CONEY ISLAND CREEK RESILIENCY STUDY
August 6th, 2015
Coney Island Community Update
Presentation Agenda

• Overview

• Regional Resiliency

• Long-term Flood Protection Recommendations
  – Alignments and Precedents
  – Floodgate Typologies
  – Water Quality and Ecology

• Outreach and Next Steps
Current Study Status
Overview

Purpose of feasibility study: Develop long-term strategy to protect Coney Island & Gravesend from effects of storm surge and sea level rise

- Conduct robust technical analysis of large-scale tidal barrier & wetlands concept presented in SIRR report
- Identify specific measures to provide near-term flood protection
- Recommend comprehensive flood protection plan and define implementation steps

Coordinated interagency effort:

- Managed by NYCEDC on behalf of ORR
- Close partnership with DEP, Parks, City Planning
- State and Federal agencies (e.g., DEC, Army Corps) also involved

Funding: 100% Sandy CDGB funds
Scope of Study

Questions to be answered:

1. Is the tidal barrier & wetlands concept **technically feasible**? What are the environmental, engineering, and regulatory challenges, and how could they be overcome?

2. Is this a **cost-effective** way of addressing the threats severe weather and sea level rise pose to Coney Island and Gravesend?

3. What measures can be advanced to provide **near-term flood protection**?

4. Are there opportunities to provide other **community benefits**, such as improved access to waterfront recreation, without compromising the primary goal of flood protection?

5. What do community stakeholders think about the Creek proposal and how it could **best address their needs**?

Providing Integrated Solutions for a Resilient Coney Island Creek
City Team

Providing Integrated Solutions for a Resilient Coney Island Creek

EDC
Elijah Hutchinson (PM)

Mayor’s Office for Recovery & Resiliency (ORR)

Other Agency & Community Outreach

Consultant Team

DPR

DOT

DEP

DCP
Providing Integrated Solutions for a Resilient Coney Island Creek
Study Milestones

Providing Integrated Solutions for a Resilient Coney Island Creek

Pre-Kickoff Community Meeting at Coney Island YMCA

Begin study 4Q 2014

“Deep Dive” into existing conditions

OCT 2014

Jan-Feb 2015

APR-May 2015

Continued collaboration with Agencies & Community

Mar-Jul 2015

Long-term Flood Protection Recommendations
Including exploring regional resiliency context

Project Findings including implementation and phasing strategies

Sep-Oct 2015

End study 4Q 2015

JUL-AUG 2015

Quantifying Benefits associated with project

APR-May 2015

Pre-Kickoff Community Meeting at Coney Island YMCA

“Deep Dive” into existing conditions

MAR-JUL 2015

Long-term Flood Protection Recommendations
Including exploring regional resiliency context

Project Findings including implementation and phasing strategies

SEP-OCT 2015

End study 4Q 2015

MAY-AUG 2015

Open Space and Community Infrastructure Planning
Including identifying opportunities for recreation and community infrastructure

AUG 2015

Community Meeting #3

OCT 2014

Continued collaboration with Agencies & Community

APR-May 2015

Pre-Kickoff Community Meeting at Coney Island YMCA

“Deep Dive” into existing conditions

MAR-JUL 2015

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MAY-AUG 2015

Open Space and Community Infrastructure Planning
Including identifying opportunities for recreation and community infrastructure

AUG 2015

Community Meeting #3
Key Feedback & Principles

- **DEC AND US ARMY CORPS OF ENGINEERS:**
  - **Water Quality:** Post-barrier condition should avoid exacerbating existing hydrodynamic and water quality conditions
  - **Sediment Quality:** Sediment quality and the origins of materials currently found in the Creek need to be managed
  - **Barrier Performance:** Important to understand the sustainability of the long-term protection measures in terms of hydrodynamics and O&M
  - **Ecological “success”:** Discussed a range of measures of project success, including habitat complexity, species richness, benthic functioning, sediment quality improvements and sustainability
  - **Alternatives:** Options evaluated for the long-term protection measure should include a non-barrier alternative
Key Considerations
Regional Resiliency Efforts
Regional Resiliency Efforts

