



**BUILDING INNOVATION:
TRANSFORMING
NYC'S BUILDINGS
TOWARDS
CLIMATE RESILIENCE**

NYC'S BUILDINGS MUST TRANSFORM OVER THE NEXT 30 YEARS

- >>> Consume less energy
- >>> Emit less greenhouse gas
- >>> Resilient to a changing climate

WE NEED YOU!



TO HELP RETROFIT BUILDINGS!



Climate

**Mayor's Office of
Climate Policy and Programs**

**Mayor's Office of
Resiliency**

**Mayor's Office of
Sustainability**

**+ many city
departments**

Buildings
City Planning
New York City Housing Authority
Citywide Administrative Services
School Construction Authority
Economic Development Corporation
Housing Preservation & Development
Design & Construction
Health & Hospitals

TOPICS FOR TODAY

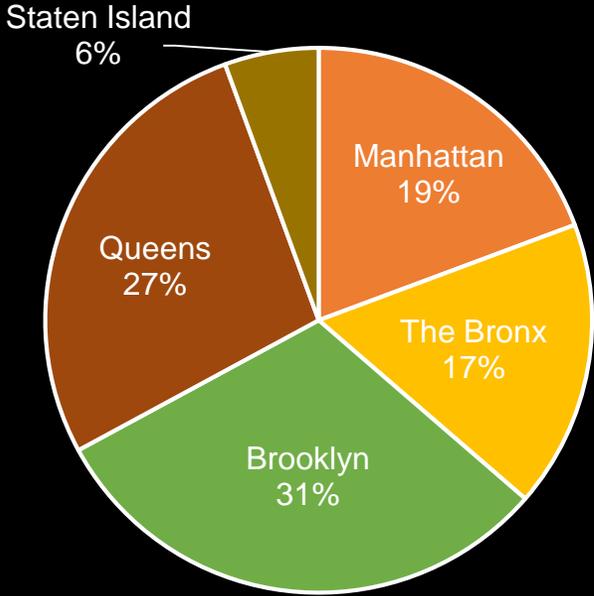
What climate vulnerabilities threaten NYC's buildings?

What is the scale of NYC's building stock transformation?

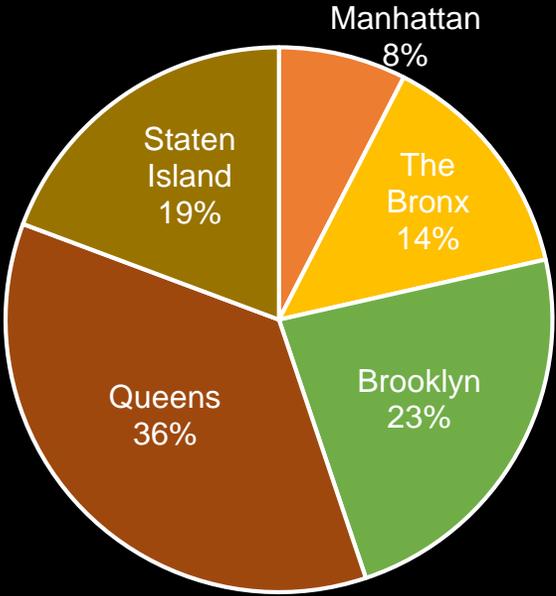
What are the challenges facing climate retrofits in NYC?

What are some promising opportunities to accelerate retrofits?

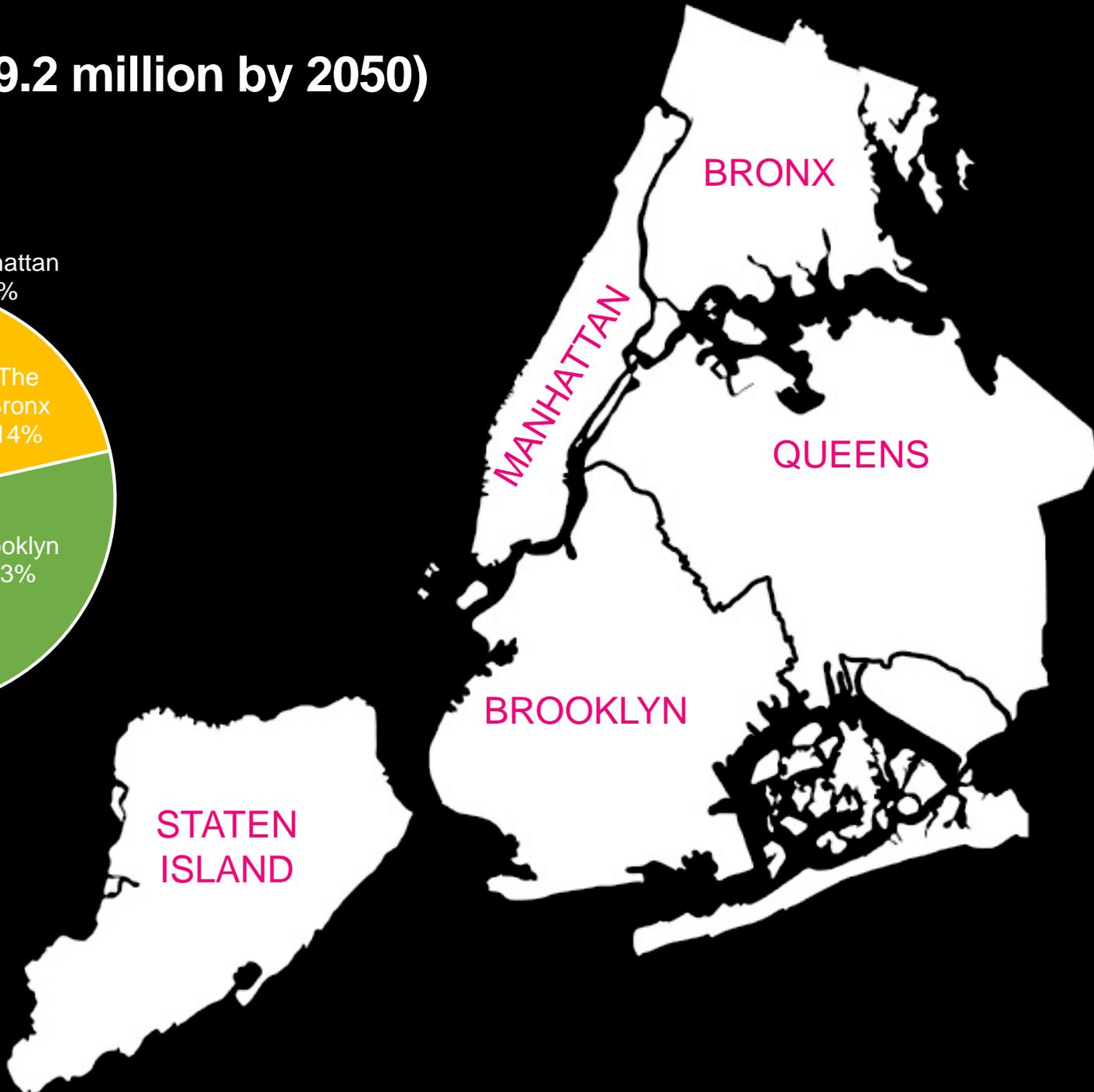
8.6 million residents in 300 sq miles (9.2 million by 2050)



