storefront interface, all buildings using the above-mentioned retrofitting strategy (Strategy B) will have their commercial lobbies equipped with showpit areas or limited seating function (see NYCDCP 2014, 86). The loosening of use regulation will bring about an even more human-scaled and interactive streetscape relationship.



Retrofitted Streetscape | Permanent

Flood Resilience

3.75 (▲ 2.50)

Building Integrity & Visual Consistency

3.50 (▼ 0.50)

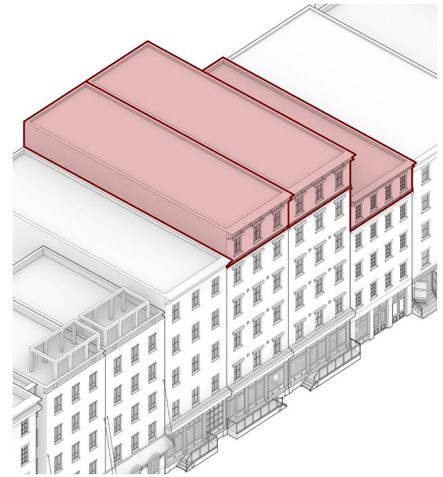
Streetscape Experience & Social-Spatial Relationship

4.30 (▼ 0.08)

Floor Area Transfer

Est. Overall FAR: 4.92 (▲ 0.57) ;

Est. Total Usable Floor Area: 175,000 (▼ 5,000) sqft.



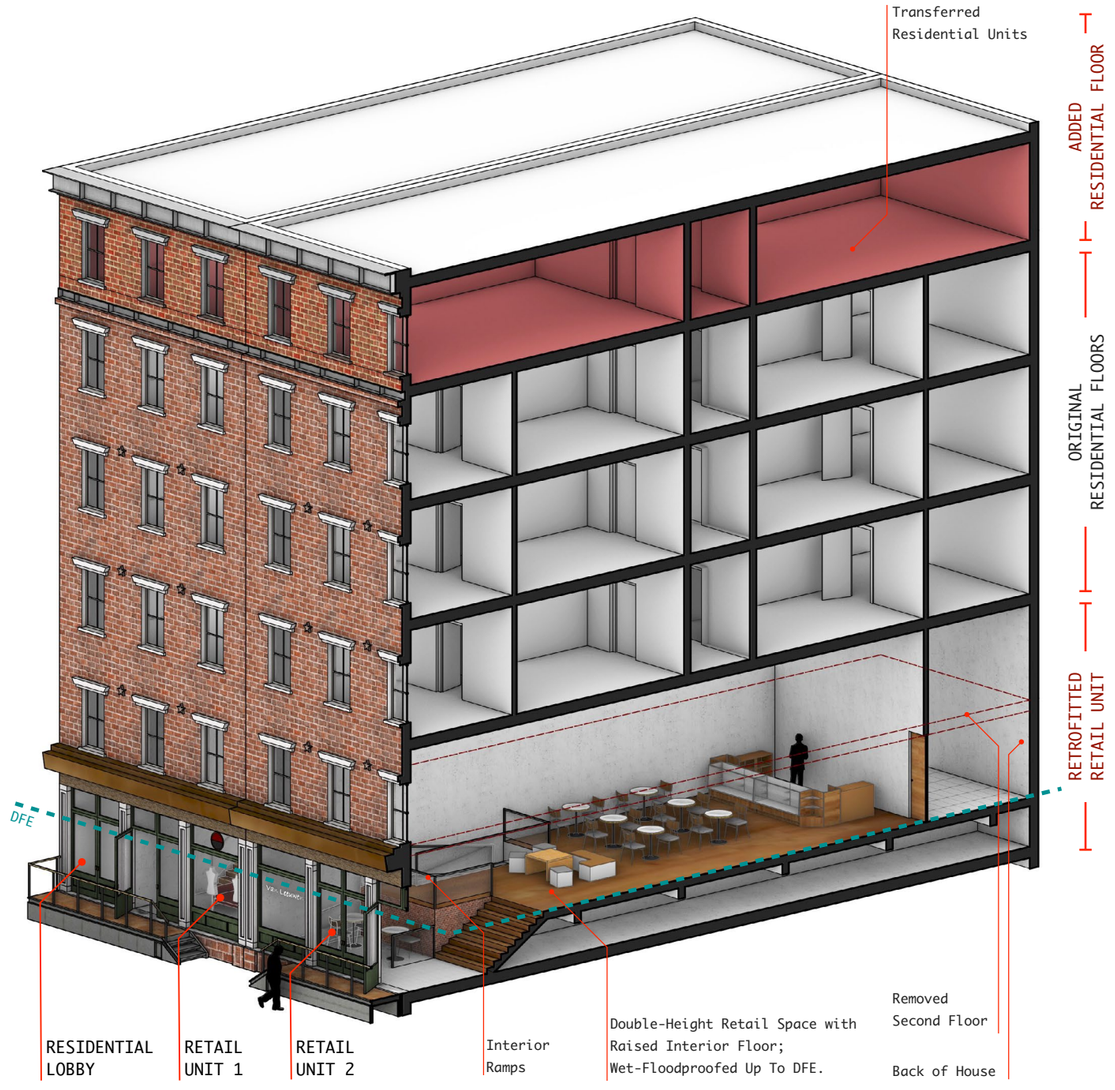
Rooftop additions shall be executed when double-height retail units with raised interior floorplate result in the loss of residential floor area. In this study, the facade cladding of additional floors are designed to match the red-brick texture of the street wall; local material changes and restrained details add to the identifiability of rooftop addition (see Grimmer & Weeks 2010).

With floor plates raised inside the storefronts and transitional lobbies with display and seating functions created on street level, the social-spatial relationship of the Front Street interface is retained as much as possible; the elevated, wet-floodproofed retail floor also provides reliable flood resistance. Tradeoffs in floor area, economic feasibility, and building integrity, etc. will be further analyzed in the Discussion section.

Retrofitted Streetscape | During Flood Event

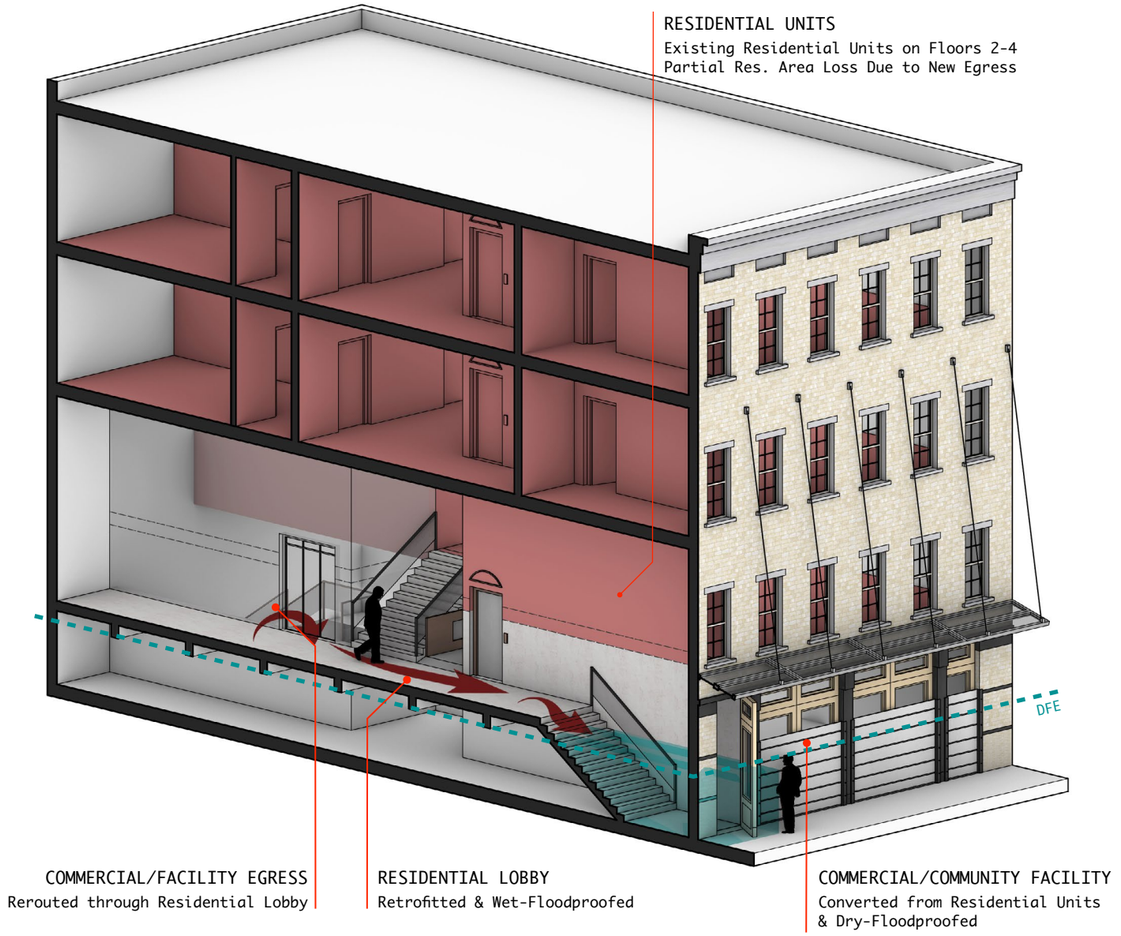
Before an anticipated flood event, deployable flood shields and dry-floodproofing enclosures are set up and fixed to the anchors embedded on the exterior of historic structures. Many retail storefronts — except for those able to be elevated from the inside — adopt the dry-floodproofing solution as it doesn't involve significant spatial reconfiguration. Whenever applicable, the residential lobbies of mixed-use structures are wet-floodproofed, and will serve as the egress of retail units in the same building. When dry-floodproofing enclosure and temporary egress on the sidewalk are inevitable, the redesigned sidewalk ensures minimum width for pedestrian passage.

Case Study | 224 Front Street



Built Year: 1910 (ZoLa Data); substantial subsequent changes. **Type:** Mid-Rise Mixed-Use.
Retrofitting Strategy: Non-Structural Elevation with Double Height Retail Space ("Strategy B").

This case represents a group of larger mixed-use structures along the street that have the ability to accommodate interior ramps and stairs necessary for the creation of internally raised retail space. Accompanying the transformed, double-height retail unit are a street-level commercial lobby and an added floor to make up for the lost residential floor area.



Built Year: 1816; major alterations in 1897 (LPC Data). **Type:** Mid-Rise Residential.
Retrofitting Strategy: Function Conversion and "Mix-and-Match" of Floodproofing ("Strategy C").

Originally a residential structure, the street level of this building will be converted into commercial or community use so it may be dry-floodproofed and wouldn't need to be abandoned. To further reduce the streetscape impact and feasibility concern caused by dry-floodproofing enclosure on sidewalk, the egress of the commercial/community facility is rerouted through the elevated and wet-floodproofed residential lobby. The "Mix-and-Match" of floodproofing with reconfigured egress is also commonly used in this study on other structures along Front Street (Strategy A2); nevertheless, it should be noted that the reconfigured egress and the elevated residential lobby may result in some loss of residential floor area and involve major spatial redesign.

Discussion

The South Street Seaport design study has demonstrated that historic retail corridors can be flood retrofitted while considerably retaining their streetscape quality and experience. Nevertheless, such retrofitting intervention will inevitably compromise other Adaptive Streetscape goals, and can only be achieved upon necessary regulation reforms and procedural establishments.

Tradeoffs

The streetscape-sensitive design strategies adopted in this study require extensive physical interventions to historic structures, including (but not confined to) the reworking of masonry walls for water tightness, the removal of floor plates and creation of double-height retail units, the rerouting of interior egress, and rooftop additions. These treatments will potentially compromise the following Adaptive Streetscape goals.

- Building Integrity: the extensive reworking of historic fabrics may bring about significant material and spatial changes beyond what's typically allowed by local preservation regulation.
- Floor Area: some losses in active floor area may still be inevitable despite rooftop additions on selected structures, which may raise further issues from an economic perspective.

Moreover, the extensive work required by the design scheme may also raise feasibility questions in terms of stakeholder and tenant consensus.

Regulatory Standard Reform

This study has once again highlighted some key regulatory reforms necessary for the streetscape-sensitive flood retrofitting of urban historic structures, including allowing active function in wet-floodproofed commercial lobbies, allowing basements/cellars of mixed-use structures to exist or partially exist, and recognizing the "mix-and-match" of dry and wet-floodproofing treatments, etc. Furthermore, local zoning policy regarding parcel and height calculation should continue to be revised, and the local preservation design review guideline should also be updated to allow necessary material and spatial impacts brought by flood retrofitting.

Street/Neighborhood-Level Planning Procedure

Several street-level strategies proposed in this study — including shared dry-floodproofing enclosures and partial enlargement of sidewalks — will require an urban planning process and coordination between multiple agencies. A street/neighborhood-scaled retrofitting master plan will be helpful as it may not only address these issues, but also identify suitable retrofitting strategies for individual structures, and envision how a consistent streetscape may be coordinated across individual buildings and the street space.

