FOSTERING COLLABORATION FOR CLIMATE ADAPTATION AND DECARBONIZATION IN THE BUILT ENVIRONMENT

NIBS Webinar

July 9th, 2024

1. Introduction of the speakers

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Outline

1. Introduction of the speakers
2. Topic of today
3. Learning Objectives
4. Climate Change & the Built Environment
5. Climate Mitigation in the Built Environment
6. Building Resilience
7. Q/A

2. Topic of Today

- In a time of increasing climate extremes, this session **emphasizes the importance of bridging the gap between the public and private sectors to prepare for climate challenges**. It will cover climate mitigation (energy conservation and sustainable practices) and climate adaptation (readiness for extreme weather events).

- This session will discuss **preparing for and mitigating climate extremes in the built environment**. It will cover understanding climate risk, asset vulnerability, and emergency/permanent risk mitigation solutions for the private sector.

- This webinar will provide detailed insight into risk mitigation and global best practices, highlighting **the importance of public-private collaboration in building climate-resilient cities**. The session aims to inspire innovative solutions and partnerships to address climate change challenges, empowering individuals and organizations to contribute to a more resilient and sustainable built environment.

3. Learning Objectives

1. Understand the value proposition associated with ESG (Environmental, Social, and Governance) performance, including the benefits and significance of effectively implementing ESG practices within buildings.

2. Understand the current state of practice of climate resilience planning and risk preparedness in the public and private sector through best practice introductions.

3. Understand climate risk mitigation through risk scoring and defining base and design flood elevations for built assets, performing vulnerability assessments, and defining conceptual solution strategies for flood mitigation.

4. Learn from real-world examples, such as Battery Park City in New York City, and 7 Square Endeavour in Rotterdam, on how private sector investments can supplement public resources for an integrative approach on climate resilience, decarbonization and hazard mitigation

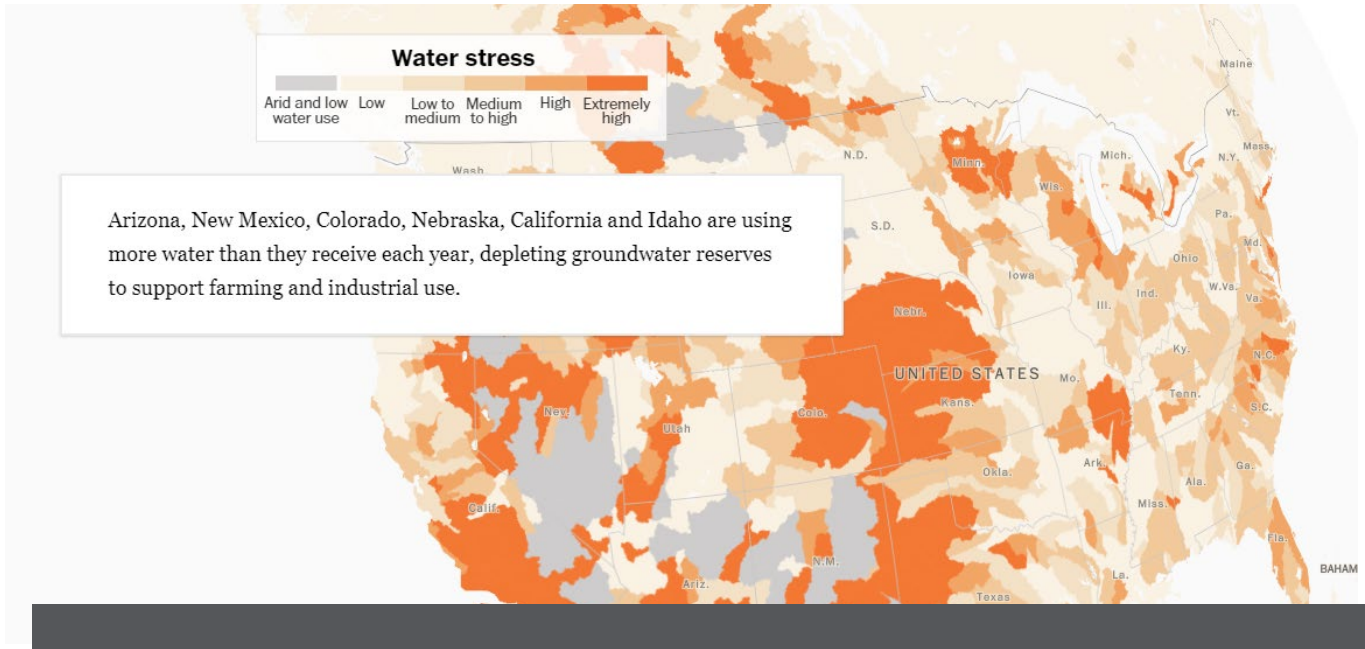
Introduction in Climate Change & the Built Environment

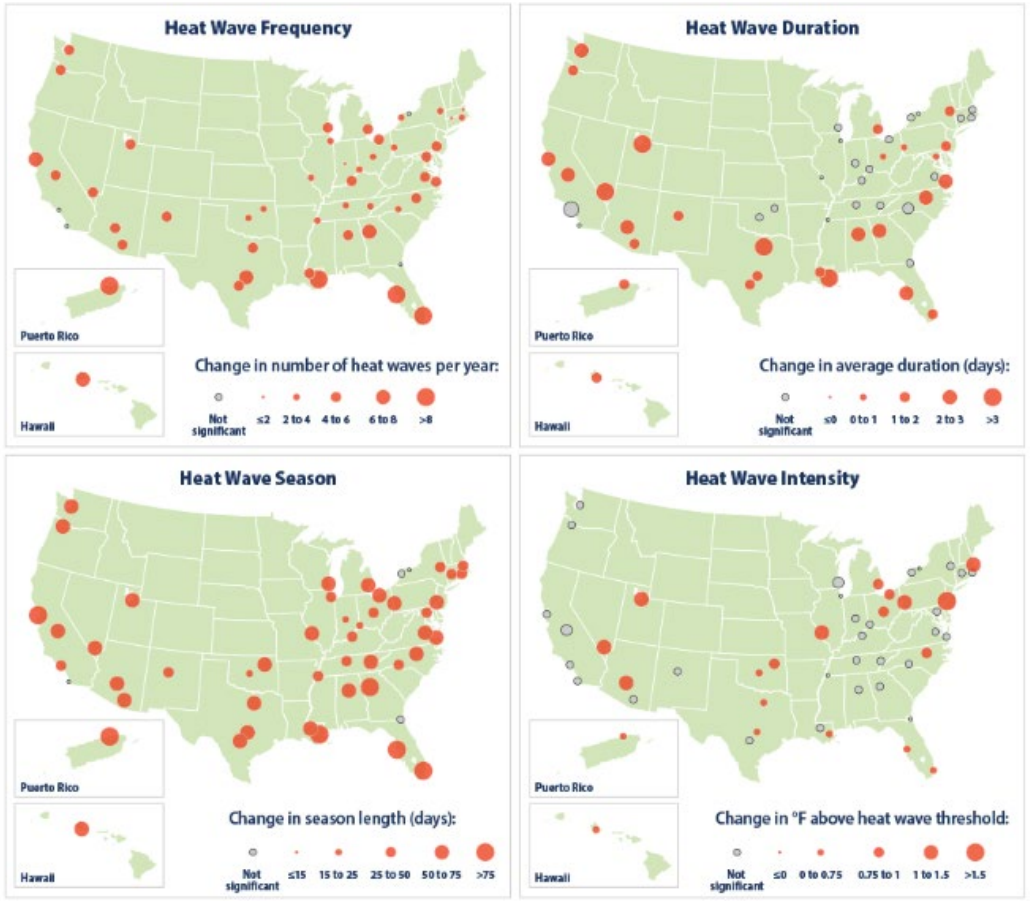
Flood, heat, drought. Our climate is changing...

National Institute of BUILDING SCIENCES™ ARCADIS

32 U.S. cities, including New York and San Francisco, are sinking into the ocean and face major flood risks by 2050, new study reveals

Flooding in the neigborhood of Freeport, Long Island on Jan. 13, 2024. (Image credit: Getty Images)