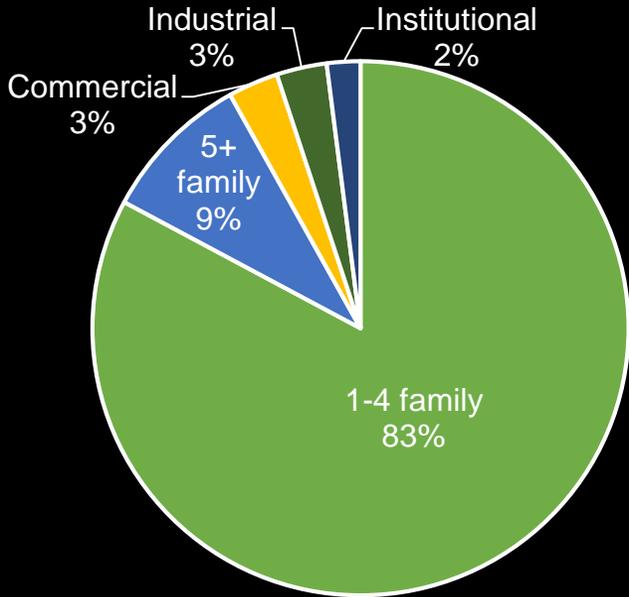
Population distribution



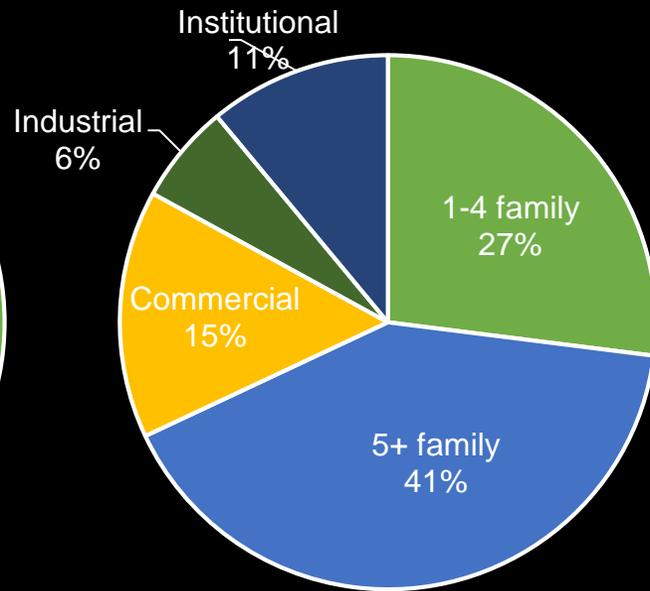
Land area



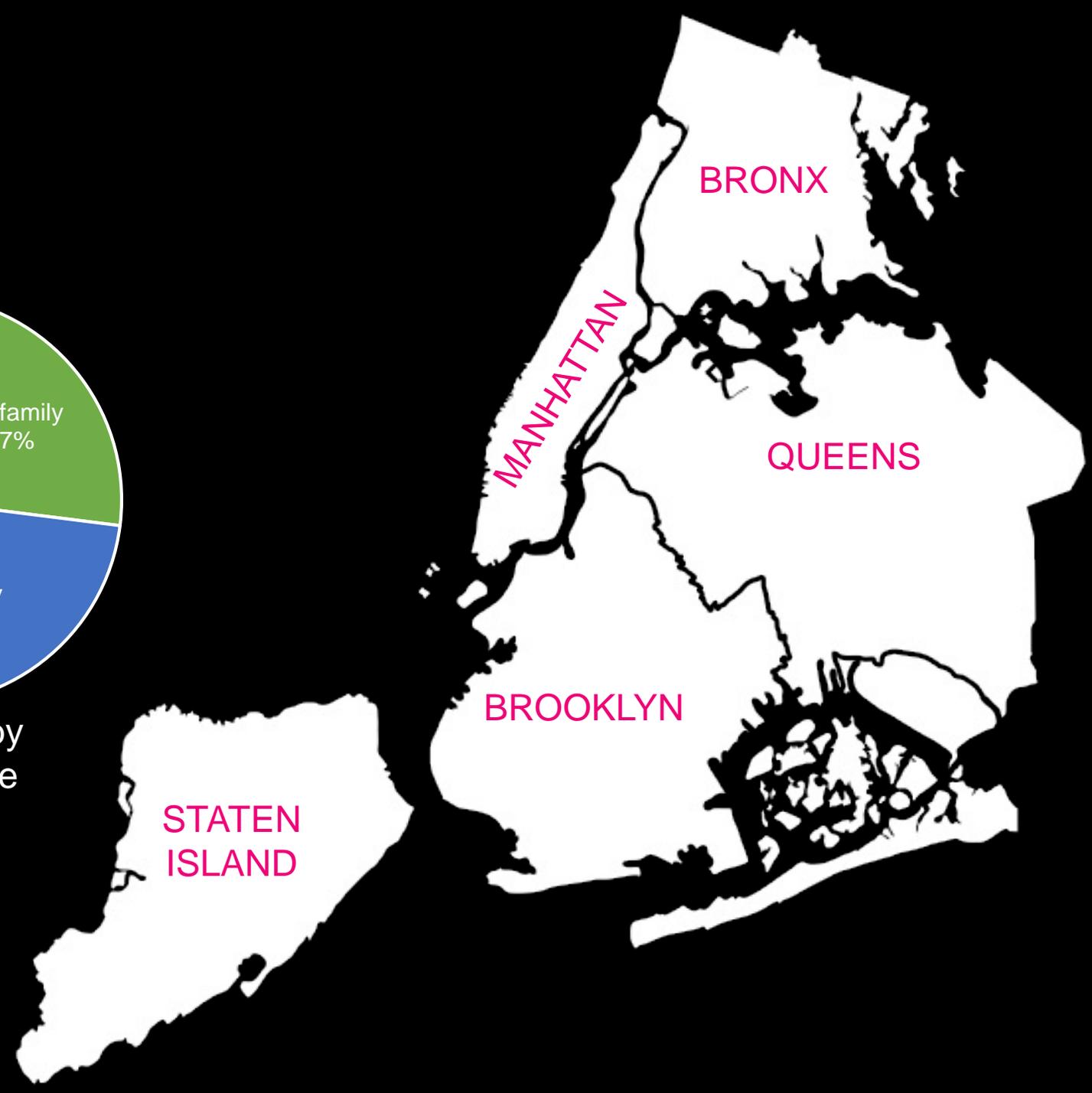
1 million buildings



Building type

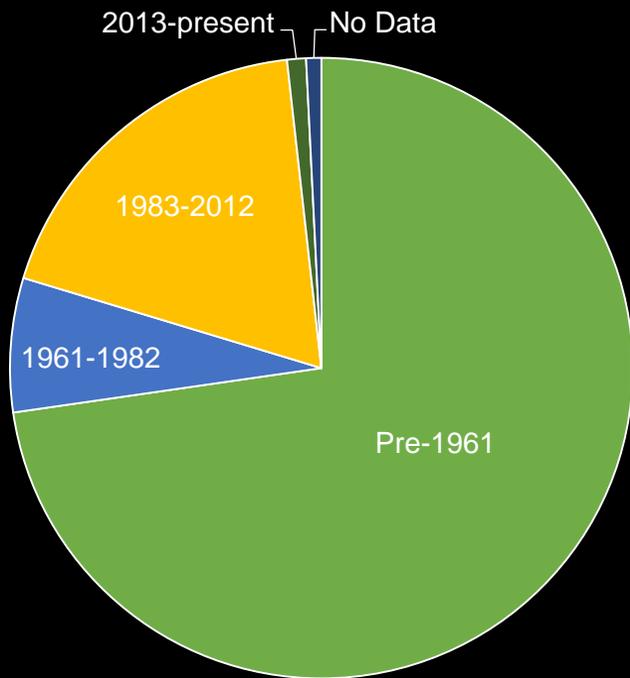


Floor area by building type

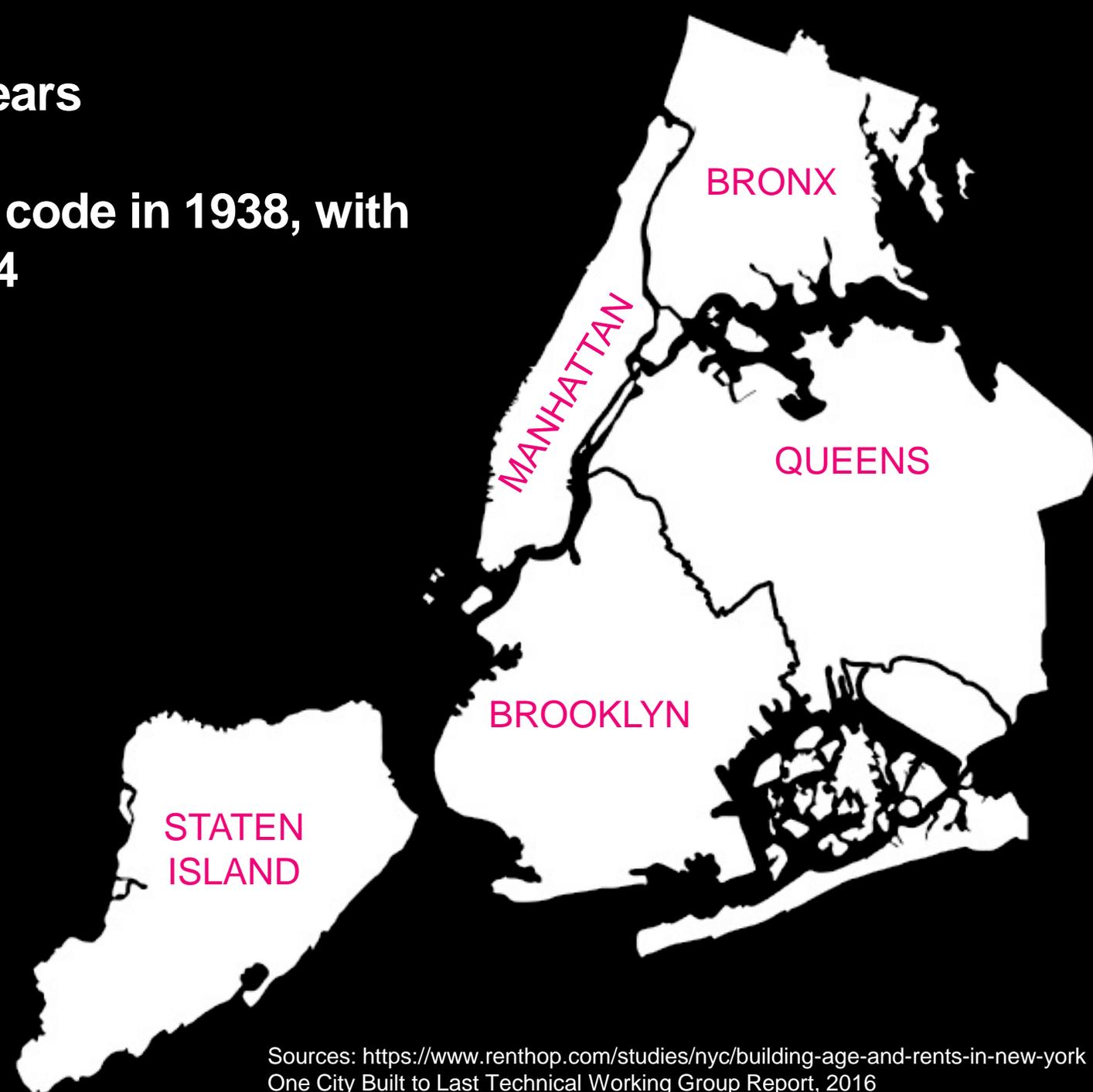


Median building age citywide is 90 years

Many predate the city's first building code in 1938, with major updates in 1968, 2008 and 2014

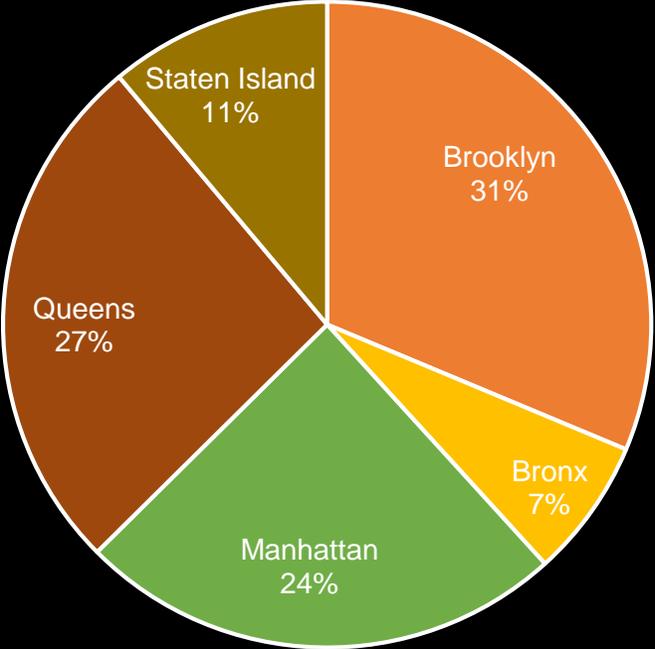


Buildings by year built or significant alteration



82,736 new building & major alteration permits since Oct 2012 (Hurricane Sandy)

= 291 million sq ft of floor area
= 411,700 new dwelling units



Borough share of building permits





520 miles of coastline; more than Miami, Boston, San Francisco, Los Angeles combined



10.29.2012

HURRICANE SANDY CAUSED UNPRECEDENTED DAMAGE...

51 sq mi flooded (17% of NYC)

44 lives lost

\$19 billion in damage and lost
economic activity

2 million New Yorkers left without
power for several weeks



...AND EXPOSED A BROADER VULNERABILITY

Area flooded was **1.5x** the 100-year floodplain defined on flood insurance maps.

30,000 damaged single-family homes
25,000 damaged two-family homes
5,000 damaged 3-5 family homes

-  100-year floodplain in FEMA 2007 Flood Insurance Rate Maps
-  Sandy Inundation Area beyond 100-year floodplain





THE INTENSITY AND IMPACTS OF MAJOR STORMS WILL INCREASE

By the 2050s, a Sandy-like storm could cause \$90 billion in damage and economic loss – nearly five times Sandy's impact.

COASTAL STORMS ARE NOT THE ONLY CLIMATE HAZARD WE MUST PREPARE FOR



Max wind speed
increase from 80mph to
110mph
by 2050s



Up to
30 in
sea level rise
by 2050s



4-11%
increase in avg.
precipitation
by 2050s



**Birmingham,
Alabama-type**
heat & humidity
by 2050s

**COASTAL STORMS:
SURGE + WIND**

**SEA LEVEL RISE:
TIDAL FLOODING**

**CLOUDBURST STORMS:
INLAND FLOODING**

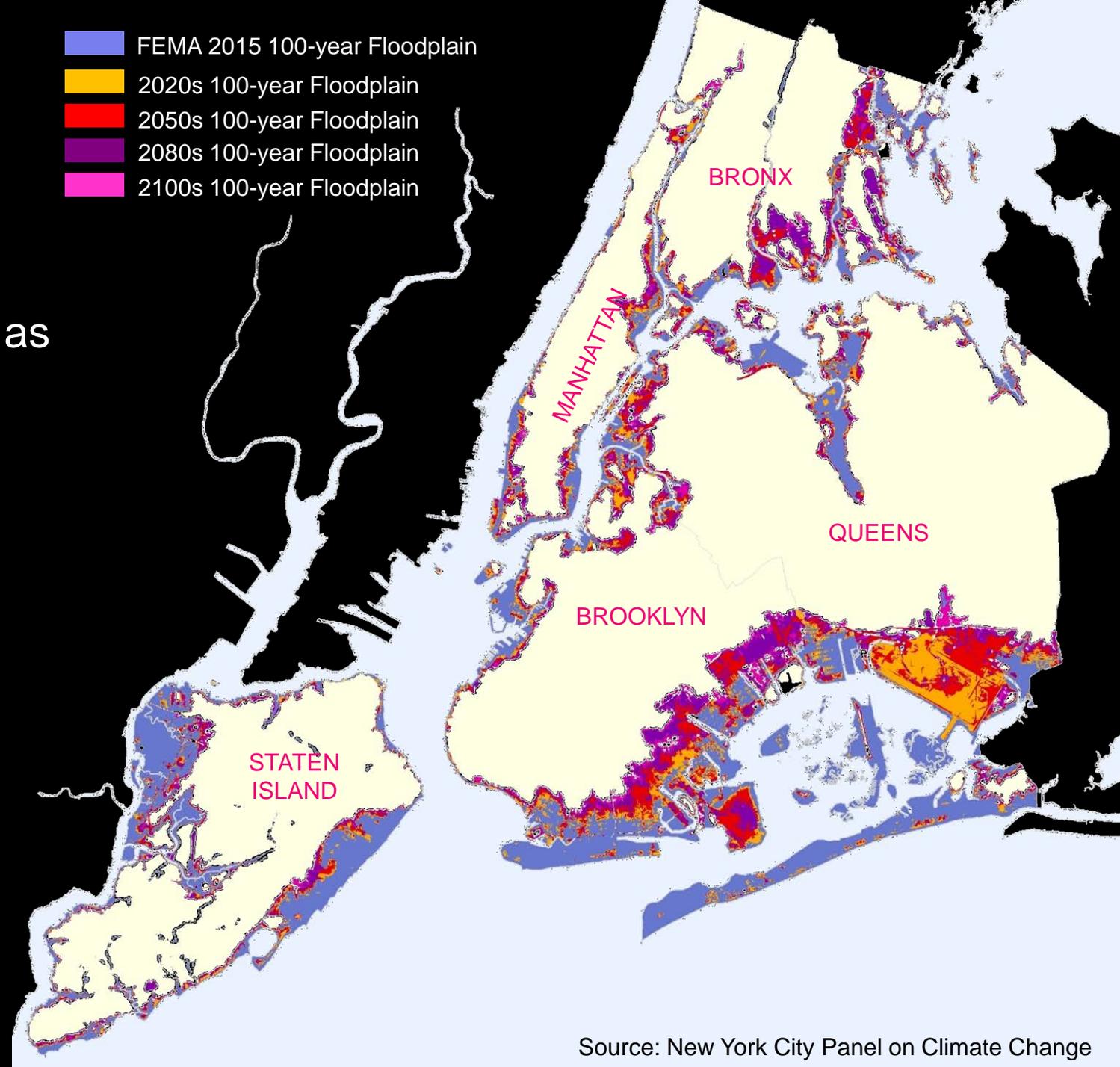
**EXTREME TEMPS:
HEAT WAVES**

VULNERABILITY INCREASES AS SEA LEVELS RISE

400,000 New Yorkers live in the floodplain, about the same population as New Orleans or Tampa.

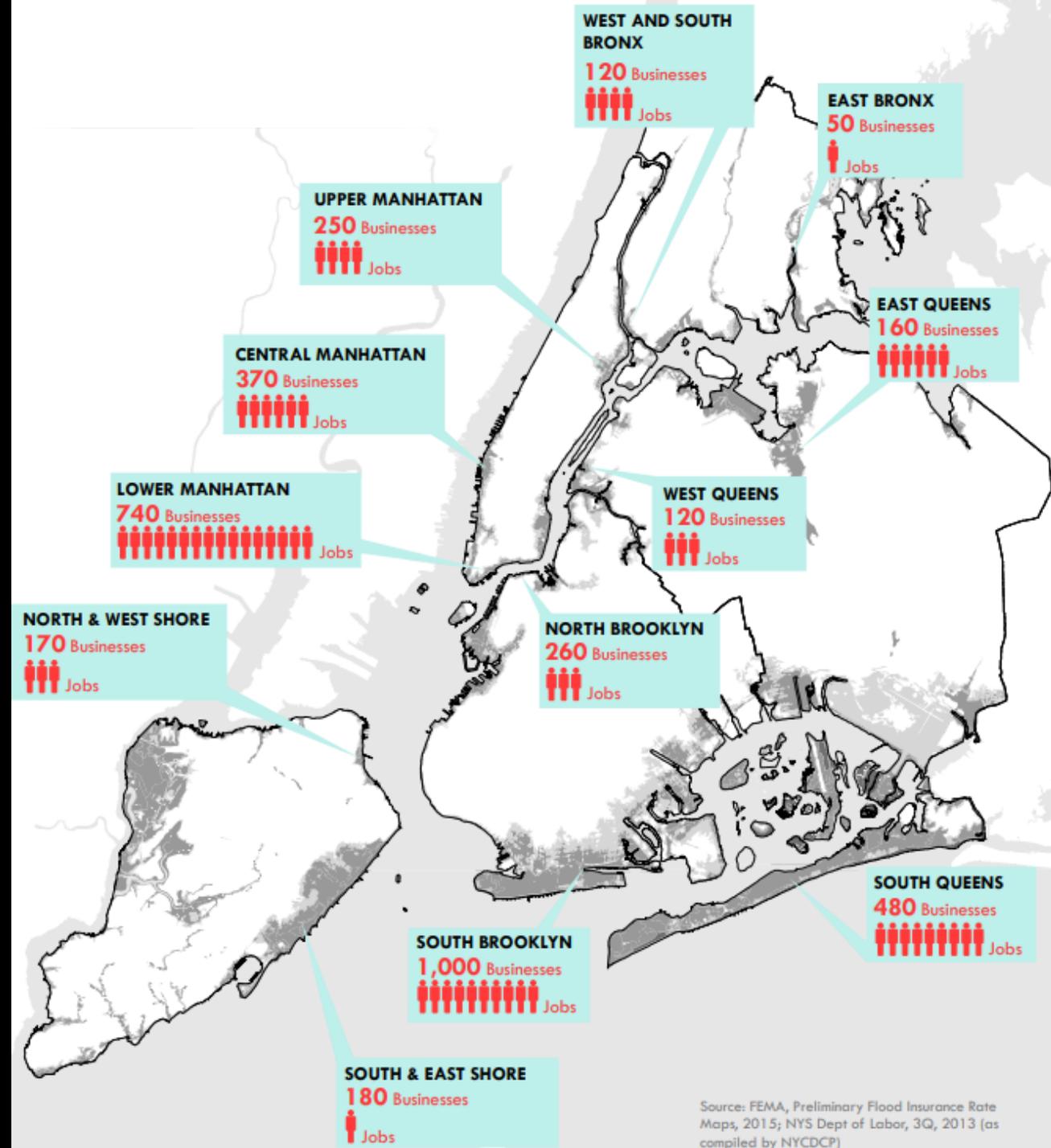
2,400 buildings built in the current floodplain since Oct 2012

- FEMA 2015 100-year Floodplain
- 2020s 100-year Floodplain
- 2050s 100-year Floodplain
- 2080s 100-year Floodplain
- 2100s 100-year Floodplain

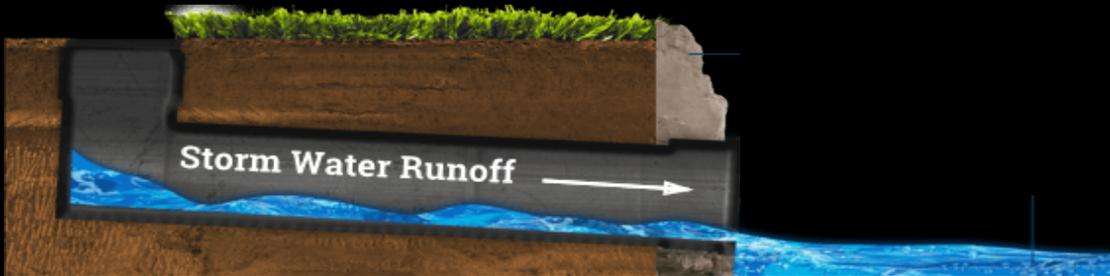


COMMERICAL AND INDUSTRIAL USES ARE ALSO VULNERABLE

3,900 retail businesses, employing 67,000 people, are in the floodplain.