Appendix: Current Streetscape Evaluation Sheet

Flood Resilience | 2.00

	1	2	3	4	5
Average lowest residential floor elevation as compared to BFE & DFE	< BFE – 4ft	≥ BFE – 4ft	≥ BFE	≥ DFE	≥ DFE+1ft
Percentage of areas with active use on street level	≥ 80%	80 – 60%	60 – 40%	40 – 20%	< 20%
Percentage of flood-proofed area on street level	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of basement area as compared to street-floor building floor area	≥ 80%	80 – 60%	60 – 40%	40 – 20%	< 20%

Building Integrity & Visual Consistency | 4.00

	1	2	3	4	5
Percentage of identifiable historic structures along both sides of the corridor	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Current condition of historic structures	Poor	Fair	Average	Good	Excellent
Extent of existing modification to historic facades	Extensive	High	Medium	Low	Very Low
Number of identifiable historic architectural elements and ornaments on street level	Scarce	Few	Moderate	Frequent	Abundant
Permanent material impact brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Low	Very Low
Permanent visual impact on street level brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Low	Very Low
Permanent visual impact on rooftops brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible
Permanent physical impact on street space brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible

Streetscape Experience & Social-Spatial Relationship | 4.38

	1	2	3	4	5
Percentage of continuous street wall along both sides of the street corridor	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of street-level transparency (for mixed-use/commercial corridor only)	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of active use along both sides of the street	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of storefronts with outdoor dining/seating (for mixed-use/commercial corridor only)	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Average main entrance elevation of structures on both sides of the street as compared to street level	≥ 4ft	3–4ft	2–3ft	1–2ft	< 1ft
Identifiable architectural patterns (fenestration, pilasters, etc.) on street level	Scarce	Few	Moderate	Frequent	Abundant
Number of storefronts, awnings, canopies and signage (for mixed-use/commercial corridor only)	Scarce	Few	Moderate	Frequent	Abundant
Liminal space for pedestrian passage / Ability to walk along the sidewalk	Very Low	Low	Acceptable	Good	High
Permanent visual impact on rooftops brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible
Estimated pedestrian behavioral/mind map change brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Low	Very Low

Appendix: Retrofitted Streetscape Evaluation Sheet

Flood Resilience | 3.75

	1	2	3	4	5
Average lowest residential floor elevation as compared to BFE & DFE	< BFE – 4ft	≥ BFE – 4ft	≥ BFE	≥ DFE	≥ DFE+1ft
Percentage of areas with active use on street level	≥ 80%	80 – 60%	60 – 40%	40 – 20%	< 20%
Percentage of flood-proofed area on street level	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of basement area as compared to street-floor building floor area	≥ 80%	80 – 60%	60 – 40%	40 – 20%	< 20%

Building Integrity & Visual Consistency | 3.50

	1	2	3	4	5
Percentage of identifiable historic structures along both sides of the corridor	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Current condition of historic structures	Poor	Fair	Average	Good	Excellent
Extent of existing modification to historic facades	Extensive	High	Medium	Low	Very Low
Number of identifiable historic architectural elements and ornaments on street level	Scarce	Few	Moderate	Frequent	Abundant
Permanent material impact brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Low	Very Low
Permanent visual impact on street level brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Low	Very Low
Permanent visual impact on rooftops brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible
Permanent physical impact on street space brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible

Streetscape Experience & Social-Spatial Relationship | 4.30

	1	2	3	4	5
Percentage of continuous street wall along both sides of the street corridor	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of street-level transparency (for mixed-use/commercial corridor only)	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of active use along both sides of the street	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of storefronts with outdoor dining/seating (for mixed-use/commercial corridor only)	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Average main entrance elevation of structures on both sides of the street as compared to street level	≥ 4ft	3–4ft	2–3ft	1–2ft	< 1ft
Identifiable architectural patterns (fenestration, pilasters, etc.) on street level	Scarce	Few	Moderate	Frequent	Abundant
Number of storefronts, awnings, canopies and signage (for mixed-use/commercial corridor only)	Scarce	Few	Moderate	Frequent	Abundant
Liminal space for pedestrian passage / Ability to walk along the sidewalk	Very Low	Low	Acceptable	Good	High
Permanent visual impact on rooftops brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible
Estimated pedestrian behavioral/mind map change brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Low	Very Low

03

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Living Above the Street
Stewarding New York City's Historic Built Environment Towards Flood Resilience

An Onera Prize in Historic Preservation Project

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Living Above the Street
Stewarding New York City's Historic Built Environment Towards Flood Resilience

DIGITAL REPORT 05

Adaptation Design Study: East Harlem

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About

This report is part of the independent research project “Living Above the Street: Stewarding New York City’s Historic Built Environment Towards Flood Resilience,” which is supported by Onera Foundation under 2022 Onera Prize for Historic Preservation.

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This Onera Prize research project is developed upon the author’s M.S. Historic Preservation thesis:

Wang, Ziming. 2022. “Living Above the Street: Flood Retrofitting and Adaptive Streetscape of New York City’s Historic Districts.” M.S. Historic Preservation Thesis, Columbia University.
https://doi.org/10.7916/fn43-vb19.

Cover Image:
Adapted Streetscape of East 118th Street in East Harlem Historic District During a Flood Event.
Rendering by the Author.

East Harlem Historic District possesses a residential character made up of speculative row houses, flats and tenements predominantly built in the late 19th century centering East 116th Street. The impressively long and intact rows of residential buildings contribute to a streetscape that is still typical of Harlem, but rarely found elsewhere in Manhattan.

See Designation Report of East Harlem Historic District, National Park Service, 2019.

1940 Tax Photo for 440 East 118th Street (Block 1711, Lot 32).
Courtesy of NYC Department of Records and Information Services.

Contents

01

Executive Summary

Executive Summary

Paired with **Digital Report 04: Adaptation Design Study — South Street Seaport** which lays out flood adaptation strategies for the vibrant retail corridor of Front Street in South Street Seaport historic district, this report envisions the flood adaptation of East 118th Street — a **historic residential corridor** in East Harlem, New York City. Encompassing long and impressively intact groups of speculative row houses and embellished by larger-scaled residential buildings such as flats and tenements, the streetscape of the East 118th Street corridor represents the typical residential building types and urban forms found in New York City's historic neighborhoods. Contrary to the South Street Seaport design study where the author proposes more radical and experimental flood adaptation strategies in order to balance flood resilience with street-level interactivity, **the intention of the East Harlem Design Study is to identify feasible and relatively low-cost flood retrofitting strategies friendly to residential property owners, preferably involving limited spatial alterations.**

The findings of this design study demonstrate that by using already mature flood retrofitting solutions such as wet-floodproofing, dry-floodproofing and internal elevation, **residential structures (especially small-scaled structures like row houses) can be feasibly adapted towards flood resilience without substantial spatial alteration or streetscape change. However, such conclusion is valid only if necessary reforms and updates in historic preservation standards and flood regulations are made.** While the Landmarks Preservation Commission has published technical guidelines for equipment relocation and flood shield installation on locally designated historic structures, more extensive policy-making is needed to guide the whole process of flood retrofitting, as well as to cover a broader range of floodproofing interventions and regulate potential contradictions between preservation standards and general flood regulations; on the other hand, reforms in local flood regulations (Building Codes and Flood Zoning) that allow for more flexible choice of retrofitting strategies and better recognize streetscape-sensitive design treatments identified in this study will also benefit the adaptive transformation of historic streetscapes towards flood resilience.

Compared and contrasted with each other, Digital Reports 04 and 05 have together showcased how urban historic streetscapes may have different functions, characters and adaptation priorities, which lead to drastically divergent design strategies and outcomes. Such observation calls for the establishment of a site-specific scenario-planning procedure on block or neighborhood scale that helps set basic parameters for adaptation interventions, which will be further discussed in *Digital Report 06: Policy & Procedural Recommendations*.

02

Adaptation Design Study:

East Harlem

Designation, Streetscape Significance, and Street Corridor Selection

Designated as a National Register Historic District in 2019, the East Harlem Historic District possesses a largely residential character made up of speculative row houses, flats and tenements centering the commercial spine of East 116th Street. Mostly built in the 1870s and 1880s in Italianate style, an extensive stock of row houses still exist today in long, impressively intact rows along cross streets in the district; they are supplemented by flats and tenements built slightly later and in smaller numbers, as well as some public and commercial buildings scattered among residential buildings. The large, intact groups of row houses and other historic residential buildings have contributed to a streetscape that is still typical of Harlem, but "rarely found elsewhere in Manhattan"; the historic transformation of housing typology in Harlem from row houses to flats and tenements also reflects the neighborhood's evolution from a middle-class enclave to an immigrant district housing working-class residents from East Europe, Italy, Puerto Rico and other regions (NPS 2019).

To compare and contrast with the South Street Seaport design study (see Report 04) which features a mixed-use street corridor with vibrant commercial atmosphere, this design study seeks to focus on a residential street corridor that represents the historic district's predominant building types. Upon consulting designation data and FEMA's flood maps, **East 118th Street between 1st Ave. and Pleasant Ave**. is selected for design study. As a residential street flanked largely by contributing buildings of the historic district, intact groups of row houses and tenements have created a consistent historic streetscape and a continuous street wall along this residential corridor; at the same time, the street's sloped topography poses interesting challenges for flood retrofitting. Due to its inclined terrain, the west end of the street section has an elevation of around 7.5 ft above sea level, while the east end is around 12.5 ft above sea level. Therefore, according to FEMA's PFIRM map, only the west two-thirds of the street section falls within the 1% floodplain, which has a local BFE of 12 ft above sea level; while the remaining east one-third falls within the 0.2% floodplain — where flood retrofitting is encouraged by New York City's Flood Zoning, but not required by the city's Building Code. In this study, flood retrofitting strategies are envisioned for buildings located in either the 1% or the 0.2% floodplain.

Residential structures have been placed at the center of New York City and FEMA's flood adaptation policy-making, and row houses ("Attached/Semi-Attached Residential Buildings") are identified as one of the most populous building types in New York City's floodplain (see Report 03). For these reasons, the East Harlem design study may be able to elicit findings that are not only of local applicability, but also relevant to other flood-threatened historic residential corridors across the city; discussions made in this design study may also be able to connect historic buildings with existing flood adaptation policy-making for residential homes at-large.

Site Map

Historic Designation and Flood Risk Map.

Base Map: FEMA PFIRM Panels 3604970087G (2013) & 3604970091G (2015);
Data Sources: CRIS/Map PLUTO/LPC Landmarks Map.

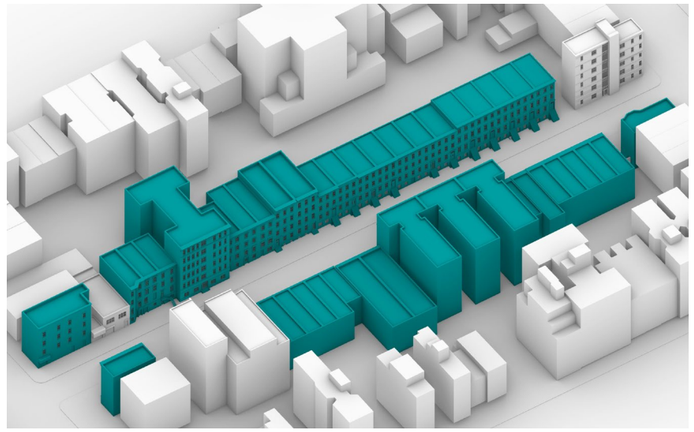
Existing Condition Documentation

East 118th Street Between 1st Avenue & Pleasant Avenue, South Side.

Current Street Elevation with DFE & Primary Residential Floor Elevations.

Street Elevation Data Source: NYC Open Data. Building Basement Data Source: MapPLUTO.

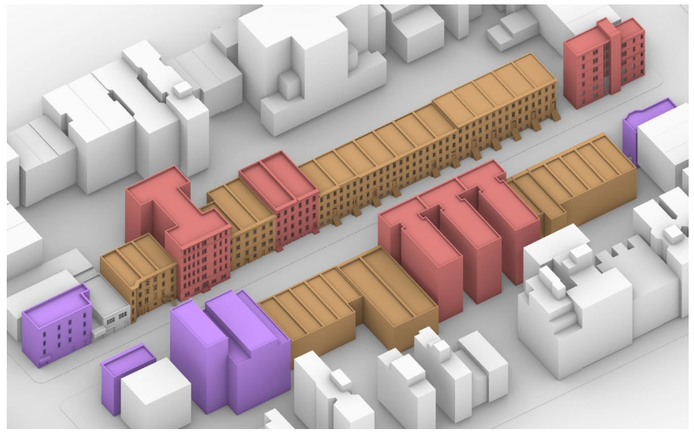
0 100 ft



Building Age

- Contributing
- Non-Contributing

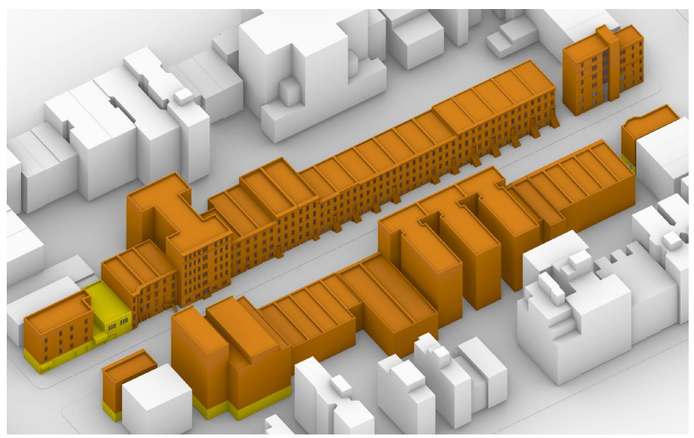
All three major historic building types of East Harlem — row houses, flats and tenements — are represented along the street. This street corridor retains an impressively intact human-scaled historic streetscape, with the only exception of two large-scaled contemporary developments.



Building Type

- Attached Residential
- Mid-Rise Residential
- Mid-Rise Mixed-Use

Attached residential buildings (row houses) make up the majority of the street corridor's building stock, supplemented by several mid-rise residential or mixed-use buildings (flats, tenements, new developments).



Building Use by Floor

- Retail
- Residential

The 118th street corridor showcases a largely residential character. Several retail units (e.g. grocery store and barbershop) exist on the street floor of residential buildings near 1st and Pleasant Avenues.

Building Profile: Age, Type, and Use.

Existing Streetscape & Evaluation

Flood Resilience

1.75

Building Integrity & Visual Consistency

4.00

Streetscape Experience & Social-Spatial Relationship

4.40

Floor Area Transfer

Estimated Overall FAR: 2.71 ;

Estimated Total Usable Floor Area: 255,800 sqft.

Retrofitting Strategy Mapping & Key Retrofitting Treatments

Streetscape Evaluation & Overall Intention

Unlike the case for profit-generating commercial structures, residential property owners may be more sensitive to the cost and feasibility of flood retrofitting projects; furthermore, potential reductions in flood insurance premium may also serve as an important incentive. To transform the East 118th street corridor towards flood resilience while preserving its intact historic fabric and human-scaled, residential characters, this design study seeks to:

- **Develop low-cost and practical retrofitting strategies that involve limited spatial alterations, which help to both enhance the feasibility of retrofitting projects, and preserve the street corridor's historic characters;**
- **If possible, prioritize strategies recognized by New York City's Building Code, FEMA's floodplain management standards, and NYCLPC's technical guidelines on equipment relocation and dry floodproofing. Compliance with these rules will streamline the permit process for property owners, as well as bring opportunities in flood insurance premium reduction.**

Under the intentions set above, the following sections lay out possible retrofitting strategies for the street corridor's major building types (row houses/attached residential, mid-rise residential, and mid-rise mixed-use), and assign them for each building along the street corridor.

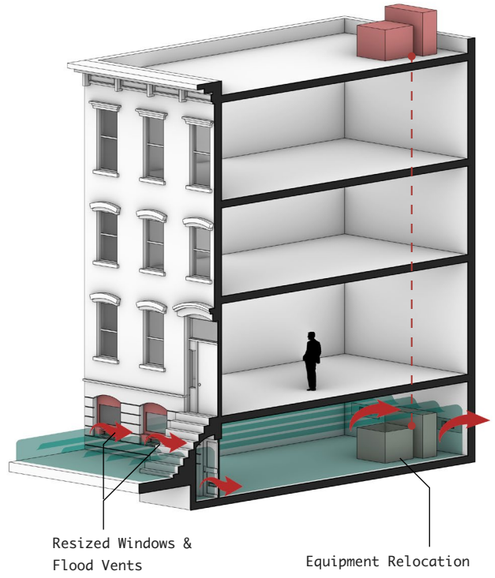
Row Houses: Low DFE Scenario vs. High DFE Scenario

If a row house along the street corridor has a stoop and a partially above-ground basement, then local DFE (which is on average 4 feet above street level) is likely below its primary residential floor; on the contrary, if a row house doesn't have a stoop and is directly entered at street level, then local DFE will be above its primary residential floor (which means floodwater may directly impact living spaces). For easier reference, this report names the former situation "Low DFE Scenario," and the latter "High DFE Scenario."

