Multi-benefit Infrastructure for Flood Resilience

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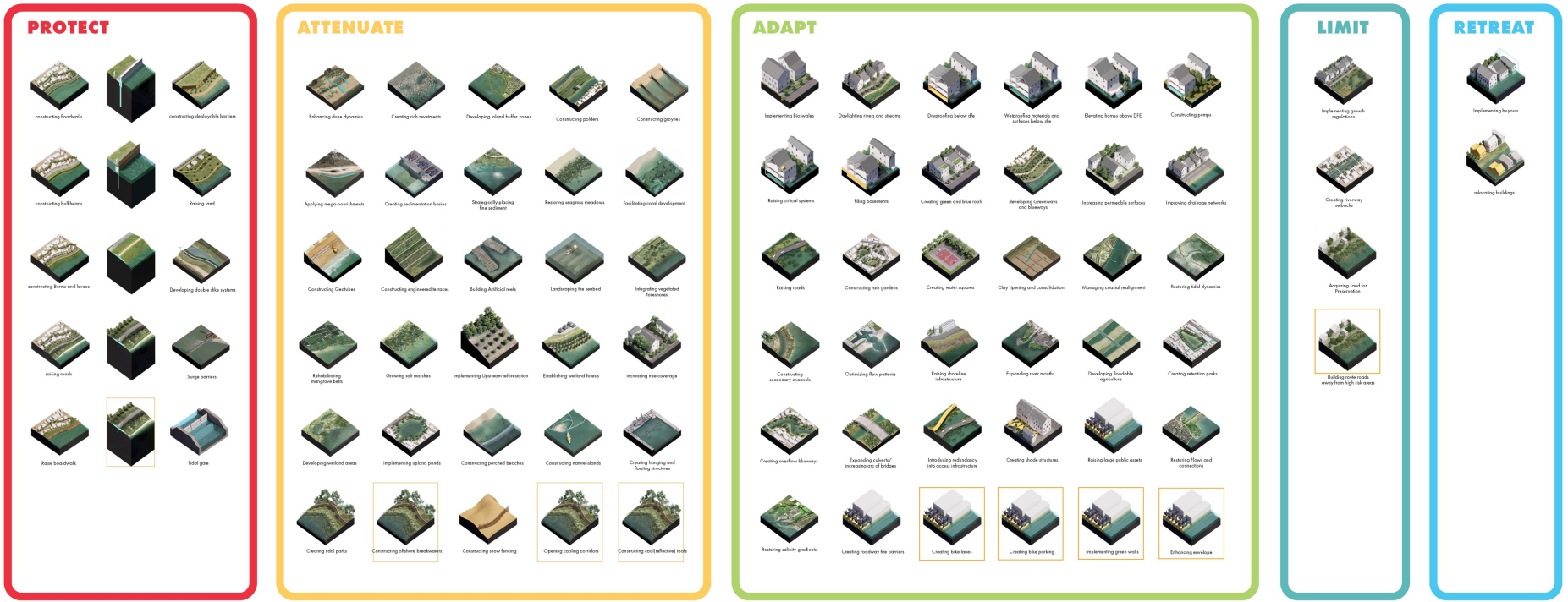
Designing multi-benefit flood infrastructure

Considerations that can guide design and planning:

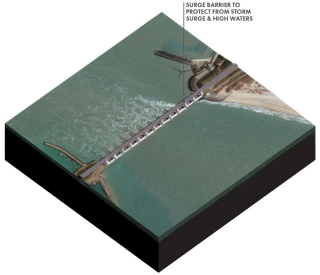
- Design criteria and prioritization framework
- Spatial requirements and constraints
- Multi-hazard design and function
- Adaptability and long-term implications
- Local applicability and appropriateness
- Alignment with stakeholder goals and objectives

Toolkit of strategies for flood mitigation

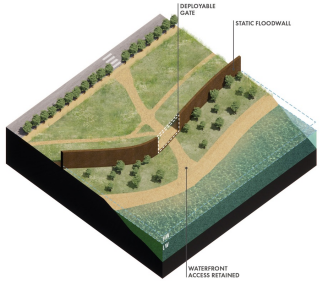


Source: One Architecture & Urbanism

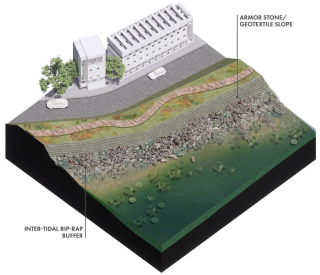
Toolkit of coastal barriers for flood risk reduction