BLUE-SKY TIDAL FLOODING OCCURRING IN SOME COASTAL NEIGHBORHOODS ALREADY



PART OF THE CITY'S COASTLINE WILL EXPERIENCE DAILY FLOODS BY 2050

Tidal flooding impacts streets and basements, weakens wood-frame structures, interferes with building systems, and impacts the habitability of coastal neighborhoods.

	Miles of coastline at risk
Bronx	6.2
Brooklyn	11.5
Manhattan	1.3
Queens	21.4
Staten Island	2.6
Total	43

520 miles total coastline

- High tide 2020
- High tide 2050
- At risk shorelines



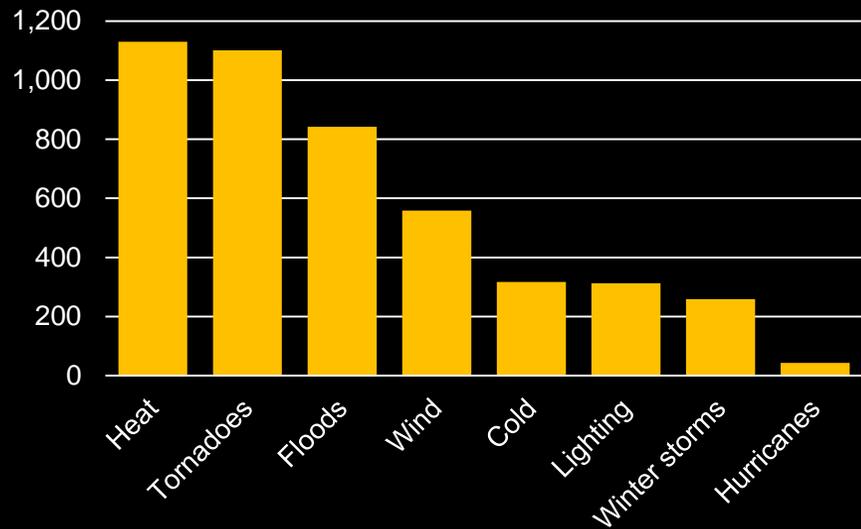
EXTREME RAIN RISK IS A YEAR-ROUND THREAT IN NYC

Cloudbursts can overload storm drainage systems, causing inland flooding.



Islip, NY 2014 after two hours of intense rain

HIGH TEMPERATURES POSE THE GREATEST IMMEDIATE RISK TO LIFE AND SAFETY



U.S. fatalities by hazard, 2006-2015

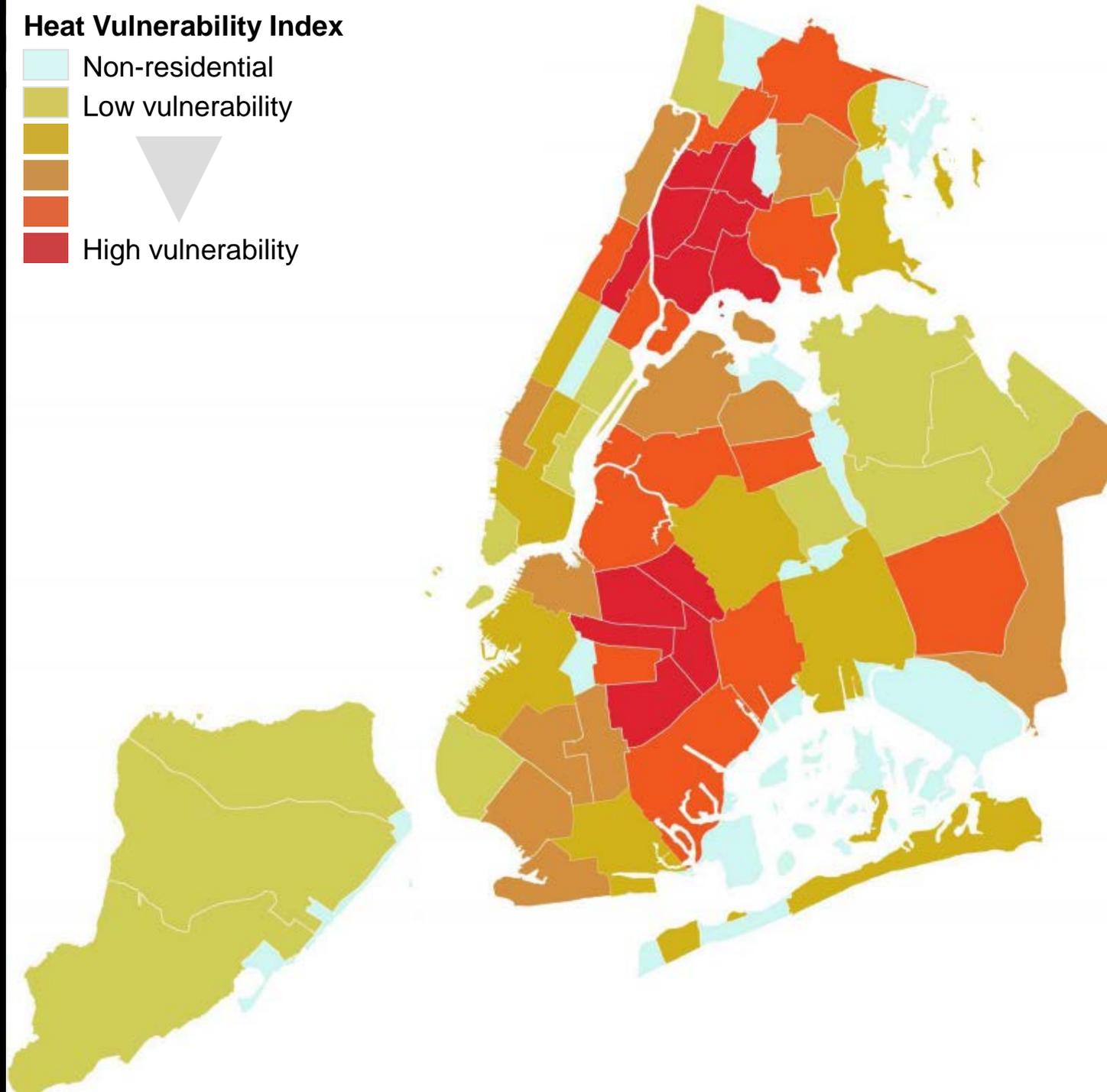
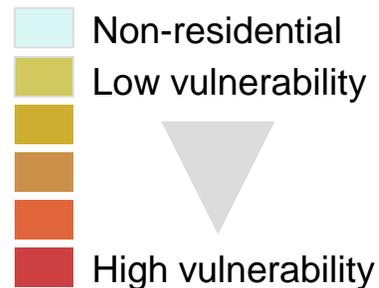




NEIGHBORHOOD AND BUILDING CHARACTERISTICS EXACERBATE HEAT WAVES

Physical environment and demographics overlap in disadvantaged neighborhoods

Heat Vulnerability Index

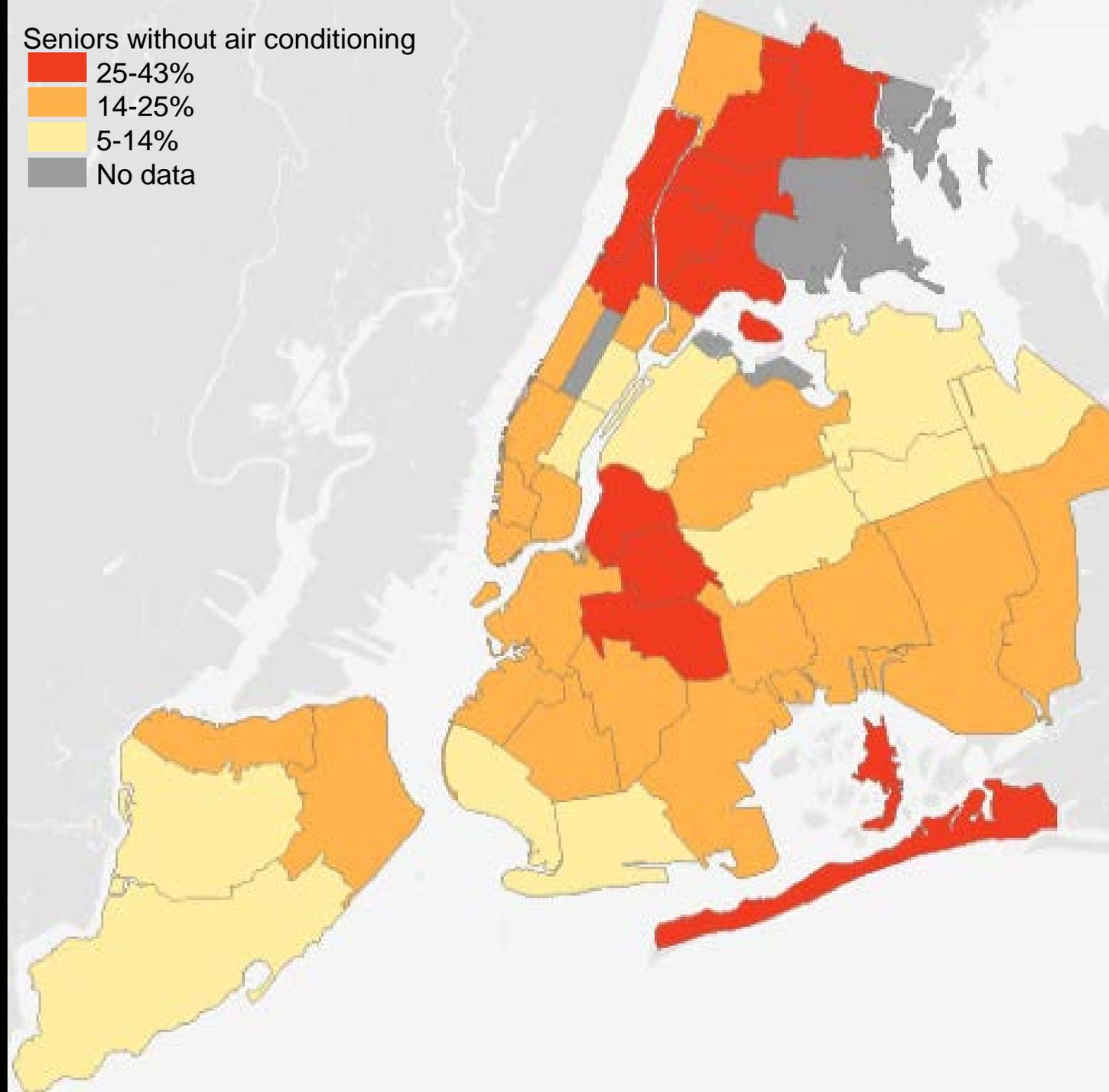
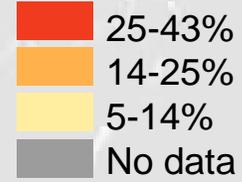


HEAT WAVES ARE RISKIEST FOR THE ELDERLY, POOR AND SICK

Indoor temperatures can be 20°F hotter than outdoor temperatures in the absence of air conditioning.

85% of heat-related deaths occur after exposure to heat inside the home.