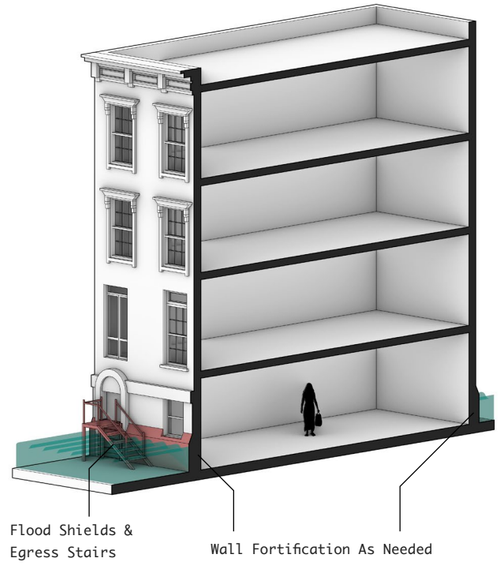
Low DFE Scenario: Wet-Floodproofing the Basement

If the established flood level is beneath a row house's primary residential floor, then the structure can be simply wet-floodproofed under DFE. Specifically, flood vents shall be installed on basement walls, and basement windows shall either be replaced with flood damage-resistant materials, or be relocated above flood level. Critical equipment inside the basement shall be relocated onto the rooftop, pursuant to NYC Landmarks Preservation Commission's technical guideline for relocating mechanical equipment.

The wet-floodproofing strategy complies with the general rule for residential structures set out by Appendix G of New York City's Building Code. However, **it should be noted that besides wet-floodproofing measures, both NYC's current Building Code and NFIP's insurance premium reduction standards require the whole basement to be filled in residential structures** (see NYC Building Code G304.1.1; NYCDCP 2014). Nevertheless, for feasibility considerations, a number of studies have advocated for the wet-floodproofing or dry-floodproofing, instead of elimination, of basement spaces (NYCDCP 2014, 69; NYCDCP 2016, 4; Boston 2018, 16). In this case, given considerations on feasibility, historic fabrics and streetscape implications, wet-floodproofing of the basement is recommended. **If the property owner chooses to fill the basement instead of wet-floodproofing, the areaway should still be retained, and decorative fenestration shall be made on the basement wall facing areaway** (see "Attached Residential" section of Report 03).



Low DFE Scenario



High DFE Scenario

High DFE Scenario: Dry-Floodproofing First-Floor Door & Windows

If a row house is directly entered from street level, then local DFE is likely several feet above its first floor. In this case, the structure is recommended to be dry-floodproofed. First-floor doors and windows shall be sealed with deployable flood shields, and wall sections under the DFE may be fortified as needed; alternatively, first-floor window openings may be relocated above flood level, if such intervention only involves minimal form change. In addition to main entrances on street level, some buildings along the street corridor have stairs leading from the street to the second floor (see street elevation documentation); if no such arrangement is present and all egress routes are blocked by dry-floodproofing shields, then egress stairs shall be designed and installed together with

flood shields (see “Attached Mixed-Use” section of Digital Report 03; Digital Report 04; and case studies in this report for instances). Since structures along the street corridor typically incorporate front yards, the installation of deployable egress stairs is not likely to cause intrusion to sidewalk spaces.

Dry-floodproofing may be a far more feasible solution in the High DFE Scenario as compared to wet-floodproofing, which requires either abandoning the first residential floor and turning it into storage or access use, or relocating the first residential floor up to the rooftop through rooftop addition (see “Attached Residential” section of Digital Report 03). **Although NYCLPC’s technical guidelines for flood shields and barriers encourages the dry-floodproofing of historic structures, dry-floodproofing a residential structure is not yet recognized by NYC Building Code or FEMA standards. Some policy reform would be needed to address this contradiction, and further recognize dry-floodproofing as a feasible retrofitting strategy for historic residential structures that involves minimal spatial change and structural reconfiguration.**

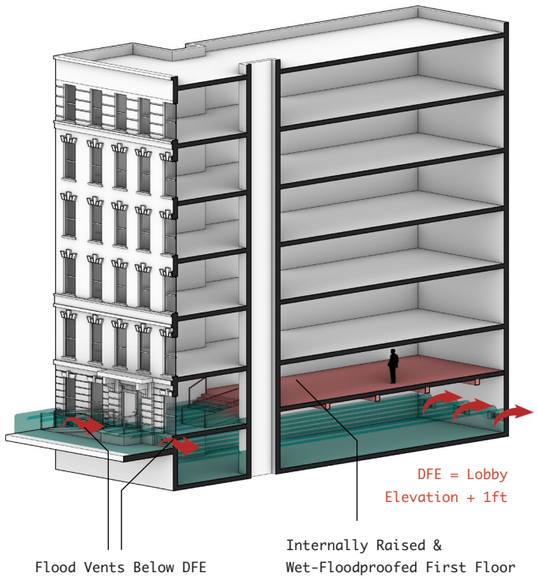
Mid-Rise Residential: Interior Elevation or First-Floor Function Conversion

The mid-rise residential buildings (mostly tenements) along the street corridor typically have lobbies slightly raised from street level and accessed through several steps of stairs. Based on the height difference between DFE and the first floor, two different strategies may be adopted:

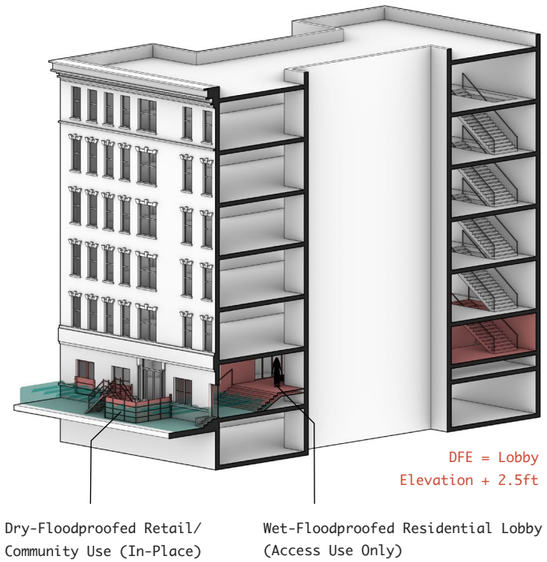
If local DFE is only slightly (e.g. 1 ft) higher than a building’s first floor, then a modest elevation of the first floor’s floorplate would suffice to bring all living spaces above flood elevation. Accompanying the elevation of the first floor, the basement space shall be wet-floodproofed.

If local DFE is significantly (e.g. 3 ft) higher than a building’s first floor, and that interior elevation intervention would seriously impact the first floor’s ceiling height, then the building’s first floor is recommended to remain at the original height, and be converted into community or retail use. This intervention turns the structure from Mid-Rise Residential to Mid-Rise Mixed-Use; then, the new community or retail use on street level shall be dry-floodproofed, while the residential lobby shall be wet-floodproofed.

These two strategies are both relatively feasible, and respectful to historic tenement buildings’ spatial layouts. **Similar to the case of row houses, although these strategies are in accordance with the general rules set out by New York City’s Building Code (wet-floodproofing and structural elevation for residential structures, and in-place dry-floodproofing option for non-residential structures), some policy reforms — such as allowing the existence of basements and allowing the “mix-and-match” of floodproofing treatments (see Digital Report 04 for instances) — are needed for these strategies to be fully recognized by Building Code.** As recommended practices for the flood retrofitting of mid-rise residential structures, both of the strategies listed above are discussed in more detail in the “Mid-Rise Residential” section of Digital Report 03.



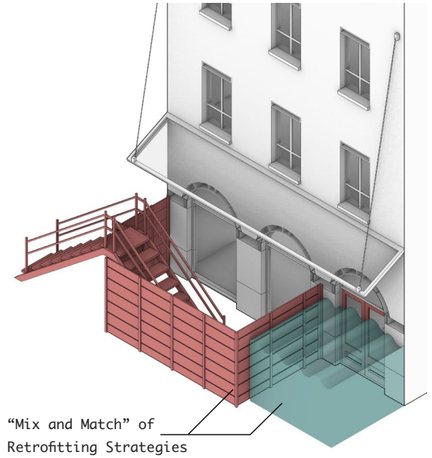
Mid-Rise Residential: Interior Elevation



Mid-Rise Residential: First-Floor Function Conversion

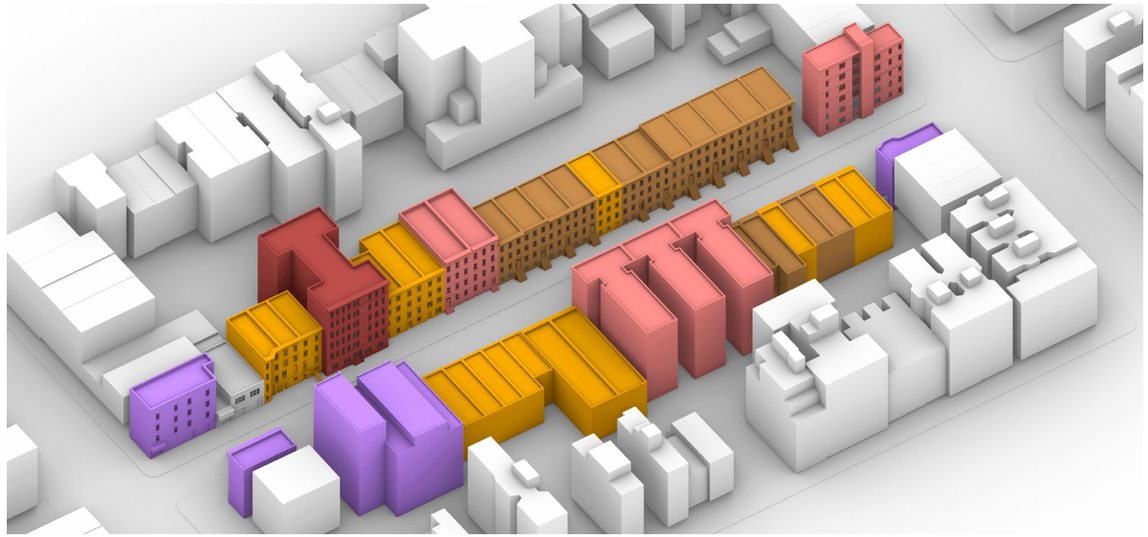
Mid-Rise Mixed-Use: “Mix-and-Match”

For the small number of mid-rise mixed-use structures along the street corridor, dry-floodproofing for retail or community use on street level is recommended, while the residential lobby shall be wet-floodproofed. Such “mix-and-match” strategy brings the same result as the second scenario (first-floor function conversion) discussed above for mid-rise residential structures; more detailed design strategies and case studies may be seen in the “Mid-Rise Mixed-Use” section of Digital Report 03, as well as the South Street Seaport design study featured in Digital Report 04.



Retrofitting Strategy Mapping

Corresponding to flood retrofitting strategies laid out in the previous sections, the illustration on the next page maps overall retrofitting methods assigned to each structure along the street corridor.



A1 Row House | Low DFE Scenario

A2 Row House | High DFE Scenario

B1 Mid-Rise Residential | Interior Elevation

B2 Mid-Rise Residential | First-Floor Function Conversion

C Mid-Rise Mixed-Use | “Mix-and-Match”

Streetscape Change and Policy Reforms

Since this design study seeks to explore feasible flood retrofitting strategies suitable for historic residential structures, most recommended practices are in-place wet-floodproofing or dry-floodproofing treatments that won’t involve significant spatial alteration or layout modification (major spatial changes are more frequently proposed for mixed-use structures studied in Digital Report 04). Therefore, not much permanent streetscape change would result from these flood retrofitting interventions — which potentially helps property owners to go through preservation design review processes. However, as mentioned in previous sections, key policy reforms are still necessary in order for retrofitting strategies identified in this design study to be recognized by current flood regulations on local and Federal level. Key areas of potential policy reform include:

- **Allowing the basements of residential structures to continue to exist, on condition that they are wet-floodproofed or dry-floodproofed;**
- **Allowing dry-floodproofing for residential structures with relatively mild flood risk;**
- **Allowing the “mix-and-match” of dry-floodproofing and wet-floodproofing on mixed-use structures.**

Retrofitted Streetscape | Permanent

Flood Resilience

3.00 (▲ 1.25)

Building Integrity & Visual Consistency

4.00 (▼ 0.00)

Streetscape Experience & Social-Spatial Relationship

4.29 (▼ 0.11)

Floor Area Transfer

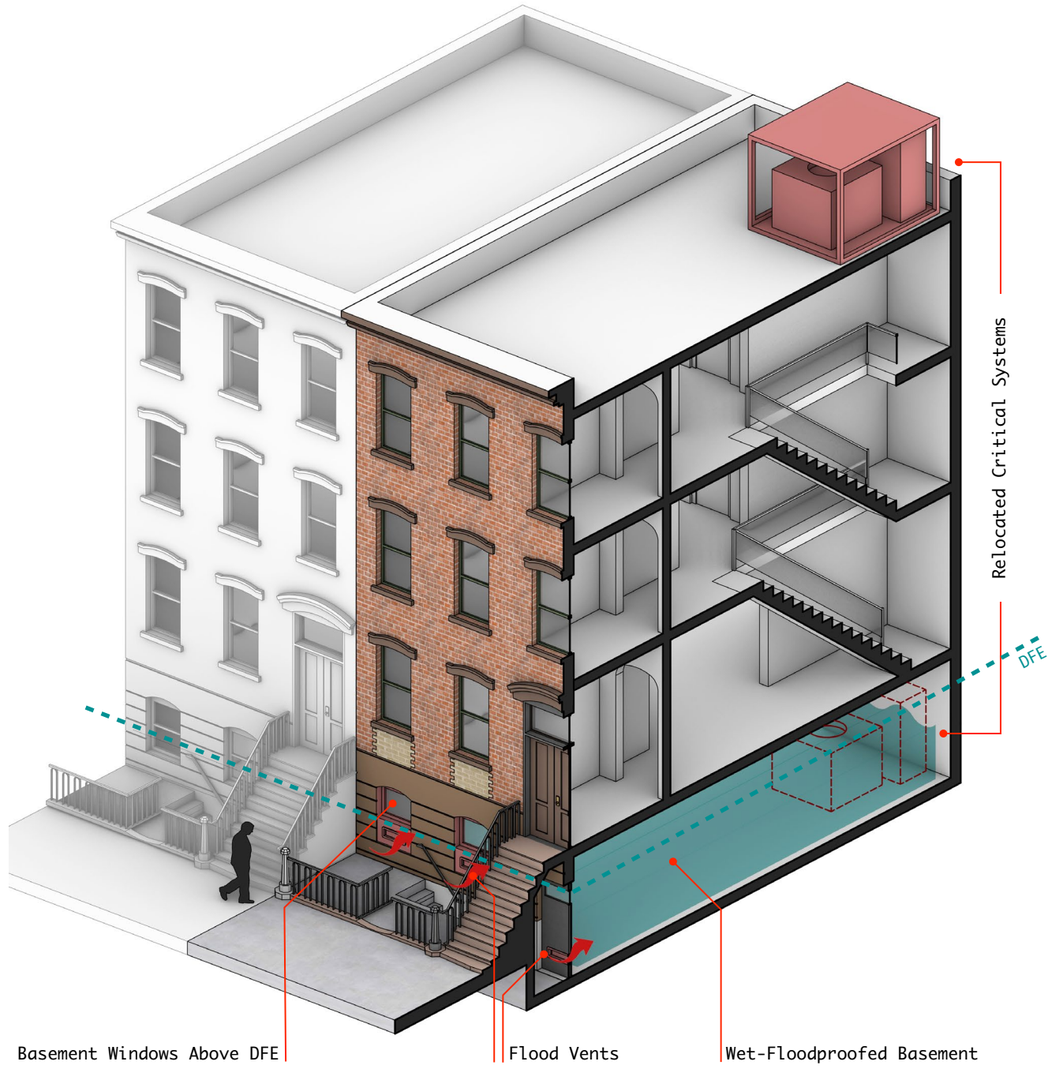
Est. Overall FAR: 2.67 (▼ 0.04) ;

Est. Total Usable Floor Area: 252,400 (▼ 3,400) sqft.

