

# A City With Resilience

Harrison Hecht and Jake Goldzweig

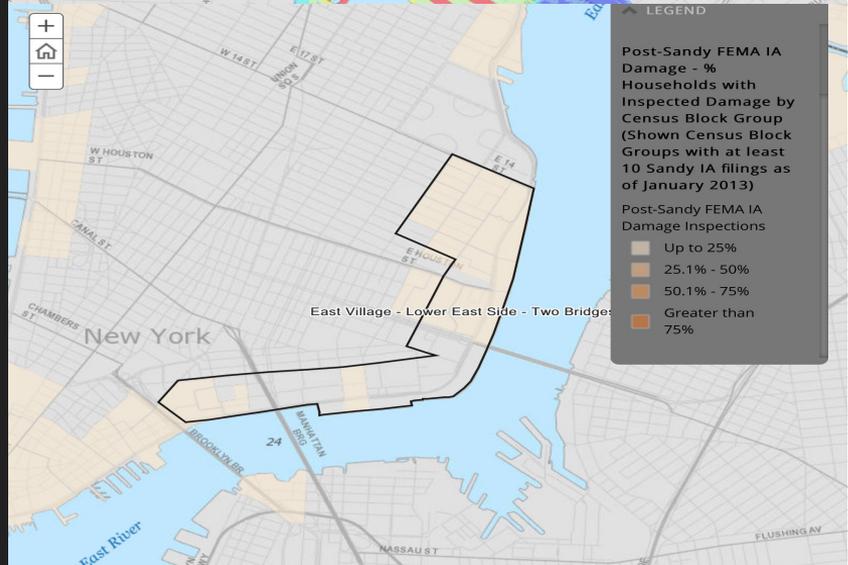
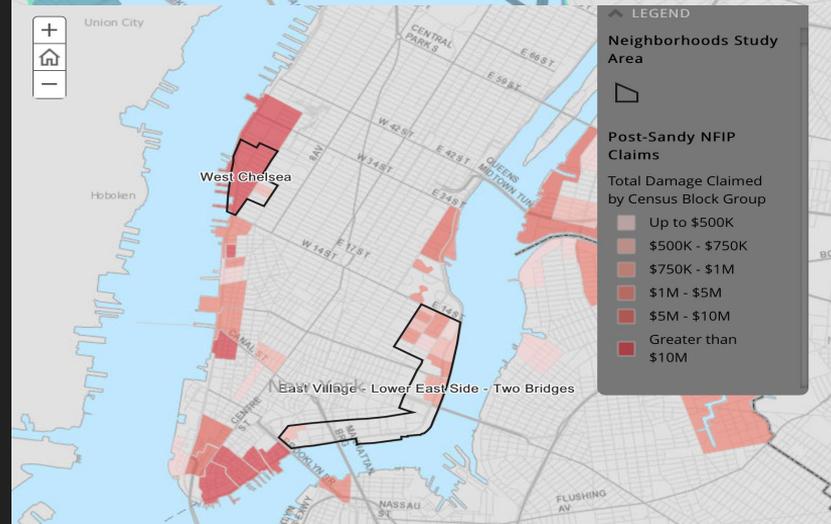
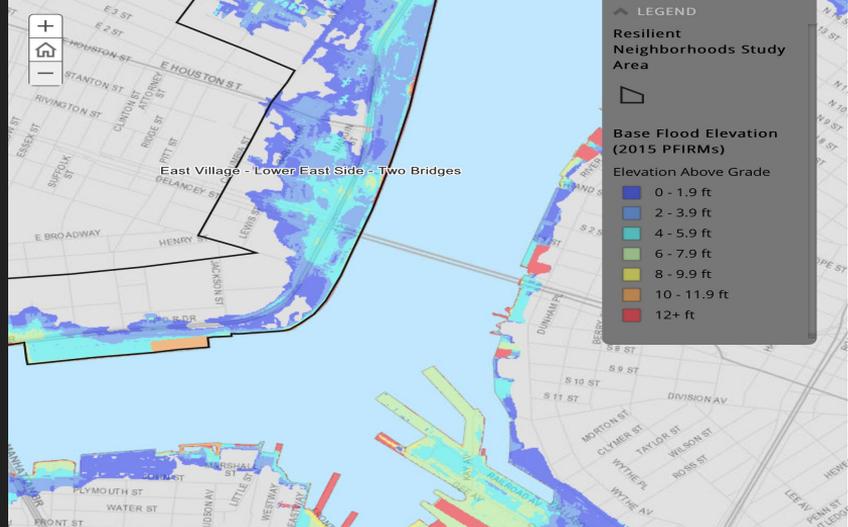
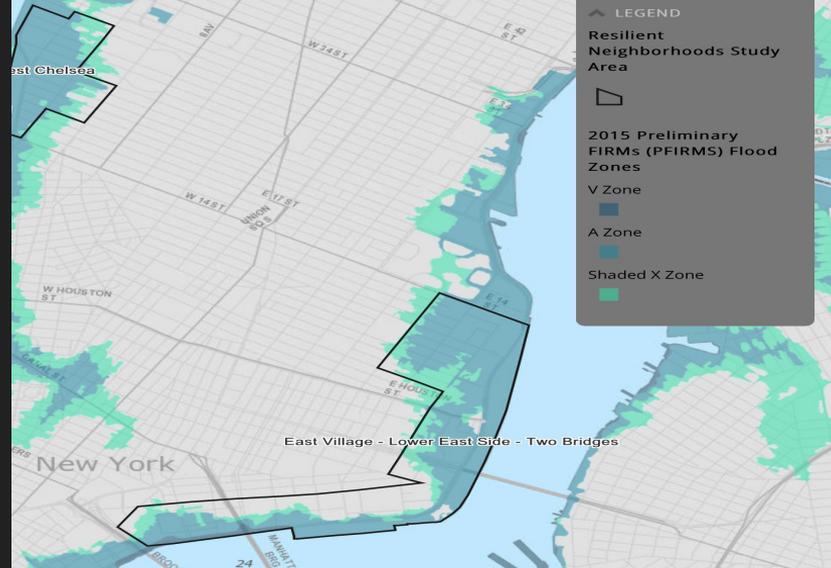
# Problem Statement