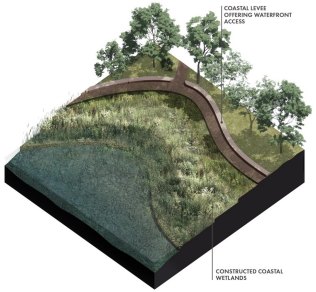
Surge barrier



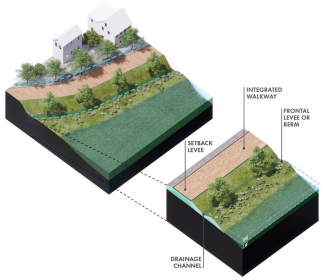
Deployable flood gates



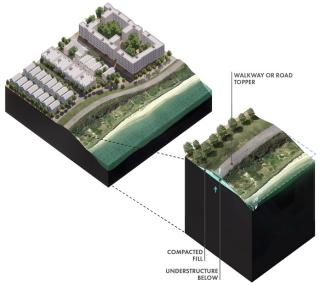
Revetments



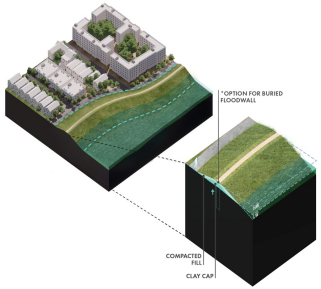
Raised walkway



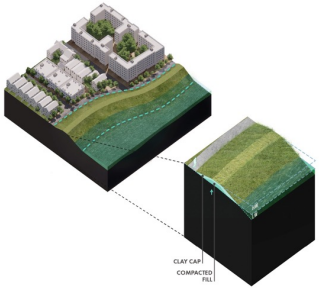
Setback levees



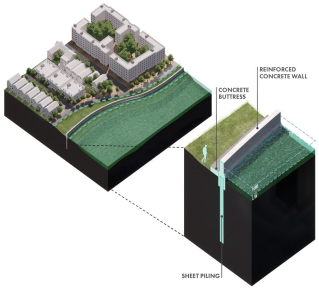
Raised roads



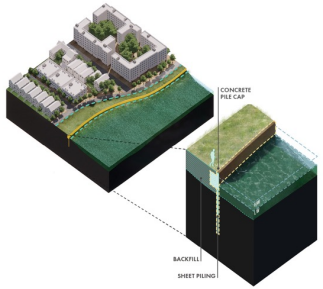
Buried floodwalls



Levees / berms



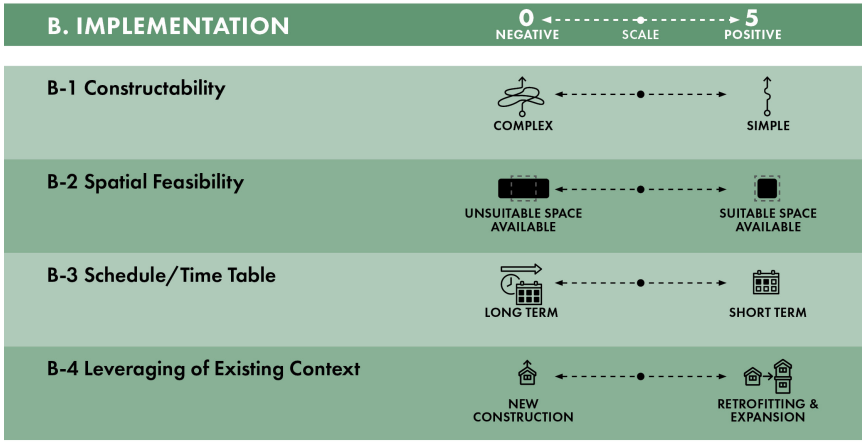
Floodwalls

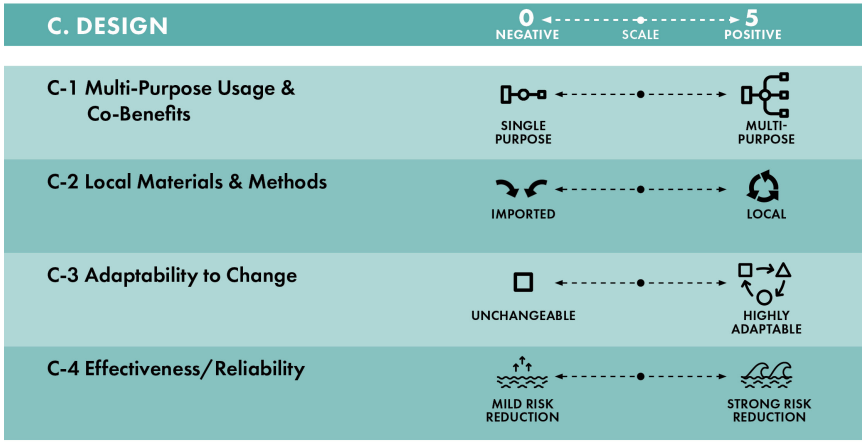


Bulkheads

Source: One Architecture & Urbanism

Establishing criteria & setting a prioritization framework





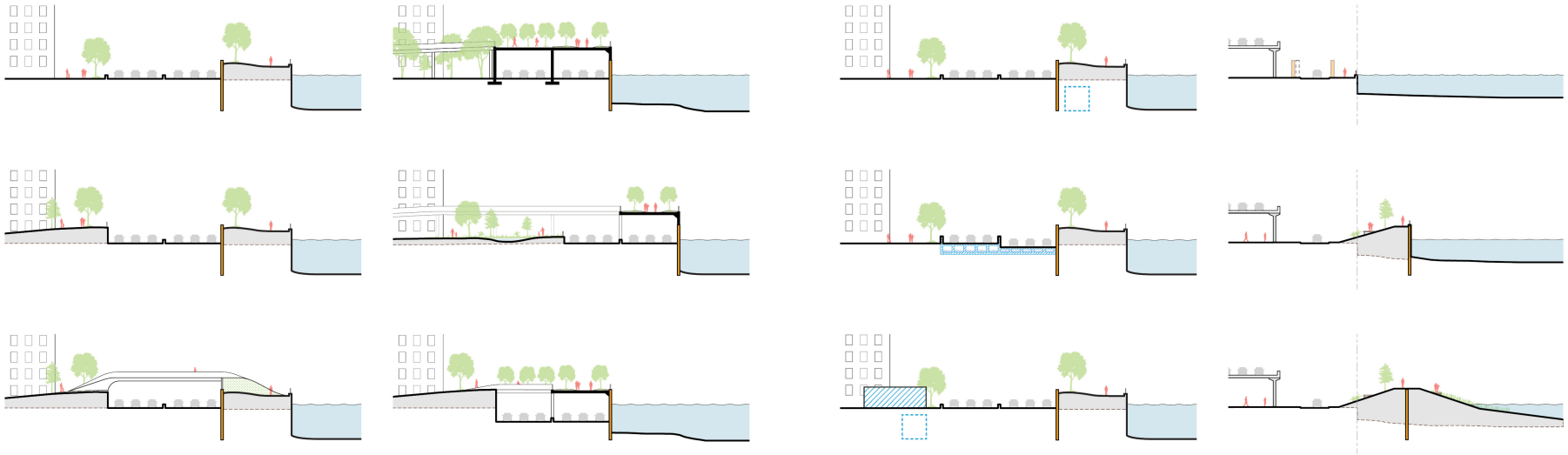
Source: One Architecture & Urbanism