Retrofitted Streetscape | During Flood Event

In advance of anticipated flood events, deployable flood shields shall be set up for row houses adapted under the High DFE Scenario as well as for all non-residential uses. Temporary egress stairs shall also be placed next to dry-floodproofing enclosures, in order to serve emergency evacuation needs. Row houses adapted under the Low DFE Scenario and tenements and flats with their first floors elevated will utilize flood vents to allow floodwater to enter and exit beneath primary residential floor.

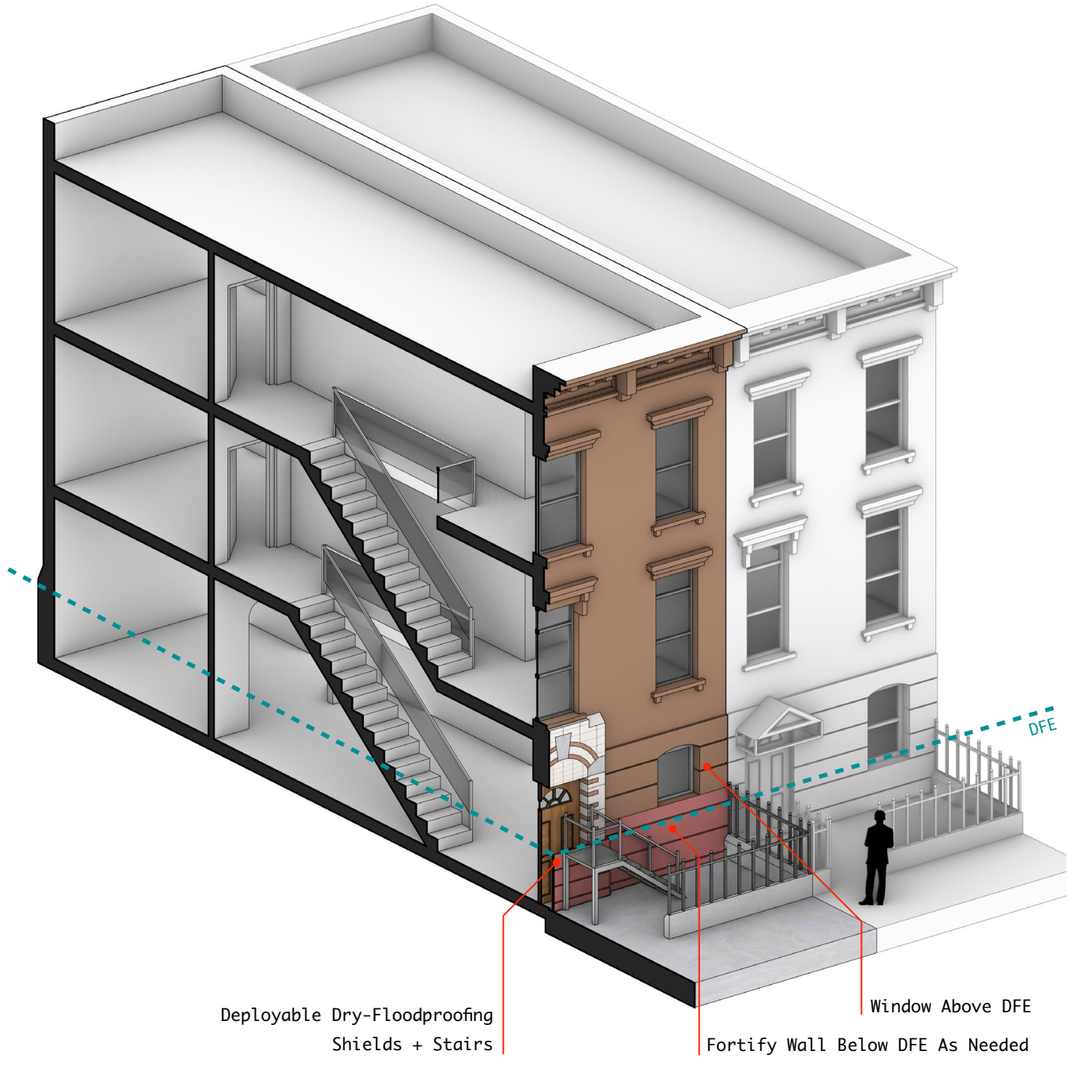
Case Study | 429 East 118th Street



Built Year: c. 1875 (NPS Data). **Type:** Row House with Stoop and Basement.
Retrofitting Strategy: Wet-Floodproofing ("Low DFE Scenario").

This row house with front stoop represents the **"Low DFE Scenario"** — where local DFE is below the primary residential floor. In this case, the structure shall be wet-floodproofed, with the basement serving as a temporary storage for flood water. Necessary interventions under this scenario include placing flood vents, relocating basement windows above DFE, and moving critical systems onto the rooftop.

Case Study | 412 East 118th Street

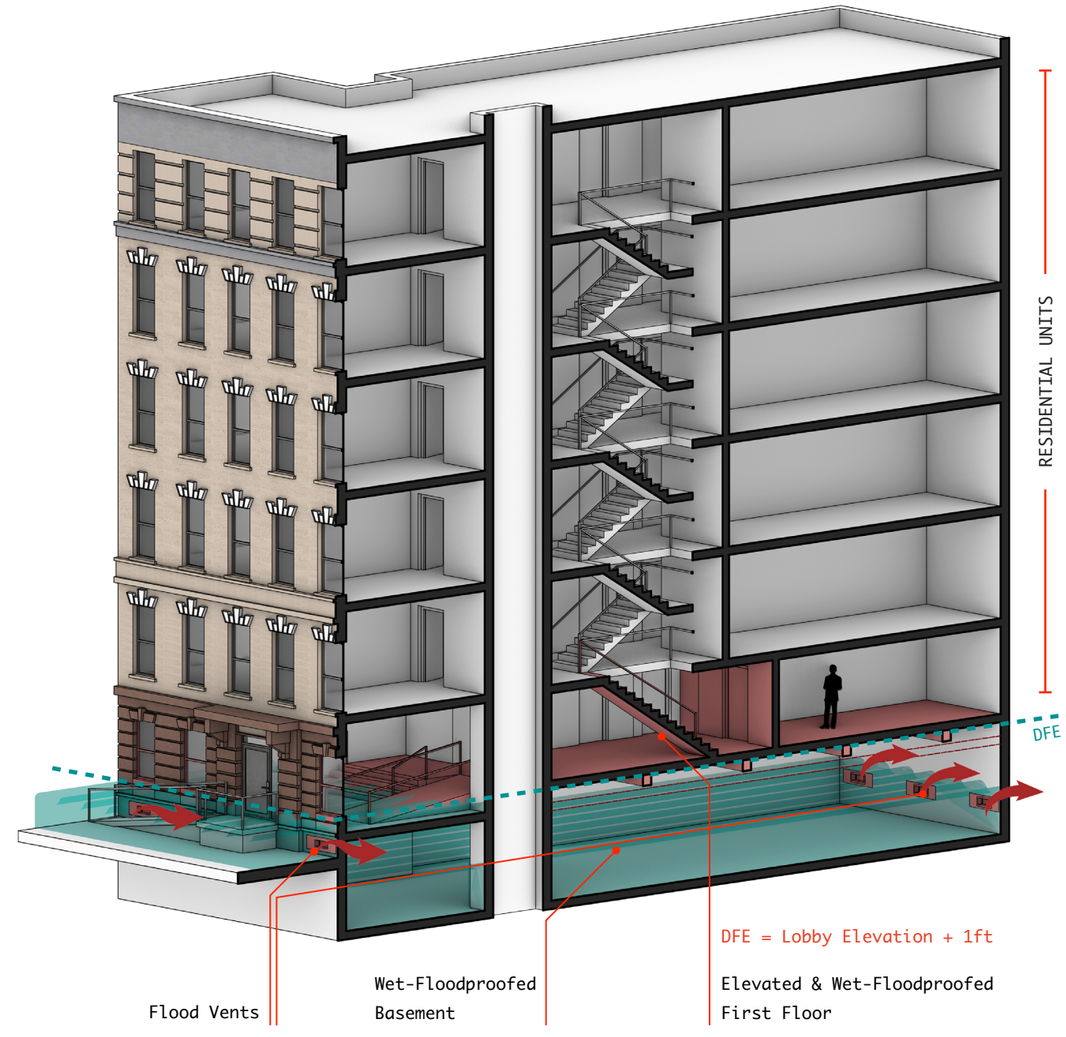


Built Year: 1877; Subsequently Refaced (NPS Data). **Type:** Row House without Stoop.

Retrofitting Strategy: Dry-Floodproofing ("High DFE Scenario").

Entered directly from street level, this row house represents the **"High DFE Scenario"** where local DFE is several feet higher than the primary residential floor. Given the relatively mild flood height (about 3.5 ft above ground), this structure is recommended to be dry-floodproofed. First-floor windows shall be moved above DFE; wall below DFE shall be fortified as needed; deployable flood shields and egress stairs shall be installed prior to flood events.

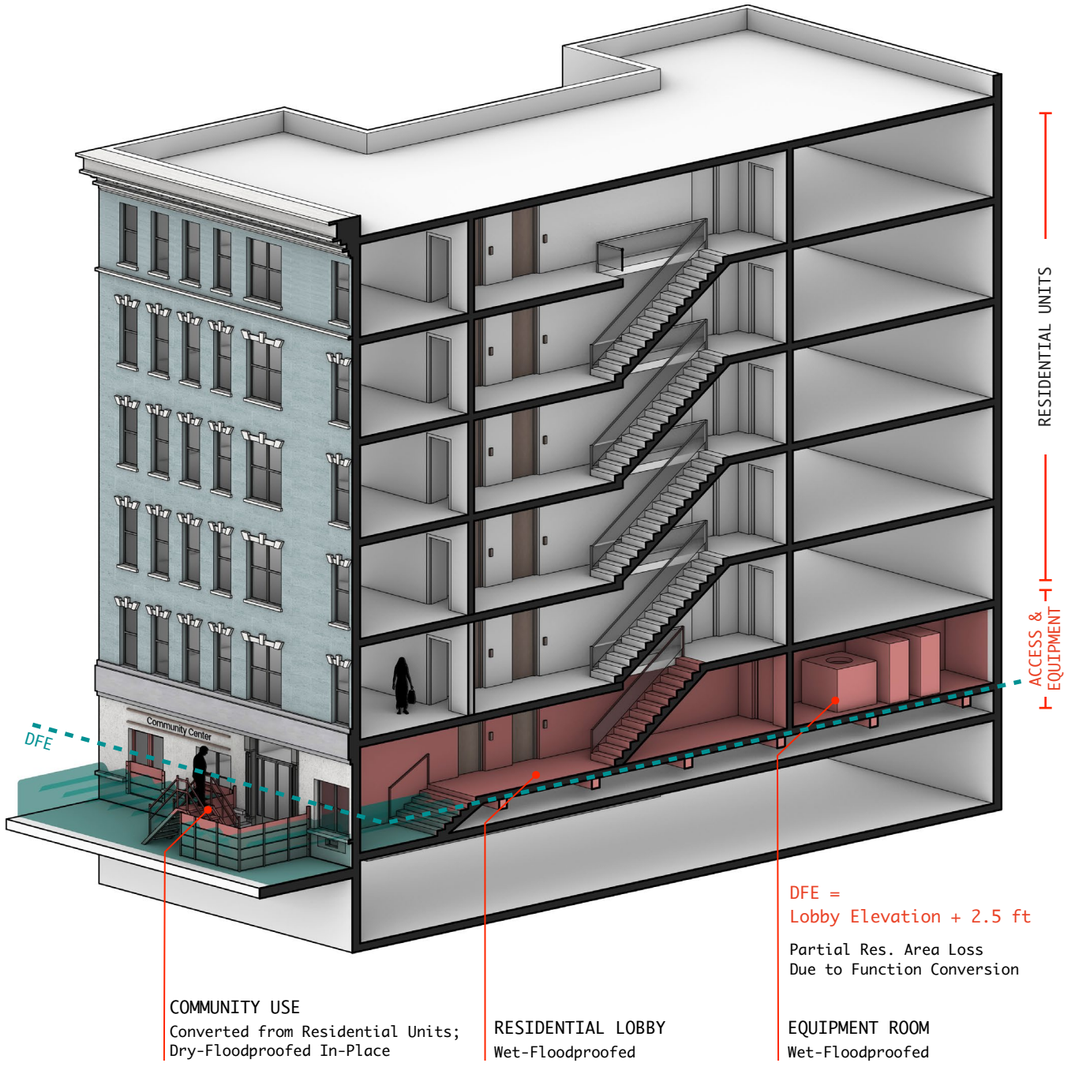
Case Study | 430 East 118th Street



Built Year: 1906 (NPS Data). **Type:** Mid-Rise Residential.

Retrofitting Strategy: Wet-Floodproofing and Interior Elevation.

This tenement building has its lobby above street level, and local DFE is just around 1 ft higher than existing lobby elevation. In this case, slightly raising the first floor from the interior would suffice to bring all residential spaces above DFE. As stairs and ramp are added into the lobby space, all residential units may remain in place; and the basement shall be wet-floodproofed utilizing flood vents.



Built Year: 1907; Subsequently Refaced (NPS Data). **Type:** Mid-Rise Residential.

Retrofitting Strategy: First-Floor Function Conversion.

This tenement building has a local DFE 2.5 ft higher than lobby level, which restricts the applicability of interior elevation because such intervention would significantly impact ceiling height. In this case, the first floor is recommended to be converted into community use and dry-floodproofed in-place; the remaining residential lobby shall be wet-floodproofed, and serve access and storage functions only.

Flood Adaptation, Streetscape Change & Policy Reform

This design study has revealed that by utilizing already-mature flood retrofitting solutions such as wet-floodproofing, dry-floodproofing and internal elevation, residential structures (especially small-scaled structures like row houses) can be feasibly adapted towards flood resilience without substantial spatial alteration or streetscape change. Unlike the design schemes proposed for mixed-use structures in Digital Report 04 which largely involve wholesale rehabilitation, the flood retrofitting of residential structures may often be achieved through a combination of incremental interventions (e.g. installation of flood vents, relocation of critical equipment, and dry-floodproofing wall sections under DFE).

However, such vision is valid only if necessary reforms and updates in historic preservation standards and flood regulations are made. Although New York City's Landmarks Preservation Commission has already published technical guidelines for equipment relocation and flood shield installation on locally designated historic structures, more extensive policy-making is still urgently needed to guide the whole process of flood retrofitting, as well as to cover a broader range of floodproofing interventions and to regulate potential contradictions between preservation standards and general flood regulations. On the other hand, reforms in local flood regulations (Building Codes and Flood Zoning) that recognize the continued existence of basements, dry-floodproofing option for residential structures, and "mix-and-match" of dry and wet-floodproofing for mixed-use structures will also be critical, since they will help resolve standard compliance issues for streetscape-sensitive retrofitting design strategies identified in this study, and open up opportunities for flood insurance premium reduction and other potential financial incentives.