We aim to push developers and architects to design and create more weather resistant buildings in lieu of rising sea levels and hurricanes for residents among Lower Manhattan, especially near coastal areas. Businesses, real estate and Manhattan residents are also a stakeholder since they can be affected just as much as the buildings.

# Secondary Research

# LES: Resilient Neighborhoods Initiative

- Hurricane Sandy: 800 households received damage assistance (90% renters households), which made up 34% of all household file claims in Manhattan.
- 100 buildings / 6,000 residential units can be affected by a 10 year storm while 500 buildings / 19,000 residential units can be affected by a 50 year storm.
- Between 0-5.9 ft (flooding) in LES, East Village, and Two Bridges
- \$8.7 Million Insurance claims in LES, East Village, and Two Bridges
- \$68.3 Million in Manhattan and \$200.6 Million in NYC.
- 13% of NFIP claims paid to multifamily buildings were in the LES, East Village, and Two Bridges.



# Interview: Waterfront Alliance

- W.A. focus on Resilience, Access and Ecology
- Have/provide guidelines for companies beginning to utilize land such as Greenpoint Landing & Starlight Park
  - Resilience: Structural and able to overcome flooding and sea level rise
  - Access: Accessibility to water and transport.
  - Ecology: Sustainable production and development; focus on clean water and vegetation growth.

**STRONG**

Are you protected from coastal flooding?

**STATISTICS**

**408k**  
New Yorkers have a 50% chance of a major flood in their homes by 2060

**41%**  
of those are economically and socially vulnerable

## SCORECARD Residential/Commercial Project Type

401 POSSIBLE POINTS

### CATEGORY 1: Site Selection & Planning (SS & P)

Y	?	N		POSSIBLE POINTS: 43
●	●	●	<b>Credit 1</b> (Priority) Use a Multi-Disciplinary Project Team and Design Process	4
●	●	●	<b>Credit 2</b> (Priority) Conduct Assessment of Site's Vulnerability to Climate Change and Sea Level Rise	4
●	●	●	<b>Credit 3</b> (Priority) Avoid "Bluefield" Development	4
●	●	●	<b>Credit 4.1</b> Project Siting: Site Near Existing Waterborne Transportation	1
●	●	●	<b>Credit 4.2</b> Project Siting: Site Near Area Underserved by Open Space	1
●	●	●	<b>Credit 4.3</b> Project Siting: Site in Area Participating in FEMA's Community Rating System	1
●	●	●	<b>Credit 4.4</b> Project Siting: Clean a Brownfield	5
●	●	●	<b>Credit 5.1</b> Building Siting: Avoid Development in High Potential Erosion Area	2
●	●	●	<b>Credit 5.2</b> Building Siting: Avoid the 100-Year Floodplain	6
●	●	●	<b>Credit 5.3</b> Building Siting: Maximize Upland Views	2
●	●	●	<b>Credit 6</b> Raise Elevation: Increase Freeboard of Buildings	4
●	●	●	<b>Credit 7.1</b> Building-Scale Protection: Provide Wet Floodproofing	2
●	●	●	<b>Credit 7.2</b> Building-Scale Protection: Provide Dry Floodproofing	2
●	●	●	<b>Credit 8</b> Site Perimeter Protection: Provide Deployable Flood Barriers	1
●	●	●	<b>Credit 9</b> Incorporate Streetscape Enhancements to Mitigate Elevation Changes	2
●	●	●	<b>Credit 10</b> Participate in FEMA's National Flood Insurance Program	2