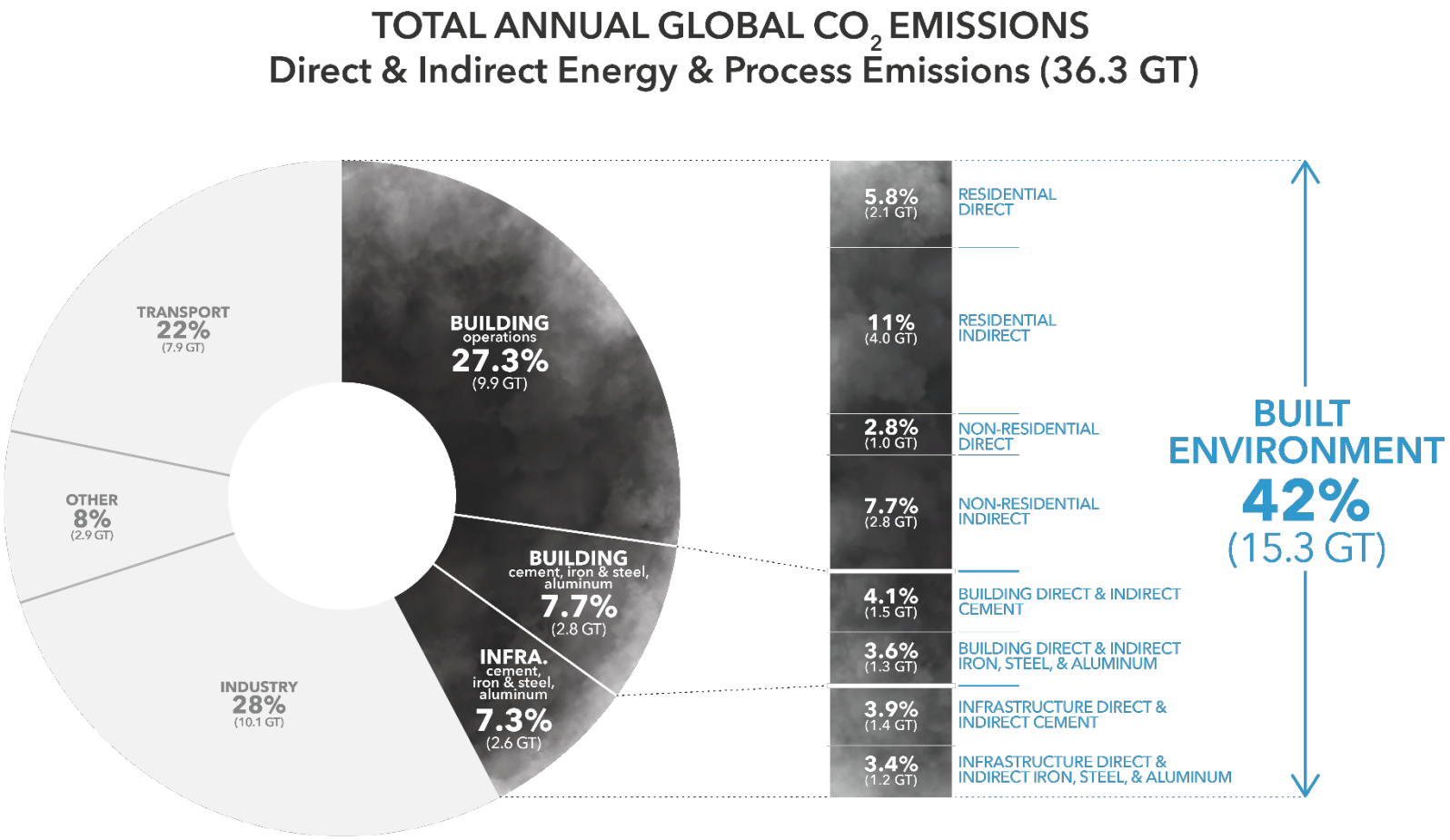


https://www.epa.gov/climate-indicators/climate-change-indicators-heat-waves

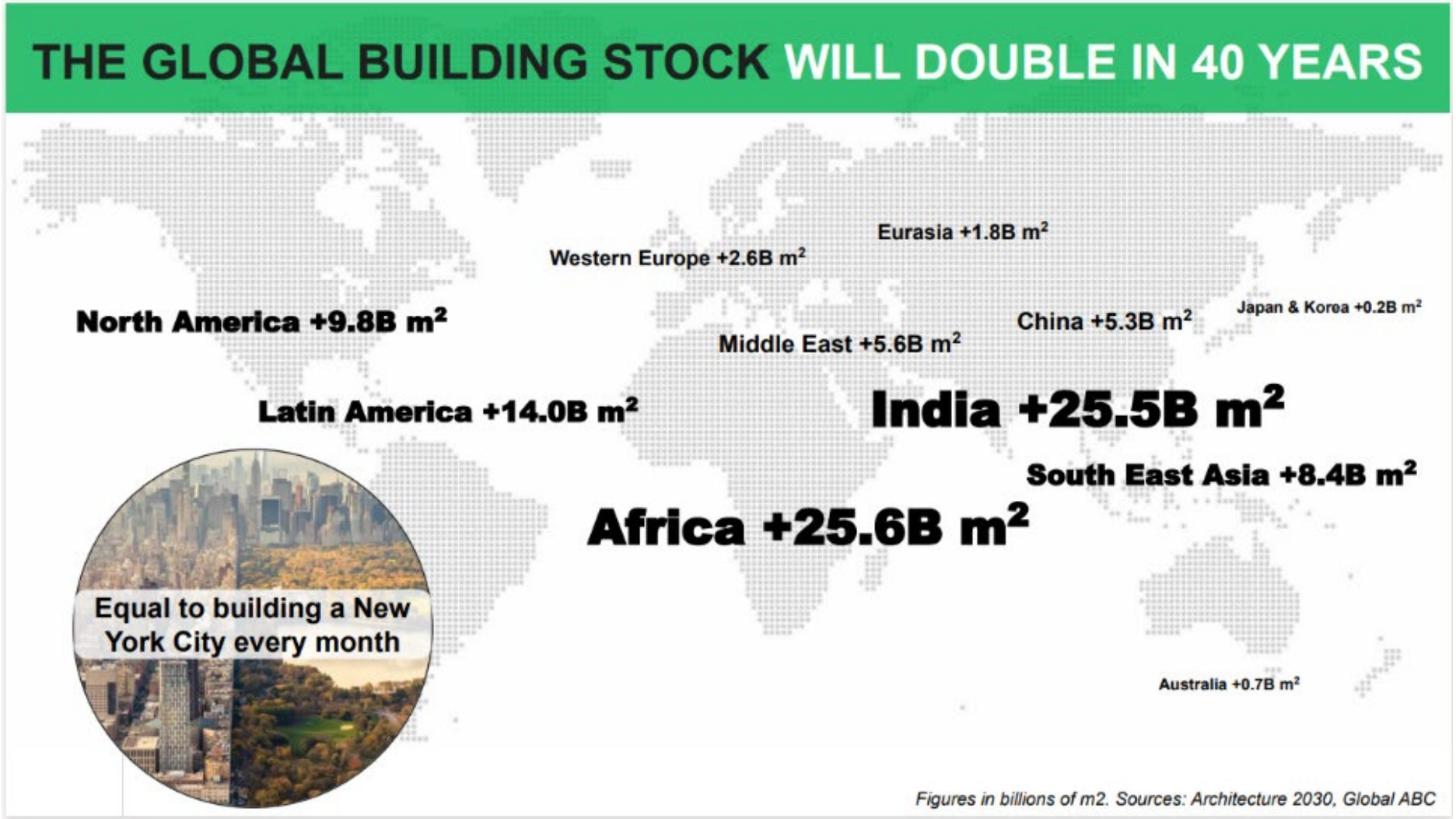
"The extremes of today, in the future, will be the new normal."

https://www.washingtonpost.com/climate-environment/interactive/2023/water-scarcity-map-solutions/

Close to half of all global emissions are produced in the construction and operation of built assets.



While the industry has begun to decarbonize, increasing populations will drive exponential growth in construction.



Strong ESG and Sustainability Credentials Increase Investment Potential

> *Assuring sustainable and ethical just management of Environmental, Social and Governance (ESG) risks, opportunities and impacts that can affect future revenue of a financing"*
>
> www.arcadis.com/esg-esia

> *Sustainability is meeting the needs of the present without compromising the ability of future generations to meet their own needs."*
>
> *United Nations Brundtland Commission*

Future of the Built Environment

BUILDINGS FOCUS ON PERFORMANCE

The sustainability performance, energy performance, and other performances are central drivers for comfortable living and working, and also determine the value of a building.

ENABLING WORKING AND LIVING IN A 24-HOUR ECONOMY

In our 24-hour global economy buildings will provide combined working and living space. Leisure, sports, shops and other amenities are combined in buildings that provide 24-hour connectivity.

CLIMATE RESILIENT

Buildings are entirely climate resilient: green, energy neutral buildings that are designed to withstand floods and heat stress and that are part of climate resilient cities and urban areas.

CIRCULAR BUILDINGS

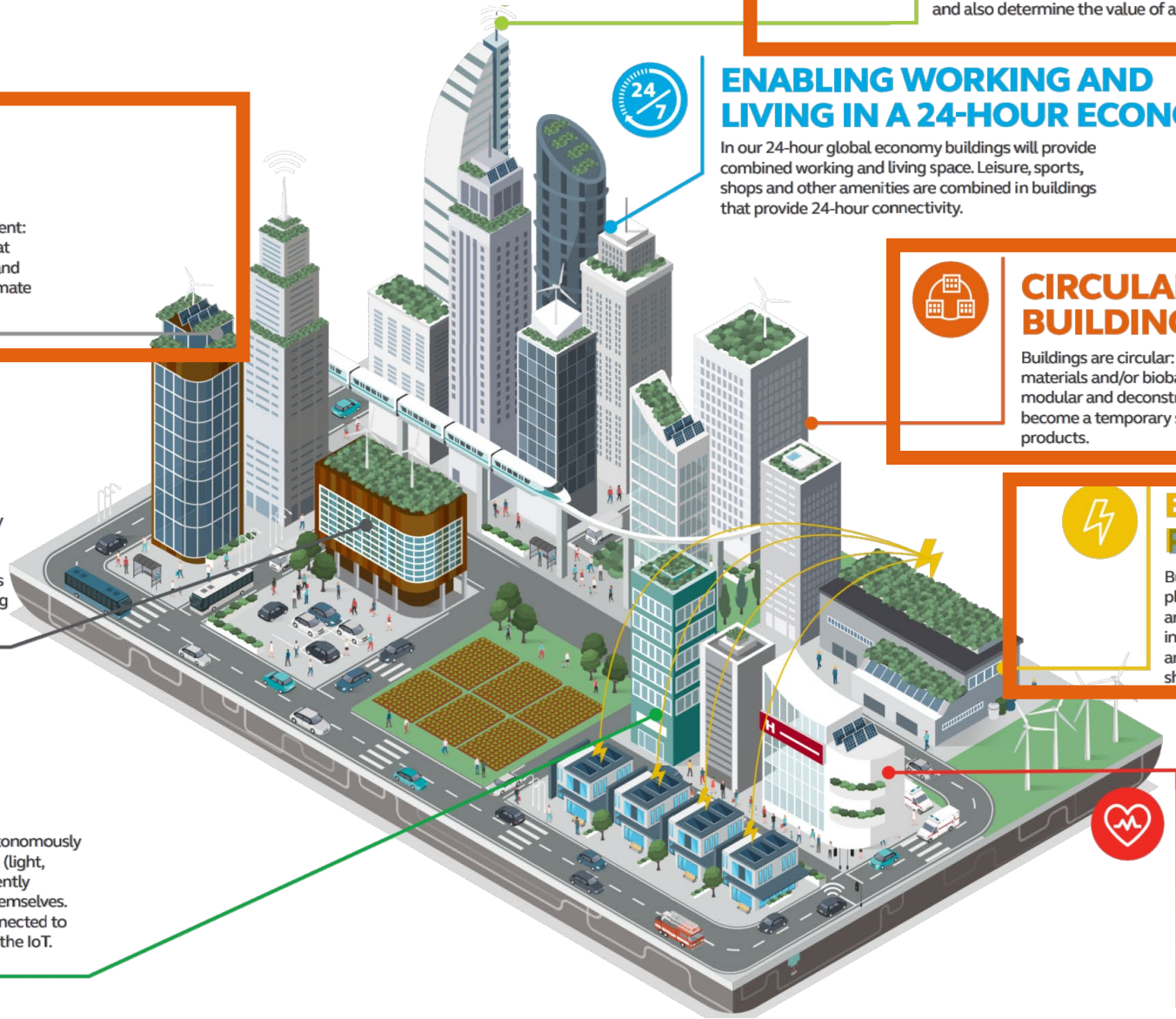
Buildings are circular: built with reused materials and/or biobased materials, are modular and deconstructable. They have become a temporary storage of materials and products.

FLEXIBLE BUILDINGS

Buildings will facilitate flexible use. They are adapted for changes in use on the short term, while being constructed for the long term. Smaller and flexible units will provide living spaces for the growing urban population.

ENERGY POSITIVE

Buildings create energy through photovoltaic solutions and are highly energy efficient and independent of fossil fuels. Buildings are connected to a smart grid to share and store electricity and heat.



COGNITIVE BUILDINGS

Buildings will be able to autonomously manage its internal climate (light, temperature, air) and efficiently adjust e.g. energy use by themselves. Cognitive buildings are connected to smart grids and are part of the IoT.

SUPPORT A HEALTHY LIFESTYLE

Buildings provide a healthy environment: healthy noise management, optimal temperature management, clean air and daylight. The design fully supports the wellbeing of its users.

Climate Mitigation in the Built Environment

What is Net Zero?

- Greenhouse gas emissions from human activity are in balance with emissions reductions. It refers to the equilibrium between greenhouse gas production and removal from the environment.
- Balance between greenhouse gas production and removal from the environment.

GHG Scope Classification

Scope 1

Direct emissions from owned or controlled assets and/or facilities.

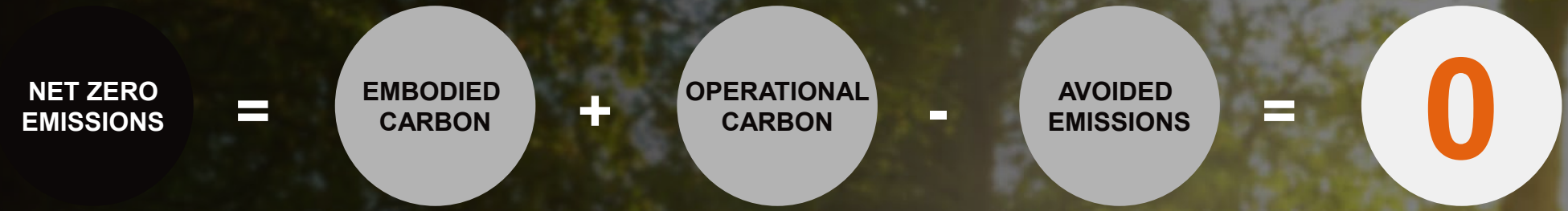
Scope 2

Indirect emissions from the purchased energy *(electricity, steam, heating & cooling)*

Scope 3

Indirect emissions from purchased upstream or downstream activities such as goods and services, transportation, and distribution, leased assets, and/or end-of-life treatment of sold products.

What is Net Zero Carbon?