Seniors without air conditioning



GROUNDWATER TABLE IS RISING WITH SEA LEVEL

Dynamics of groundwater table rise on utilities and buildings is under study



■ 2100 Groundwater Impacts



**CLIMATE SCIENCE AND CLIMATE
ADAPTATION ARE DEVELOPING
FIELDS, BUT WE CAN SAY WITH
CONFIDENCE:**

**NEW YORKERS ARE ALREADY EXPERIENCING DISRUPTION
AND HAZARDOUS CONDITIONS TODAY**

**THE POTENTIAL FOR DAMAGE, DISPLACEMENT, AND LOSS
OF LIFE IN COMING DECADES IS SIGNIFICANT**

OUR WORK IS URGENT, IMMEDIATE, AND LONG-TERM

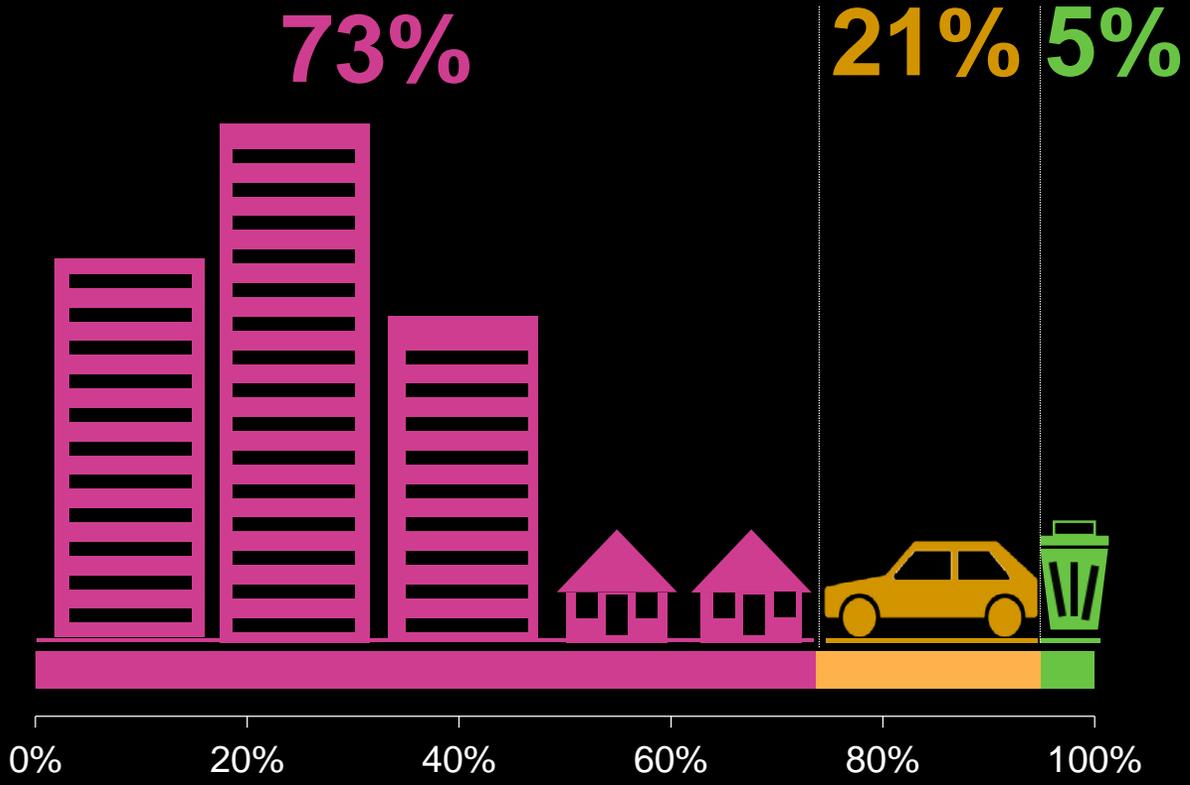
**CLIMATE UNCERTAINTY MEANS WE MUST CONTINUALLY
PLAN, ACT, EVALUATE AND ADJUST**



**NYC'S EXISTING BUILDINGS MUST
TRANSFORM TO BECOME
CLIMATE CHANGE RESILIENT**



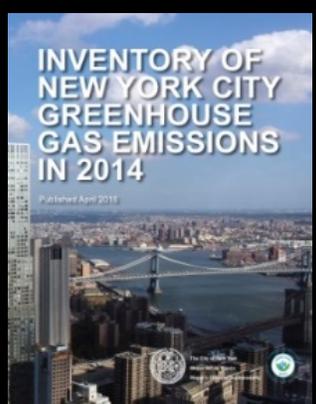
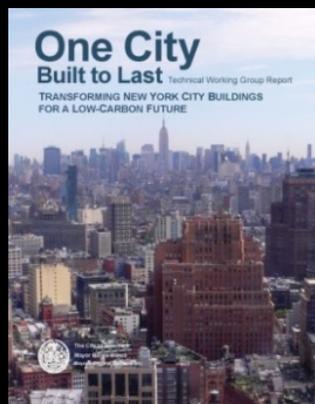
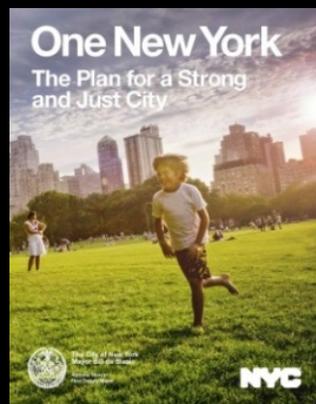
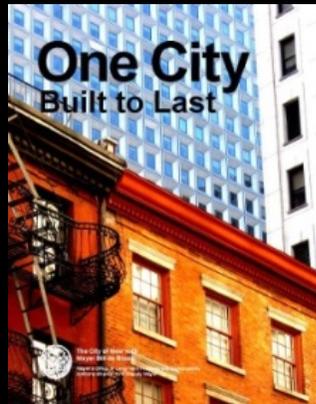
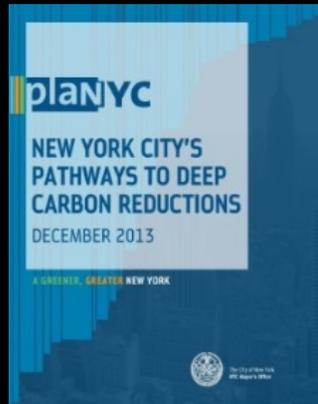
NYC'S GREENHOUSE GAS EMISSIONS



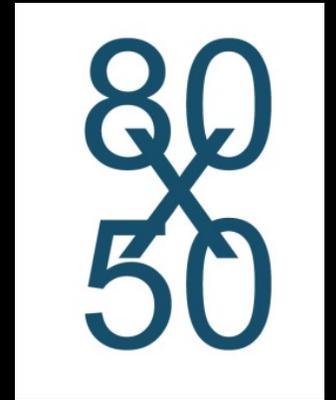
Fossil fuel combustion in buildings produces greenhouse gas and must be reduced

Source: One City Built to Last, 2016

NYC'S STRATEGY FOR REDUCING GREENHOUSE GAS EMISSIONS IN BUILDINGS



2016
Integrated 80x50 Action
Plan



**80% carbon
reduction
by 2050**

2014

PlaNyC: NYC's
Pathways to Deep
Carbon Reductions

2014

One City Built
to Last

2015

One New York: The Plan
for a Strong and Just City

2016

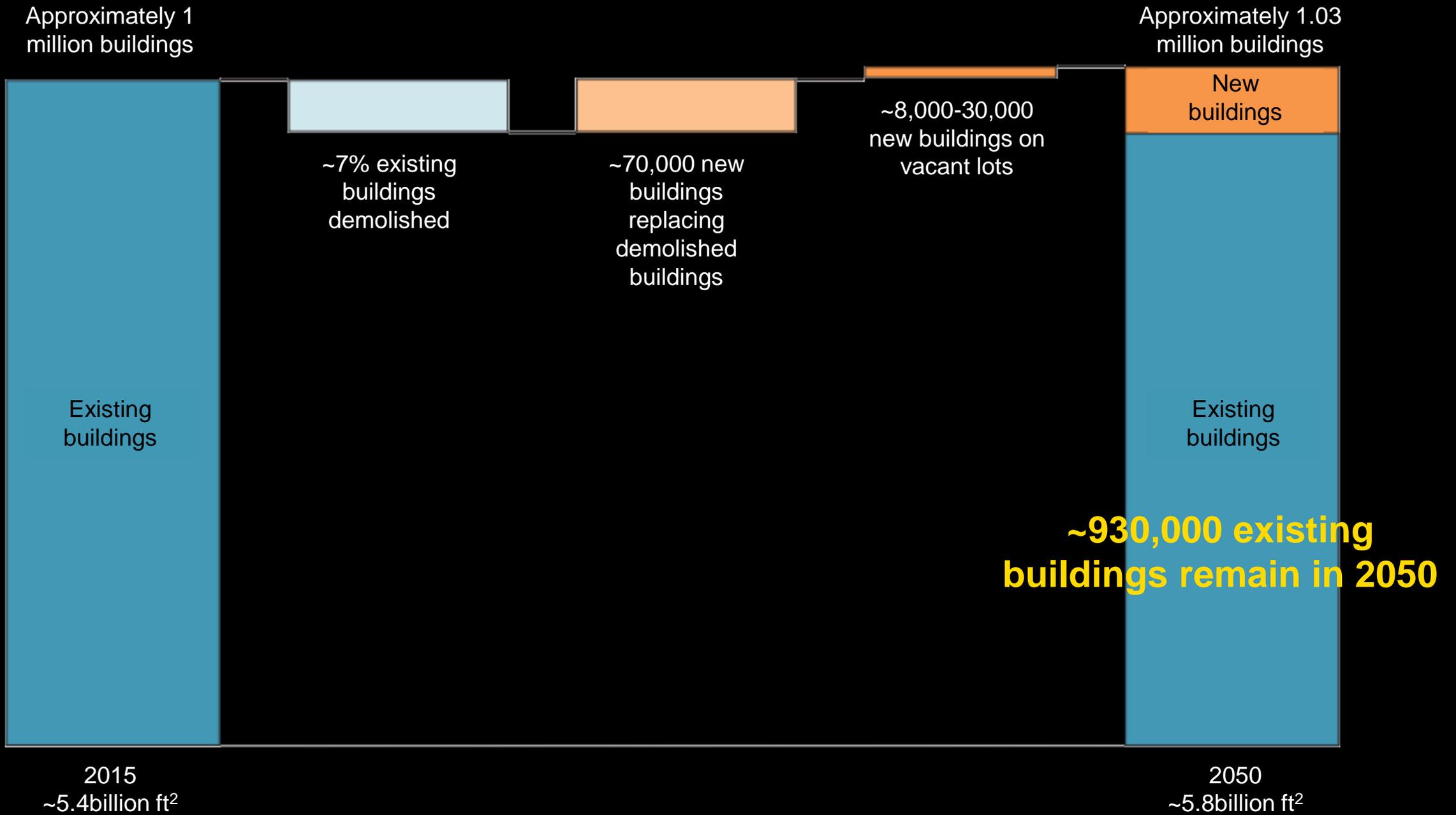
OneNYC 2016
Progress Report

2016

One City: Built to Last
Technical Working
Group Report

2016

2014 Inventory of
NYC GHG emissions



URBAN RESILIENCE

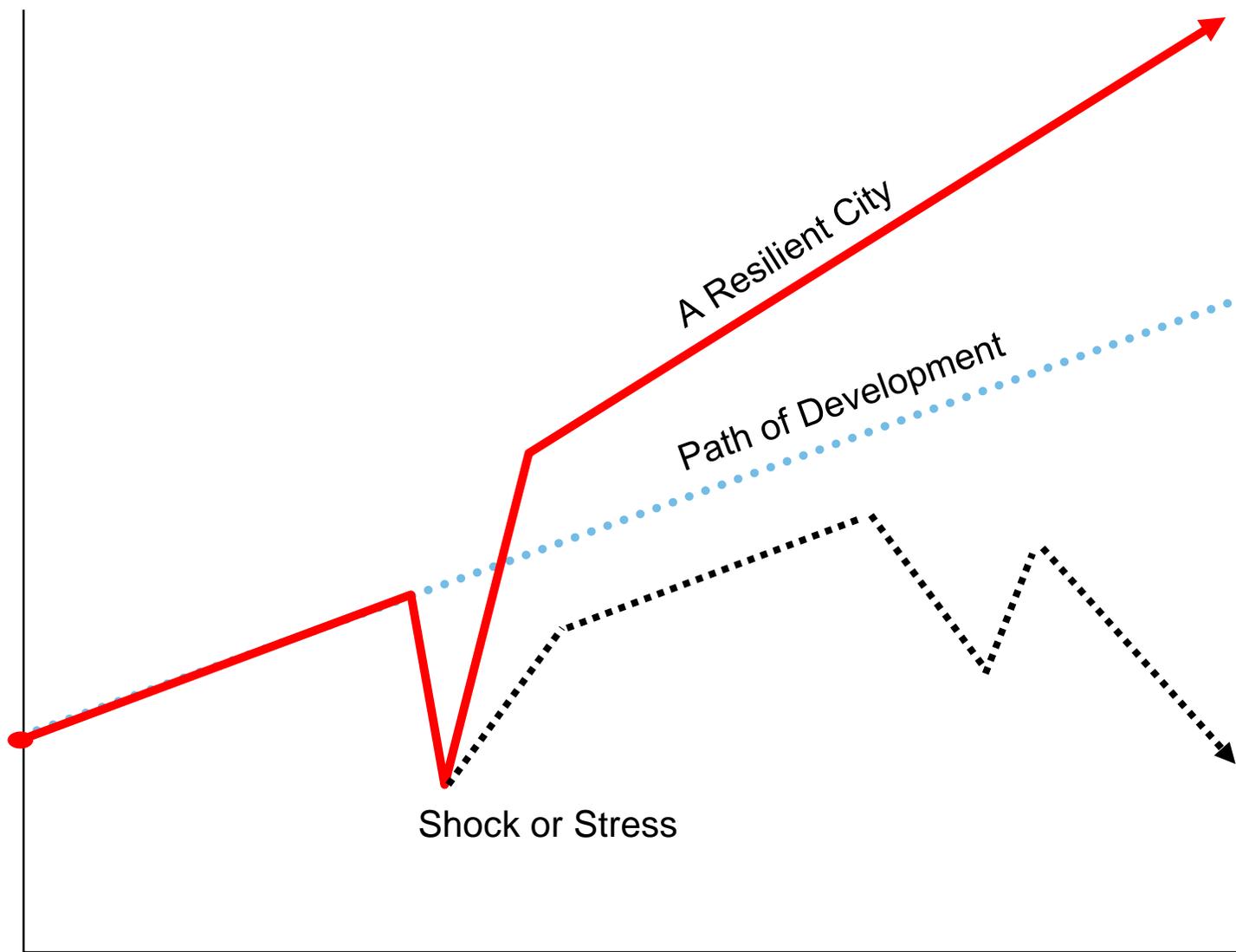
100

RESILIENT CITIES

The capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of **chronic stresses** and **acute shocks** they experience.