Criteria describe project characteristics, for example: project cost & funding; ease of implementation; design qualities.

Objectives describe desired project outcomes, for example: urban livability; economic and social considerations; flood risk control / damage reduction

HATS objectives: reduced physical damages & avoided economic disruption

Understanding spatial requirements & constraints



Rethinking Elevation

Rethinking Transportation Infrastructure

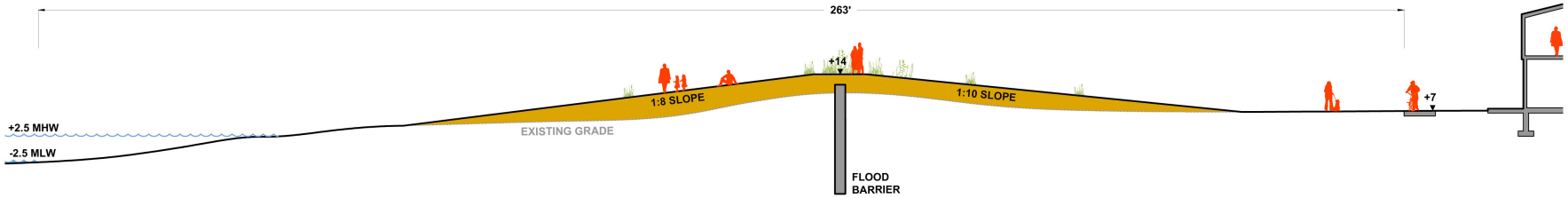
Rethinking Stormwater Management

Rethinking The Shoreline

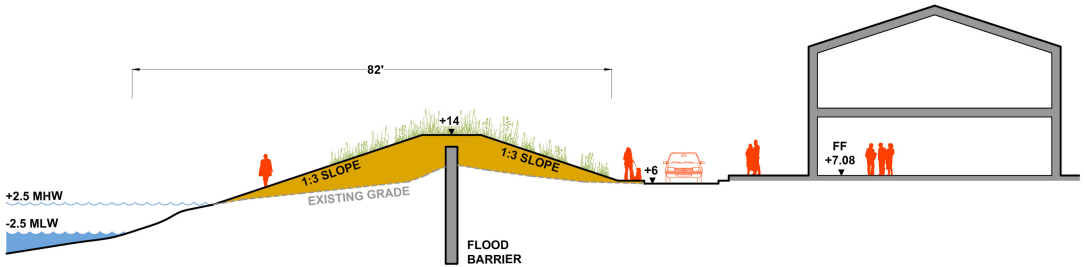
Exploring a suite of alignments and options for typical waterfront conditions