- Upfront carbon
- Use stage embodied carbon
- End of use carbon

- Direct emissions
- Indirect emissions

- Exported green power
- Carbon offsets

OPERATONIAL | GHG emissions associated with operations of a building

This includes all carbon released from energy to heat and power the building :

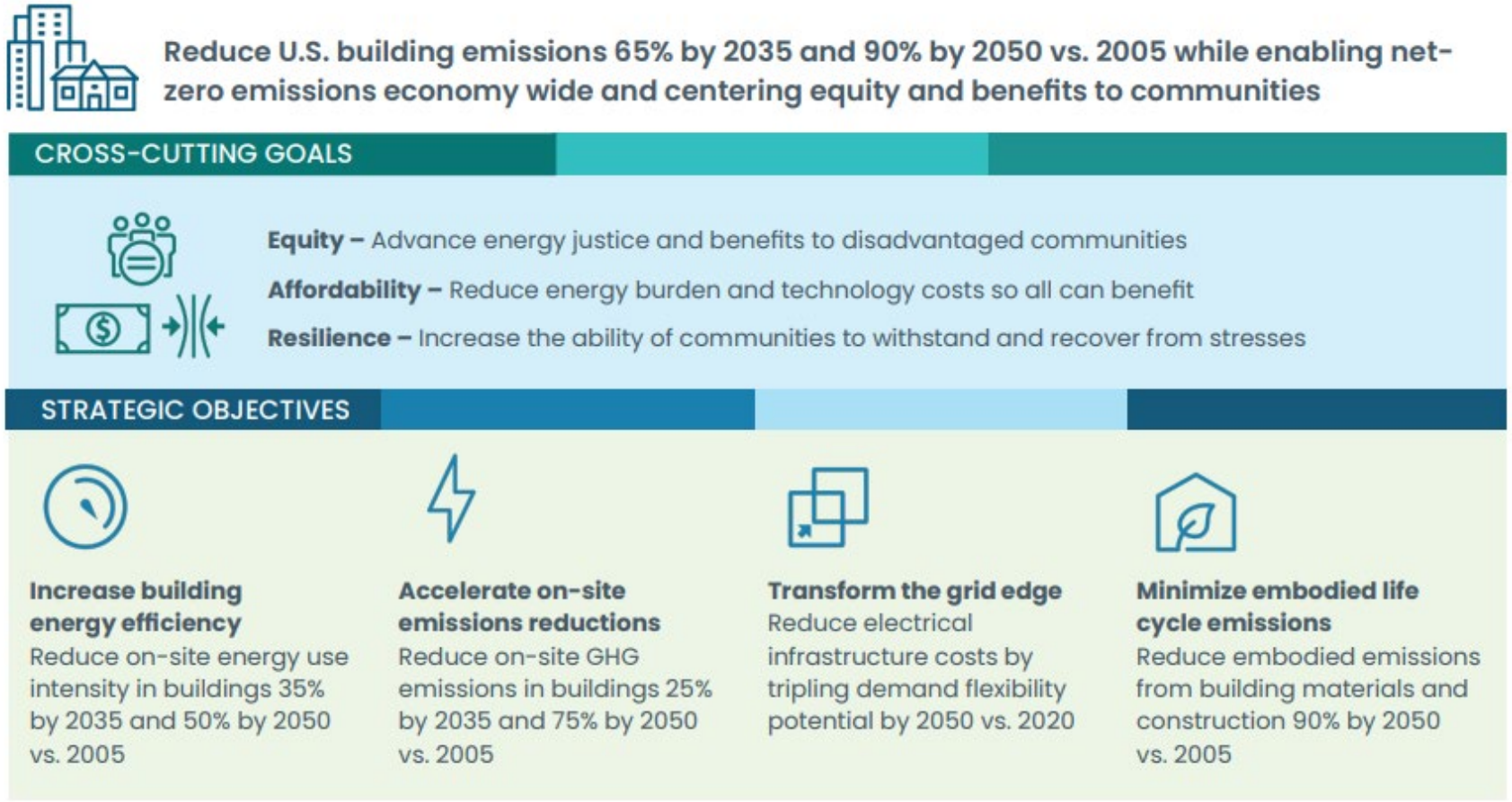
- Lighting
- Sanitary water
- Power & plug loads (idle consumption)
- Heating, Cooling, Ventilation
- Building envelop (windows, walls, roof, etc.)
- Lifts, automatic doors, etc.

EMBODIED | GHG emissions associated with construction and demolition

- Raw material extraction
- Manufacturing and processing, transportation and installation of all building materials
- Carbon released by plants and machinery throughout the building process

Federal Goals

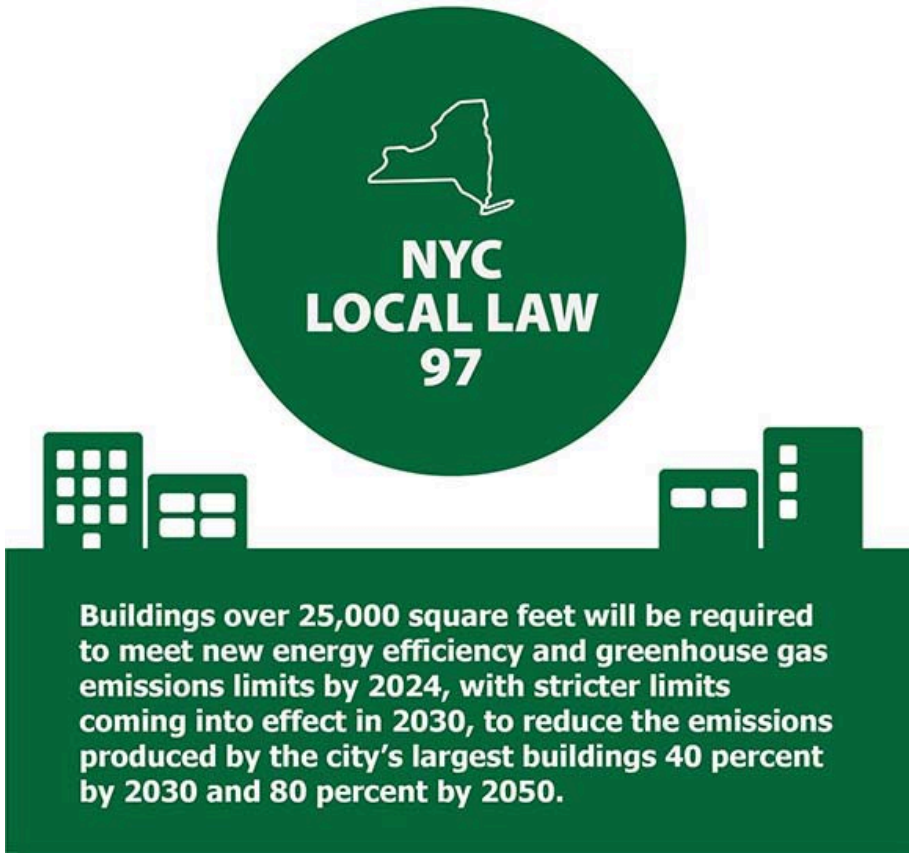
The first National Blueprint for the Buildings sector –
Decarbonizing the U.S. Economy by 2050, was launched in April, 2024.

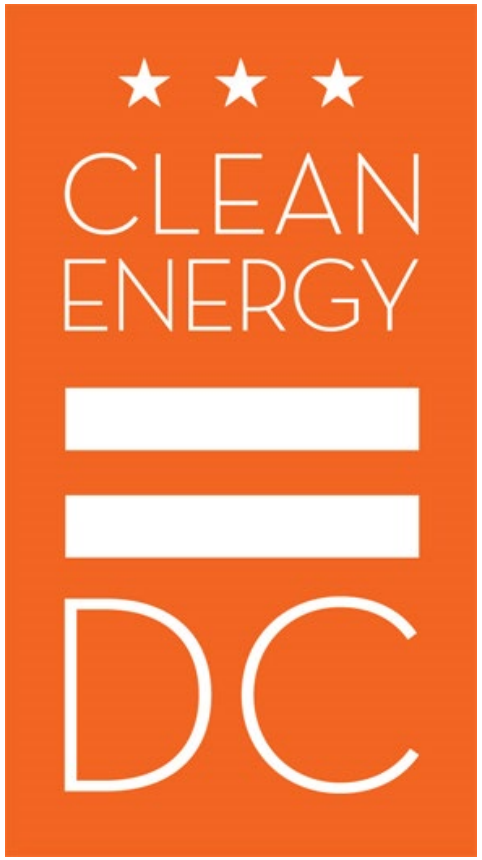


Rapid decarbonization of the buildings sector by 2050 is marked by the achievement of three crosscutting goals and four strategic objectives.

U.S. Department of Energy, 2024

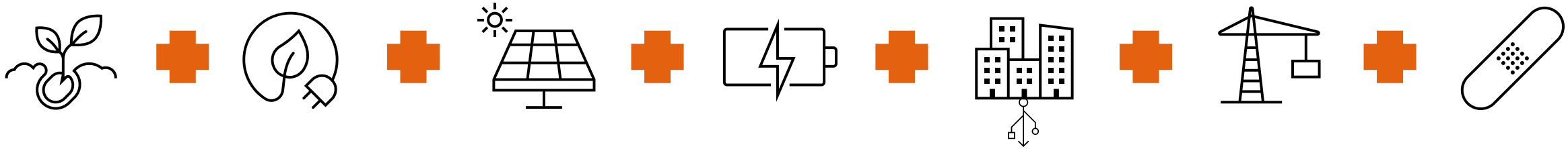
Local regulation of energy and carbon from buildings





How can we decarbonize buildings?

The more carbon you save upfront, the less carbon offsets are needed.