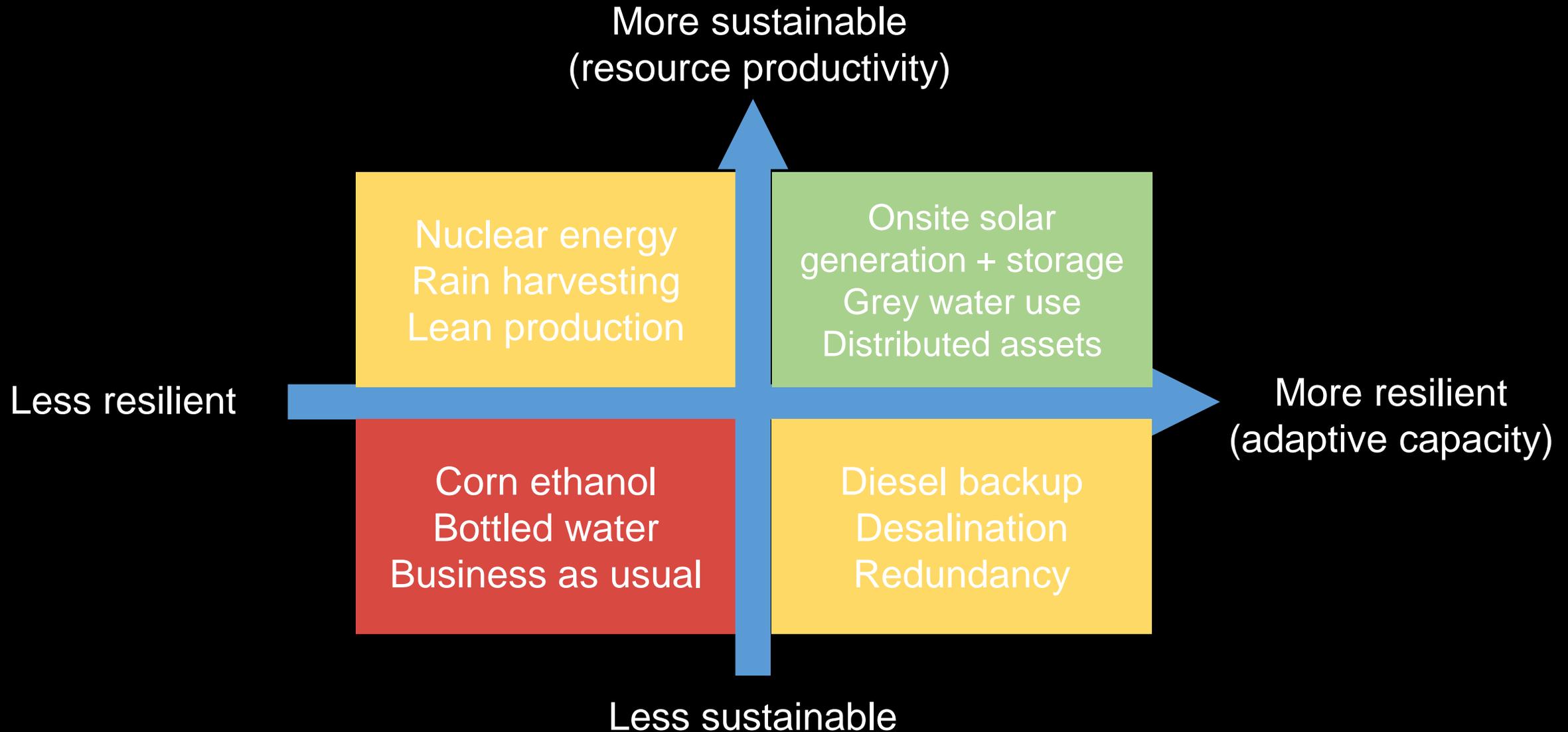


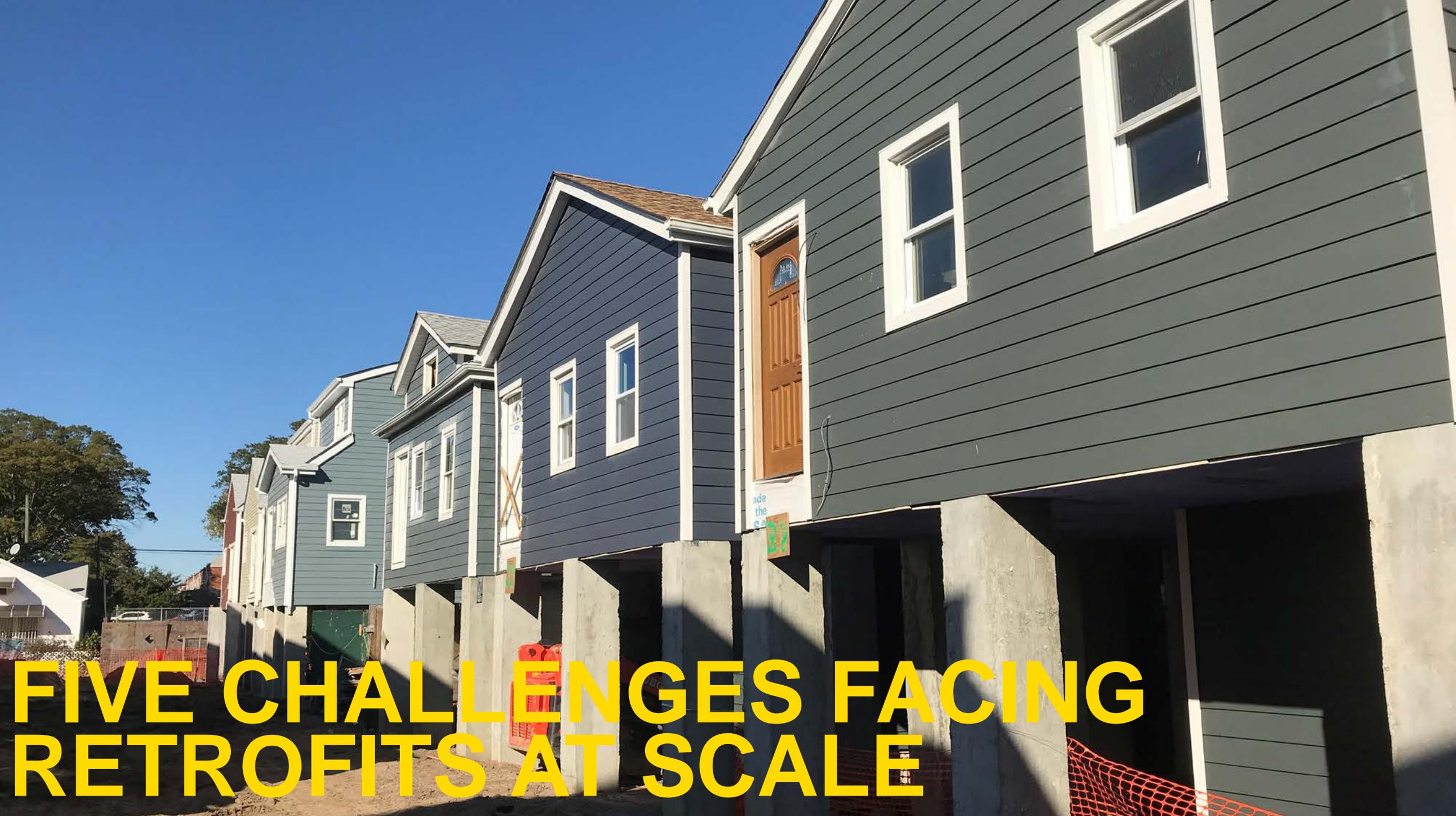
Shocks and stresses can bring opportunities for cities to evolve, and in some circumstances, transform.





RESILIENCE & SUSTAINABILITY



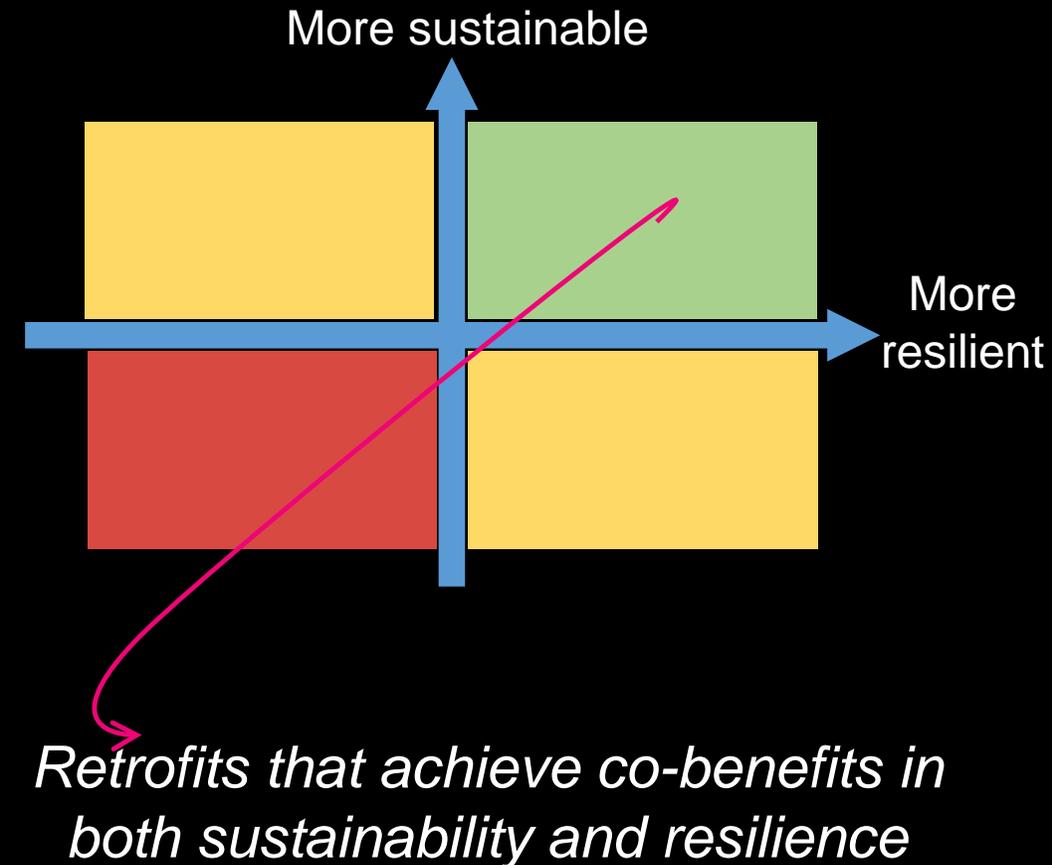


FIVE CHALLENGES FACING RETROFITS AT SCALE

1. MOST CLIMATE RESILIENCE RETROFITS LACK IMMEDIATE FINANCIAL INCENTIVE

Investments in climate resilience can facilitate **avoided cost** savings and several co-benefits, however these can be difficult to quantify and usually don't have immediate payoff (like investments in energy efficiency).

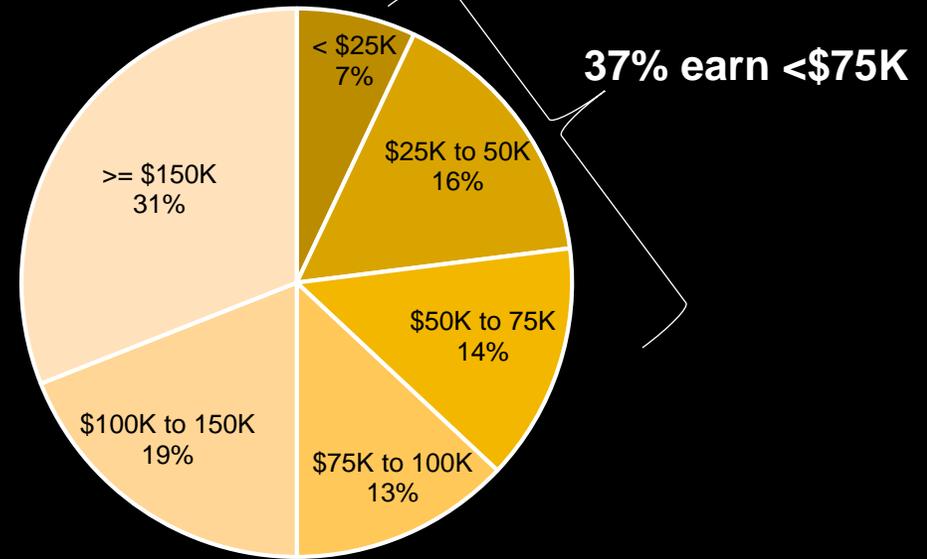
NIBS reports that society saves \$6 for every \$1 spent through federally-sponsored climate resilience retrofit programs.



2. MANY OWNER-OCCUPIED HOUSEHOLDS IN THE FLOODPLAIN FACE FINANCIAL BURDENS

Limited ability to undertake major retrofits or pay annual flood insurance premiums.

Urban heat increases air conditioner use and exacerbates energy costs.



Annual median income for households in owner-occupied homes in the floodplain



Median monthly utility costs per household



3. INSUFFICIENT AWARENESS OF CLIMATE CHANGE HAZARDS AND RISKS

BUILDING DESIGNERS/CONTRACTORS/SUBCONTRACTORS [SUPPLY]

1. **Knowledge gaps** regarding climate risks and implications on building design
2. Few resilience strategies address **multiple climate risks** that will occur during a building's lifecycle
3. Silos prevent **information transfer** regarding climate risks and retrofit strategies

HOMEOWNERS/RENTERS/INSURANCE INDUSTRY [DEMAND]



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HOMEOWNERS/RENTERS/INSURANCE INDUSTRY [DEMAND]

1. Many homeowners remain uninformed about present or future climate change risks and **don't purchase flood insurance**.
2. Insurance premium credits often **don't offset construction costs or reflect avoided losses** enabled by climate resilience retrofits.
3. Property sellers **lack sufficient incentive to disclose climate risks** to buyers.

4. DIFFERENT CLIMATE CHALLENGES REQUIRE DIFFERENT RETROFIT PATHWAYS



Coastal Storms: Surge + Wind



Sea Level Rise: Tidal Flooding



Cloudburst Storms: Inland Flooding



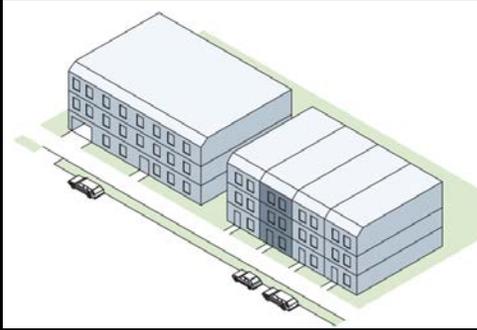
Extreme Temperatures: Heat Waves + Cold Snaps



Groundwater Table Rise: Coastal + Inland Flooding

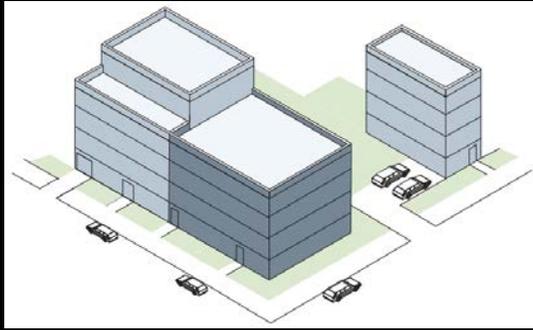
5. DIFFERENT TYPOLOGIES REQUIRE DIFFERENT RETROFIT PATHWAYS