Tradeoffs in Streetscape Significance

Comparing two sets of streetscape evaluation scores before and after proposed adaptation intervention, it can be observed that the mostly in-place interventions recommended in this study are not likely to bring major impacts to the formal and experiential values of East Harlem's residential historic streetscape. However, due to several interior elevation and function conversion cases that require additional space for access use, some usable floor area loss would still be inevitable.

Given the repetitive and grouped nature of speculative row houses and tenements, new forms on street level created by flood adaptation interventions (e.g. flood vents under basement windows) will have the potential to achieve a rhythm compatible with historic architectural and urban forms, which may be considered as an additional layer of the streetscape's formal evolution and historic significance.

Appendix: Current Streetscape Evaluation Sheet

Flood Resilience | 1.75

	1	2	3	4	5
Average lowest residential floor elevation as compared to BFE & DFE	< BFE – 4ft	≥ BFE – 4ft	≥ BFE	≥ DFE	≥ DFE+1ft
Percentage of areas with active use on street level	≥ 80%	80 – 60%	60 – 40%	40 – 20%	< 20%
Percentage of flood-proofed area on street level	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of basement area as compared to street-floor building floor area	≥ 80%	80 – 60%	60 – 40%	40 – 20%	< 20%

Building Integrity & Visual Consistency | 4.00

	1	2	3	4	5
Percentage of identifiable historic structures along both sides of the corridor	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Current condition of historic structures	Poor	Fair	Average	Good	Excellent
Extent of existing modification to historic facades	Extensive	High	Medium	Low	Very Low
Number of identifiable historic architectural elements and ornaments on street level	Scarce	Few	Moderate	Frequent	Abundant
Permanent material impact brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Low	Very Low
Permanent visual impact on rooftops brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible
Permanent physical impact on street space brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible

Streetscape Experience & Social-Spatial Relationship | 4.40

	1	2	3	4	5
Percentage of continuous street wall along both sides of the street corridor	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of street-level transparency (for mixed-use/commercial corridor only)	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of active use along both sides of the street	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of storefronts with outdoor dining/seating (for mixed-use/commercial corridor only)	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Average main entrance elevation of structures on both sides of the street as compared to street level	≥ 4ft	3–4ft	2–3ft	1–2ft	< 1ft
Identifiable architectural patterns (fenestration, pilasters, etc.) on street level	Scarce	Few	Moderate	Frequent	Abundant
Number of storefronts, awnings, canopies and signage (for mixed-use/commercial corridor only)	Scarce	Few	Moderate	Frequent	Abundant
Liminal space for pedestrian passage / Ability to walk along the sidewalk	Very Low	Low	Acceptable	Good	High
Permanent visual impact on rooftops brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible
Estimated pedestrian behavioral/mind map change brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Low	Very Low

Appendix: Retrofitted Streetscape Evaluation Sheet

Flood Resilience | 3.00

	1	2	3	4	5
Average lowest residential floor elevation as compared to BFE & DFE	< BFE – 4ft	≥ BFE – 4ft	≥ BFE	≥ DFE	≥ DFE+1ft
Percentage of areas with active use on street level	≥ 80%	80 – 60%	60 – 40%	40 – 20%	< 20%
Percentage of flood-proofed area on street level	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of basement area as compared to street-floor building floor area	≥ 80%	80 – 60%	60 – 40%	40 – 20%	< 20%

Building Integrity & Visual Consistency | 4.00

	1	2	3	4	5
Percentage of identifiable historic structures along both sides of the corridor	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Current condition of historic structures	Poor	Fair	Average	Good	Excellent
Extent of existing modification to historic facades	Extensive	High	Medium	Low	Very Low
Number of identifiable historic architectural elements and ornaments on street level	Scarce	Few	Moderate	Frequent	Abundant
Permanent material impact brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Low	Very Low
Permanent visual impact on rooftops brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible
Permanent physical impact on street space brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible

Streetscape Experience & Social-Spatial Relationship | 4.29

	1	2	3	4	5
Percentage of continuous street wall along both sides of the street corridor	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of street-level transparency (for mixed-use/commercial corridor only)	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of active use along both sides of the street	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Percentage of storefronts with outdoor dining/seating (for mixed-use/commercial corridor only)	< 20%	20 – 40%	40 – 60%	60 – 80%	≥ 80%
Average main entrance elevation of structures on both sides of the street as compared to street level	≥ 4ft	3–4ft	2–3ft	1–2ft	< 1ft
Identifiable architectural patterns (fenestration, pilasters, etc.) on street level	Scarce	Few	Moderate	Frequent	Abundant
Number of storefronts, awnings, canopies and signage (for mixed-use/commercial corridor only)	Scarce	Few	Moderate	Frequent	Abundant
Liminal space for pedestrian passage / Ability to walk along the sidewalk	Very Low	Low	Acceptable	Good	High
Permanent visual impact on rooftops brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Compatible	Invisible
Estimated pedestrian behavioral/mind map change brought by flood retrofitting (for retrofitted streetscape only)	Extensive	High	Medium	Low	Very Low

03

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DIGITAL REPORT 06

Policy & Procedural Recommendations

Living Above the Street
Stewarding New York City's Historic Built Environment Towards Flood Resilience

An Onera Prize in Historic Preservation Project

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About

This report is part of the independent research project “Living Above the Street: Stewarding New York City’s Historic Built Environment Towards Flood Resilience,” which is supported by Onera Foundation under 2022 Onera Prize for Historic Preservation.

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Further Readings

To view and download the whole series of policy & design reports, please visit:
https://www.livingabovethestreet.nyc/reports.

This Onera Prize research project is developed upon the author’s M.S. Historic Preservation thesis:

Wang, Ziming. 2022. “Living Above the Street: Flood Retrofitting and Adaptive Streetscape of New York City’s Historic Districts.” M.S. Historic Preservation Thesis, Columbia University.
https://doi.org/10.7916/fn43-vb19.

Cover Image based on:
G.W. Bromley & Co. *Manhattan Land Book* (1934), Plate 4. New York : G.W. Bromley & Co., 1934.

As a conclusion to the whole research project, this report puts forward policy-making agendas and procedural recommendations synthesized from findings made and directions explored throughout the author’s research.

PFIRM Floodplain at the Junction of Manhattan, Brooklyn, and Queens.
Source: FEMA. PFIRM Panels 3604970201G; 202G; 203G; 204G. FEMA Map Service Center.

Contents

01

Executive Summary

Executive Summary

Addressing the “missing pieces” that lie within New York City’s current heritage resilience framework, this research project seeks to better understand the vulnerability of New York City’s historic streetscapes under physical flood risks and flood adaptation interventions, and develop value assessment methods, design strategies and policy solutions for the adaptive transformation of New York City’s historic streetscapes towards flood resilience. As a conclusion to the whole project, this report synthesizes all the findings made and policy-making potentials identified throughout the author’s research, and turns them into specific policy-making agendas and procedural recommendations.

In Chapter 02, the author briefly summarizes the issues investigated and findings made in Digital Reports 01 — 05. Chapter 03 proposes a “planning — design — review” process for the flood adaptation of historic street corridors generalized from the real-world, street-scaled adaptation design studies made in this project. In Chapter 04, the author summarizes all needs for policy reform and policy-making identified throughout the project into 9 policy-making agendas, covering measures and actions that include building code reform, retrofitting mandate establishment, design guideline production, heritage mapping, neighborhood-scaled thinking, information sharing, incremental retrofitting, and financial incentives. These agendas are developed in New York City’s context, based on both the previous Digital Reports and suggestions and opinions extracted from the Policy-Maker & Stakeholder Interview series carried out as part of the project. To envision how these policy-making agendas may be carried out in the real world, each agenda is paired with one or more governmental agencies identified as key institutional actors on Federal, State, and local level.

While some explorations have already been made in this project on the issues and agendas raised by the author, this project’s investigation is still largely experimental in nature. Real-world changes must be supported by more systematic and large-scale policy-making efforts undertaken by the city’s preservation and planning agencies, along with necessary Federal-level policy reforms. By providing a more generalized planning and design process and situating the project within the larger picture of heritage resilience policy-making, this report seeks to shed some light on the efforts that can be made in the near future to further support the flood adaptation of New York City’s various flood-threatened historic assets.

02

Research Summary and Key Findings

This research project seeks to better understand the vulnerability of New York City's historic streetscapes under physical flood risks as well as flood adaptation interventions as regulated by the city's existing flood policy framework, and develop design and policy solutions for the adaptive transformation of New York City's historic streetscapes towards flood resilience. This Chapter offers a concise summary of the research carried out in this project, as well as key findings made in the previous Digital Reports.

Report 01 - Flood Risk of New York City's Historic Built Environment examines how New York City's historic urban forms are susceptible to adverse impacts brought by physical flood risks, and compounded by the lack of sufficient flood adaptation and preservation policy-making. GIS mapping of historic districts, historic neighborhoods, and designated buildings within (or intersecting) the city's current floodplain reveals that physical flood threats do cause a significant risk to New York City's historic built environment, and that the city's floodplain covers a vastly diverse collection of historic assets that vary in scale, construction, style, use, and designation status. The examination of the city's flood regulation framework and historic preservation standards demonstrates that flood elevation mandates established in the city's Building Code and flood zoning have caused uncontrolled streetscape changes in waterfront communities; although there have been some policy and design guidelines made to regulate the flood retrofitting design of general existing structures and waterfront neighborhoods, historic buildings and districts have been largely left out in the city's flood resilience discourse. Without innovative design strategies, review processes, financial incentives and effective retrofitting mandates, historic urban forms are left at even higher stakes.

Identifying streetscape change as the key area of tension brought by flood adaptation interventions, Report 02 - Adaptive Streetscape: Concept & Framework demonstrates that flood resistance is not the only goal in the adaptation of New York City's historic built environment, and that we must take a broader scope of heritage and economic values into account. A set of adaptation goals, parameters, and metrics should be set up, in order to better evaluate streetscape quality changes brought by adaptation interventions, and balance the tradeoffs between different values. On this front, the report proposes an "Adaptive Streetscape" framework that features four key adaptation and preservation goals including "Flood Resilience," "Building Integrity & Visual Consistency," "Streetscape Experience & Social-Spatial Relationship," and "Floor Area Transfer." Based on existing streetscape theories, adaptation regulations and preservation standards, 24 semi-quantitative metrics are set up under these four lenses to evaluate streetscape change; the intricate tradeoffs between Adaptive Streetscape goals, and the association between each goal and specific flood adaptation design strategies are also discussed.

Addressing the absence of streetscape-sensitive design strategies targeted at New York City's historic buildings and neighborhoods, Report 03 - Streetscape-Sensitive Design Strategies seeks to explore such strategies based on nationwide flood retrofitting regulations and guidelines (including the city's own flood zoning and *Retrofitting Buildings for Flood Risk* report), successful built cases, together with the author's own illustrative input. Although many design guidelines for the flood retrofitting of historic or existing building stock have been actively developed by policy-making entities across the country in recent years, New York City's historic built environment still poses a unique challenge, given its high-density building types that often involve mixed uses, multi tenants, narrow lots, active basement use and attached construction, as well as the city's flood retrofitting policy framework that only has relatively preliminary streetscape provisions and especially lacks historic preservation considerations. On the individual building scale, this report characterizes New York City's floodplain building stock into six major building types, pairs each building type with one or two overall retrofitting methods, lists preservation and streetscape considerations under each retrofitting scheme, provides streetscape mitigation design solutions, and examines their Building Code compliance; on the neighborhood scale, this report briefly lists the several adaptation models that have been recently proposed or implemented in cities across the U.S. These design strategies are further summarized into a *streetscape-sensitive design toolbox* — a preliminary flood adaptation and streetscape mitigation design guideline presented in tabular form for New York City's historic buildings and neighborhoods. Policy discussions at the end of Report 03 reveal that reforms in local flood regulation and extensive local preservation policy-making are urgently needed to better accommodate streetscape-sensitive design strategies, address unique challenges associated with urban building types, embrace incremental retrofitting, incorporate neighborhood-scale thinking, and guide the whole flood adaptation process of historic urban environment.

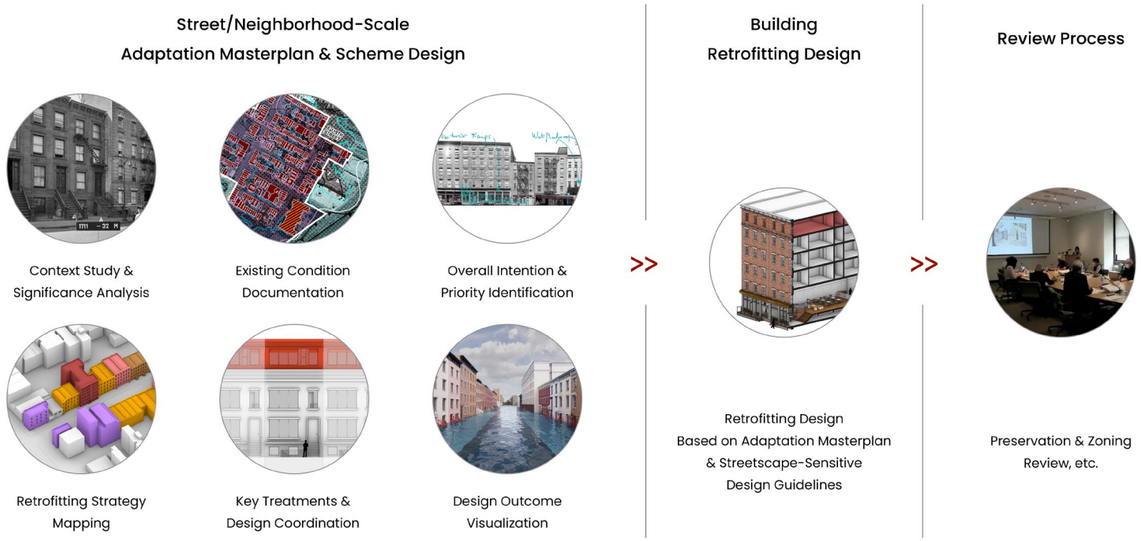
Applying the Adaptive Streetscape framework and streetscape-sensitive design strategies to New York City's real-world historic built environment, Digital Reports 04 and 05 feature two street-scaled adaptation design studies respectively investigating a historic mixed-use/commercial corridor (Front Street in South Street Seaport) and a historic residential corridor (East 118th Street in East Harlem). In each report, the author carries out a context study, maps the street corridor's current condition and building profiles, and evaluates the existing streetscape's significance with the Adaptive Streetscape framework. Such information provides a ground for the identification of adaptation priorities and suitable retrofitting strategies for each building type; based on overall priorities and strategies set up for each street corridor, the author then proceeds to building-scaled design studies, and visualizes the streetscape transformation brought by proposed adaptation interventions — which is evaluated again with the Adaptive Streetscape framework to reveal streetscape quality changes. The design studies demonstrate that although historic street corridors can be flood adapted with their key streetscape values and characters largely retained, such adaptation intervention will inevitably involve tradeoffs with other preservation and economic goals, and can only be achieved upon necessary regulation reforms and procedural establishments. More importantly, they reveal that since different historic streetscapes have different uses, heritage values, characters and adaptation priorities that lead to drastically different design strategies and outcomes, a neighborhood-scaled scenario planning process is vitally important for the adaptive transformation of urban historic built environment.