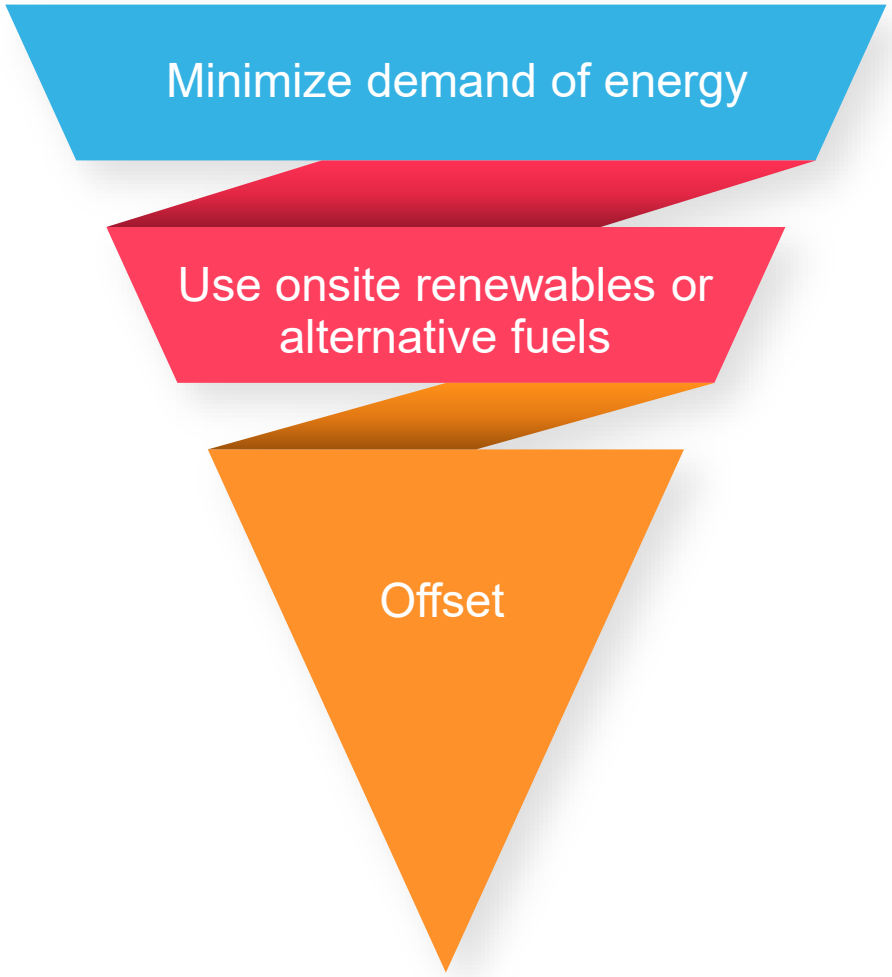


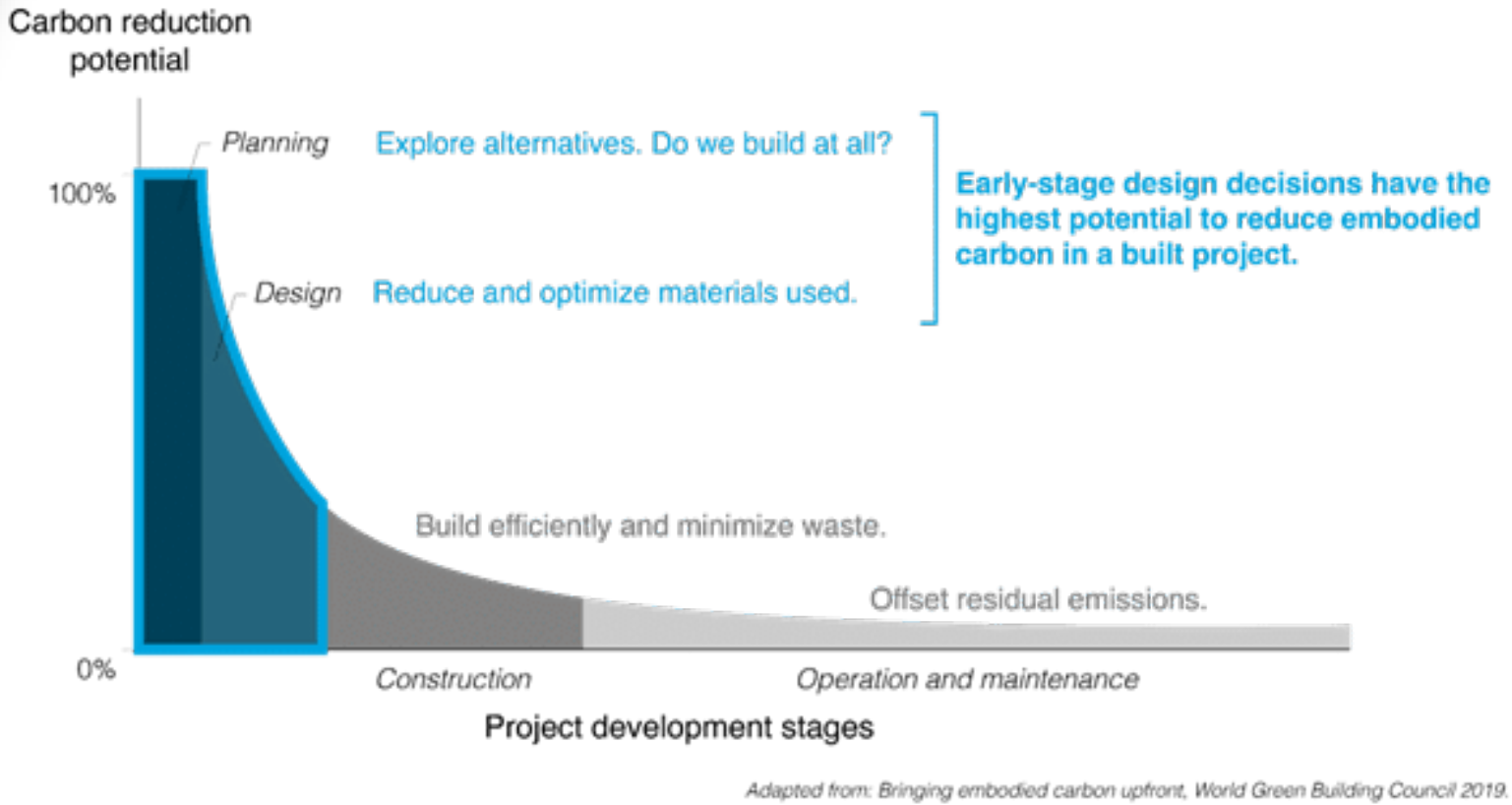
Smart Growth + **Energy Efficiency** + **Renewable Energy** + **Grid Integration & Storage** + **Building Electrification** + **Embodied Carbon** + **Carbon Offsets**

- **DEEP ENERGY RETROFIT** • DAYLIGHT HARVESTING • SOLAR PV • **GEOTHERMAL** • BATTERY STORAGE • **MATERIAL OPTIMIZATION**
- INSULATION • BUILDING FORM • RADIANT COOLING • **THERMAL STORAGE** • HEAT PUMP • STRUCTURAL OPTIMIZATION
- SPACE UTILIZATION • PASSIVE DESIGN • SOLAR THERMAL • **DISTRICT ENERGY** • ELECTRIC VEHICLE PARKING • EPDS & HPDS
- AIR TIGHTNESS • RIGHT SIZING • BIPV • COMMUNITY ENERGY • NET METERING • DESIGN FOR DISSASSEMBLY
- **15 MINUTE CITY** • EQUIPMENT EFFICIENCY • MICRO HYDRO • **MICRO GRID** • BIDIRECTIONAL CHARGING • DURABILITY
- BUILDING ORIENTATION • RADIANT HEATING • WASTE HEAT RECOVERY • LOAD BALANCING • SMART BUILDINGS • RIGHT TO REPAIR
- TRANSPORTATION • THERMAL COMFORT • DEMAND RESPONSE • PRECOOLING • PREHEATING • PREFABRICATION • MODULAR

Tactics to achieve deep emission reductions

The price of carbon offsets are expected to increase. Act now by prioritizing solutions that will reduce the need for carbon offsets.





Adapted from: Bringing embodied carbon upfront, World Green Building Council 2019.

The cost of change increase per development stage.

7 Square Endeavour

Schouwburgplein Rotterdam – The Netherlands

- Solving Urban Challenges Together

Goal

A **carbon-neutral** and **climate-resilient** Schouwburgplein (Theater Square) by 2030

Principles

- The square as a Rotterdam testing ground for sustainable and climate-adaptive measures
- Exemplary and scale able
- (Local) collaboration is key (bottom-up)
- Strategic and integrative approach
- Together with and for the neighborhood
- The Rotterdam square is the first square in a series of seven worldwide.
- Innovative cyclic solutions and reproducible business cases

The Area

How?

Public-private partnership: complementary stakeholders working together

Integrated approach

Redevelopment Schouwburgplein

SEVEN SQUARE ENDEAVOUR

Three strategies (intertwined)

Climate adaptation

Water Strategy

Climate adaptation | Optimize space | Liveablity

Place & Space

Financial Model | Climate **Mitigation**

Energy Strategy

Urban Water Buffer

Smart water storage and discharge system

Green Roof

Blue roof

Yellow Roof

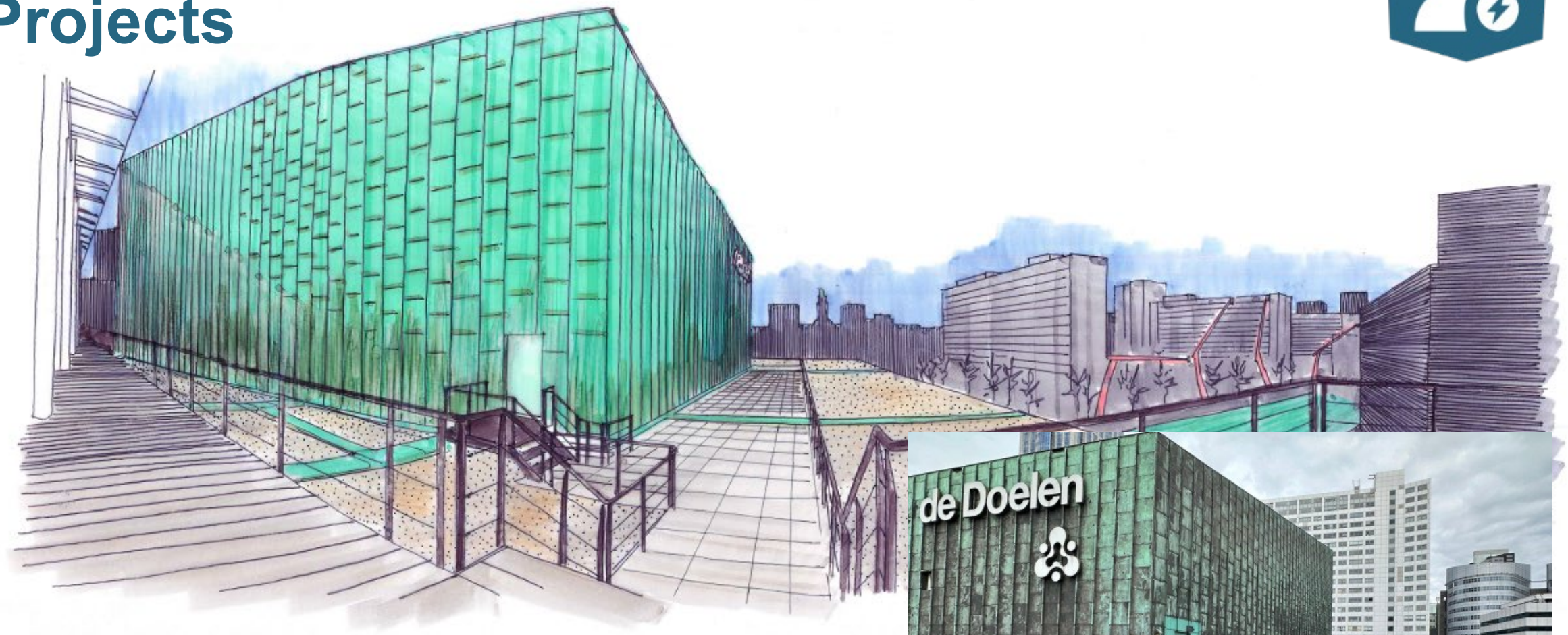
Red roof

Explore (collective) purchasing and/or generation of green energy

Collective Cold-Heat Storage System (ATES)

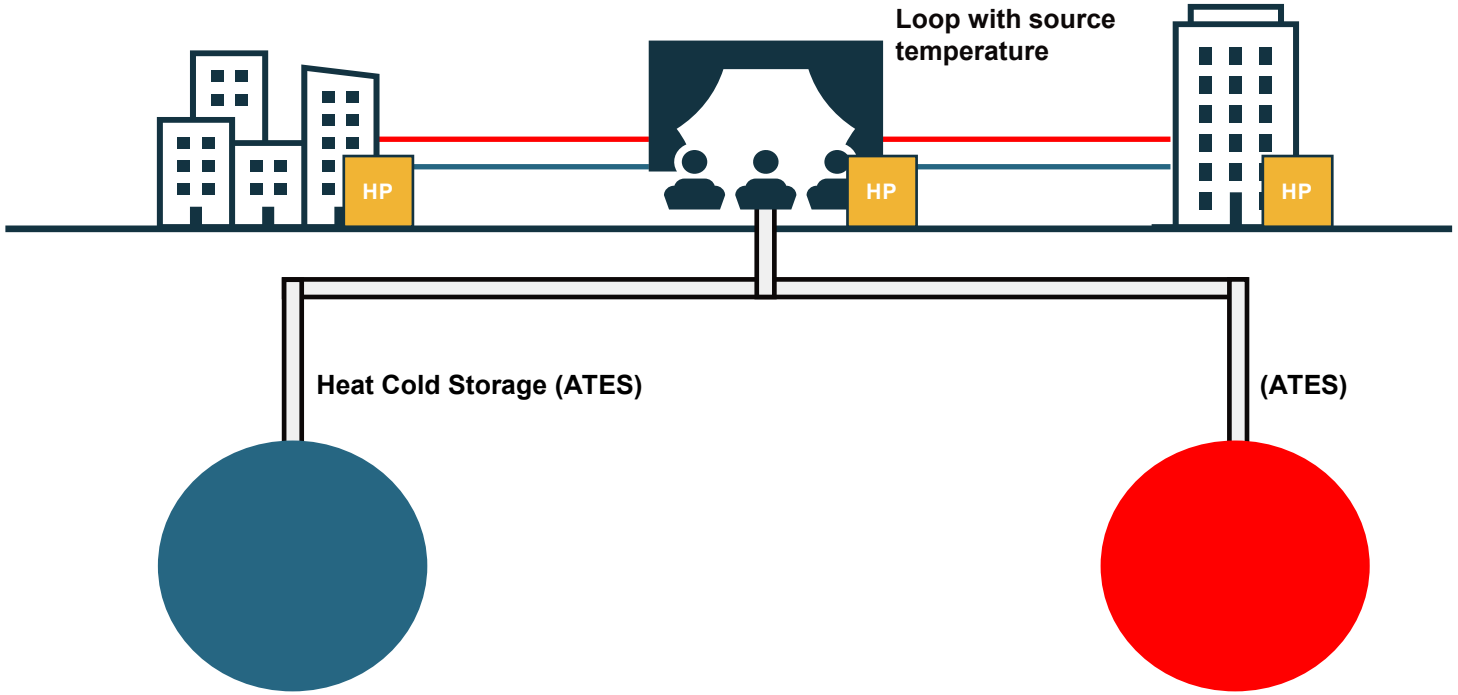
Energy monitoring, storage and exchange

Projects



Sustainable Roof De Doelen

Energy system



One of the options: Decentralized heatpump system

Conclusions

Movement by inspiration!