Source: One Architecture & Urbanism

Understanding spatial requirements & constraints



B1: WIDE BEACH

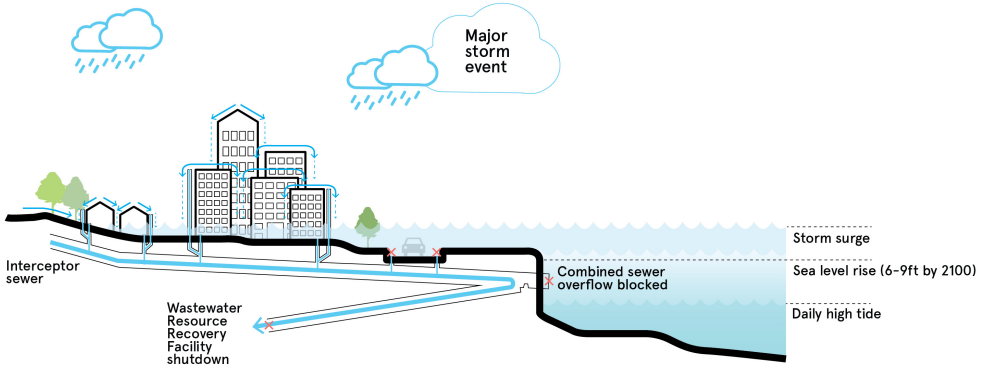


B2: NARROW BEACH

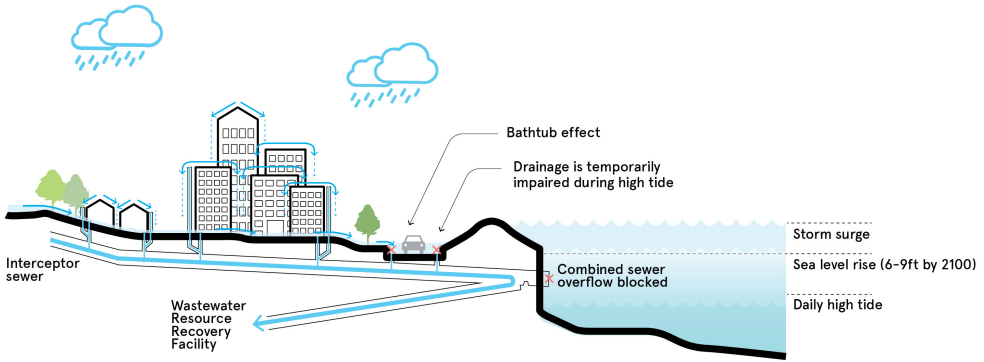
Exploring a suite of alignments and options for typical waterfront conditions

Source: One Architecture & Urbanism

Addressing multiple hazards: surge, sea level rise, stormwater, heat…



How will the trapped stormwater drain?