With an intention to bridge the gaps between the discourses of flood adaptation and historic preservation in the context of New York City, these reports address the “missing pieces” that lie within New York City’s current heritage resilience framework by understanding flood risk, exploring localized design strategies, developing value assessment methods, and delineating needs for policy reform and policy-making. However, as a project experimental and exploratory in nature, the author’s research alone is far from sufficient to cover every issue in the whole city’s heritage resilience planning and policy-making. Synthesizing the findings made and directions explored in Reports 01-05, Chapter 3 will introduce a *planning-design-review* process summarized from the street-scaled design studies carried out in this project, and Chapter 4 will lay out the key policy-making actions that could be taken by Federal, State and local-level institutional actors to further facilitate the adaptive transformation of New York City’s historic built environment. As the conclusion to this research project, these policy and procedural recommendations seek to provide a more generalized solution, and link the project’s exploration with larger policy reform and policy-making agendas well needed in New York City’s flood regulation systems and historic preservation standards.

03

Design Process & Recommended Practices in the Flood Adaptation of Historic Street Corridors

As the design studies in this project have demonstrated, different historic streetscapes have different uses, heritage values, characters and adaptation priorities, which may lead to drastically different design strategies and outcomes. Given the diversity that lies in historic neighborhoods and streetscapes, normative standards (e.g. design guidelines) laying out appropriate or inappropriate treatments at large — the typical tool that historic preservation practice has heavily relied on — may not be sufficient; instead, a neighborhood-scaled scenario planning ***process*** is required in order to reach site-specific decisions that balance multiple conflicting values, and provide guidance for building-level retrofitting solutions which achieve both flood resilience and consistent urban form transformation. Generalizing the methodology explored in real-world adaptation studies featured in Digital Reports 04 & 05, this Chapter proposes a flood adaptation process for historic street corridors, which follows the "planning — design — review" procedure as illustrated and narrated below.



Recommended design process for the flood adaptation of historic street corridors.
Image sources: NYC Department of Records and Information Services ("Context Study & Significance Analysis"); NYC Landmarks Preservation Commission ("Preservation & Zoning Review"). All other illustrations are made by the author.

Stage 1 | Street/Neighborhood-Scale Flood Adaptation Master Plan & Scheme Design.

As multiple streetscape-sensitive flood retrofitting design strategies identified in this project involve coordination among adjacent structures or interventions on sidewalk space, a street or neighborhood-scale adaptation master plan and scheme design is an essential first step to ensure the appropriate transformation of urban historic streetscape towards flood resilience. Such master plan and scheme design may be in the form of an individual document commissioned by local planning or preservation agency (like Philadelphia's 2020 *Manayunk Main Street Historic District Guide* or NYCDCP's *Resilient Neighborhood* studies), or, in New York City's context, be incorporated into LPC's historic district master plan system.

Such master plan should be able to inform community stakeholders of local flood risk and building profiles, and recommend appropriate retrofitting strategies for major building types along the street corridor. It should also point out key areas where proportions, visual consistency and streetscape expression shall be coordinated among different structures, and establish a design guideline to aid individual retrofitting design projects. It is recommended that the street/neighborhood-scale master plan incorporate the following components:

1. **Context Study and Significance Analysis.** Basic historic context research shall be provided to establish an understanding of the historic street corridor's designation status and significance. Such understanding is essential in the identification of high-priority values and goals to be pursued in the flood adaptation planning process.

2. **Existing Condition Documentation.** The street corridor's site plan shall be surveyed, and overlaid on historic designation boundaries and FEMA floodplains; street elevation and building profiles (e.g. age, type, and use) shall also be documented. These information are critical to community stakeholders and property owners as they help them to understand the applicable flood adaptation mandates and historic preservation standards, and plan for retrofitting projects on individual properties.

3. **Overall Intention & Priority Identification.** Street/neighborhood-scale adaptation master plan shall explicitly lay out the resilience, heritage, and economic goals prioritized in adaptation planning and preservation design. Such goals (e.g. "to achieve flood resilience while retaining the vigorous retail street interface," or "to identify feasible retrofitting strategies that enhance flood resilience with limited spatial alteration") will serve as an overall philosophy that guides the selection of flood retrofitting strategies on buildings and street space, and shape the outcomes of adaptation design.

4. **Retrofitting Strategy Mapping.** Based on the distribution of major building types along the street corridor and street/neighborhood-scale adaptation priorities set above, an overall retrofitting method shall be assigned to each building. Such designation streamlines the resilience planning process, and informs property owners of the suitable retrofitting actions they could take. Existing neighborhood-scaled resilience infrastructure projects in the area (if any) should also be taken into account, as they may have impact on the flood risks that local buildings will face and the suitable retrofitting methods that should be chosen. A group of neighboring buildings with the same design, or buildings under the same type shall generally be designated the same retrofitting method, in order to ensure a consistent streetscape transformation. If alterations are proposed on sidewalk or street space (e.g. local sidewalk widening) to accommodate retrofitting interventions, they should also be laid out upon consultation with local transportation authorities.

5. **Key Retrofitting Treatments & Provisions for Retrofitting Design Coordination.** Building on the previous steps, the master plan shall lay out key building-level retrofitting treatments that can be repeated along the street corridor wherever possible (such as "solid, articulated foundation," "storefronts raised from the interior," or "dry-floodproofing anchors on street-level openings"), and delineate key architectural elements (e.g. cornice) or formal and physical features (e.g. height of elevation, overall design of rooftop addition) that must be coordinated among structures for a consistent design outcome. Specific design guidelines and provisions can be made based on existing preservation standards to further regulate the design of these features.

6. **Design Outcome Visualization.** If possible, the master plan shall visualize the potential permanent streetscape changes brought by proposed retrofitting interventions through elevation drawing or renderings. A clear, visual representation of the adaptation design helps mitigate confusion and accelerate the adaptation process. By agreeing on the neighborhood-scale scheme design, both local planning and preservation agencies and individual homeowners will have a clearer understanding regarding how the structures shall be retrofitted, how streetscape changes shall be coordinated, and which interventions are likely able to go through design reviews.

The street/neighborhood-scale master plan is recommended to be made based on a collective dialogue among local preservation organizations, city-level planning, transportation and preservation agencies, community members, along with consulting firms and other stakeholders. A successfully developed master plan may in many ways serve as a "roadmap" to flood resilience for local communities. With the street/neighborhood-scale master plan in hand, community leaders and stakeholders will have a transparent understanding of the community's resilient future; and individual homeowners will be well informed of the flood risks of their properties, as well as how they may achieve flood resilience through incremental retrofitting or substantial improvement. In the meantime, streetscape provisions and guidelines ensure a coordinated streetscape expression despite that the actual process of flood adaptation is carried out on a building-by-building basis.

Stage 2 | Individual Building Retrofitting Design

Retrofitting designs of individual structures along the historic street corridor shall be carried out under recommendations made by the street/neighborhood-scale master plan. While the master plan lays out the suggested overall method (e.g. dry-floodproofing, or interior elevation) and key streetscape parameters of retrofitting design, individual property owners and architects will still have say on most details of the project.

Streetscape mitigation should be a key consideration in the flood retrofitting design of individual historic structures. The streetscape-sensitive design guidelines developed in Report 03 may be consulted as a reference; if a structure is listed under local or Federal historic designation, its flood retrofitting design should also abide by design guidelines published by the local preservation agency, or nationwide guidelines such as The Secretary of the Interior's Standards for the Treatment of Historic Properties or the NPS *Guidelines on Flood Adaptation for Rehabilitating Historic Buildings* (2021).

Stage 3 | Design Review and Other Permit Procedures

After the completion of the flood retrofitting design, historic structures with local landmark designation or located in local historic districts will need to go through LPC design reviews for project approval. As flood retrofitting often involves extensive reworking of a building's physical fabric (e.g. the dry-floodproofing of walls) and significant spatial changes (e.g. structural elevation, interior elevation and rooftop addition) that wouldn't normally be accepted by general preservation standards, flood retrofitting projects on historic structures may encounter difficulties getting permission. While a number of cities across the U.S. have set specific design review guidelines for the flood retrofitting of historic structures, New York City's permit guidelines are still largely focused on small-scaled interventions (such as door/window restoration and storefront replacement), and generally excludes major spatial changes. Extensive flood retrofitting policy-making expanded from LPC's existing technical guidelines on equipment relocation and flood shield installation are needed to guide flood retrofitting interventions on historic structures, and remove policy barriers that hinder the implementation of such interventions.

Besides local preservation design review, other forms of review and permit procedures may also be required. Historic buildings that are retrofitted with FEMA/NPS funding may need to go through the Section 106 Review; as suggested by NYCDCP's *Retrofitting* report (NYCDCP 2014, 92), dry-floodproofing enclosures on sidewalk space may require a revocable consent from local Department of Transportation (DOT). As local-level preservation and transportation review procedures for flood retrofitting projects still remain largely unclear, they should be developed jointly by city authorities in respective fields in the near future.

Connecting neighborhood-scale adaptation planning and building-scale design intervention, the planning — design — review process introduced above may enable the flood adaptation of historic street corridors in a way that respects local social-spatial characters and historic urban forms. Ideally, such planning process shall be incorporated into NYC Landmarks Preservation Commission's existing historic district master plan system; however, this would require the historic district master plan system itself to change as well, since current rules in historic district master plans are still very much focused on specific treatments on individual architectural elements, without a scenario planning approach that establishes a more sophisticated understanding of the broader social-spatial values of historic urban environment.

04

Policy Reflections &

Policy-Making Agendas

Policy-Making Agendas

Agenda 1

Incorporate Flood Resilience Standards for Historic Buildings into the City's Building Code and Preservation Guidelines.

Agenda 2

Develop an Integrated GIS System that Maps the Flood Threat Faced by New York City's Historic Built Environment.

Agenda 3

Revise Local Building Code and Flood Zoning to Further Address the Challenges and Needs Associated with Urban Building Types.

Agenda 4

Develop Design & Policy Guidelines for the Flood Retrofitting of Historic Structures, with an Emphasis on Urban Form Change and Streetscape Design.

Agenda 5

Embrace and Incentivize Partial or Incremental Retrofitting on Existing Structures.

Agenda 6

Incorporate Neighborhood-Scale Thinking in Local Resilience Planning.

Agenda 7

Increased Investment and Enhanced Inter-Agency Coordination.

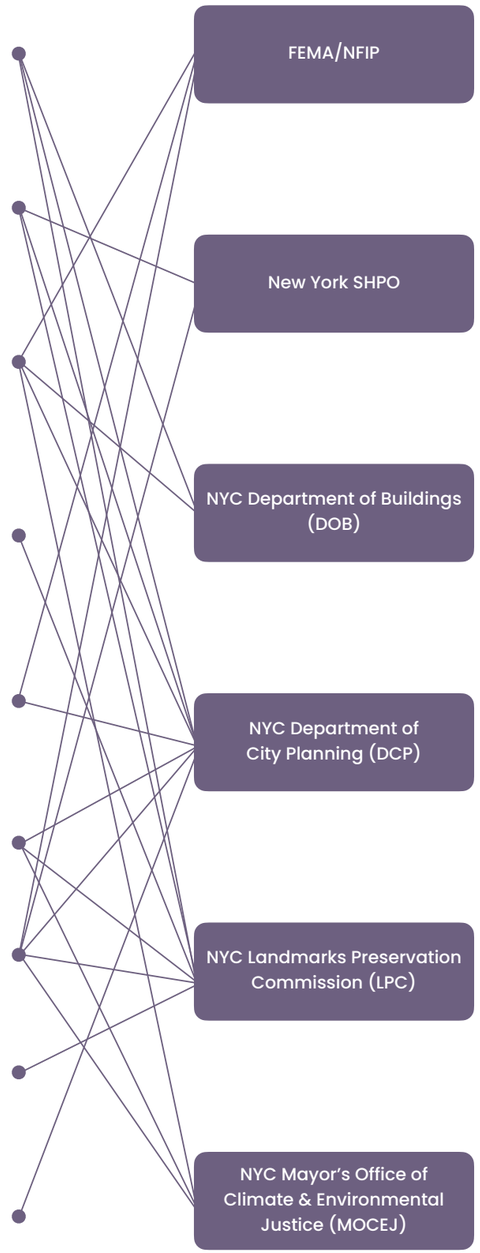
Agenda 8

Develop a Consolidated Platform to Share Information on Heritage Resilience with the Public.

Agenda 9

Connect Flood Retrofitting with Other Climate Resilience Undertakings.

Institutional Actors



Design solutions and policy issues are closely intertwined in the discourses of flood adaptation and historic preservation. In Report 03, based upon streetscape-sensitive design strategies identified for New York City's flood-threatened historic buildings and neighborhoods, the author identified the needs for local flood regulation reform and historic preservation policy-making in order to better accommodate streetscape-sensitive design strategies, address unique challenges associated with urban building types, embrace incremental retrofitting, incorporate neighborhood-scale thinking, and guide the whole flood adaptation process of historic urban environment.

However, New York City's policy-making at the intersection of flood adaptation and historic preservation shouldn't stop at simply providing design guidelines for flood-threatened historic buildings; other policy-making and heritage management actions regarding building code reform, retrofitting mandate establishment, heritage mapping, information sharing, and financial incentives are just as important and relevant in the cause of transforming the city's historic built environment towards flood resilience. While this project has made explorations on some of the fronts just mentioned, real-world changes must be supported by more systematic and large-scale policy-making efforts undertaken by the city's preservation and planning agencies. Furthermore, although flood adaptation is largely regulated on the municipal level across U.S. cities, some Federal-level standards (for example, FEMA's "substantial improvement" mandate and floodplain management regulations) still serve to set a baseline for local policies. Therefore, some local policy reforms deemed necessary by this project (and other research reports such as NYCDCP's *Resilient Retail* published in 2016) would require Federal-level policies to reform accordingly or provide more flexibility.

Based on these observations, this Chapter summarizes all needs for policy reform and policy-making identified throughout this research project into specific policy-making agendas. These agendas are developed in New York City's context, based on both Digital Reports 01-05, and suggestions and opinions extracted from the Policy-Maker & Stakeholder Interview series carried out as part of the project. Full transcripts of interviews with preservationists, urban planners, architects, contractors, homeowners and community stakeholders are published at https://www.livingabovethestreet.nyc/interviews. To envision how these policy-making agendas may be carried out in the real world, the author identifies FEMA/NFIP, New York SHPO, NYC Department of Buildings (DOB), NYC Department of City Planning (DCP), NYC Landmarks Preservation Commission (LPC), and NYC Mayor's Office of Climate and Environmental Justice (MOCEJ) as key institutional actors capable of shaping or influencing the city's heritage resilience policies, and pairs each policy-making agenda with one or more key institutional actors.

A total of 9 policy reform and policy-making agendas are identified as the conclusion to the whole research project. They are illustrated on p. 17, and discussed as follows:

Agenda 1 | Incorporate Flood Resilience Standards for Historic Buildings into the City's Building Code and Preservation Guidelines.

Key Institutional Actors: NYCDOB; NYCDCP; NYCLPC.