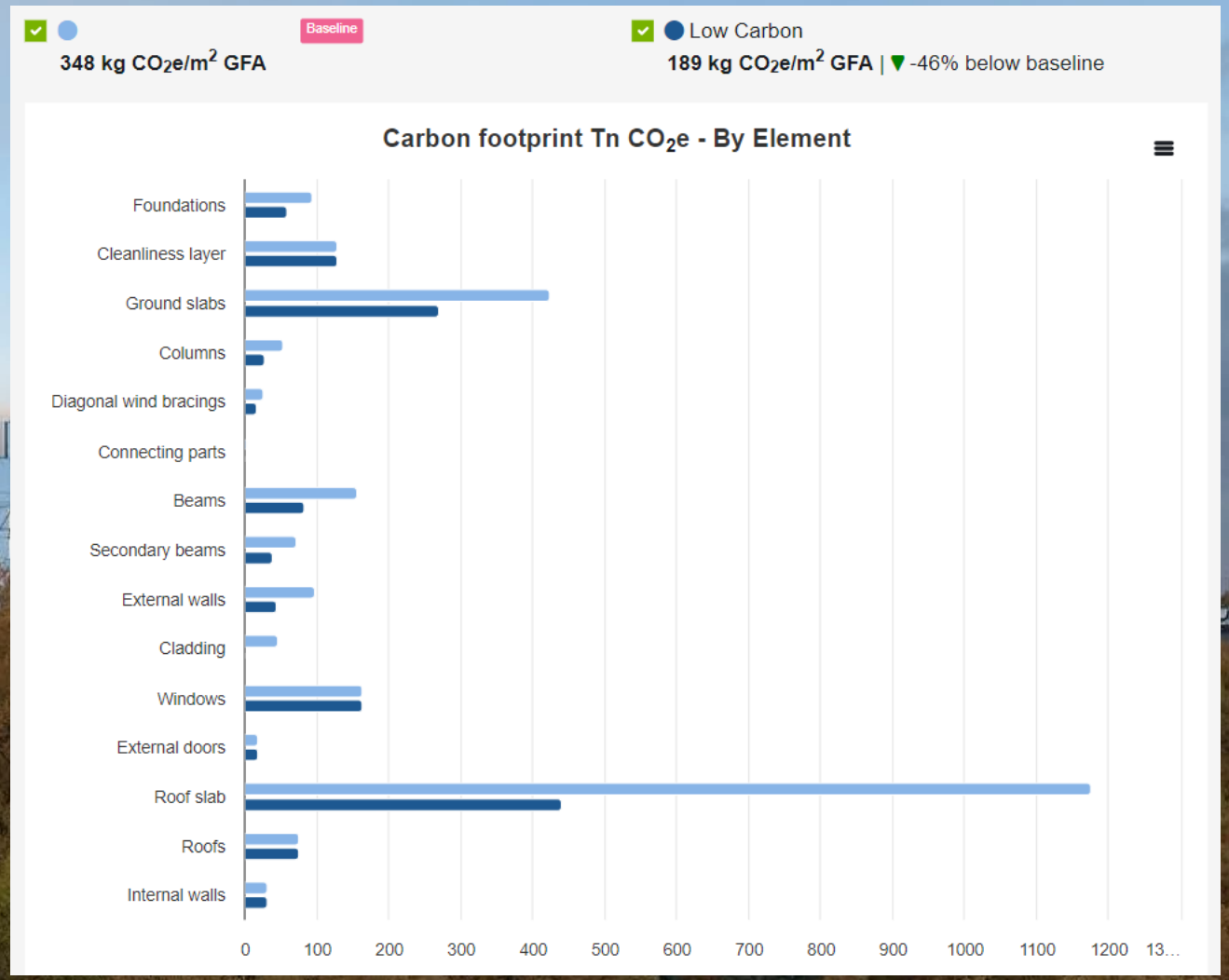
- It starts with an idea and inspiration
- Find the right partners and people
- Find an authentic cooperation model
- With this you will create energy and momentum

Embodied and operational carbon management for Metrolinx on their Ontario Line Metro Development.

- Arcadis is leading the building design for Ontario Line's Rolling Stock, Systems, Operations and Maintenance Facility (RSSOM).
- Location: Toronto
- The Ontario Line will bring 15.6 kilometres of much-needed rapid transit to Toronto to make moving around the city better, faster, and easier than it is today. RSSOM is where the new trains will be housed, cleaned, and maintained to keep them running smoothly.

Conclusions

- Work together with low-carbon suppliers in stead of focusing on desktop research only.
- Leveraging economies of scale
- Specifying lower carbon concrete is a huge opportunity to reduce whole life cycle carbon
- Not all companies have EPD information, so collaboration is crucial.
- Low carbon suppliers have in-house sustainability experts who can provide more information.

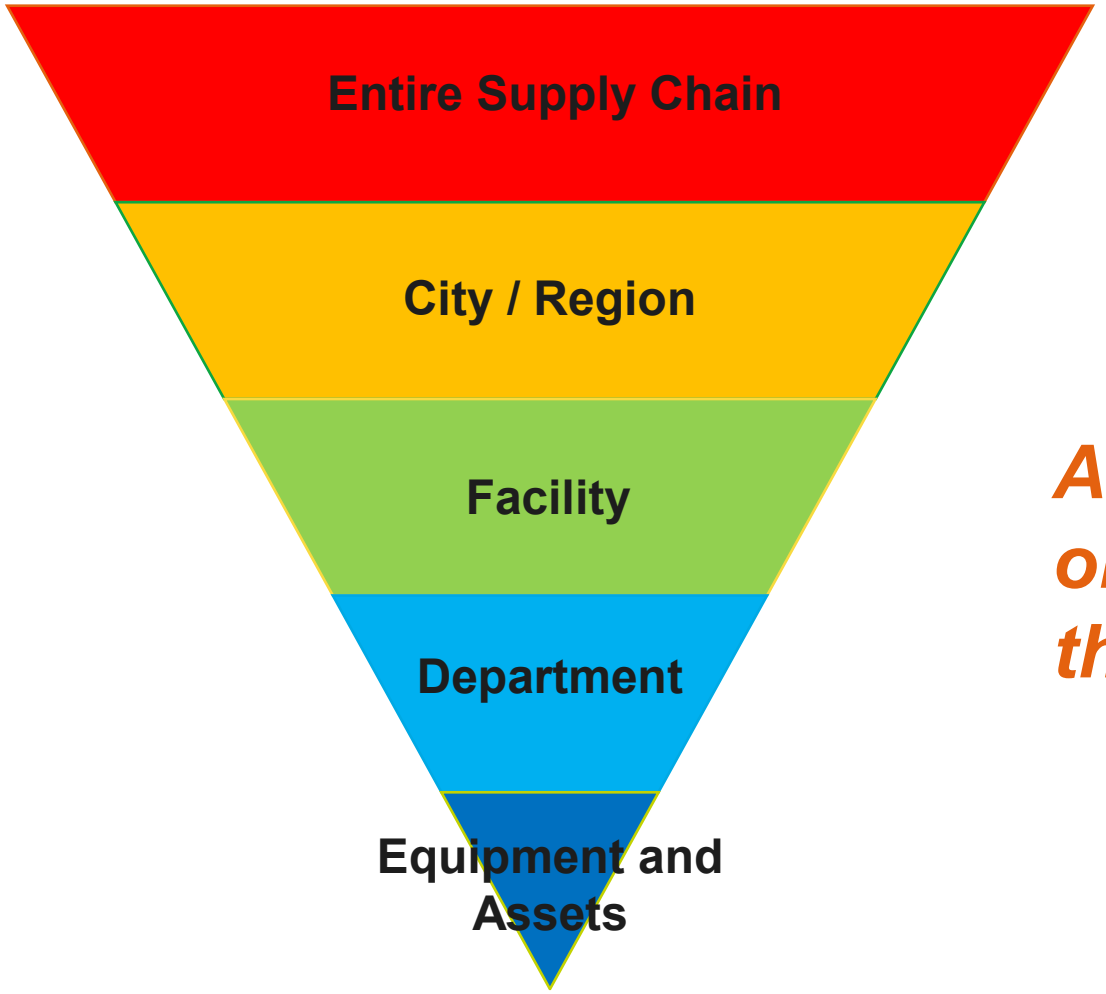


Quick Risk Facts Adaptation

- 28 events >1B, totaling $93B in damage in 2023 alone
- Over 75% of federally declared disasters are flood-related
- Floods account for greater loss of life and property than all other hazards combined
- Flood waters do not obey jurisdictional boundaries
- Actions within a watershed can lead to increased or reduced flooding upstream, downstream, and sideways
- FEMA flood maps do not cover all sources of flood risk and may not be accurate