Source: One Architecture & Urbanism

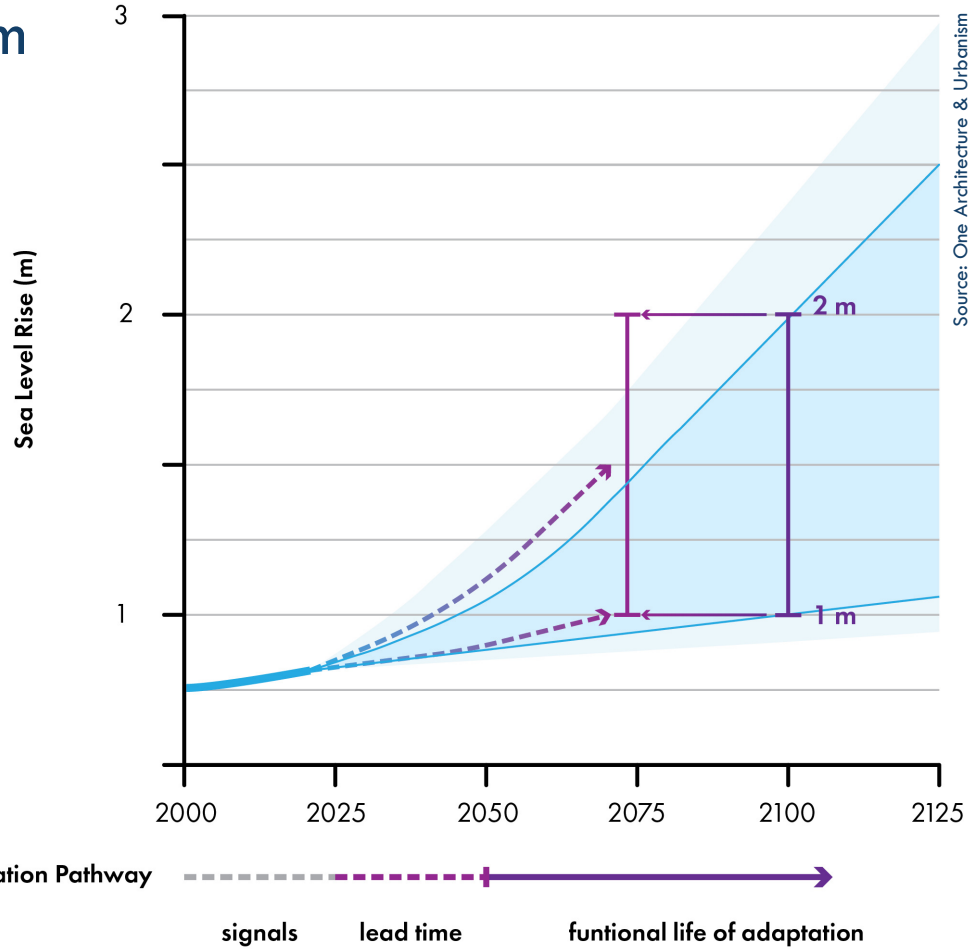
Addressing multiple hazards

Drainage strategy goes hand in hand with flood protection

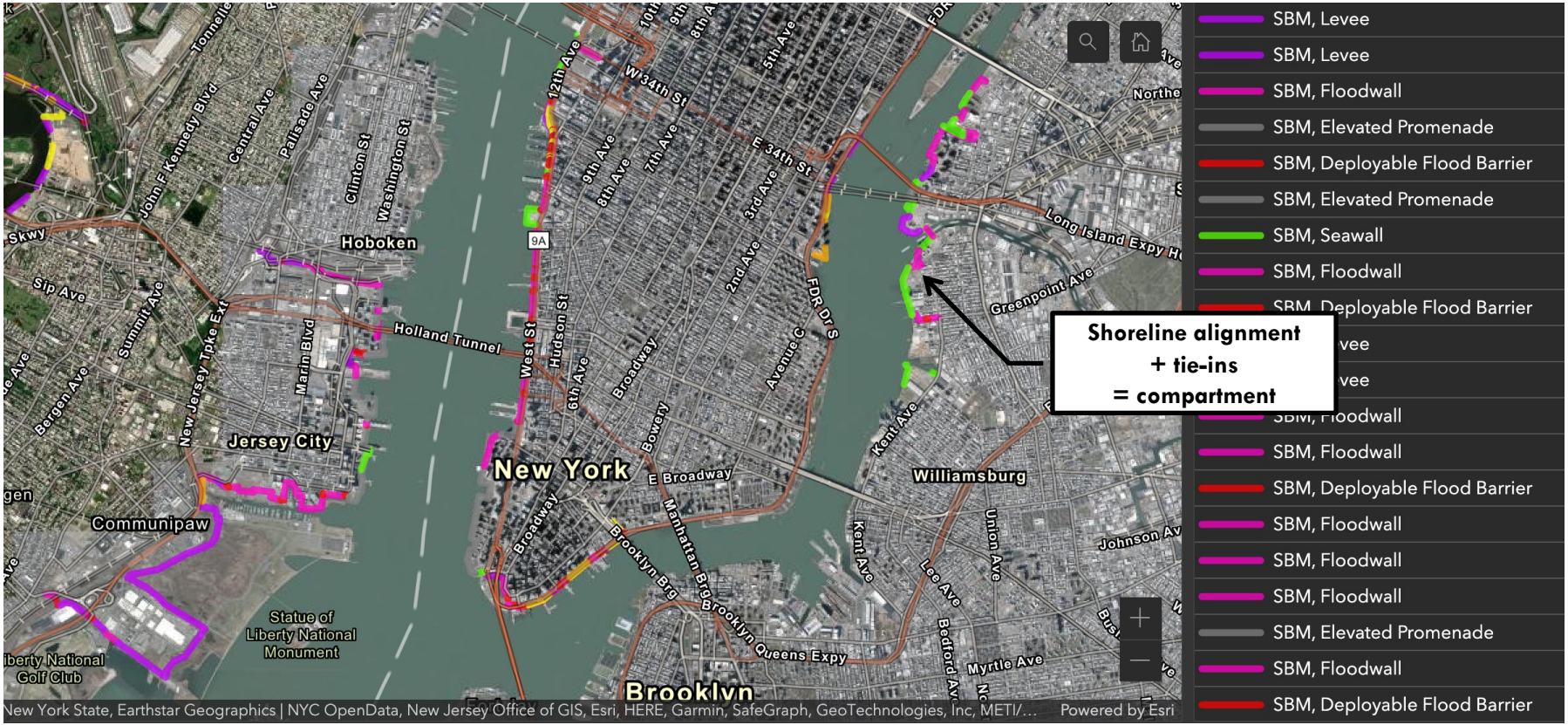
	PARKS	OPEN SPACE: SOFTSCAPE	OPEN SPACE: HARDSCAPE	NYCHA CAMPUS	PLAZAS	SURFACE PARKING	RIGHTS-OF-WAY	VACANT LOTS	NEW DEVELOPMENT	BUILDING ROOFTOP
SUBSURFACE DETENTION	5% OF AREA, 1.5' STORAGE DEPTH	5% OF AREA, 1.5' STORAGE DEPTH		5% OF AREA, 1.5' STORAGE DEPTH	25% OF AREA, 1.5' STORAGE DEPTH	25% OF AREA, 1.5' STORAGE DEPTH				
GREENSTREET							20% OF ROADWAY LENGTH, 1' STORAGE DEPTH, 5' WIDE			
BASINS & SWALES	5% OF AREA, 3' AVERAGE DEPTH	5% OF AREA, 3' AVERAGE DEPTH		5% OF AREA, 3' AVERAGE DEPTH	5% OF AREA, 3' AVERAGE DEPTH	5% OF AREA, 3' AVERAGE DEPTH				
ROOFTOP DETENTION										10% OF AREA, 3" OF STORAGE CAPACITY
DETENTION REGULATION								75% OF AREA, 1" OF RAINWATER CAPACITY	20% OF AREA, 1" OF RAINWATER CAPACITY	