# NYC's Response to Rising Water Catastrophe

- Over 400,000 New Yorkers currently live within the 100-year floodplain.
  - Bloomberg Administration's 2013 Special Initiative for Rebuilding and Resiliency (SIRR) projected that an additional 400,000 New Yorkers will live within flood-susceptible areas by 2050.
- As a response to Hurricane Sandy in 2014, New York began requiring mechanical systems to be installed above the "*design flood elevation*" — one to two feet higher than the highest expected flooding — at buildings, like American Copper, that are being constructed or substantially renovated in a floodplain.



# What is NYC Doing?

- **High-rise safety:** New high-rise buildings must meet additional safety standards:
- **Stairway connections:** Public halls that connect two stairways are not required in certain new,
- **Major enlargements.** Alterations that more than double the floor area of a building may require that the entire building be upgraded to current codes.
- **Accessibility:** requirements align with the Federal Americans with Disabilities Act and Fair Housing Act.

## American Copper Buildings



JDS developers wanted tenants to live in the towers for at least a week, no matter how high floodwaters may reach nor how long the power is out.

## The Hudson Yards



- A “bathtub” secured by “submarine doors” seals off and waterproofs all critical infrastructure which sits under the flood plain.
- Equipped for underfloor or overhead air distribution
- Rainwater Harvesting that collects stormwater from roof to replenish cooling towers & irrigate landscaping to minimizing its burden on the city’s sewer system

# Further Methodology

# 5 Elements

**What?** Create ways to make buildings more resilient to hurricanes and rising sea levels.

**For Whom?** For residents of Lower Manhattan (residential) while considering other stakeholders such as tourists and businesses (commercial).

**Context (context, facts, why):** In a world where rising sea levels and hurricanes are becoming more frequent and consequential, the facts prove that it is time to implement new designs more efficiently.

**Goals:** We aim to push developers to consider the importance of developing resilient structures, for both residential and commercial purposes.

**Assumptions:** We need to test the assumptions that developers are not planning long-term for future developments.

# Discovery / Redesign / Design Challenge

Discovery: Buildings can be built resilient to rising tides and hurricanes but many are not being built this way (due to short term costs).

Potential Redesign ideas:

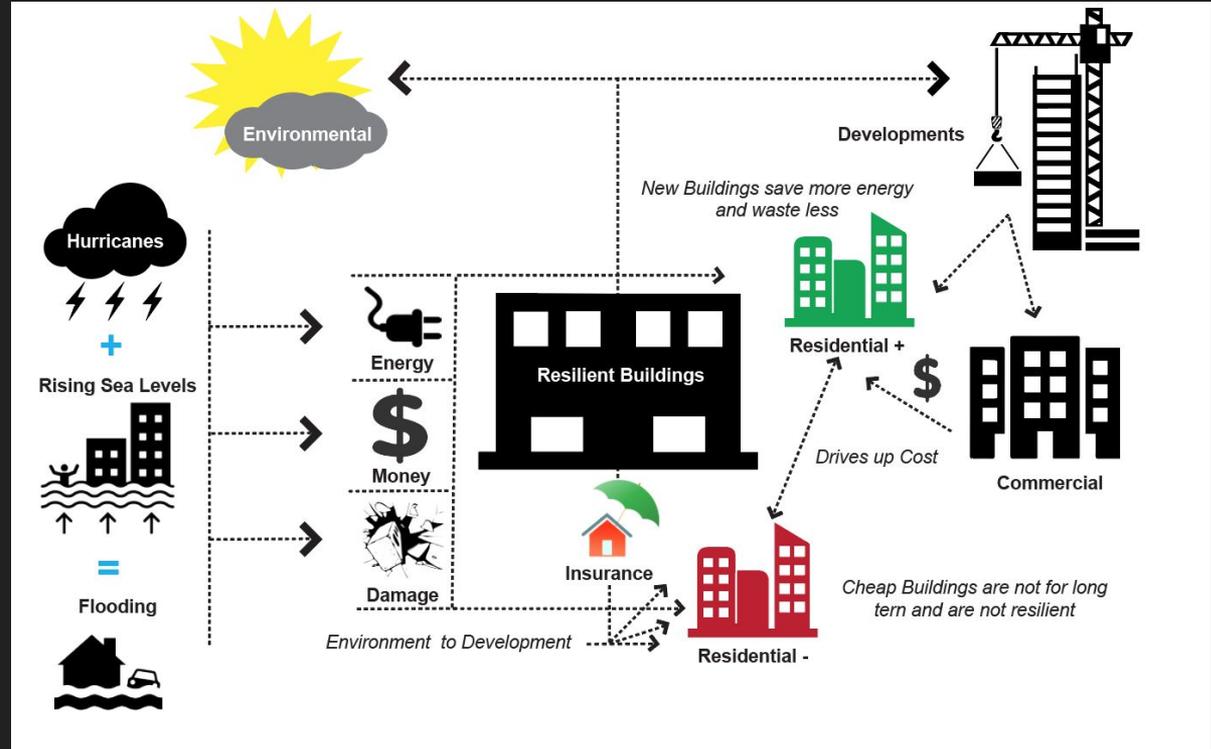
1. Guidelines (refer to Waterfront Alliance)
2. Redesign waterfront railings to be 3 feet high
3. Tube or pipe system to guide water.
4. Architectural Installation (guides or filters water)

Design Challenge: Can it be implemented?



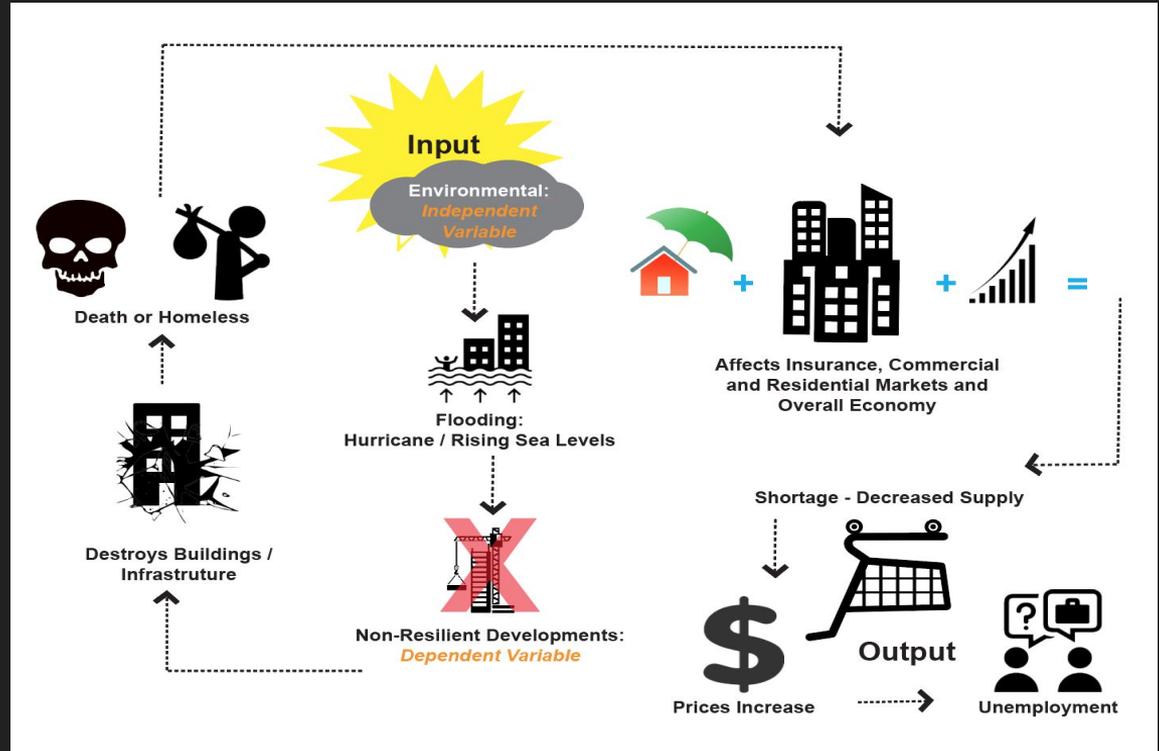
# Mind Map

- Connections between the environment and developments.
- Positives and Negatives in Residential
- Resilient buildings depend on developments but are impacted by the environment.
- Energy, money and damage are key factors.