Assessing Risk & Resilience

Interdependency, cascading impacts



Always look at least one scale up from the level of interest

A Systems Approach to Climate Robust Water Management

Connect all scales and build the business case


Built Asset Management


Digital/Cyber


Operations


Organization Culture


Regulatory Framework


Polices and Standards


Roles, Responsibilities and Authorities


Financial Resources


Human Resources


Emergency and Risk Management

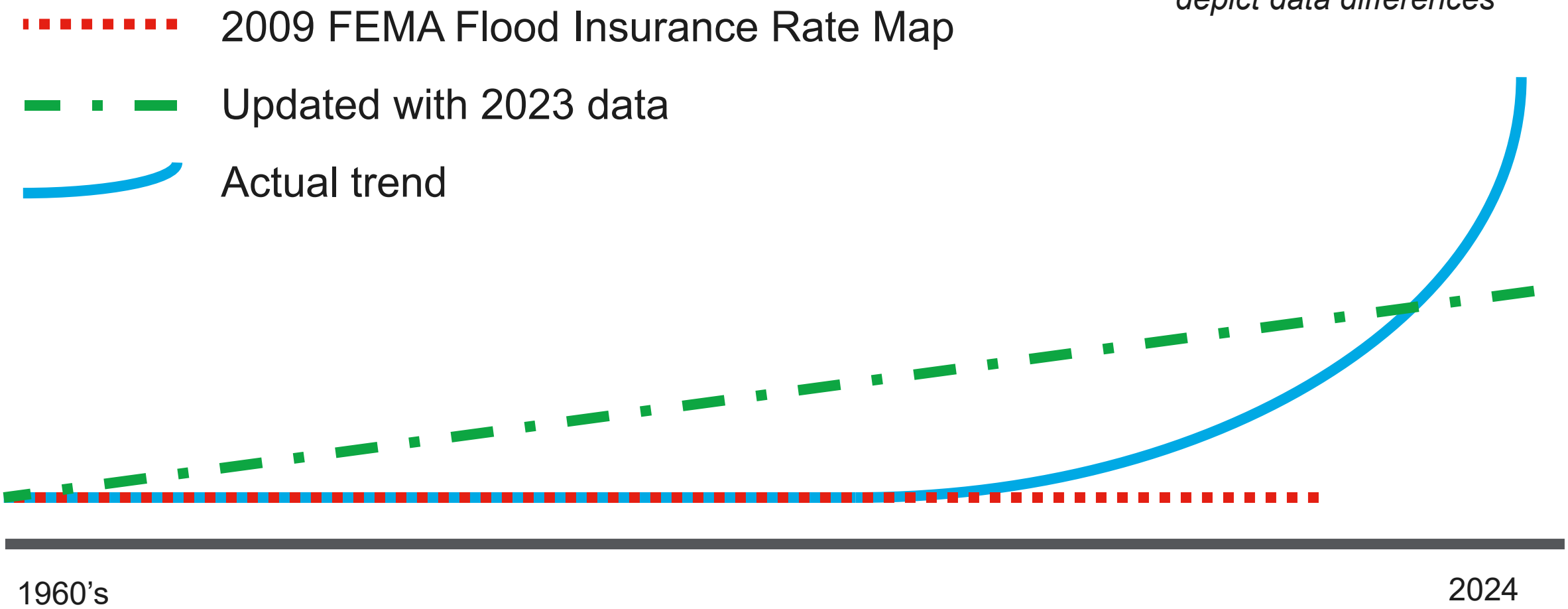

Long-Term Strategic Planning


Stakeholder Coordination

…between public and private systems

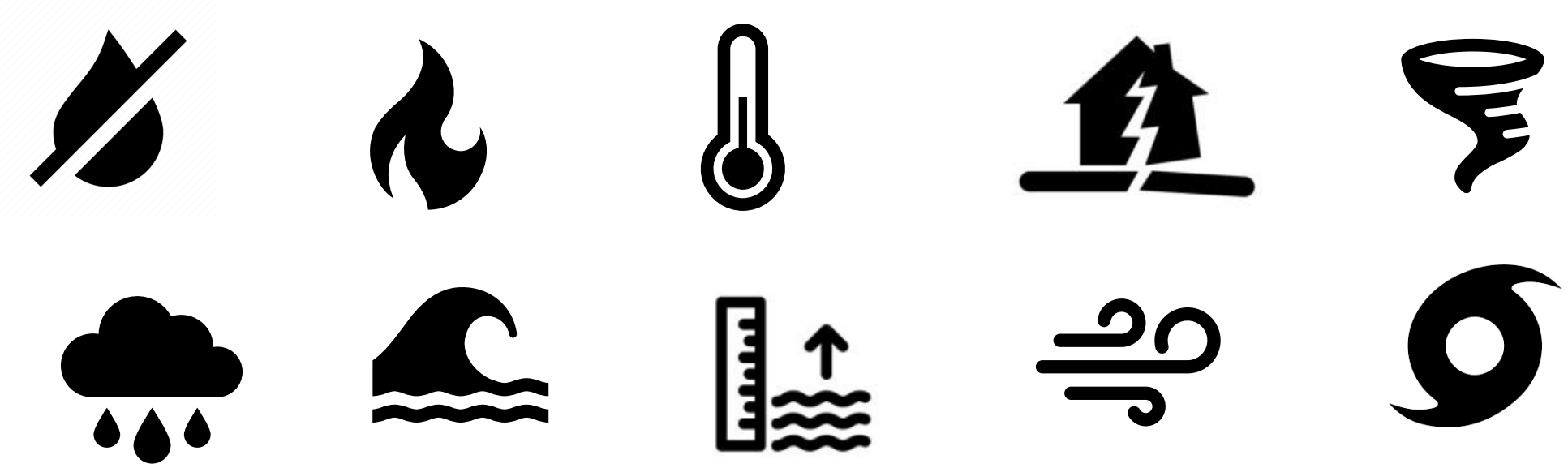
Know your data

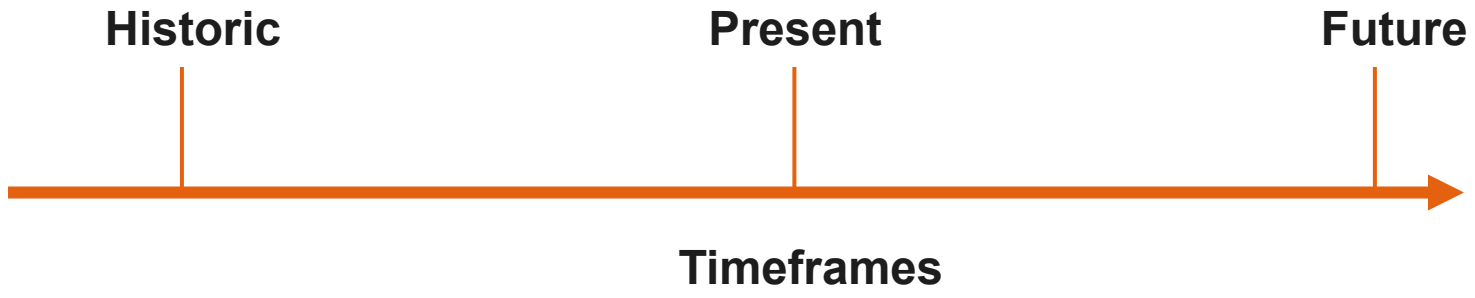
**lines drawn only for illustration and not intended to accurately depict data differences*



Assessing Risk & Resilience

Hazard Screening



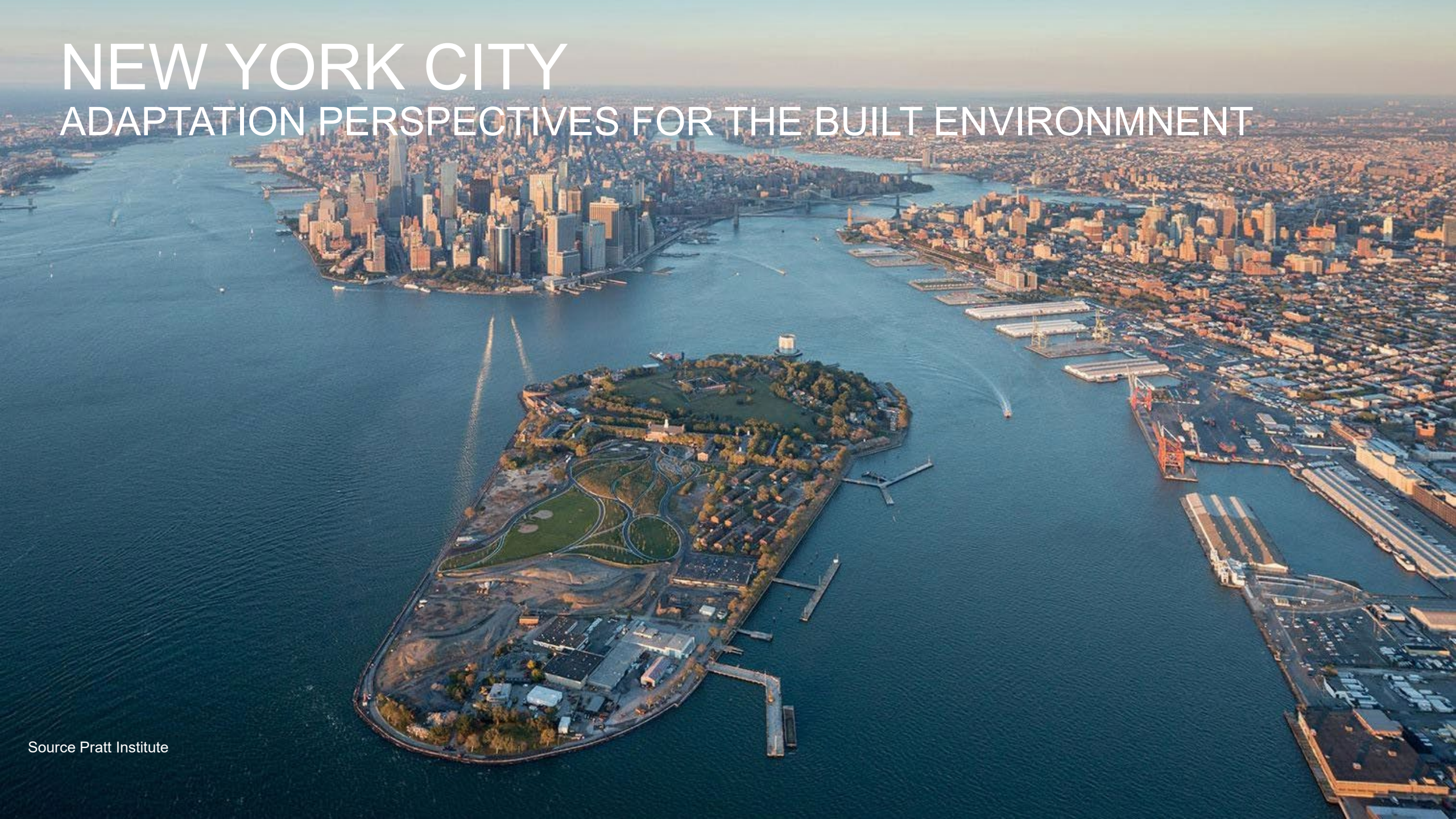


	Hazard Risks						
	Drought (Water Stress)	Heat Stress	Earthquake	Flooding	Sea Level Rise	Hurricane & Typhoon (Wind)	Wildfire
Property 1	LOWER	LOWER	LOWER	MEDIUM	MEDIUM	HIGHER	LOWER
Property 2	LOWER	LOWER	LOWER	HIGHER	HIGHER	HIGHER	LOWER
Property 3	LOWER	LOWER	LOWER	HIGHER	HIGHER	HIGHER	LOWER
Property 4	LOWER	LOWER	LOWER	HIGHER	LOWER	HIGHER	LOWER

Property	Hazard Likelihood					
	Flooding	Sea Level Rise	Extreme Wind	Earthquake	Wildfire	Drought
Property 1	HIGHER	HIGHER	MEDIUM	LOWER	HIGHER	HIGHER