Source: Starr Whitehouse / One Architecture & Urbanism

Planning to ensure long-term adaptability & resilience

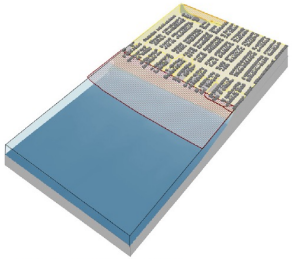


Working with local context and conditions

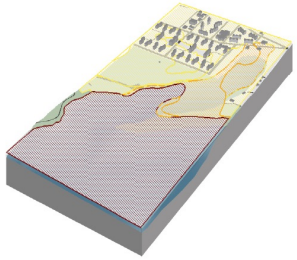


Source: USACE

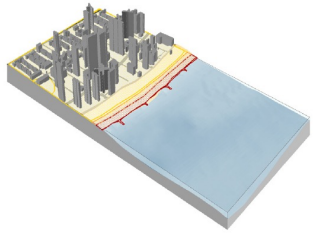
Working with local context and conditions



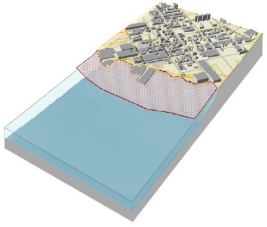
OCEANFRONT BEACHES
LOW DENSITY RESIDENTIAL



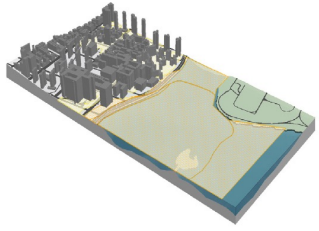
COASTAL MARSHES
MEDIUM DENSITY RESIDENTIAL



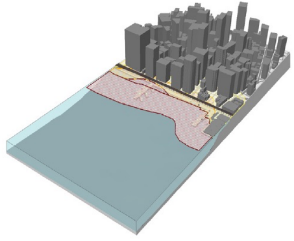
OCEANFRONT BEACHES
MEDIUM DENSITY RESIDENTIAL



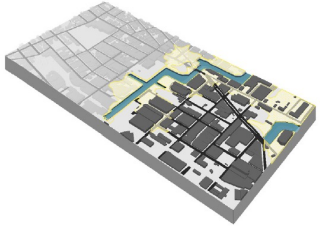
HARDENED SHELTERED BAY PLAINS
INDUSTRIAL/MED. DENSITY RESIDENTIAL



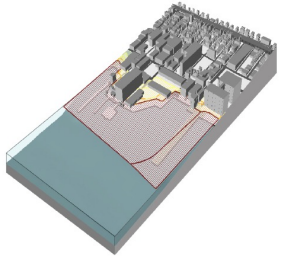
HARDENED SHELTERED BAY PLAINS
MEDIUM DENSITY RESIDENTIAL



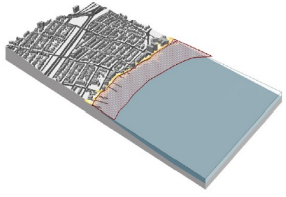
HARDENED SHELTERED BAY PLAINS
VERY HIGH DENSITY COMMERCIAL