As Digital Report 01 has revealed, NFIP's floodplain management standard offers two options for local communities to regulate the flood retrofitting of historic buildings: Communities can either exempt all designated historic buildings from the retrofitting mandates set out by the "substantial improvement" provision, or include them under the mandate, while allowing historic buildings to acquire FEMA Variances in their retrofitting projects. Currently, some local and State-level building codes (e.g. those of Charleston, SC and Florida) have already positioned historic buildings under flood resistance standards (whether through the "substantial improvement" standard set out by FEMA or locally-made rules), and included variance-granting procedures; however, New York City still only exempts historic buildings from the substantial improvement mandate, without placing a local flood resilience standard applicable for historic buildings. Such exemption perpetuates the vulnerability of historic buildings under physical flood risks, and delays the development of the city's heritage resilience policies. On this front, the following reforms are suggested:

- The City's Building Code should incorporate flood resilience standards for historic buildings, either by placing them under the substantial improvement mandates, or establishing an independent system of requirements. Such policy change should be accompanied by the establishment of variance-granting procedures, as well as corresponding provisions on urban design and floor area calculation provided by the city's Flood Zoning.

- Once flood resistance standards are established for historic buildings in the floodplain, the city's historic preservation agency (LPC) shall publish technical guides to delineate the review, permit, and variance-granting processes for flood retrofitting projects on locally designated historic buildings. The agency's current *Permit Guidebook* should also be revised to incorporate flood resilience recommendations. Miami-Dade County's *Resilient Rehab* guideline (2021) — where resilience considerations are analyzed for each architectural element as an addition to other design recommendations and regulations — would be a great example. The incorporation of flood resilience standards and considerations into existing permit guides will not only serve to inform wholesale retrofitting projects, but also encourage incremental resilience-building through small-scaled repairs and updates.

- On Federal level, current NFIP regulations allow Federally designated historic structures to enjoy subsidized flood insurance rates regardless of whether they're flood retrofitted or not (FEMA 2008, 8-9). Further updates in the flood insurance policies may be made to encourage flood retrofitting projects on historic properties by financially differentiating retrofitted historic buildings with those without flood resilience measures.

Agenda 2 | Develop an Integrated GIS System that Maps the Flood Threat Faced by New York City's Historic Built Environment.

Key Institutional Actors: NYCDCP; NYCLPC; NYSHPO.

With a myriad of urban data collected, organized, and published for public use, New York City is commonly seen as a leader in data-driven decision-making and public-oriented data sharing. The city's ZoLa (Zoning & Land Use Map) platform is one of the several publicly accessible online platforms nationwide where floodplain boundary and local historic designation are visualized in the same map interface (for similar platforms developed by other cities, see for example, City of Newport, RI's GIS Portal, and St. Augustine, FL's GIS Portal). However, local historic designation data remain only a supporting layer within the ZoLa system, and haven't been integrated into the city's flood hazard visualization platforms such as NYC Flood Hazard Mapper. Furthermore, given the various historic assets present in New York City's floodplain, local designation alone may not be sufficiently able to represent the flood risks faced by New York City's historic built environment. The extensive data collection and survey efforts taken by agencies such as New York SHPO (through its Hurricane Sandy Historic Resource Survey of Select Waterfront Communities) and NYCDCP (through its PLUTO and flood hazard mapper programs) should be combined with NYCLPC's local designation data, and developed into a more comprehensive geographic information system that facilitates a better understanding of the profiles of various types of historic assets located within the floodplain. Specifically, the following actions are recommended:

- To facilitate heritage resilience policy-making and harness public awareness, the Landmarks Preservation Commission shall take the lead in developing an integrated flood risk map platform that showcases the flood risk faced by New York City's historic assets, whether they are individual landmarks or historic districts, designated under local Landmark Law or Federal/State register. Currently available National/State register and floodplain data as well as other general urban data may be linked into the system through coordination with other agencies such as New York SHPO, FEMA, and NYCDCP.

- Local and Federal/State historic designations, as well as other buildings, facilities, and neighborhoods of high value or vulnerability, shall be included into New York City's online flood map portal — NYC Flood Hazard Mapper — as supporting layers.

Agenda 3 | Revise Local Building Code and Flood Zoning to Further Address the Challenges and Needs Associated with Urban Building Types.

Key Institutional Actors: FEMA; NYCDOB; NYCDCP; MOCEJ.

It is observed throughout this study that NFIP's floodplain management requirements, premium reduction

standards, state and local-level retrofitting guidelines and existing built cases are all to a great extent concentrated on detached single homes. However, as this research project and a number of NYCDCP's planning studies (see for example, the *Retrofitting* report of 2014 and the *Resilient Retail* report of 2016) have revealed, the high density, mixed use, multi tenants, narrow lots, active basement use, and attached construction of New York City's high-density floodplain building types call for floodproofing and flood retrofitting strategies that are not supported or acknowledged by the current Federal and local flood regulations. Treatments such as the "mix-and-match" of multiple floodproofing strategies or the continued use of floodproofed below-grade spaces are not only contributing to the streetscape discourse of historic buildings, but also necessary for a greater stock of floodplain buildings to reach flood resistance without losing the capability of normal operation. To address the mismatch between urban building types and flood resistance standards designed largely for detached residential homes, Federal and city-level policy-making entities should further research the retrofitting challenges and strategies associated with high-density urban building types, and put forward construction standards, insurance policies, zoning rules and streetscape design guidelines that offer more flexibility and encourage streetscape-sensitive flood retrofitting projects on high-density urban building stock. Specifically, the following policy-making actions are needed:

- Local building and planning agency (NYCDOB & NYCDCP) should continue to publish research reports that lay out suitable retrofitting strategies for high-density urban building types, and connect with FEMA/NFIP for the prospect of updating Federal-level regulations that often undergird the inflexibility of local Building Codes. Key potential areas of Building Code reform include:
  - Allowing the "mix-and-match" of dry-floodproofing and wet-floodproofing on the same structure;
  - Allowing the continued existence of basements, cellars and other below-grade spaces on condition that they are properly floodproofed or drained;
  - Recognizing dry-floodproofing on residential buildings with attached construction;
  - Allowing limited, active retail lobby use in mixed-use structures where the interior first floor is raised;
  - Acknowledging and encouraging creative access design strategies proposed in the city's existing retrofitting design reports, such as dry-floodproofing enclosures with egress stairs or the rerouting of dry-floodproofed retail egress through residential lobbies (see Section 4.5 of Report 03 for details).

- Besides Building Code reforms, the city's planning agency (NYCDCP) should continue to produce updated zoning standards and incentives, as well as streetscape design regulations to assist the flood adaptation of waterfront built environment. Changes in NFIP strategies may also be needed to recognize the retrofitting strategies that are currently not eligible for premium reduction.

- Given the fact that a number of creative design strategies proposed in the city's existing retrofitting design

reports don't have many built-out cases, the city's Department of City Planning and Mayor's Office of Climate and Environmental Justice (MOCEJ) may launch grant programs to assist pilot retrofitting projects on New York City's specific urban building types such as Semi-Attached/Attached Mixed-Use.

Agenda 4 | Develop Design & Policy Guidance for the Flood Retrofitting of Historic Structures, with an Emphasis on Urban Form Change and Streetscape Design.

Key Institutional Actor: NYCLPC.

Responding to the flood risks of New York City's historic buildings and the extensive spatial changes that flood retrofitting interventions may cause, LPC has in recent years published two technical guidelines on equipment relocation and flood shield installation for locally designated historic structures. These guidelines echo this project's finding that dry floodproofing may be a strategy beneficial to the preservation of historic characters and streetscape relationships for certain building types (e.g. row houses and semi-attached/attached residential structures); however, dry-floodproofing may not be the best solution for every building type, and these individual interventions are only a small part of the array of flood retrofitting actions that could be taken on historic buildings. Therefore, extensive policy-making by LPC is still urgently needed to further guide the whole flood retrofitting process of local historic buildings. With streetscape change identified as the key area of tension by both this project and a number of existing nationwide retrofitting guidelines on historic structures (e.g. Charleston's *Design Guidelines for Elevating Historic Buildings* and Miami Beach's *Buoyant City*), New York City's future design guidelines should emphasize on regulating streetscape expression and coordinating urban form change. Specifically, the city's design & policy guidelines on the flood retrofitting of historic structures shall be able to address the following issues:

- It should be developed based on similar existing guidelines across the country, and target New York City's floodplain historic building stock. It should be able to cover a wide range of applicable flood adaptation interventions, as well as the resilience planning process where property owners and architects choose the most suitable retrofitting method for flood-threatened structures.

- It should delineate design review processes both for individual flood retrofitting projects, and for a group of properties in historic districts that bear the same design.

- It should be able to address the potential conflicts between flood retrofitting guidelines for historic buildings and the city's general Building Code and preservation standards, and indicate which set of regulations will prevail when these conflicts are present.

- Upon consulting other city agencies (e.g. NYCDOT, NYCDOB, and NYCDCP), rules should be made regarding how adaptation strategies that may involve intervention on sidewalk space (e.g. implementation of dry-floodproofing enclosures; see Report 03, 52-53; NYCDCP 2014, 90-93) shall be permitted and executed.

- The city's flood retrofitting guidelines for historic buildings shall also establish a preservation philosophy that embraces appropriately carried-out flood retrofitting interventions as new layers of architectural features that supplement the character and significance of historic structures.

Since flood retrofitting projects often involve more substantial formal, spatial, and material changes than normally accepted by general preservation standards, a set of dedicated flood retrofitting design guidelines for historic buildings are crucial for the real-world implementation of flood retrofitting on designated historic structures. It is recommended that the LPC take the lead in developing such policy and design guides, as a supplement to its current *Rules* and *Permit Guidebook*.

Agenda 5 | Embrace and Incentivize Partial or Incremental Retrofitting on Existing Structures.

Key Institutional Actors: NYCDCP; FEMA.

Flood resilience and regulation compliance aren't always achieved at once through total overhaul or large-scale renovation; a more feasible approach for property owners would be to gradually incorporate flood resilience measures in a piecemeal manner. This is especially true for high-density urban building types: since the once-and-for-all structural elevation option is generally excluded for these building types, many of their recommended design schemes can be divided into smaller steps. For example, the "Interior Elevation and Wet-Floodproofing" scheme proposed in Digital Report 03 may be achieved by first relocating critical equipments up to the rooftop, then replacing existing materials below DFE with flood-resistant ones during repair or maintenance, and finally, wet-floodproofing and elevating the whole interior retail floor plate.

However, neither the city's Building Code nor NFIP's premium reduction standard currently recognizes these partial retrofitting solutions, nor grants them lower flood insurance premiums (see NYCDCP 2016, 4). Such exclusion fails to incentivize property owners to carry out incremental flood adaptation undertakings; many of which are streetscape-sensitive design strategies identified in this study, that are not totally compliant with the city's current Building Codes and therefore may only be considered as partial retrofitting treatments.

These situations call for the recognition of partial and incremental retrofitting treatments by NFIP and local flood zoning. It is recommended that the city's Department of Planning work with FEMA/NFIP to continue to develop financial incentives and zoning bonuses rewarding partial retrofitting actions — especially those friendly to historic streetscapes — based on the several existing zoning bonus provisions set out in the city's 2019-2021 Flood Zoning (see NYCDCP 2019, 77-99).

Agenda 6 | Incorporate Neighborhood-Scale Thinking in Local Resilience Planning.

Key Institutional Actors: NYCLPC; NYCDCP; MOCEJ.

As adaptation design studies featured in Digital Reports 04 & 05 and the "planning — design — review" procedure proposed in Chapter 03 have demonstrated, street/neighborhood-scale adaptation planning is crucial for the streetscape-sensitive transformation of urban historic built environment towards flood resilience. The street/neighborhood-scale adaptation master plan is not only able to coordinate urban form changes between different structures and the street space, but also sets clear adaptation goals and parameters for local homeowners and community stakeholders, as well as provides key information and recommendations that would aid individual flood retrofitting projects. However, the street/neighborhood-scale master plan is only one of the ways in which neighborhood-scale thinking should be incorporated into the heritage resilience discourse: to preserve urban forms and link flood adaptation actions on multiple scales, local resilience planning must also acknowledge existing neighborhood-scale resilience infrastructure projects, encompass more social justice considerations, and explore a more thorough understanding of the social-spatial values of historic streetscapes and urban space. Specifically, the following actions are suggested:

- Incorporate the street/neighborhood-scale flood adaptation master plan process developed in Chapter 03 into NYCLPC's existing historic district master plan system, or NYCDCP's *Resilient Neighborhood* studies. It is observed that historic districts and neighborhoods have been largely left out of the city's flood resilience discourse: there hasn't been a study dedicated to the preservation and adaptation of a historic neighborhood within DCP's Resilient Neighborhood series, and LPC's existing historic district master plans are still largely focused on preservation design provisions for particular architectural elements. By integrating neighborhood-scale flood adaptation master plan into these two systems, resilience goals and parameters can be feasibly established leveraging existing policy-making mechanisms.
- Acknowledge neighborhood-scaled resilience infrastructure projects taking place in the city's waterfront communities. As introduced in Digital Report 03, New York City is currently executing a collection of neighborhood-scaled resilience infrastructure projects that seek to form a continuous flood barrier surrounding Lower Manhattan and take waterfront neighborhoods out of the floodplain. However, the city's current flood zoning and Building Code don't differentiate buildings in communities with neighborhood-scaled resilience measures, against those not protected by these measures. More detailed policy-making that acknowledges large-scale resilience infrastructure projects will potentially relieve the burden of building retrofitting in Lower Manhattan neighborhoods, and indirectly help preserve the fabrics of historic districts and neighborhoods in the area.
- Invest in pilot neighborhood-scale adaptation projects targeted at New York City's historic districts and neighborhoods. Paralleling the large-scale waterfront flood defense system being carried out by the city, the LPC, DCP and MOCEJ shall launch and support pilot neighborhood adaptation projects in the city's waterfront historic communities, focusing on interventions on buildings and street space that may supplement waterfront infrastructure construction. Actions and projects that can be taken within these neighborhood adaptation projects may include adaptation planning, rain gardens, permeable ground surface, building retrofitting, and updated drainage systems.
- Further integrate social justice considerations into neighborhood resilience planning. It can be easily seen that most of the city's current resilience infrastructure projects are concentrated on neighborhoods in Lower Manhattan, and it's learned from this project's interview series that some other communities vulnerable to flood risk — such as East Harlem — haven't been able to gain the same attention, assistance or investment in their neighborhood resilience planning processes. While current resilience infrastructure projects (such as those under the Lower Manhattan Climate Resiliency initiative) are largely experimental and pilot in nature, neighborhoods with high flood risk and indicators of social vulnerability (e.g. low-income, high immigrant or BIPOC population) shall be further prioritized by MOCEJ when they get extended into citywide communities.
- Establish a more comprehensive understanding of the social-spatial values of historic streetscape and urban space. As the "Adaptive Streetscape" framework demonstrates, the flood adaptation of urban historic streetscapes needs to build on a thorough understanding of the various resilience, heritage, and economic goals and values associated with historic streetscapes and urban space. However, as today's preservation standards are largely focused on architectural elements that reflect building-level historic significance, the understanding of broader social-spatial values of street and urban space remains relatively preliminary. Based on LPC's historic district designation program and existing streetscape theories made by urban scholars and researchers (see Section 3.1 of Digital Report 02), it is recommended that LPC carry out studies to explore a more comprehensive value assessment procedure for historic urban spaces and streetscapes, which may aid preservationists and planners to balance conflicting values in the neighborhood resilience planning process.
- Explore flood adaptation strategies on medium-scaled urban complexes, such as NYCHA campuses. While some adaptation strategies have been discussed on both the building scale and the neighborhood scale, medium-scaled urban complex — such as NYCHA campuses — may be a type of asset that is easily overlooked by planners and preservationists. Specific campus-scaled design strategies developed for these complexes may bring about more adaptation choices and opportunities as compared to the traditional building-by-building approach of flood retrofitting; furthermore, as 37 NYCHA properties are listed or eligible for listing on the National Register, the flood adaptation of NYCHA campuses (and other complexes) is also of close preservation relevance. It is recommended that NYCHA together with NYSHPO and DCP continue to develop campus-level adaptation strategies, based on existing pilot studies and projects such as the Red Hook Houses Resiliency Project and the recovery & resiliency project at Coney Island Sites.