# Flow Analysis

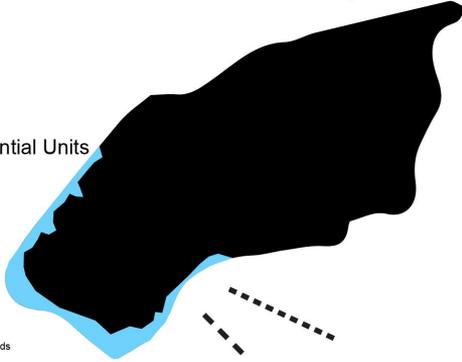
- Developments depend on environment - affects non-resilient developments
- Destruction impacts life and employment as well as the economy.
- Non-Resilient developments when affected by the environment lead to shortages, which cause prices to go up and negatively affect the economy and increase unemployment.



# Long Range Forecasts - Flood - Lower Manhattan

Map - Flooding Range Lower Manhattan for 2020 / 1% Annual Increase / LES & East Village

21,790 Residential Units  
591 Buildings



LES and East Village

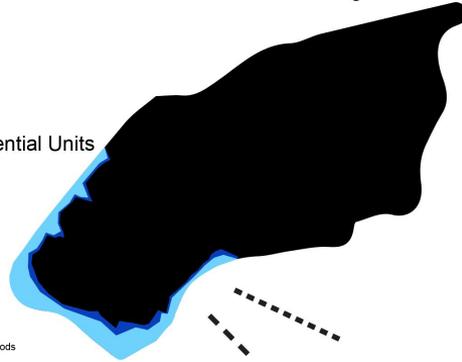
Source: Resilient Neighborhoods  
Flood Risk Atlas  
Link: <http://dcp.maps.arcgis.com/apps/MapJournal/index.html?appid=87d8af3603aa4e7b9f7ece4e4615ce41>

Map - Flooding Range Lower Manhattan for 2050 / 1% Annual Increase / LES & East Village

22,650 Residential Units  
620 Buildings

*\*860 more  
Residential Units*

*\*29 more  
Buildings*



LES and East Village

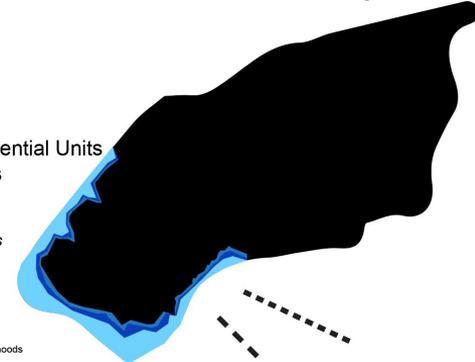
Source: Resilient Neighborhoods  
Flood Risk Atlas  
Link: <http://dcp.maps.arcgis.com/apps/MapJournal/index.html?appid=87d8af3603aa4e7b9f7ece4e4615ce41>

Map - Flooding Range Lower Manhattan for 2080 / 1% Annual Increase / LES & East Village

24,230 Residential Units  
650 Buildings

*\*1580 more  
Residential Units*

*\*30 more  
Buildings*



LES and East Village

Source: Resilient Neighborhoods  
Flood Risk Atlas  
Link: <http://dcp.maps.arcgis.com/apps/MapJournal/index.html?appid=87d8af3603aa4e7b9f7ece4e4615ce41>

Insight: even at just 1% annual increase, numbers increase (amount of residential units and buildings affected) and could be expedited as this is just a forecast.

