Financial District and Seaport Climate Resilience Master Plan: Building a Comprehensive Resilience Strategy for Lower Manhattan

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SUMMARY (150 words)

In October 2012, Hurricane Sandy hit New York City and exposed Lower Manhattan's vulnerabilities to climate change. To reduce flood risk to the Financial District and Seaport, NYC Economic Development Corporation retained the Arcadis-led consultant Team to study climate adaptation strategies for both neighborhoods. This work is part of the City's broader strategy to invest over $500 million in capital projects in Lower Manhattan beginning in 2021.

Given the unique convergence of climate risk and physical constraints, it is critical to examine both on-land and in-water solutions (i.e., extending the shoreline of Lower Manhattan) to implement a comprehensive resilience strategy. Our presentation will explore (1) the process to develop project alternatives to reduce flood risk – including sea level rise, coastal storms, and precipitation; (2) key project challenges and solutions, including siting blue-green drainage infrastructure, complex transportation and maritime infrastructure; and, (3) funding and financing strategies, including phasing and governance.

KEYWORDS

Climate Resilience, Community Resilience, Social Infrastructure, Stormwater Management, Urban Resilience

INTRODUCTION

For over 400 years, the historic identity of New York City has been rooted in Lower Manhattan. Serving for generations as the center of maritime uses and trade for the City and the region, as well as a doorstep for immigrants through Ellis Island and Castle Clinton, Lower Manhattan also has transformed over time into a global economic and financial capital. In October 2012, Hurricane Sandy hit New York City and exposed Lower Manhattan's vulnerabilities to climate change. The Hurricane flooded 17% of the City's land, claimed 44 lives, and caused $19 billion in damages and lost economic activity. In Lower Manhattan, the impact of Hurricane Sandy was devastating, causing two deaths and damaging thousands of buildings, including over 21,000 homes. It caused significant damage to transportation assets, power supply, open space, and water and sewer infrastructure. The event underscored not only Lower Manhattan's value as an economic, civic, and cultural heart of New York City, but also revealed how the impacts of climate change to Lower Manhattan will likely be felt across the city and beyond.

Despite significant efforts from City and State agencies to rebuild a more resilient City, Lower Manhattan's physical conditions still present vulnerabilities. Lower Manhattan has particularly low-lying topography in some areas, dipping below the aging bulkhead at the coastal edge, as well as narrow streets and complex Transportation and Maritime Infrastructure. In addition, a large proportion of old, historic buildings are particularly vulnerable and challenging to adapt due to their age and structure.

To reduce both acute and chronic flood risk to the Financial District and Seaport, NYC Economic Development Corporation retained the Arcadis-led consultant Team to study climate adaptation strategies for both neighborhoods. Given the unique convergence of comate risk and physical constraints in the area, it is critical to examine both on-land and in-water solutions (i.e., extending the shoreline of Lower Manhattan) in order to implement a comprehensive flood risk reduction strategy. Our presentation will explore: (1) the process to develop a set of project alternatives to reduce flood risk – including sea level rise, coastal storms, and precipitation; (2) key project challenges and solutions, including siting blue-green drainage infrastructure, complex transportation and maritime infrastructure; and, (3) funding and financing strategies, including phasing and governance.

METHODS

To develop a comprehensive flood risk reduction strategy, the following workstreams were developed and methods are being employed:

Hydrodynamic Modeling

The East River is a highly dynamic environment with fast tidally driven currents, waves, and vessel activity. To study the potential impacts of a shoreline extension project alternative, including changes in water surface elevations in the East River and changes in velocities, the Arcadis Team leveraged its existing, calibrated ADvanced CIRculation (ADCIRC) model for the New York Harbor to initially screen options. As project alternatives advance, the Arcadis Team will develop a higher resolution numerical model (e.g., Delft3D), to examine scour and sedimentation concerns across the study area.

Drainage Modeling

Managing interior drainage is a critical consideration of the project. Regardless of any shoreline modifications to protect against storm surge, sea level rise and more intense storm events will stress the aging and undersized combined sewer system in the Financial and Seaport Districts in even future sunny day conditions. To manage interior drainage, the Arcadis Team is working closely with NYCEDC, as well as other city partners, such as NYC Department of Environmental Protection, to develop blue-grey solutions to store and pump stormwater. Hydrologic events considered include the present day 5-year rainfall event through to the 2100 50-year rainfall event.