One- to four-family

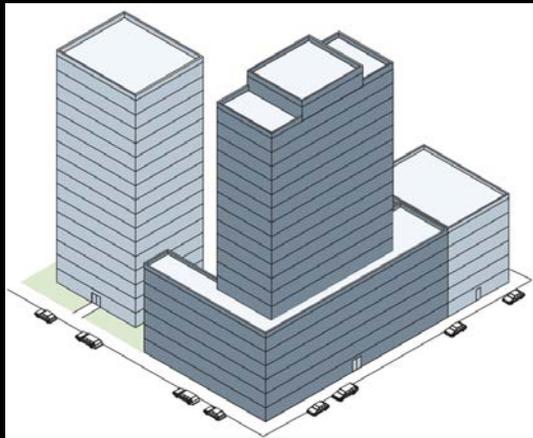


1. One-to-Four Family Home

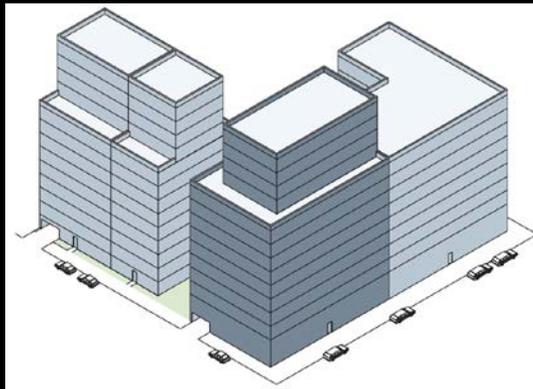
Multifamily, 5+ units



2. Multifamily, Pre-War, ≤ 7 stories

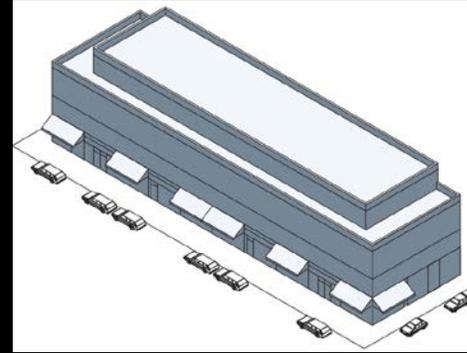


3. Multifamily, Post-war, > 7 stories

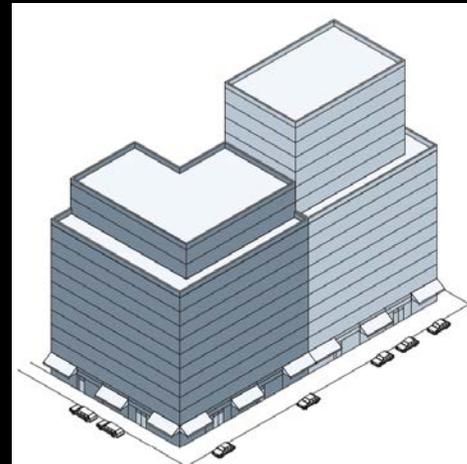


4. Multifamily, Post-war, > 7 stories

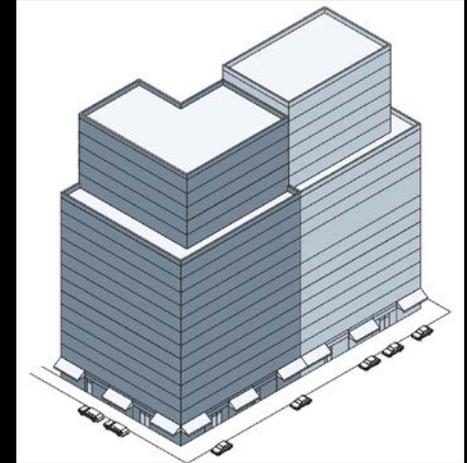
Commercial/mixed use



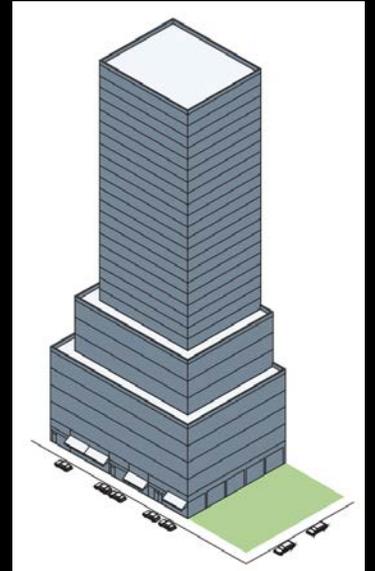
5. Commercial, Pre-War, ≤ 7 stories



6. Commercial, Pre-War, > 7 stories

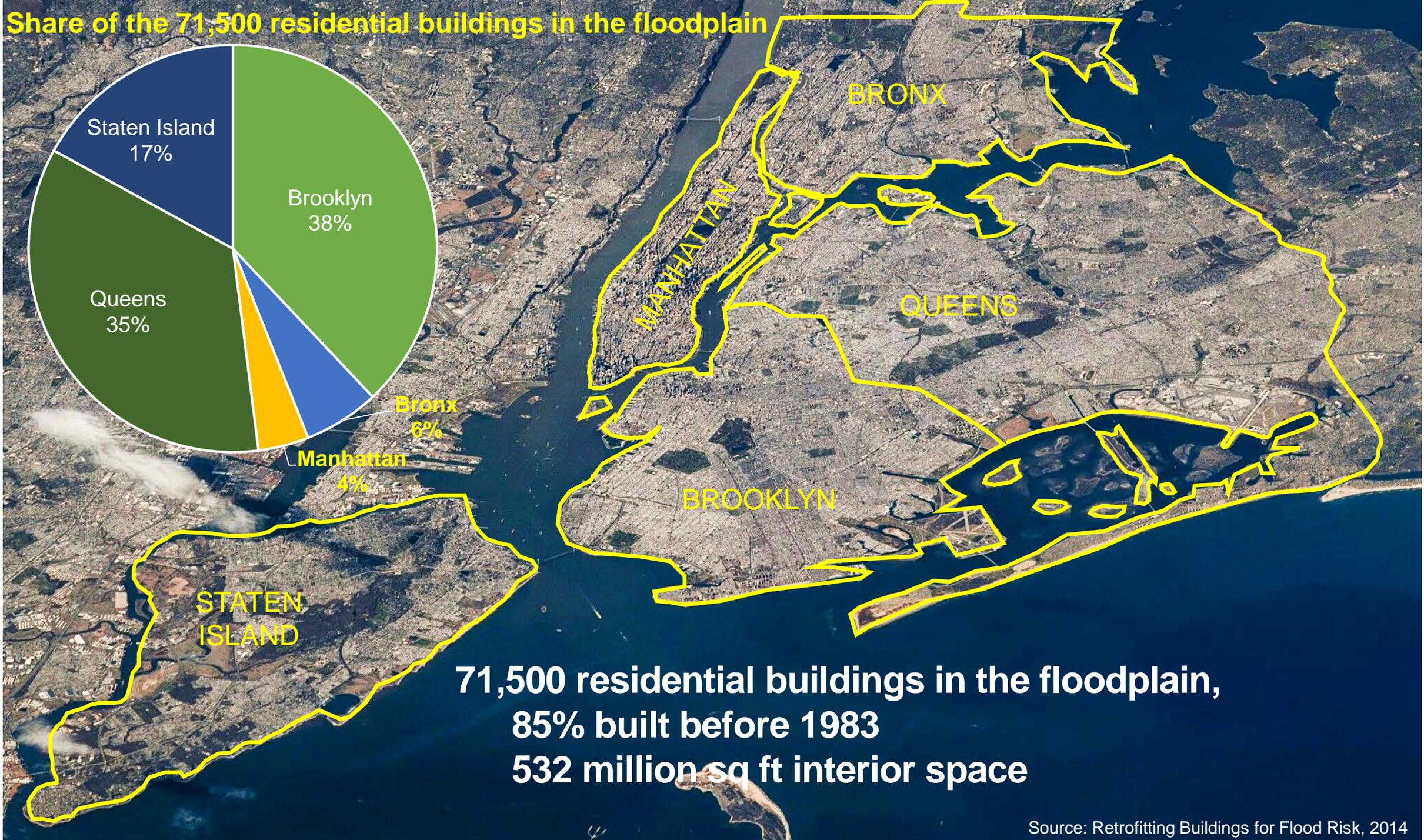
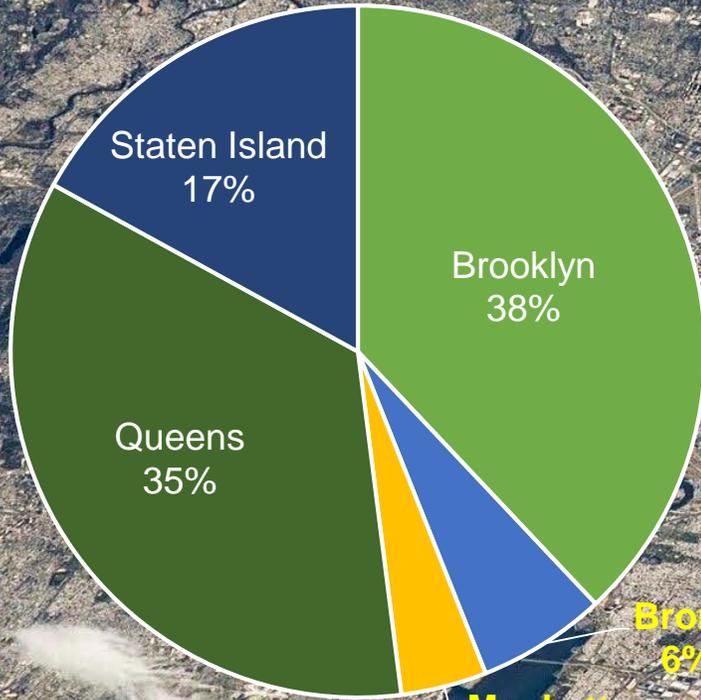


7. Commercial, Post-War, > 7 stories



8. Commercial tower

Share of the 71,500 residential buildings in the floodplain



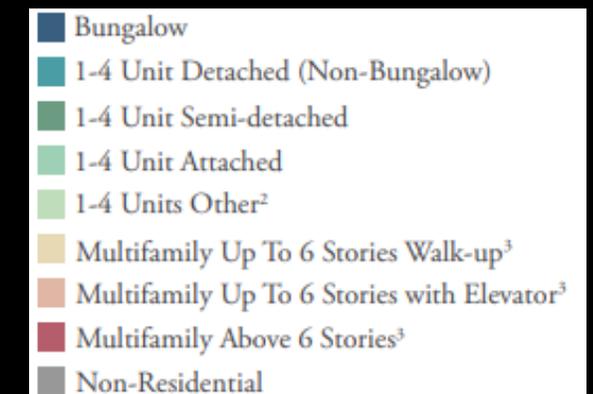
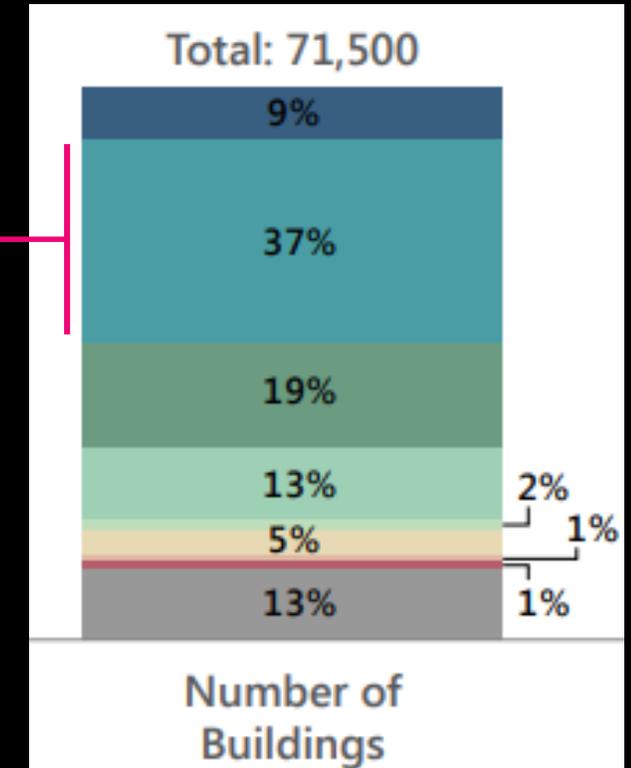
**71,500 residential buildings in the floodplain,
85% built before 1983
532 million sq ft interior space**

5. DIFFERENT TYPOLOGIES REQUIRE DIFFERENT RETROFIT PATHWAYS

~ 37% of buildings in the floodplain are 1-4 family, detached buildings on lots wider than 20 feet.

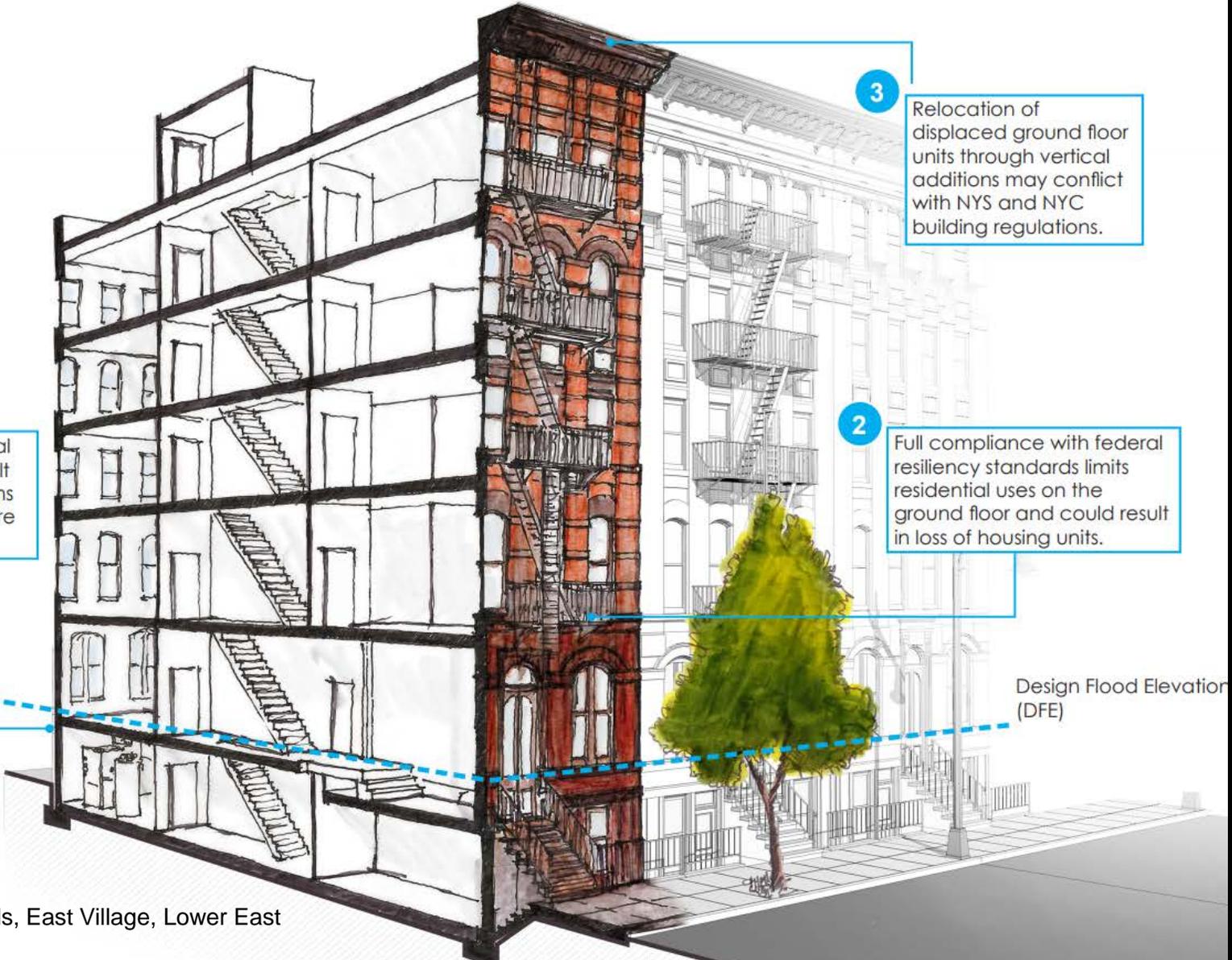
Generally these can benefit from flood insurance credits for:

1. Installing food vents/wet flood proofing
2. Raising machinery and equipment
3. Infilling basement
4. Elevating structure



5. DIFFERENT TYPOLOGIES REQUIRE DIFFERENT RETROFIT PATHWAYS

1 Noncompliance with federal resiliency standards will result in higher insurance premiums and will make securing future financing more difficult.