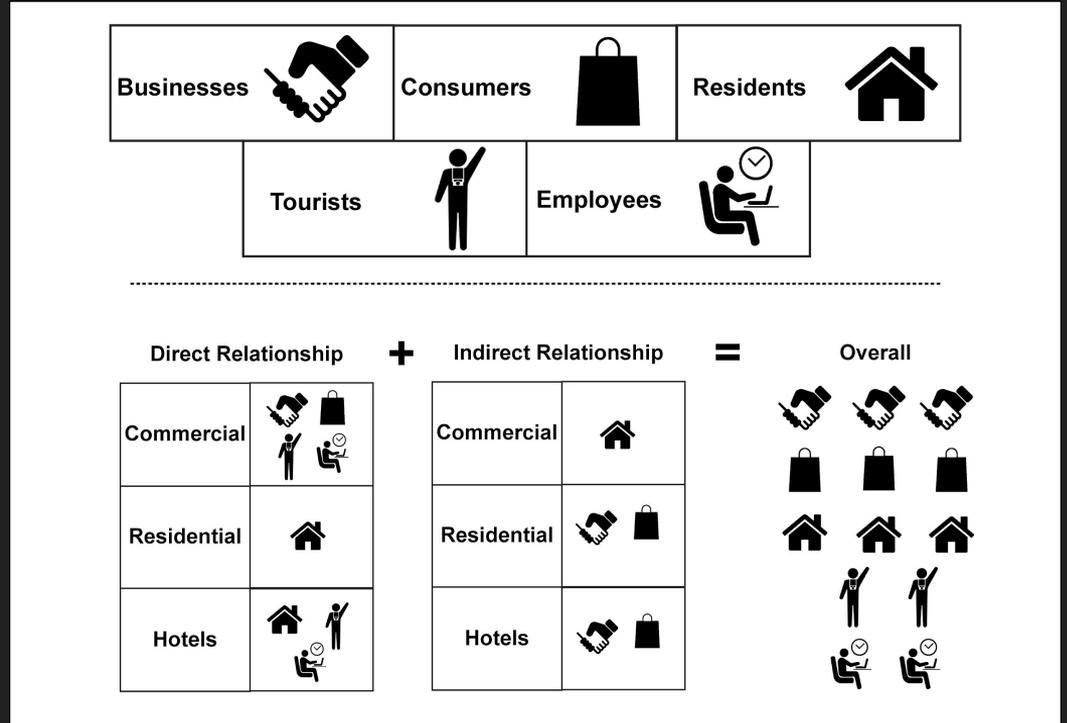
# Affinity Diagram

- Resilient vs. Non-Resilient share half of the factors (yet less important ones)
- Floods from Hurricanes or. Floods from Sea Level Rise share two out of six.
- Repair cost and term duration are shared with environments and developments.

Cheaper Land, Location, Time, Investment, Gentrification		Natural and Human Causes / Elevation and Location	
Resilient Developments	Non-Resilient Developments	Floods from Hurricanes	Floods from Sea Level Rise
Commercial	Commercial	Cyclical	Gradual
Residential	Residential	Short Term	Long Term
More Money Spent on Construction	Less Money Spent on Construction	Immediate Destruction	Gradual Destruction
Primary: Engineering and Design	Primary: Style and Cost Effective	Flooding: Flood Zones	Flooding: Flood Zones
Cost of Living	Cost of Living	Repair Costs Depend	Repair Costs Depend
Less Prone to Damage	More Prone to Damage	Damage is not solely from Flooding	Damage is solely from Flooding
Repair Costs Depend	Repair Costs Depend		
Long Term	Short Term		

# Stakeholder Mapping

- Direct vs. Indirect Relationship of Stakeholders.
- Commercial has the most directly related while Residential has the least; hotels come in the middle.
- Residential and Hotels have the most indirectly related while Commercial is the least.
- Together, Businesses, Consumers, and Residents are the most affected while Tourists and Employees are the least.



Prototype

# Prototype Proposals

1) Metal/Glass Railing

2) Sponge Installation

3) All-in-One Flood Structure

4) Green Space

5) Subway Station Sketchup

6) Mobile Application for Developers or Stakeholders



# How to Avoid Rising Waters Brochure

Outer Flap

Back

Front

Inner

Inner

Inner

## NYC FLOOD ZONES (LOWER MANHATTAN)

- CHELSEA
- TRIBECA
- EAST VILLAGE
- WEST VILLAGE
- HUDSON YARDS
- FIDI
- LES



## CHECKLIST

- WET FLOOD PROOFING
- DRY PROOFING
- FREEBOARDS
- DEPLOYED FLOOD BARRIERS
- INSTALLED EMERGENCY GENERATORS
- FLOOD GATES
- FLOOD LOGS
- FLOOD PANELS
- FLOOD VENTS

COUNT THE CHECKS IN THE BOXES

- 0-1 = NON RESILIENT
- 2-3 = SOMEWHAT RESILIENT
- 4-5 = RESILIENT
- MORE THAN 5 = VERY RESILIENT

BUILDING NAME/LOCATION:

## HOW TO AVOID RISING WATERS FOR RESIDENTIAL & COMMERCIAL BUILDINGS



## NYC EDITION

## GUIDELINES

**Purpose:** We want to assist Manhattanites in choosing weather resistant buildings that are in located in flood risk zones downtown Manhattan. We also aim to push developers to consider the importance of developing weather resistant buildings to flooding, hurricanes, and rising water levels. We need to test the assumptions that developers are not planning long-term for future developments.