HARDENED SHELTERED BAY PLAINS
INDUSTRIAL



HARDENED SHELTERED BAY SLOPES
INDUSTRIAL



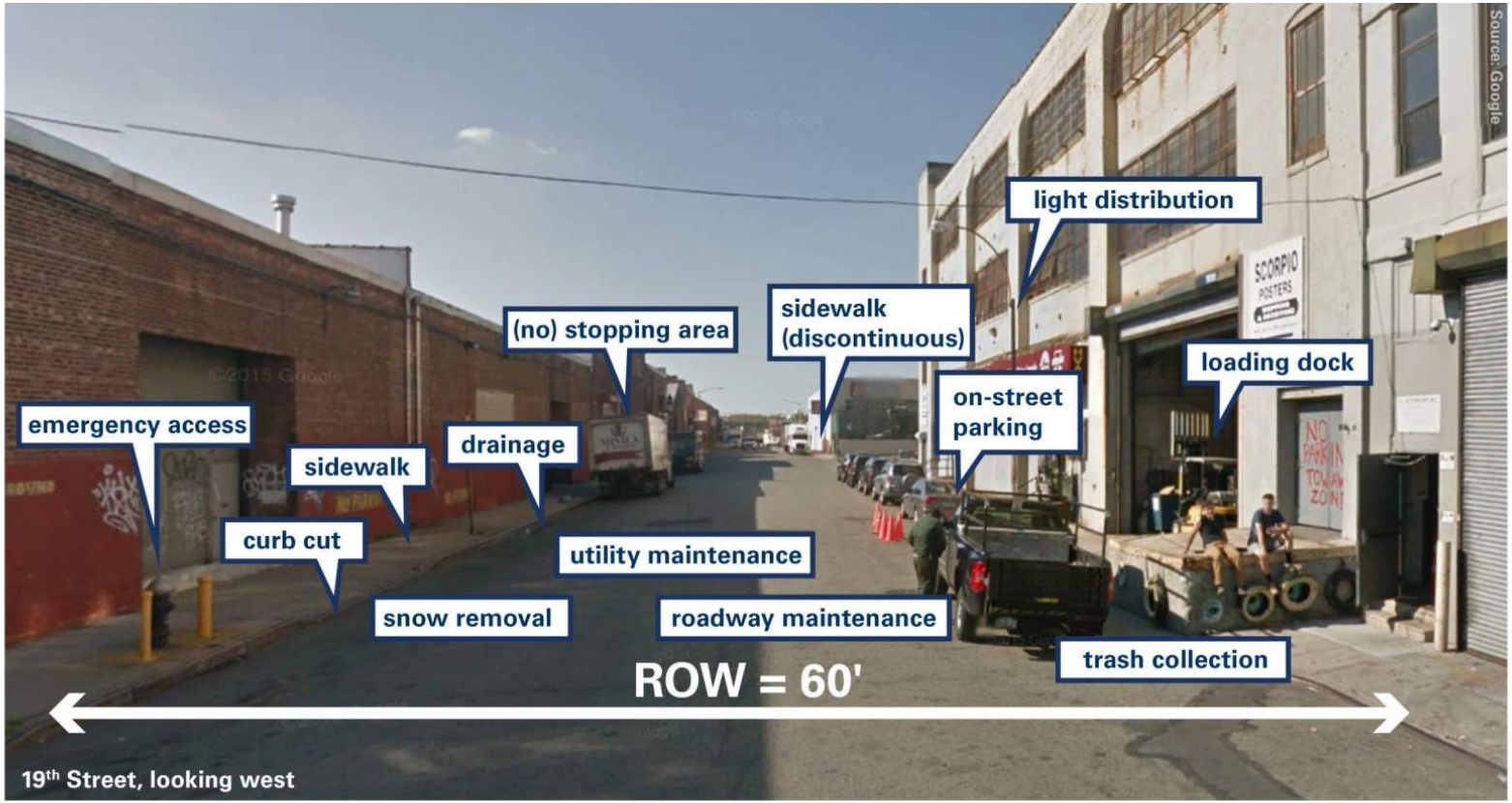
HARDENED SHELTERED BAY SLOPES
LOW DENSITY RESIDENTIAL

Source: NYC DCP, Urban Waterfront Adaptive Strategies (2013)