3 Relocation of displaced ground floor units through vertical additions may conflict with NYS and NYC building regulations.

2 Full compliance with federal resiliency standards limits residential uses on the ground floor and could result in loss of housing units.

~ 63% of residential buildings in the floodplain require retrofits that are **generally not eligible for flood insurance credits.**

Many suffer from deferred maintenance.

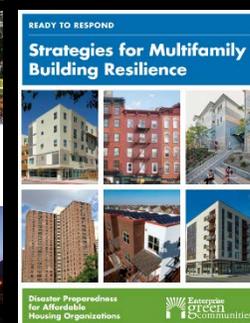
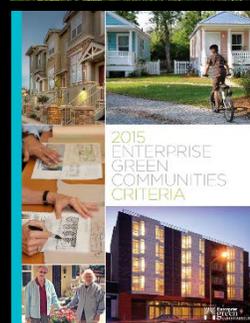
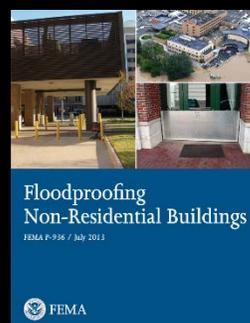
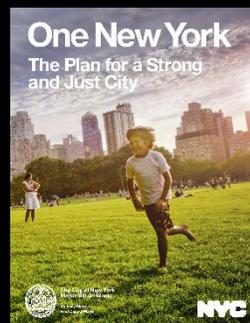
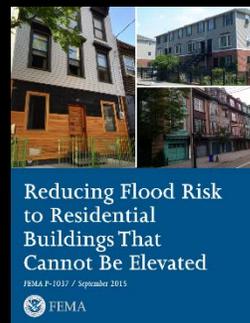
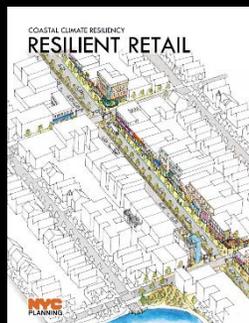
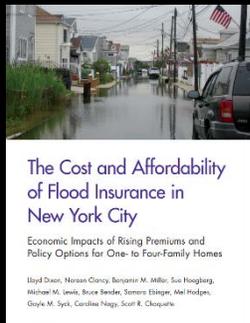
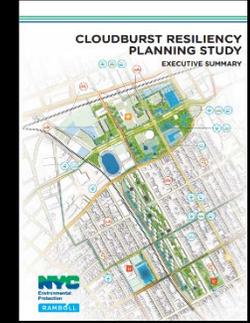
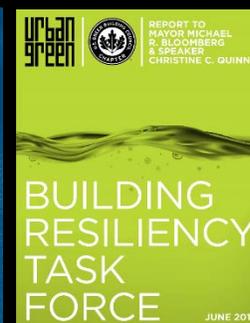
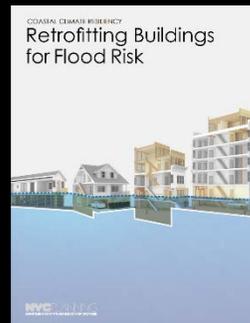
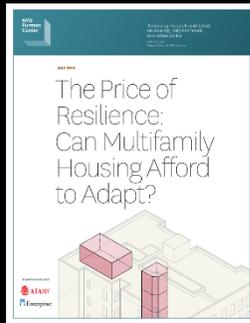


**OPPORTUNITIES FOR CLIMATE
RESILIENCE**

OPPORTUNITIES FOR CLIMATE RESILIENCE

1. NYC's regulatory framework
2. [FloodHelpNY.org](https://www.floodhelpny.org)
3. [RetrofitNY](https://www.retrofitny.org)
4. NYC Retrofit Accelerator & Carbon Challenge

1. NYC's REGULATORY FRAMEWORK: CLIMATE RESILIENCE



1. NYC's REGULATORY FRAMEWORK: BUILDING REGULATIONS

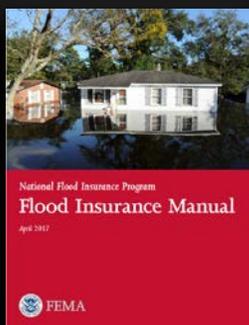


FEMA

NYC



1. **Flood Insurance Rate Maps** determine where floodplain regulations apply



2. **National Flood Insurance Program** sets insurance rates depending on building elevation and other requirements



3. **Construction Standards (ASCE 24)** mandate special requirements for flood hazard areas



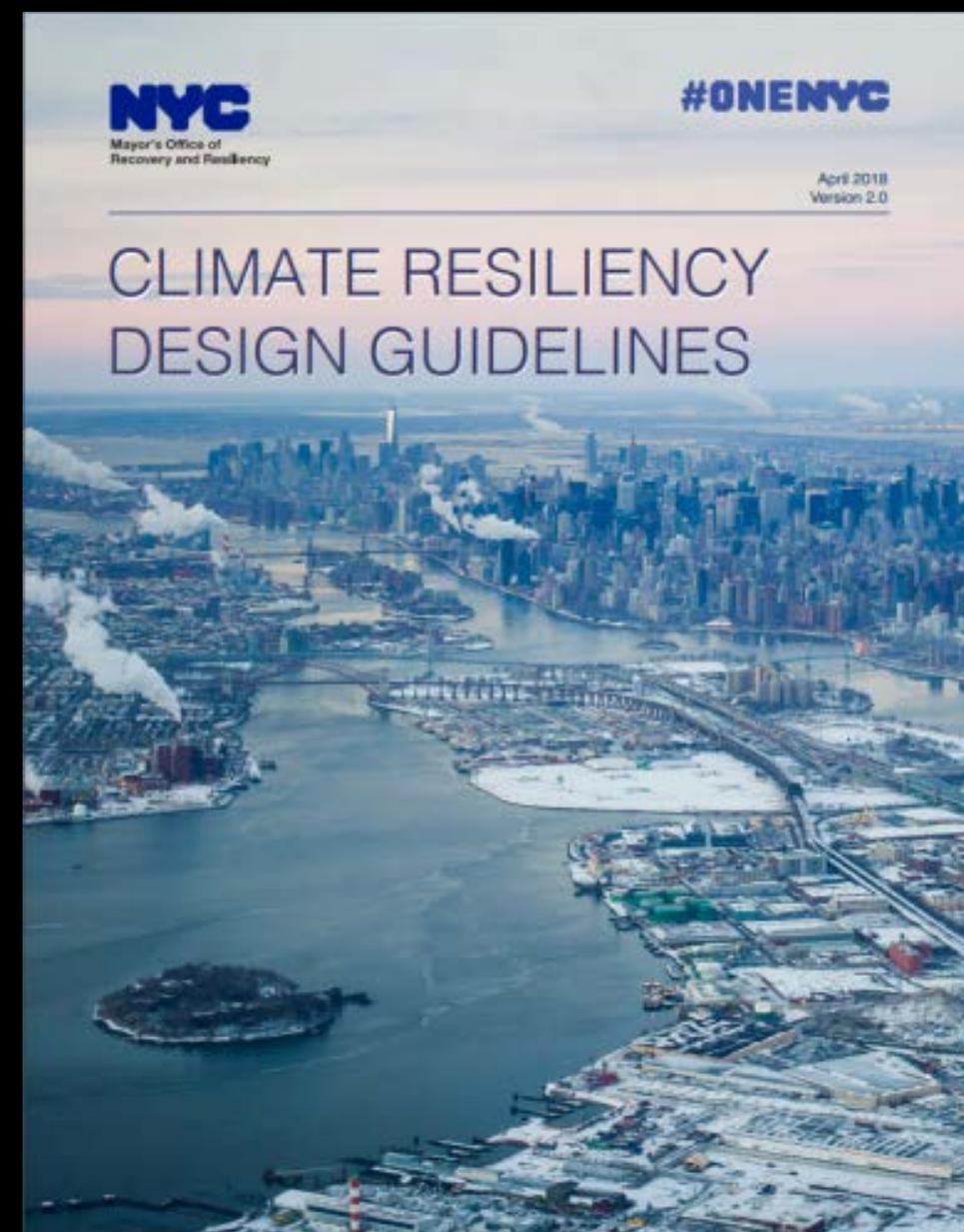
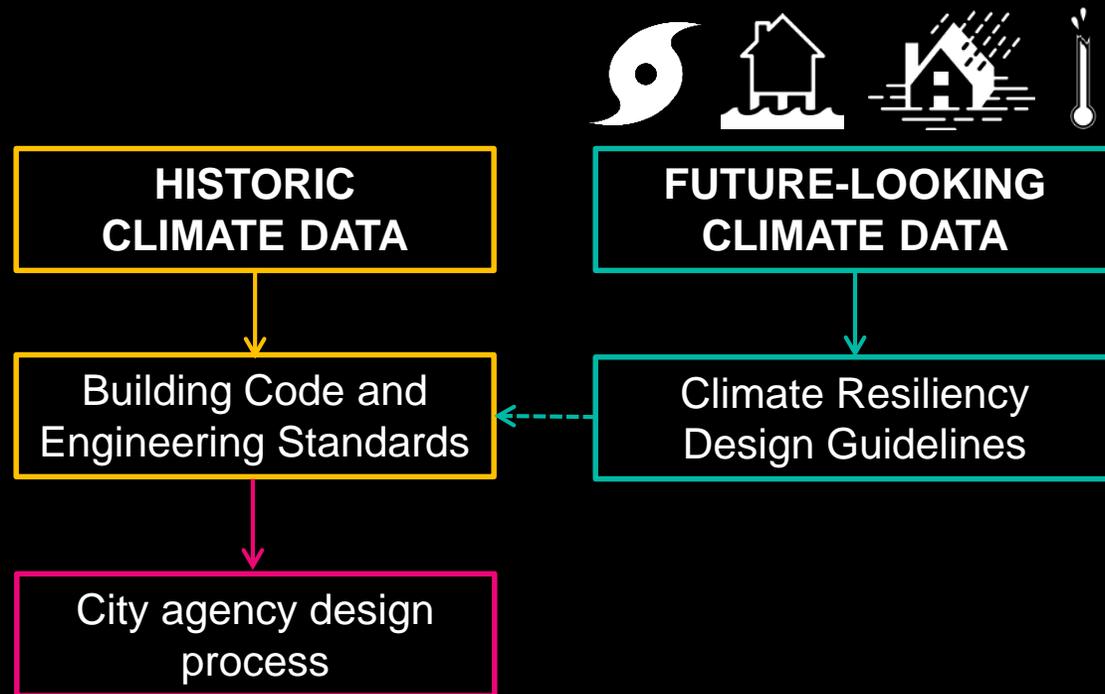
1. **Building Code** requires new buildings and substantial improvements to meet FEMA standards



2. **Zoning** accommodates these regulations and improves neighborhood character

CLIMATE RESILIENCY DESIGN GUIDELINES

NYC-specific guidance for climate-resilient design in new city capital projects, including buildings, infrastructure, and landscapes.



2. FloodHelpNY

Flood risk education and information website, with **address search tool** that locates users on the flood insurance map and a rate calculator. **Launched Oct 2016.**

Portal for a **Home Resiliency Audit program** which offers eligible owners a free on-site engineering consultation, a customized menu of resilience retrofit options, and flood insurance counseling.

Resilience benefits targeted to properties vulnerable to **coastal storms and tidal flooding.**



Governor's Office of
Storm Recovery



CENTER for NYC
NEIGHBORHOODS

NYC's flood risk is on the rise

See how to keep your home and finances safe from flooding.