NEW YORK CITY

ADAPTATION PERSPECTIVES FOR THE BUILT ENVIRONMNENT

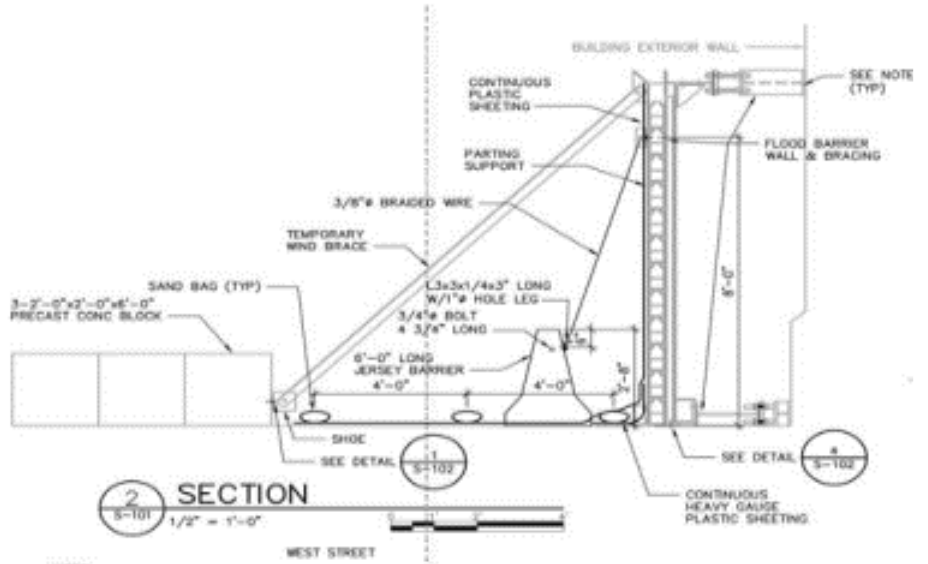


Source Pratt Institute

Hurricane Sandy, 2012
Physical Disruption

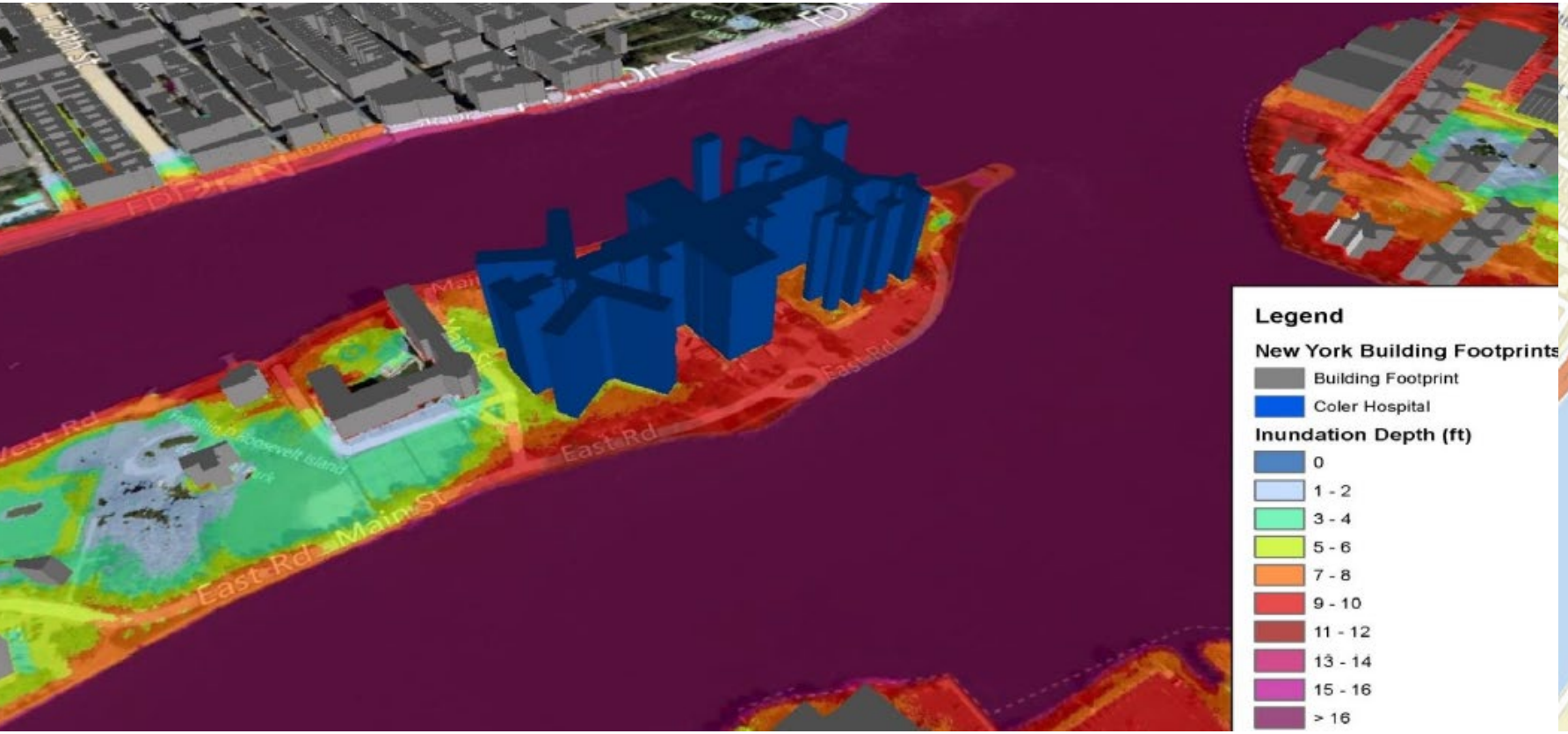
Source Rebuild by Design

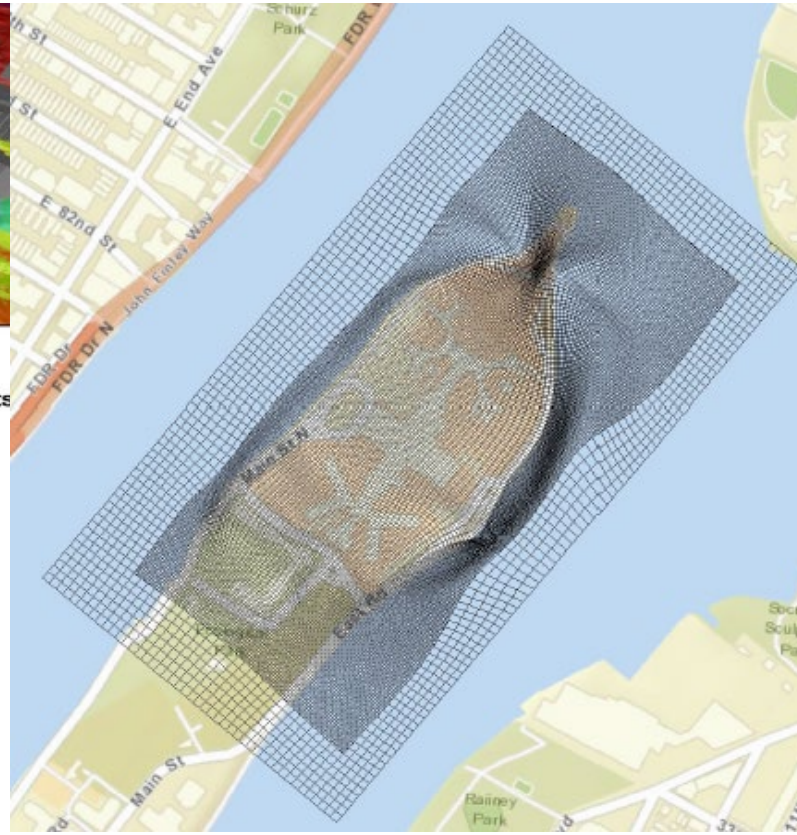
Immediate Response: Protection of Critical Assets



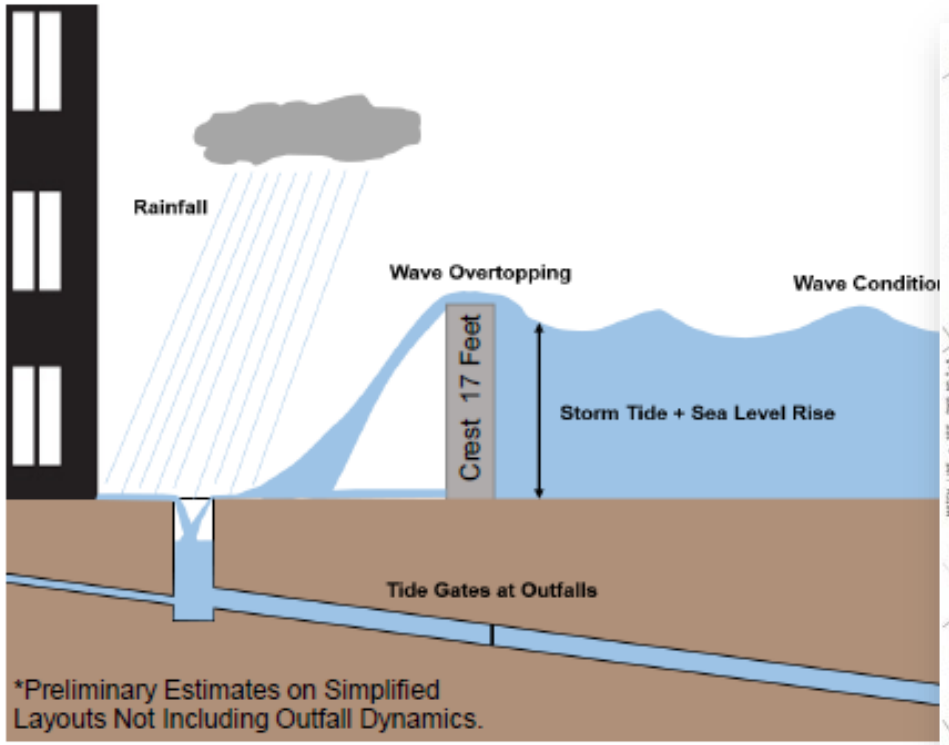
Full Perimeter Protection Of Landmark Buildings | Design, Permitting, Construction & Testing

Protecting Critical Assets
Coler Hospital, Roosevelt Island

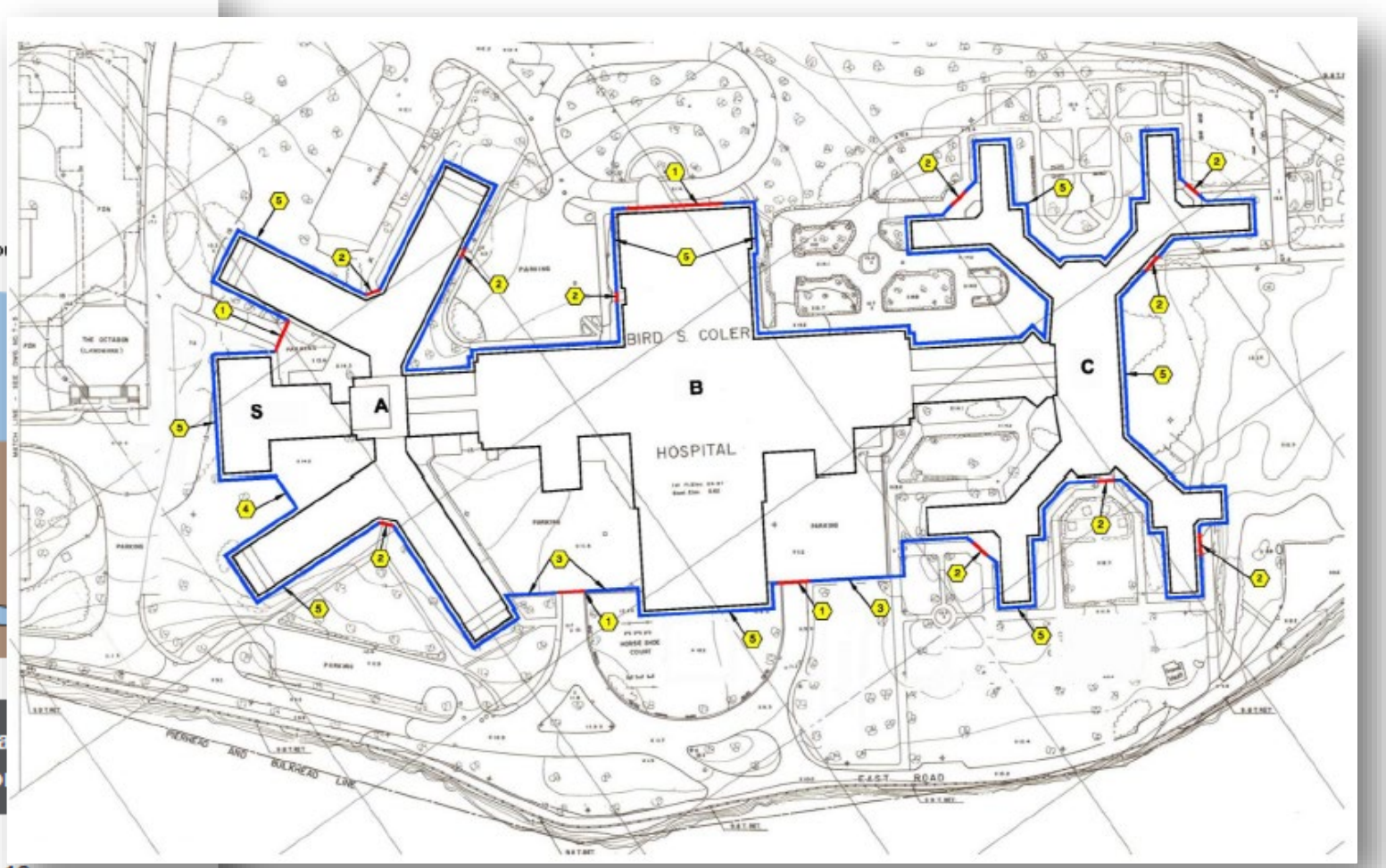




Protecting Critical Assets
Coler Hospital, Roosevelt Island



Sea Level	Interior Ponding * (Feet NAVD88)	Volume Mana Feet * (Millio
Current-Day	10.5	
2080s 10th	12.0	12
2080s 50th	16.0	32



Coler Hospital: FEMA Hazard Mitigation Plan

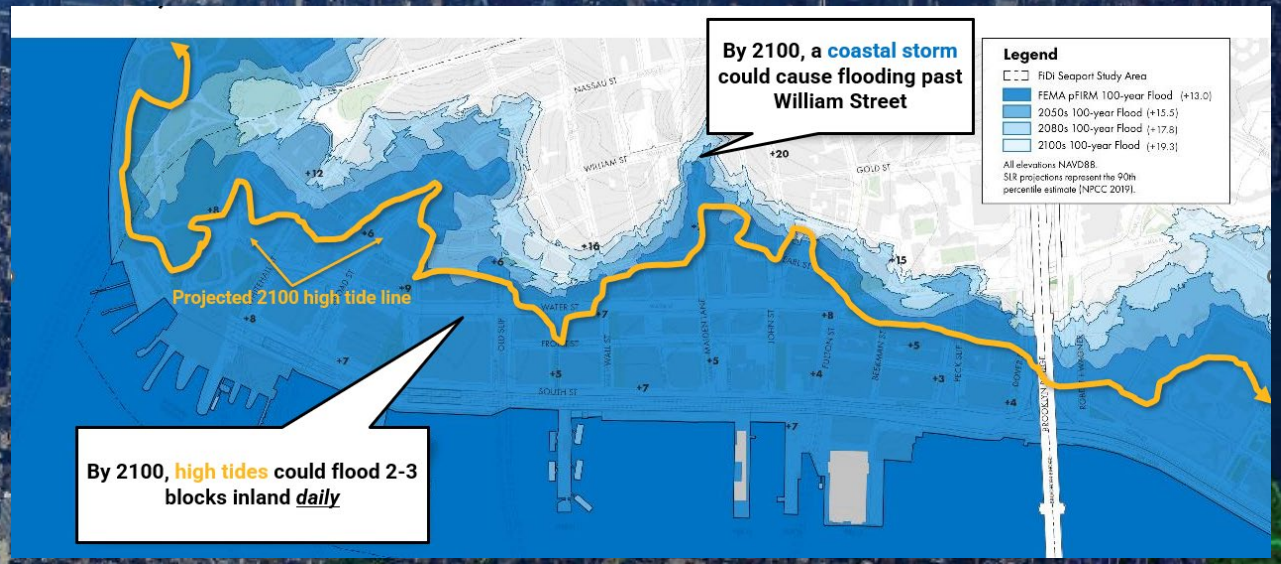
Protecting Critical Assets

Coler Hospital, Roosevelt Island

Manhattan's BIG U Flood Protection Plan

Source Rebuild by Design BIG Team

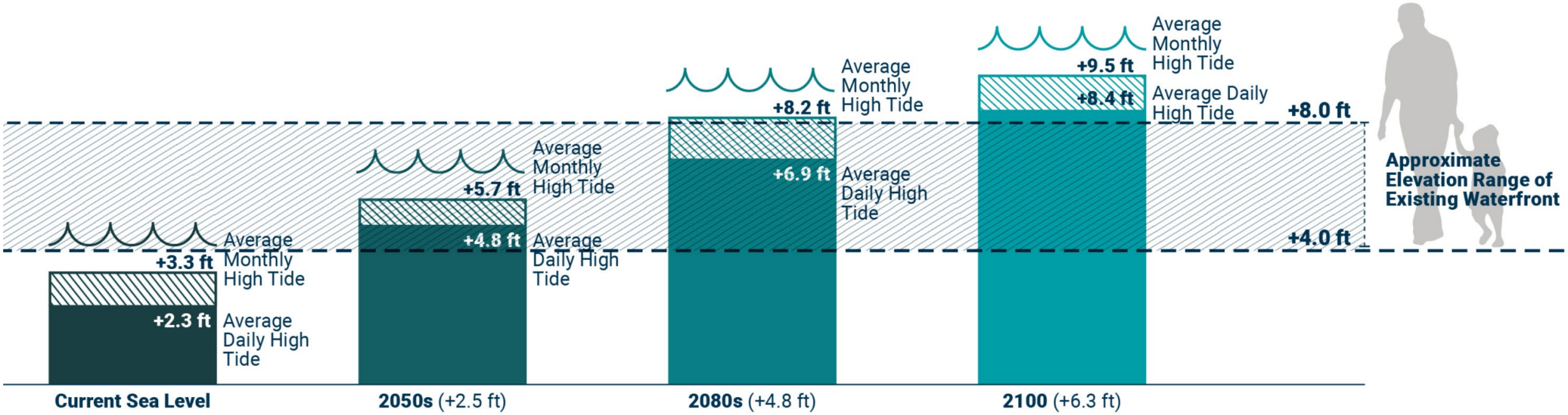
Two types of climate risks - daily tidal flooding and coastal storms, Financial District, Manhattan.