**Who would this impact?**  
Residents of NYC or tourists

**What can be done? How can we help?**  
Developers can begin to consider important design. In addition, real estate brokers and agents can begin to guide consumers to make informed, long-term decision when buying waterfront property.

**When?**  
This could be implemented immediately. Developers can begin to change the way their buildings are being designed (in a long-term manner). The city can also enforce developer codes or create new laws enforcing this.

**Where is this happening?**  
Among waterfront areas of Manhattan subjected to rising water levels and hurricane floods.

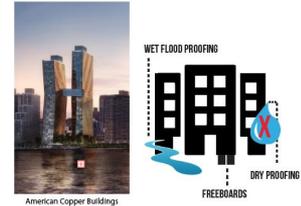
## NON-RESILIENT BUILDINGS



**NO FREEBOARDS**  
Picture of the aftermath of Hurricane Sandy in the East Village



## RESILIENT BUILDINGS

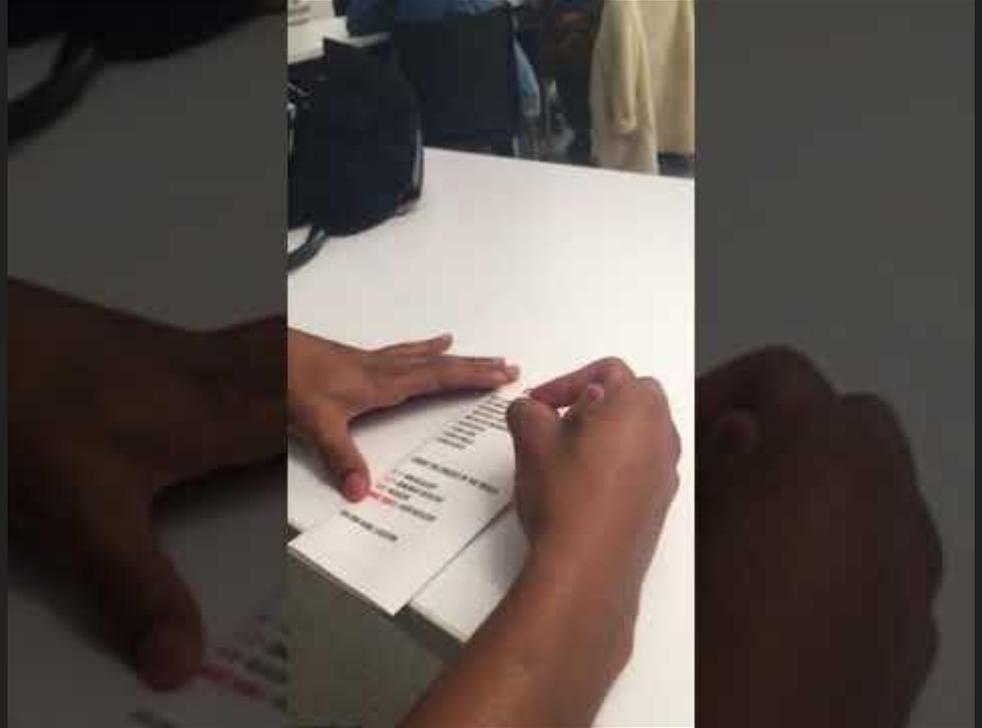


American Copper Buildings  
"JDS wanted tenants to live in the towers for at least a week, no matter how high floodwaters may reach nor how long the power is out."



# Video Trial and Insights for Prototype

- Clarify and define guidelines.
- V1 → V2 this was changed yet some people did not understand.
- This is 1 out of 5 trial videos.
- For the future, emphasize and define and perhaps visualize and make it a booklet so more information can fit.



# Final Pamphlet

## NYC Flood Zones Lower MANHATTAN

What Would Happen If The  
Sea Rose 5 Feet Higher  
In Another Superstorm?