Discover Your Risk

Sandy 2012: 14.05'

Irene 2011: 9.5'

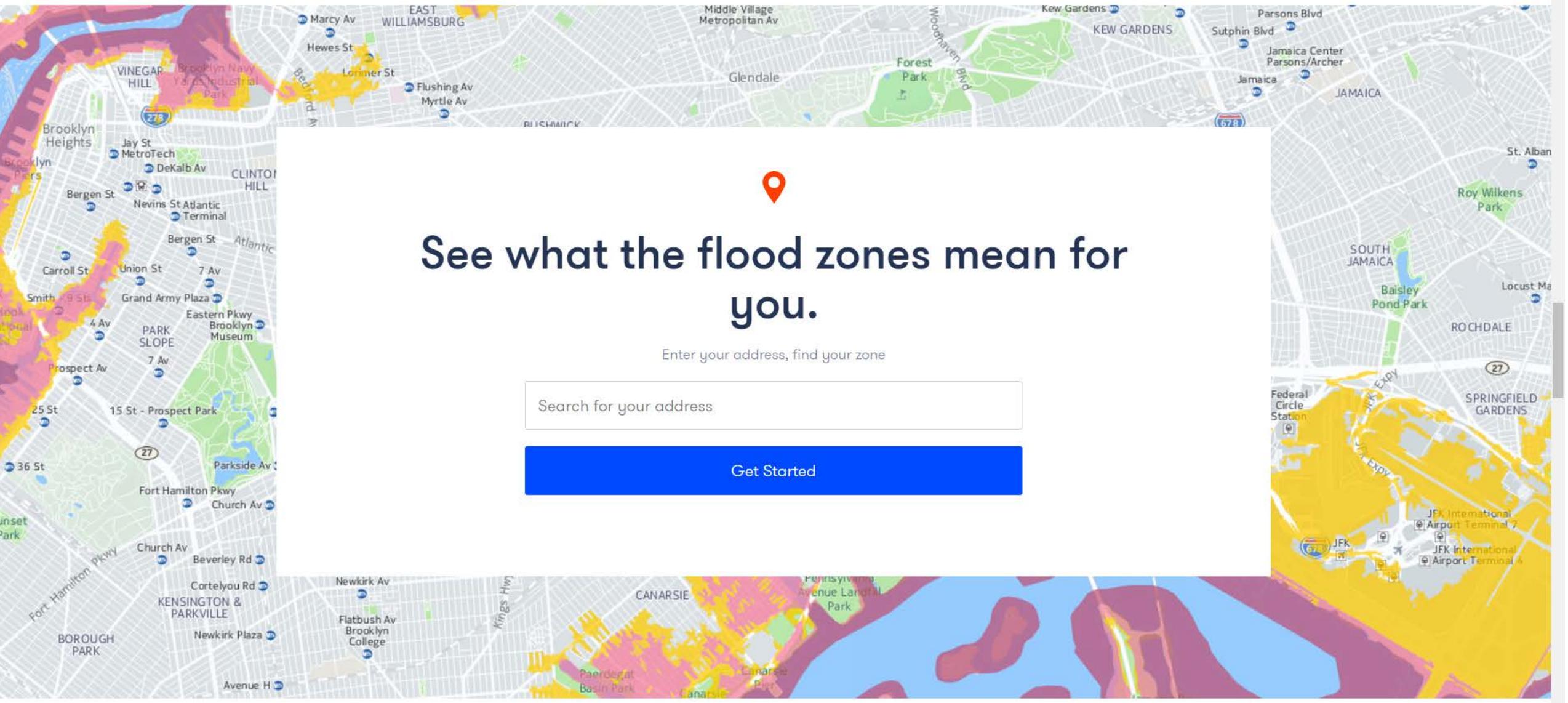
Today at 4:19PM -2.01'



Are you a homeowner in NYC?

See if you're eligible for a free personalized plan to keep your home and finances flood-safe.

Learn More



See what the flood zones mean for you.

Enter your address, find your zone

[Get Started](#)

Home Resiliency Audit Program

Protect your home and finances from floods.

See If You're Eligible

WHAT THE PROGRAM DOES

If you own a home in one of NYC's flood-prone neighborhoods, your flood insurance rates may already be on the rise. The Home Resiliency Audit Program brings together surveyors, engineers, master plumbers, and resiliency counselors to get you an accurate flood insurance quote as well as advise you on how to retrofit your home to keep insurance costs down. Depending on which flood zone you live in, you may qualify for additional free programs, such as a [backwater valve installation](#).



Program provided by
Governor's Office of Storm Recovery

WHAT YOU'LL GET



Resiliency Report

After we inspect your home and assess its flood risk, we'll send you a detailed technical report, complete with measurements and information on which retrofits (i.e., raising your mechanical systems) can make you more



Elevation Certificate

We'll also send you a document that certifies your home's elevation. If you live in a high-risk flood zone, the elevation certificate can keep your flood insurance rate from skyrocketing.



- YOU MIGHT BE THINKING:
- Who is providing these services?
 - Who is this program funded by?
 - Why were these neighborhoods chosen for the program pilot?
 - How are homeowners selected to participate in the program?
 - How many homeowners does this program serve?
 - Are there any financial benefits?
 - What's an elevation certificate?
 - Who are the counselors?
 - What if I own or am living in a multifamily building?
 - I believe I am in a neighborhood that is eligible for Home Resiliency Audits, but I can't sign up.

Ask a Question

1. FloodHelpNY RISK AWARENESS CAMPAIGN



Verizon 8:25 PM 52%

Search

Center for NYC Neighborhoods
Yesterday at 12:04 PM

NYC's flood risk is growing

Discover your risk
FloodHelpNY.org [Learn More](#)

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October 20, 2016
48th Year, No. 17

THE NEWSPAPER OF CO-OP CITY

14 • CITY NEWS • THURSDAY, OCTOBER 20, 2016

Features

A new way to decorate Halloween pumpkins

Try something new this year, and decorate and "dress" some of your pumpkins and gourds instead of carving them. They will last longer, and all ages can take an active part in creating them.

Wash the pumpkins and gourds, and dry them thoroughly. Let the children search the house for "found" items they can use for decorating: buttons, string, ribbon and bows, hats, sunglasses, construction paper, shiny paper, stickers, cotton balls, candy, doll accessories, dried weeds and flowers, pins, medals, earrings, cardboard tubes or fabric scraps.

Place all collected items on a newspaper-covered work surface. Give each child a pumpkin to decorate. Draw features with markers or paint. Once dry, add hair, beards and accessories by gluing on items or attaching them with straight pins. Carefully poke medals and pierced earrings directly into the pumpkins.

Show off the new members of your family (or decorate a pumpkin to look like you!) by displaying them at your door, on your porch, along a walkway or perched on a tree branch to catch the attention of October guests.

EXTRA IDEAS:
• For quick, make-ahead Halloween-

ing on public television nationwide. To find more of her creative family recipes and activities, visit www.donnaday.com and link to the NEW Donna's Day Facebook fan page. Her latest book is "Donna Erickson's Fabulous Funstuff for Families."

Councilman collecting coats for needy

New York City Councilman Andy King will collect winter coats for the less fortunate today through Oct. 31.

New or gently used, clean coats can be dropped off at King's district office at 940 East Gun Hill Road, Bronx, Monday through Friday, between 10 a.m. and 6 p.m.

All coats collected will be distributed in November.

For more information, contact the office of Councilman King at (718) 684-5509.

Keep your home, family & finances above water

FloodHelpNY.org

CENTER for NYC NEIGHBORHOODS

Governor's Office of Storm Recovery

NEW YORK STATE

NYC Mayor's Office of Emergency and Resiliency

2. FloodHelpNY

From 2012 - 2018, National Flood Insurance Policy enrollments in NYC **grew 58 percent**, from 32,725 to 54,978.

57 percent of 2018 policies are **in the X zone** (in the 500-year floodplain without flood insurance requirements), indicating that awareness is spreading.



Governor's Office of
Storm Recovery



CENTER for NYC
NEIGHBORHOODS



3. RetrofitNY

Cost-effective, deep energy retrofit of multifamily buildings **with residents in place**

Potential resilience benefits for **extreme temperatures**

3. RetrofitNY

Air sealed & high performance building envelope

- Panelized construction
- Site applied façade
- High performance windows & doors

Efficient mechanical & ventilation systems

- Electrified buildings
- Heat pump technology
- Energy recovery ventilation

On-site energy generation

- Solar PV



**Energie
Sprong**



Energie
Sprong



Energie Sprong





Netherlands



United Kingdom



Germany



France



New York



RetrofitNY

3. RetrofitNY

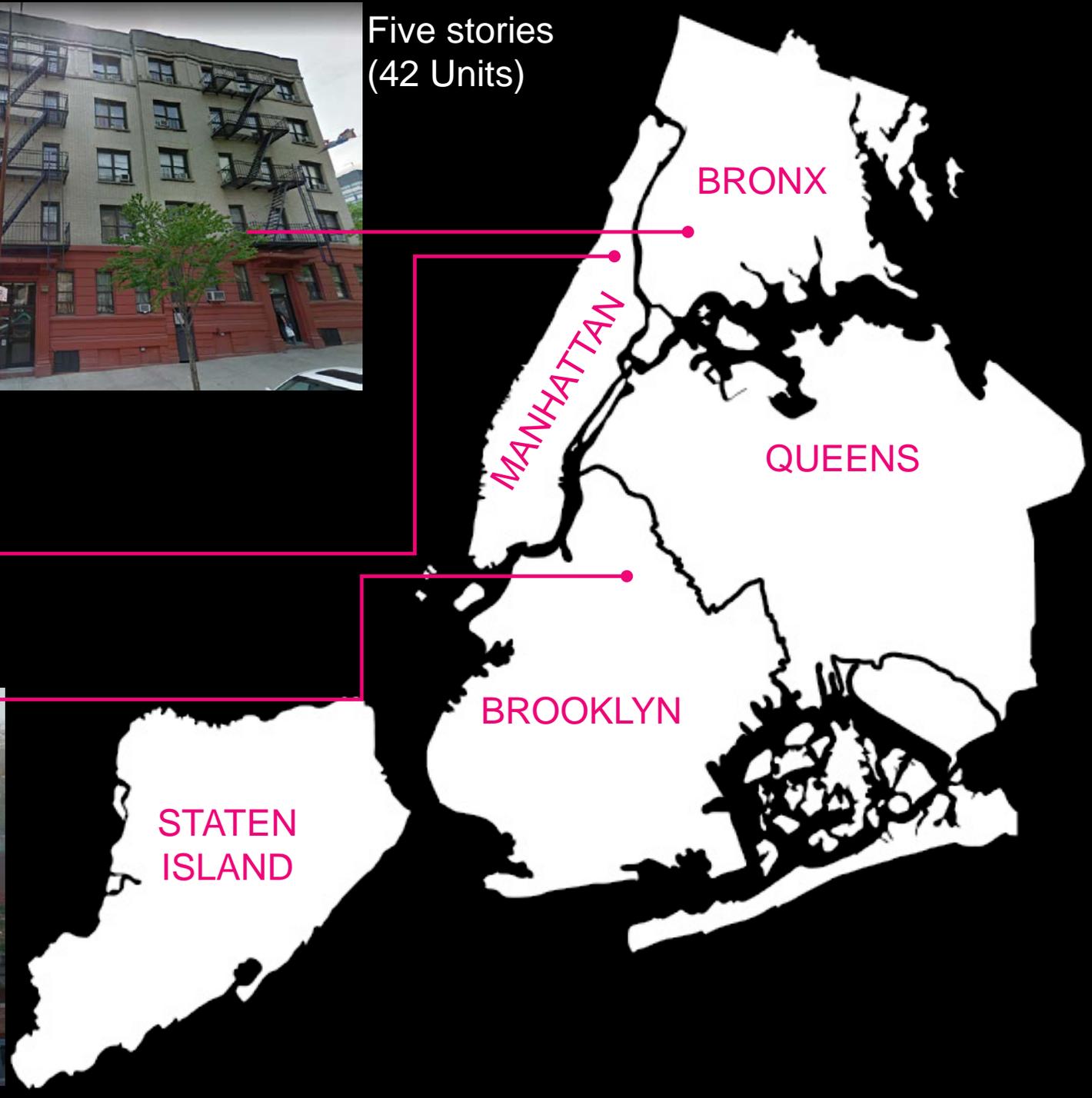
Six stories (21 units)



Five stories
(42 Units)



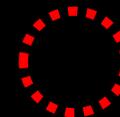
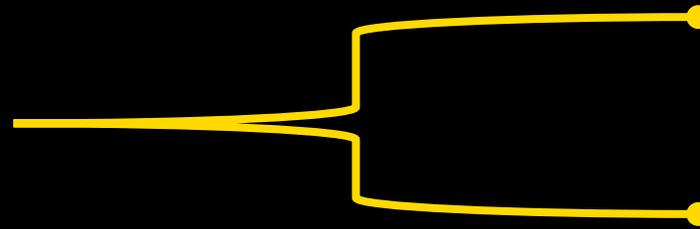
Four stories
(46 units)



3. RetrofitNY

Human habitability in temperature and humidity extremes

Could this retrofit facilitate “**passive thermal survivability**” during extended periods of temperature extremes with no/minimal power?



Source: NASA

4. NYC RETROFIT ACCELERATOR/CARBON CHALLENGE

Public-private partnerships to advance retrofits of NYC's building stock, with advice for **energy efficiency retrofits and consideration for heat and flood vulnerabilities.**



* Free Help. Simple Fixes. Big Results.

NYC Retrofit Accelerator's Efficiency Advisors will:

- **Work with you one-on-one** to understand your needs
- **Connect you with qualified contractors** to do the job
- **Find cash incentives and financing** to help pay for your upgrades
- **Train your building staff** so your building continues to run efficiently
- Support you **every step of the way** from project start to finish

4. NYC RETROFIT ACCELERATOR/CARBON CHALLENGE



Initiated Sept 2015. Expanding in 2019.

As of October 2018:

- 5,193 buildings engaged (mainly large multifamily buildings, including those with heat and flooding risks)
- 1,934 retrofits under construction or completed

Top retrofits include:

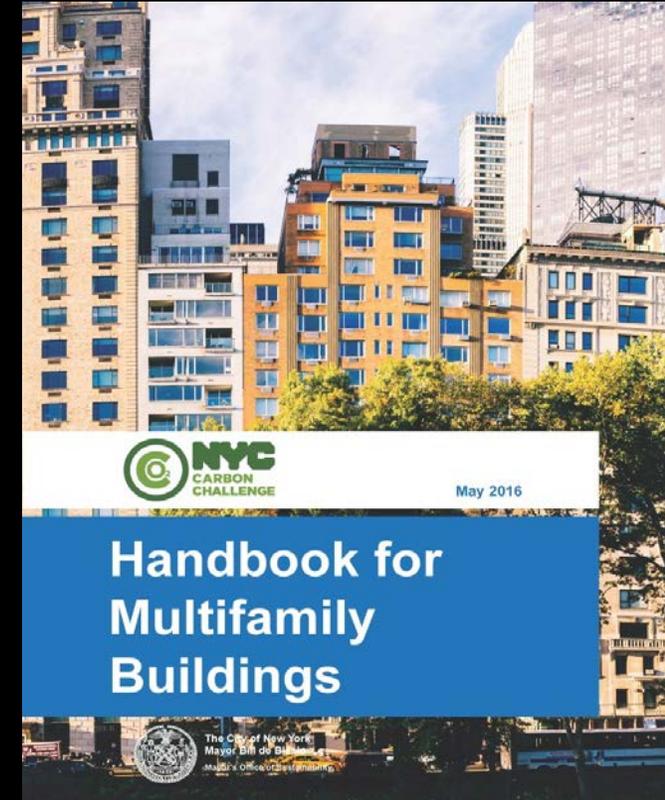
- Lighting
- Fuel switching
- Heating distribution system
- Water conservation
- Building envelope



4. NYC RETROFIT ACCELERATOR/CARBON CHALLENGE



- Major building owners/tenants commit to reducing greenhouse gas emissions by 30% or more in ten years
- Launched 2007 with 2018 progress report
- Participants represent 510 million sq ft of real estate, 9% of city-wide built floor area:
 - 18 universities
 - 9 hospital organizations
 - 41 commercial tenants
 - 13 commercial building owners
 - 22 residential management firms
 - 19 hotels



WE NEED YOU!



TO HELP RETROFIT BUILDINGS!