Agenda 7 | Increased Investment and Enhanced Inter-Agency Coordination.

Key Institutional Actors: FEMA; NYCLPC; NYCDCP; NYSHPO; MOCEJ.

Many interviewees in this study's interview series — regardless of their roles in the flood resilience and historic preservation fields — stressed the crucial importance of financial incentives (e.g. grants, tax credits and flood insurance premium reduction) in taking flood retrofitting projects into reality. While reductions in flood insurance premium serve as a major motivation for property owners to retrofit their buildings, many neighborhood businesses and cultural institutions struck by past flooding events such as Hurricane Sandy wouldn't have survived without grants from government agencies and neighborhood development associations.

However, it is indicated from the interviews that property owners often have great difficulty securing governmental grants, due to limited available funding, prolonged application and review processes, as well as specific threshold regulations (e.g. FEMA's Severe Repetitive Loss (SRL) definition and Cost-Benefit Analysis (CBA) procedure) that may not match on-the-ground situations in certain urban areas. Even if a property owner — especially a historic homeowner — succeeds in securing governmental funding, it would still be difficult and burdensome for them to navigate the multiple regulatory systems and review processes that accompany their retrofitting project. When a higher-level governmental agency (e.g. SHPO) overrides review decisions made by local regulatory agency (e.g. local historic preservation commission), the flood retrofitting project may be further delayed.

Based on these observations, the following actions are recommended:

- FEMA, National Park Service/NYSHPO, and New York City (MOCEJ) shall expand their existing hazard mitigation and climate resilience grant programs to better benefit individual homeowners and property owners. Since not many historic preservation grant opportunities are targeted at or applicable to flood retrofitting projects, retrofitting projects on historic buildings are often either financed by property owners or supported by FEMA grants; therefore, it would also be critical that Federal, State and local-level governments and preservation agencies continue to develop financial incentives and tax credits that support flood resilience undertakings on historic buildings in a more targeted manner.

- NYCLPC, New York SHPO, and FEMA should develop streamlined project review and approval procedures for the flood retrofitting of historic buildings with local or Federal/State designation. Redesigned workflows will reduce the back-and-forths in the application and review procedure; design review sessions with representatives of multiple regulatory entities present may help to expedite project approval.

Agenda 8 | Develop a Consolidated Platform to Share Information on Heritage Resilience with the Public.

Key Institutional Actor: NYCLPC.

Heritage resilience is a complicated and interdisciplinary field in nature. Therefore, homeowners and property owners often need to acquire various pieces of information and regulation (e.g. floodplain designation, design review guidelines, building code, flood zoning, insurance standards, technical guides, and available financial aids) from discrete regulatory entities on Federal, State, and local levels when they intend to carry out flood retrofitting projects on historic structures. Since it's often inconvenient to find or access these scattered information, property owners may likely be unaware of all the design, technical and financial resources available to them. A consolidated platform — similar to the Interactive Map developed as part of this project — that shares these resources with the public is a critical measure that would make heritage resilience policies better understood and flood retrofitting undertakings more feasible.

In New York City's context, it is recommended that LPC develops such an information-sharing platform for historic homeowners and property owners. The platform shall not only list LPC's own policy-making on flood retrofitting, but also include relevant funding, technical standards, and design guidelines on State and Federal levels.

Agenda 9 | Connect Flood Retrofitting with Other Climate Resilience Undertakings.

Key Institutional Actors: NYCDCP; NYCLPC.

Flood retrofitting is a form of mostly building-scaled flood adaptation undertaking that falls under the matrix of climate resilience measures. As several existing heritage resilience guidelines (e.g. Boston's *Resilient, Historic Buildings Design Guide* and Miami-Dade County's *Resilient Rehab*) have suggested, flood retrofitting interventions can actually be combined with other climate adaptation (e.g. rain garden or permeable surface) undertakings as well as climate mitigation (e.g. green roofs and energy retrofitting) measures, for additional efficiency and potentially a wider array of funding opportunities.

In New York City's context, flood retrofitting can be situated under a larger framework of climate resilience for both general existing buildings and designated historic buildings. It is recommended that the DCP launch an overarching initiative to connect its recently created *Zoning for Coastal Flood Resilience* with the *Zoning for Zero Carbon* and other similar resilience zonings currently under development; LPC may continue to develop a wider array of design and technical guidance for various resilience and sustainability undertakings, based on the brief guides it has published on flood retrofitting and passive house.

05

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Living Above the Street
Stewarding New York City's Historic Built Environment Towards Flood Resilience

An Onera Prize in Historic Preservation Project

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Living Above the Street

Stewarding New York City's Historic Built Environment Towards Flood Resilience

FEMA NFIP FIRM PFIRM 1% ANNUAL CHANCE FLOODPLAIN SFHA BFE DFE A
ZONE V ZONE COASTAL A ZONE STRUCTURAL ELEVATION NON-STRUCTURAL
ELEVATION WET-FLOODPROOFING DRY-FLOODPROOFING FLOOD VENT NYCLPC
NYCDCP NYCDOB NYSHPO FEMA NFIP FIRM PFIRM 1% ANNUAL CHANCE
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DIGITAL REPORT 07

Terms & Full Bibliography

Supplementing Digital Reports 01-06, this report provides a concise glossary of terms and acronyms used in this project, as well as a compiled full bibliography.

Contents

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About

This report is part of the independent research project "Living Above the Street: Stewarding New York City's Historic Built Environment Towards Flood Resilience," which is supported by Onera Foundation under 2022 Onera Prize for Historic Preservation.

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Further Readings

To view and download the whole series of policy & design reports, please visit:
https://www.livingabovethestreet.nyc/reports.

This Onera Prize research project is developed upon the author's M.S. Historic Preservation thesis:
Wang, Ziming. 2022. "Living Above the Street: Flood Retrofitting and Adaptive Streetscape of New York City's Historic Districts." M.S. Historic Preservation Thesis, Columbia University.
https://doi.org/10.7916/fn43-vb19.

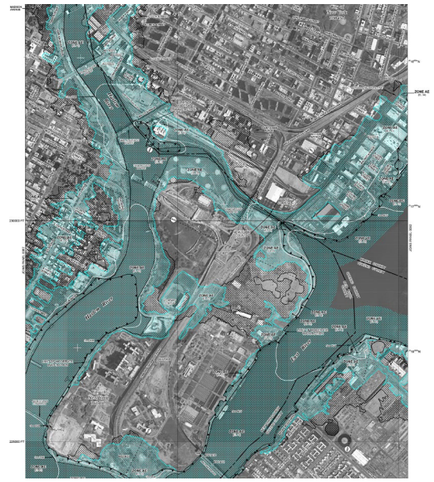
01

Terms & Acronyms

The National Flood Insurance Program (NFIP). NFIP is the nationwide flood insurance program administered by the Federal Emergency Management Agency (FEMA). New York City joined NFIP in 1983, allowing homeowners to purchase flood insurance and receive assistance following flood events (NYCDCP 2019b, 2). Currently, properties within the 1% floodplain with Federally-backed mortgages or federal housing subsidies are required to purchase this flood insurance (FEMA 2021, 1-1; NYCDCP 2014, 13).

FEMA's Flood Maps and the Flood Zone/Basic Flood Elevation (BFE) Language.

- **FEMA's Flood Maps: FIRM (Flood Insurance Rate Maps) and PFIRM (Preliminary Flood Insurance Maps).** FIRM is FEMA's official nationwide map showing areas of high flood risk (namely floodplains), Base Flood Elevations and floodways. New York City's FIRM maps are most recently revised in 2007, containing a stock of approximately 35,500 buildings in its 1% floodplain (The City of New York 2013, 23). Meanwhile, PFIRMs are FEMA's updated, non-final flood maps issued in December 2013, encompassing a stock of 71,500 buildings within the designated 1% floodplain (NYCDCP 2014, 16). New York City's current Building Code requires the usage of PFIRMs (NYCDCP 2014, 12). In accordance with the most recent flood map revisions, all illustrations in this project utilize FEMA's PFIRMs as base maps.



A Pane of FEMA's PFIRM Map (2015) Showing 1% / 0.2% Floodplain and Local BFEs.
Source: FEMA Map Service Center.

- **1% Annual Chance Floodplain, or Special Flood Hazard Area (SFHA).** Areas designated on the flood map that have a 1% chance, or greater, risk of flooding, in any given year. Also called the 100-year floodplain. FEMA's flood maps designate not only the 1% annual chance floodplain, but also the 0.2% annual chance (or 500-year) floodplain.
- **Base Flood Elevation (BFE).** The elevation of surface water resulting from a 1% annual chance flood. Local BFEs are given by FEMA's flood maps, and vary with different subdivided zones (A Zone, Coastal A Zone and V Zone, see below) inside the 1% floodplain.
- **A Zone, Coastal A Zone and V Zone.** Among the three subdivided zones in the 1% floodplain, A Zone contains the areas subject to still-water inundation and waves under 1.5 feet; V Zone contains areas subject to high-velocity wave action that can exceed 3 feet in height. Coastal A Zone involves moderate wave actions between those in A Zone

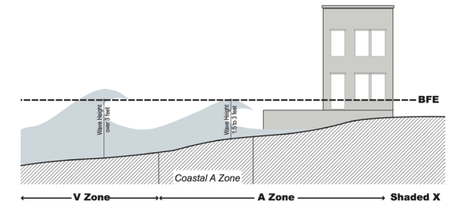


Diagram Showing the Relationship between A Zone, V Zone and BFE. Source: NYCDCP 2013a.

and V Zone (NYCDCP 2014, 16). Different wave heights lead to differences in BFE designation.

Design Flood Elevation (DFE). New York City's Building Code specifies a Design Flood Elevation, up to which floodplain buildings must gradually be elevated or floodproofed. DFE is defined by local BFE plus an additional freeboard height of typically 1 or 2 ft. Local freeboard heights vary with different building types and different floodplain designations; refer to Table 2-1 in the city's Building Code Appendix G (NYCDOB 2014) for details. For simplified calculation, in this project, DFE is always estimated as local BFE plus 1 ft.

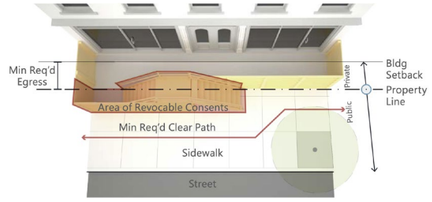
Structural Elevation and Non-Structural Elevation. Structural elevation refers to the practice of physically lifting a building above flood elevation onto a new or extended foundation, as commonly executed on detached residential houses (FEMA 2014, 5-1); non-structural elevation, on the other hand, involves the "relocation of active uses to above the DFE rather than physically lifting the superstructure" (NYCDCP 2016b, 34). In other words, under non-structural elevation, the interior program adapts while the original exterior structure remains largely unchanged. Non-structural elevation is often achieved by placing a new first floor plate above the established flood risk level, as well as constructing rooftop additions (see for example, NPS 2021, 100; NYCDCP 2014, 66-67).[1]

Instances of Structural Elevation and Non-Structural Elevation.
Source: NYCDCP 2014, 43; 73.

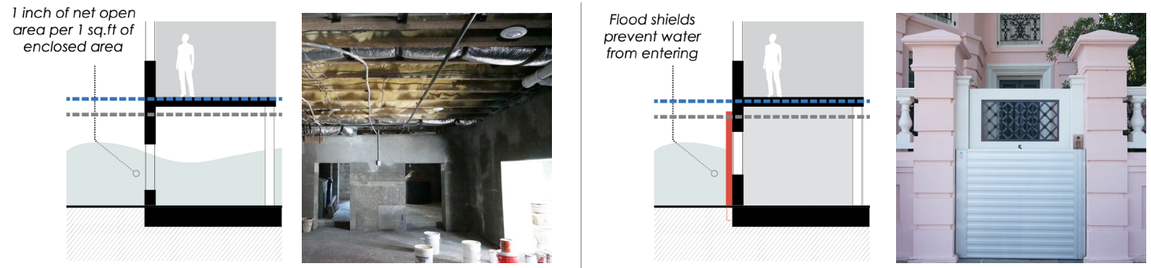
Wet Floodproofing and Dry Floodproofing. Dry floodproofing is a floodproofing method designed to keep water out of a building or its parameters, requiring the establishment of a watertight seal below the flood risk level, as well as the temporal or permanent sealing of all openings (windows, doors, etc.) below flood level (NPS 2021, 46). The sealing of openings is typically achieved by installing deployable flood shields. Meanwhile, wet floodproofing allows flood water to enter a building during flood events and drain out as it recedes, which is achieved by the placement of vents and openings below flood level (NPS 2021, 56).

Flood Vents. Openings placed in a building's facade that allow for the entry and exit of flood water, thus allowing for the equalization of hydrostatic pressures inside and outside the structure during flood events (Dunlap 2017).

Deployable Flood Shields. Metal panels that may be stacked together to form a watertight seal for window and door openings below flood level. Permanent stanchions, tracks or anchors need to be installed around wall openings in advance, so that flood shields may be fixed onto them before anticipated flood events. Since these shields will likely block ground-flood egress in flood events, in high-density urban settings, a dry-floodproofing enclosure that incorporates a set of deployable stairs which allows building occupants to cross over the flood barriers shall be placed instead (see NYCDCP 2014, 90-93).



A Dry-Floodproofing Enclosure with Temporary Egress.
Source: NYCDCP 2014, 92.



Wet Floodproofing

Dry Floodproofing

Wet-Floodproofing vs. Dry-Floodproofing.
Source: NYCDCP 2016b, 74 (Diagrams); Photographs taken by the author during Keeping History Above Water 2021 Conference (Instances).

Flood Adaptation and Flood Retrofitting. These two words may have been used somewhat interchangeably in existing reports and guidelines. In this project, "flood adaptation" refers to the general in-situ adaptation strategies and treatments on all possible scales; while "flood retrofitting" more specifically refers to retrofitting interventions on individual buildings.

Acronyms of Governmental Entities. For simpler expression, this project uses the acronym "NYCLPC" for New York City Landmarks Preservation Commission, "NYCDCP" for Department of City Planning of New York City, "NYCDOB" for New York City Department of Buildings, "NYSHPO" for New York State Historic Preservation Office.

1 NPS's *Guidelines on Flood Adaptation* (2021) calls the Non-Structural Elevation method "Elevating the Interior Structure."

02

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