Manhattan 2100 Model Provided By Pitconomy



## Guides & Tools To Consider When Purchasing Property

- Homeowners Insurance ■
- Nearby Emergency Shelters  
for Main Residences ■
- Personal Property ■
- Upkeep & Maintenance Costs ■
- Associated w/“Waterproofing” ■
- Building Age and history ■

## Avoiding Rising Waters For Residential & Commercial Buildings



### NYC EDITION

## Guidelines

Purpose: We aim to assist Manhattanites in choosing weather resistant buildings that are in located in flood risk zones. We also aim to push developers to develop buildings resistant to flooding, hurricanes, and rising water levels.

Who would this impact? Residents of NYC

What can be done? Developers can begin to consider important, storm resistant designs. Additionally, real estate brokers and agents can begin to guide consumers into making smart, long-term decision when buying waterfront property.

When?  
This could be implemented immediately. Developers can begin to change the way their buildings are being designed (in a long-term manner). The city can also enforce developer codes or create new laws enforcing this.

Where is this happening?  
Waterfront areas of Manhattan subjected to rising water levels and hurricane floods.



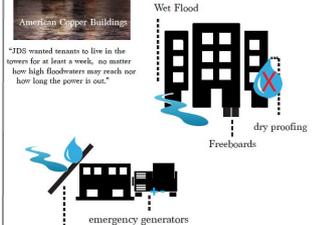
## Non-Resilient Buildings



## Resilient Buildings



- NYC Enforces:
- 1) Wet Flood Proofing
  - 2) Dry Proofing
  - 3) FreeBoards
  - 4) Deployed Flood Barriers
  - 5) Installed Emergency Generators
  - 6) Flood Gates
  - 7) Flood Logs
  - 8) Flood Panels
  - 9) Flood Vents



\*IDS wanted tenants to live in the towers for at least a week, no matter how high floodwaters may reach nor how long the power is out.

emergency generators

flood barriers

Hudson Yards Development

-Storm proof “batwings” are secured by “submarine doors” to seal & waterproof all critical infrastructure, which sits below the flood plain.  
-Rainwater harvesting collects storm water on the roof to replenish the cooling towers & irrigate landscaping to minimize its burden on the city’s sewer system



# Bibliography

- "10 Hudson Yards Sustainability & Resiliency | Hudson Yards." *HudsonYards*, [www.hudsonyardsoffices.com/office/10-hudson-yards/availabilities/building/sustainability-and-resiliency](http://www.hudsonyardsoffices.com/office/10-hudson-yards/availabilities/building/sustainability-and-resiliency).
- "Buildings - Project Requirements - Registered Design Professional." *NYC*, [www1.nyc.gov/site/buildings/industry/project-requirements-design-professional-signs.page](http://www1.nyc.gov/site/buildings/industry/project-requirements-design-professional-signs.page).
- Dunlap, David W. "Building to the Sky, With a Plan for Rising Waters." *The New York Times*, The New York Times, 26 Jan. 2017, [www.nytimes.com/2017/01/26/nyregion/resilient-design-american-copper-buildings-weather-flooding.html](http://www.nytimes.com/2017/01/26/nyregion/resilient-design-american-copper-buildings-weather-flooding.html).
- "East Village - Lower East Side - Two Bridges." *NYC*, [www1.nyc.gov/site/planning/plans/resilient-neighborhoods/east-village-lower-east-side-two-bridges.page](http://www1.nyc.gov/site/planning/plans/resilient-neighborhoods/east-village-lower-east-side-two-bridges.page).
- National Research Council Of The National Ac. "Mapping the Zone: Improving Flood Map Accuracy20102Mapping the Zone: Improving Flood Map Accuracy. 2009. 122 Pp., ISBN: 978â□0â□309â□13057â□8 \$28.80 (Softcover), \$24.50 PDF Download The National Academies Press Wwww.nap.edu." *Disaster Prevention and Management: An International Journal*, vol. 19, no. 2, 2010, pp. 274–275., doi:10.1108/dpm.2010.19.2.274.2.
- *NYC Special Initiative for Rebuilding and Resiliency*, [www.nyc.gov/html/sirr/html/report/report.shtml](http://www.nyc.gov/html/sirr/html/report/report.shtml).
- "Story Map Journal." *Dcp.maps.arcgis.com*, [dcp.maps.arcgis.com/apps/MapJournal/index.html?appid=87d8af3603aa4e7b9f7ece4e4615ce41](http://dcp.maps.arcgis.com/apps/MapJournal/index.html?appid=87d8af3603aa4e7b9f7ece4e4615ce41).