Working with local context and conditions

Source: WXY

Working with local context and conditions



Source: WXY

Aligning stakeholder goals & objectives

INTEGRATED FLOOD PROTECTION

SOLVING FOR COASTAL AND INLAND FLOODING

SOCIAL RESILIENCY

UNDERSTANDING SOCIAL COHESION AND COMMUNITY FACILITIES

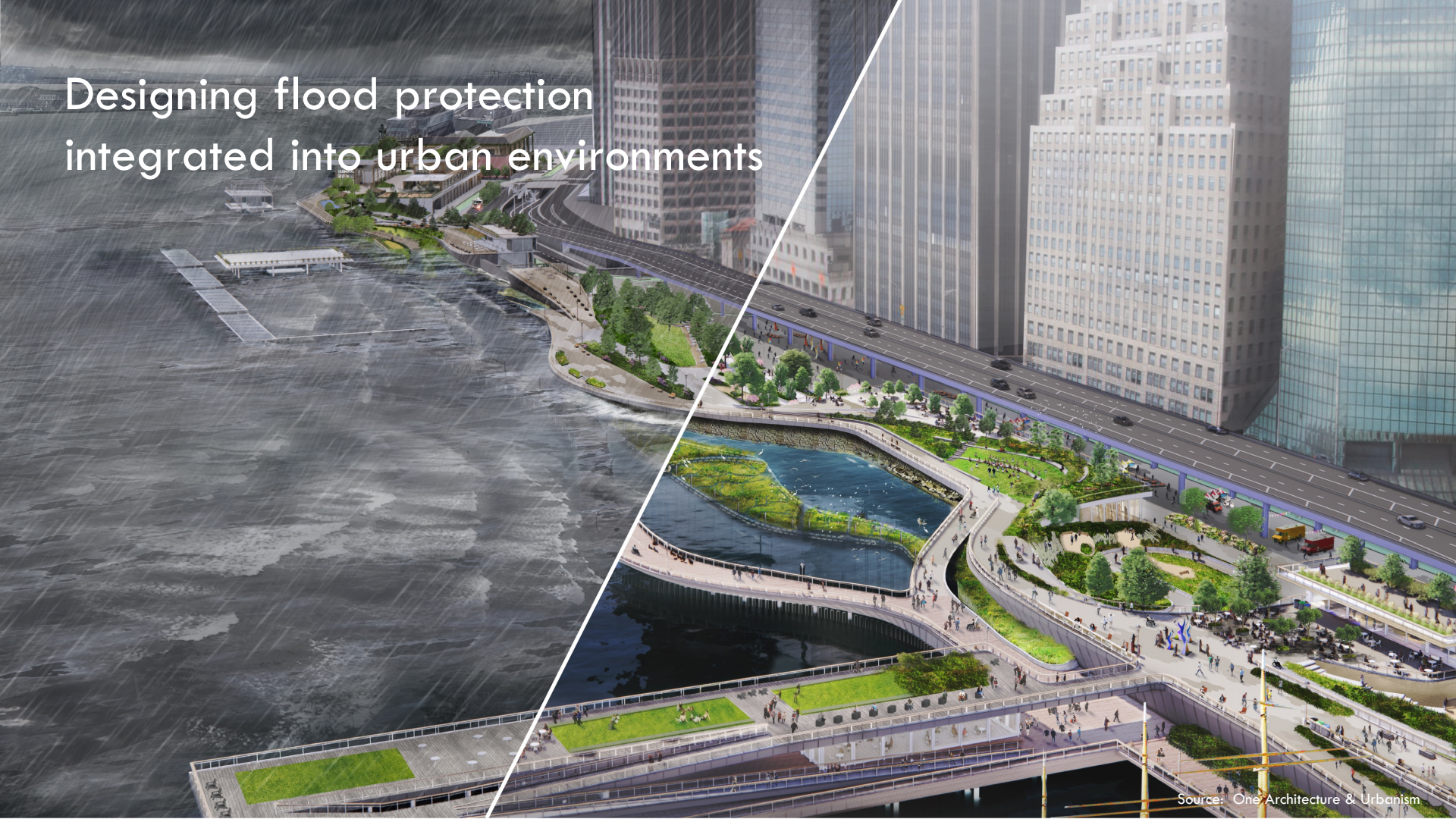
OPEN SPACE PLANNING

DESIGN OPPORTUNITIES IN PARKS AND PUBLIC SPACES

VISION PLAN

Source: Starr Whitehouse / One Architecture & Urbanism

Designing flood protection integrated into urban environments



Source: One Architecture & Urbanism

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Designing flood protection integrated into urban environments

Conceptual design of the Downtown Neighborhood Flood Barrier intended to reduce risk from future high tide flooding. This example shows a typical street condition, similar to Washington Street in Downtown. This is one way that a road elevation could serve as a barrier to flooding and be integrated within the character and experience of the Downtown streetscape.

Conceptual design of the Downtown Neighborhood Flood barrier during a flood event. The barrier is designed to protect against future flooding up to 7.5' NAVD88.

Source: One Architecture & Urbanism

Designing flood protection integrated into urban environments

Source: Mithun + One Architecture & Urbanism

Questions

- How wide do levees need to be compared to their height?
- What other flood risk reduction measures should we be considered to prevent water from coming up through the street drains and local plumbing?
- Would 15-20 ft. walls on the shoreline preclude or discourage creation of new waterfront parks?
- Will the walls divide communities from parks/waterfronts?
- For projects that have been implemented in other cities, what lessons have been learned? Have they been effective thus far? Any design flaws? What type of upkeep has been needed?
- What are examples of projects that address multiple risks and have multiple benefits? What are other cities doing?
- What are the benefits of this approach?