Urban Planning & Design

The Arcadis Team is working closely with NYCEDC and other city agencies, including NYC Planning, to develop urban design and programming strategies for integrating large-scale climate adaptation infrastructure with the existing neighborhoods and with waterfront uses and access, as well as maximizing public benefits. This work will be summarized in a program design brief that articulates target areas and gross space for buildings, open space, and operational facilities, as well as visuals to articulate the vision of the shoreline extension.

Conceptual Design

As project alternatives advance, 1-2 preferred alternatives will be advanced through conceptual design. Key elements of design will include: design elevations and level of flood risk reduction, tie-ins with upland components and navigating grade changes and edge conditions, design of deployable aspects of flood protection, fill sourcing, and geotechnical considerations.

Community Engagement and Outreach

The Arcadis Team is supporting and participating in the City's effort to conduct a robust and intensive community engagement process, acknowledging a necessary reliance on immersive and interactive digital tools considering COVID-19 and limitations on gatherings. Public and stakeholder engagement tools include: Augmented Reality / Virtual Reality and other tools to communicate flood risk, online platform and virtual meeting spaces; as well as non-digital materials such as development of a school curriculum to educate and empower youth about climate change.

RESULTS AND DISCUSSION

A successful project will define a comprehensive adaptation plan for the study area and first phase project that have community support, are technically and financially feasible, and have clear viable pathways for permitting and implementation.

The Master Plan will achieve the following core project goals:

- **Climate Resilience**: The Project must guide the adaptation of these two neighborhoods to protect against multiple hazards of climate change, including storm surge, tidal inundation, groundwater table rise, and extreme precipitation.
- **Feasibility**: The Project must be feasible from an engineering, design and construction perspective, as well as from a permitting and financial perspective.
- **Transportation and Maritime Infrastructure Integration:** This area includes the FDR Drive and several maritime uses ("Transportation and Maritime Infrastructure"). This Project must consider how this Transportation and Maritime Infrastructure can be integrated, altered, relocated and/or improved to integrate with the Shoreline Extension.
- **Public Benefits:** This Project must create a compelling, attractive vision that enhances Lower Manhattan in a lasting way and integrates placemaking, public amenities, and environmental benefits where possible.
- **Public Buy-In:** This Project must build political and stakeholder support to carry forward the approval processes and long-term implementation of this generational effort.

In addition to the core project goals, the climate resilience plan will identify environmentally conscious design solutions that support the City's goals of carbon neutrality, enhance blue-green stormwater management solutions, and mitigate the urban heat island effect and reduce risk from increasing projected head waves due to climate change.

The study will produce 1-2 preferred alternatives that may integrate social infrastructure, open space, and/or commercial and/or residential development. The work will also identify and advance a first phase project through preliminary design. As the project is currently underway, findings are anticipated before the end of 2021.

CONCLUSIONS

Early findings suggest that a project alternative that reduces comprehensive flood risk for the Financial District and Seaport is technically feasible, permittable, and implementable.

Hydrodynamic Modeling

Preliminary hydrodynamic modelling suggests there is no noticeable increase in the water surface elevations in the East River for a shoreline extension project alternative that is ~165 meters wide, with velocity impacts limited to the general vicinity of the project area. Future study is underway to consider pile-supported structures and optimizing the alignment to further reduce impacts to the East River.

Drainage Modeling

Preliminary findings suggest it is technically feasible to manage the stormwater runoff associated with a large rainfall event such as the 50-year rainfall in 2100 (2m sea level rise). Future study is underway to evaluate blue-grey solutions (e.g., pumping and storage), to reduce flood risk. Bioswales, green roofs, and green infrastructure are also being considered.

Community Programming

The Arcadis Team has started to consider a variety of programming scenarios for a shoreline extension project alternative, including one to maximize revenue potential, one to prioritize open space and community benefit, and hybrid solutions. Further work on programming, including siting infrastructure, potential building typologies with massing guidelines, and approximate program and land use mix to inform financial analyses is anticipated in early 2021.

Community Engagement and Outreach

The City hosted its first community open house earlier this year – an immersive experience that included at-scale diagrams and maps to communicate flood risk. Augmented reality and other digital tools were integrated into the open house to educate participants about climate change and the goals of the project. In addition to the community open house, the project team has implemented a broader engagement and outreach strategy to reach residents, business owners, and more through smart city technologies, like LinkNYC.