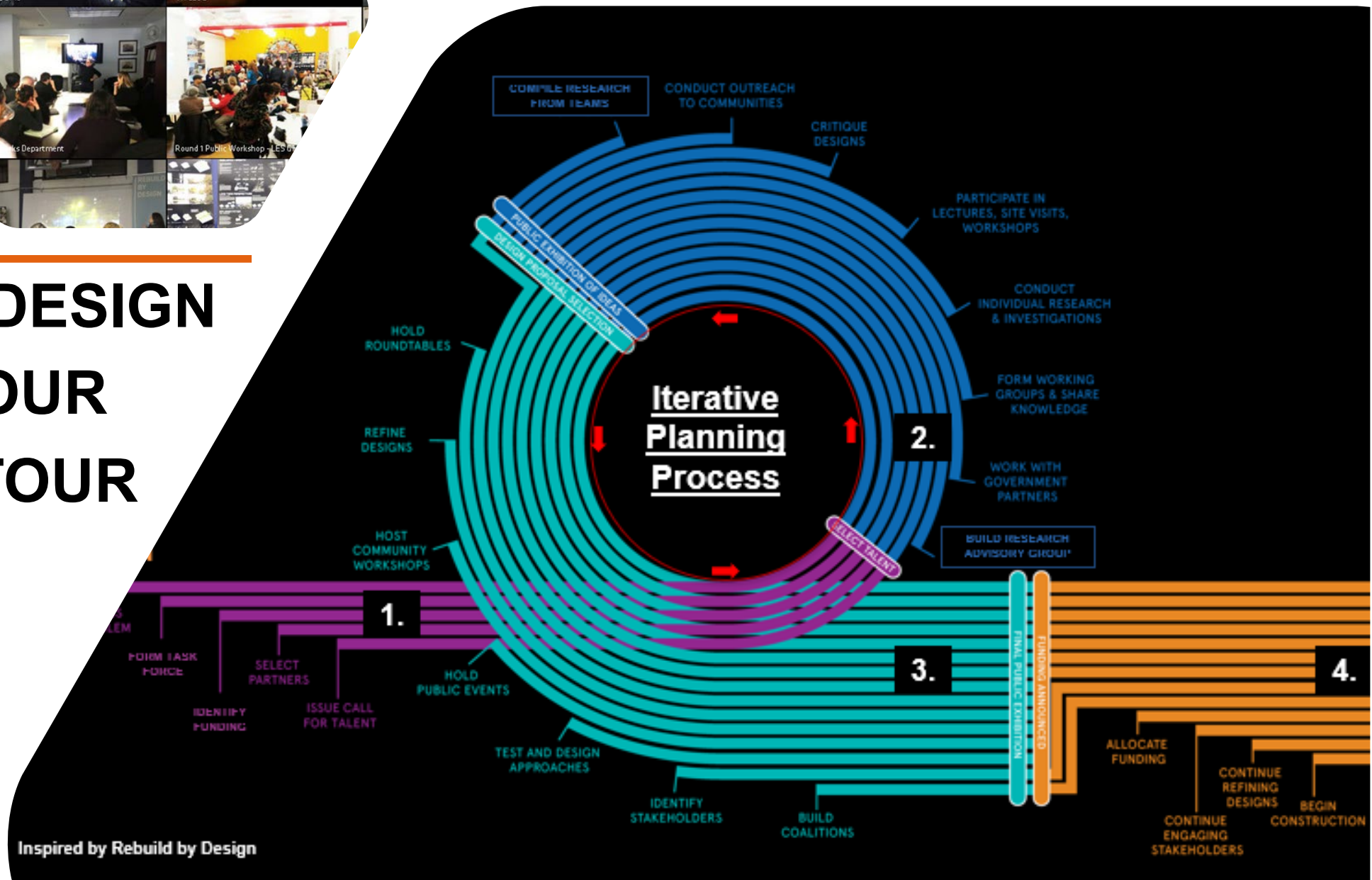
Source Rebuild by Design BIG Team

Understanding Current and Future Risk - Sea Level Rise & High Tides

High tide flooding is anticipated to cause up to four feet of flooding by the 2100s, the same height as the storm surge from Hurricane Sandy in this area.



DESIGN YOUR DETOUR

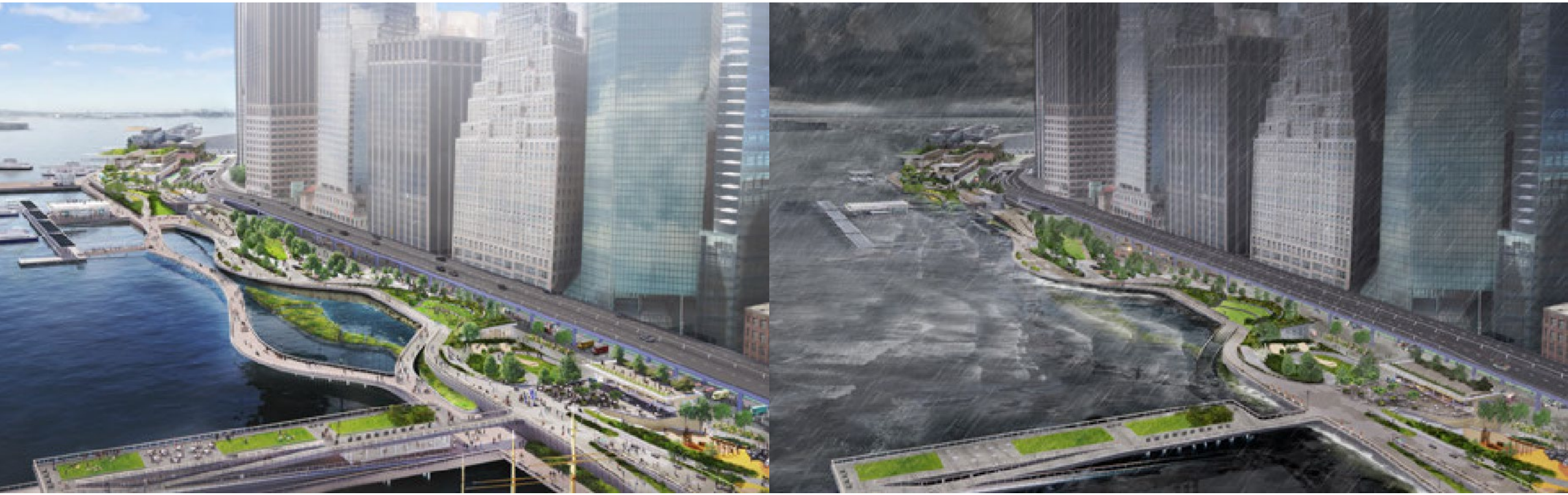


Inspired by Rebuild by Design

East Side Coastal Resilience – Concept to Realization

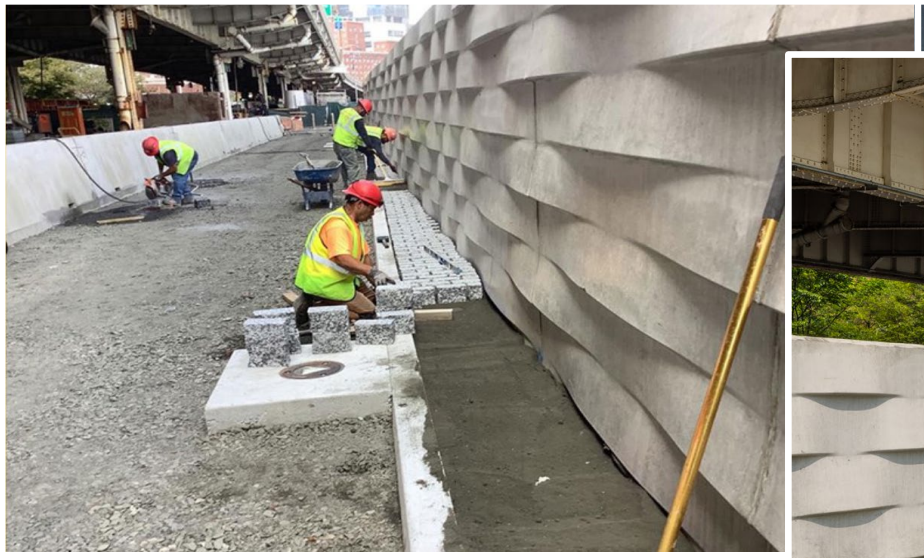
Credit: One Architecture

Financial District Masterplan



FiDi-Seaport Climate Masterplan (image ONE Architecture & Urbanism/Scape)

MOVING FROM CONCEPT TO REALIZATION



Items to Consider Evaluating Mitigation Options

Nonphysical flood risk adaptive measures:

- Zoning
- Land Use
- Floodplain mapping
- Flood insurance
- Flood warning
- Evacuation plans
- Emergency preparedness plans
- Operations & Maintenance

Local Building Codes

Building Type and Condition

- Height limitations (elevation)
- Access (ADA)
- Utilities
- Aesthetics
- Compliance with NFIP

Use of existing foundation

- Have design professional evaluate existing foundation

Hazards

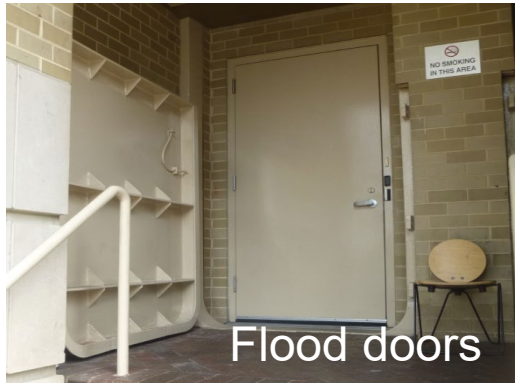
- Hydrostatic pressure
- Hydrodynamic pressure
- Debris impact
- Erosion and scour

The most common "physical" flood risk adaptive measures:

- Acquisition
- Relocation
- Elevation
- Wet Flood Proofing
- Dry Flood Proofing

Adaptation Strategy – Emergency Type Solutions

Flood Protection Alternatives Various Levels of Risk Reduction



Strive for “multiple-lines of defense” approach to building resilience where buildings are one element

Coastal defenses are strengthened as first line of defense against flooding and sea level rise

Buildings are designed to withstand and recover from flooding

Infrastructure is protected from climate hazards

Residents and businesses are prepared

Conclusions

1. Understand local climate risks through time, scale & interdependencies…
2. Work with “high-mark” climate projections…
3. Plan & design long term with Operation & Maintenance in mind…
4. Incorporate Multiple Lines of Defense thinking in design…
5. Seek highest level of risk reduction and keep the solution simple and passive when possible…
6. Emergency type solutions are for emergencies and as a 2nd line of defense and not intended for permanent use…
7. Adaptation can be an opportunity to incorporate multi-functional and sustainable features…
8. Understand the effect of longer-term plans for individual properties…

CLIMATE MITIGATION AND ADAPTATION AS OPPORTUNITY:

STRENGTHEN THE COMPETITIVENESS OF UBAN CENTERS AS A PLACE TO LIVE, WORK, AND VISIT

THANK YOU!

Q/A

Contact Us

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Climate Adaptation Solution Leader

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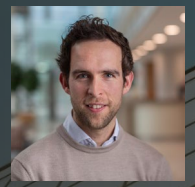

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