Providing Integrated Solutions for a Resilient Coney Island Creek

- Gravesend Houses: $175 million
- Coney Island Commercial Corridors: $15 million
- Coney Island Houses Sites 4 & 5: $40 million
- Coney Island Houses Site 1B: $25 million
- Coney Island Hospital
- Coney Island Green Streets: $1 million
- Carey Gardens Houses: $87 million
- Heber Houses: $48 million
- Surfside Gardens: $100 million
- Coney Island Houses: $112 million
- O'Dwyer Gardens/Site 8: $105 million
- Coney Island Houses Site 8: $28 million
- Broad Channel Street Reconstruction: $19 million
- Hammel Houses: $179 million
- Carleton Manor Houses: $30 million
- Ocean Bay Apartments Oceanside: $67 million
- Ocean Bay Apartments Bayside: $285 million
- Beach 41st Street Houses: $68 million
- Redfern Houses: $142 million
- Rockaway Commercial Corridors: $15 million
- Rockaway Boardwalk: $480 million
1. T-groins in Sea Gate will diminish erosion
2. Bulkheads in Sea Gate will reduce wave action
3. Coney Island Creek study will determine feasibility of tidal barrier and wetlands concept
4. 670,000 cubic yards of sand added to replenish Coney Island beaches
A Regional View

Providing Integrated Solutions for a Resilient Coney Island Creek

- Coney Island Creek F.S.
- Coney Island Beach Nourishment
- Sea Gate T-Groins and Renourishment
- Rockaway Inlet and Jamaica Bay Study
- Rockaway Beach Renourishment
Coney Island Creek
Study Area – Coney Island Creek

- Shoreline is primarily low-lying
  - Majority of the shoreline between 6 and 9 feet NAVD88
  - Regions below 6 feet NAVD88 are easy entryways for flood waters during low- and high-frequency storm events

- Low-lying areas are often adjacent to important community facilities, including public schools, NYCHA, senior housing developments, and community clinics
Shoreline Types

- Shoreline configurations include:
  - Engineered structures:
    - Bulkhead
    - Revetment
  - Non-engineered shorelines
    - Debris-strewn embankments
    - “Homemade” bulkheads
Rapid Waterfront Inspection Assessment

Shoreline Condition

- Some engineered shorelines in “serious” condition along the Creek
- Target lowest lying and gravest engineered shorelines first
Long-term Flood Protection Recommendations
Design Elevation Components

Base Design

Design Storm Event
- 100-Year Storm Event
- FEMA Storm Tide Elevation from Flood Insurance Studies

Sea Level Rise (SLR)
- 90th Percentile (High Estimate)
- New York City Panel on Climate Change (NPCC) 2015 - SLR Projection for 2050s

Freeboard

Wave Runup
- Eurotop Wave Overtopping of Sea Defense And Related Structures: Assessment Manual

Wave Overtopping
- Eurotop Wave Overtopping of Sea Defense And Related Structures: Assessment Manual

Graphs and charts illustrating the relationship between storm tide elevation, sea level rise, and wave overtopping, with corresponding elevations and rates.

Providing Integrated Solutions for a Resilient Coney Island Creek
West Barrier Alignment

Providing Integrated Solutions for a Resilient Coney Island Creek
West Barrier Alignment

- 1,700- foot width
- 100-year flood risk reduction + SLR = 22 ft NAVD88
Flood Protection Strategies and Considerations

Feasibility Considerations:

- Flood Risk Reduction
- Ecological Enhancement / Environment
- Drainage
- Implementability / Feasibility
## Flood Protection Strategies Comparison

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*Providing Integrated Solutions for a Resilient Coney Island Creek*
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East Barrier Alignment

- 500-foot width
- 100-year flood risk reduction + SLR = 17 ft NAVD88
Regional Resiliency Context
(100-Year Design Elevation 2050 SLR [NAVD88])

- Northern Tie-in
  - Design El. 17-20 feet

- Sea Gate Community
  - Design El. >22-27 feet

- Current USACE Beach Nourishment Project
  - Design El. 12 feet

- USACE Jamaica Bay Study
  - 100-year Flood Protection

Providing Integrated Solutions for a Resilient Coney Island Creek
Flood Protection “Kit of Parts” for Creek

1. Vertical Wall
2. Vertical Structure with Promenade
3. Vertical Bulkhead + Knee Wall / Sloped Back
4. Terraced Vertical Wall
5. Terraced Levee
6. Vertical Bulkhead / Sloped Back
7. Levee (2:1 Back Slope)
8. Levee (3:1 Back Slope)
Tidal Barrier Alignments
Level of Protection for in-water measures

Plan View

Bird’s Eye View

East Barrier:
• 500-foot width
• 100-year + SLR = 17 ft NAVD88

West Barrier:
• 1,700-foot width
• 100-year + SLR = 22 ft NAVD88
Flood Protection Precedents

Rhode Island, USA
Tainter Gates

Marina Bay, Singapore
Barrage

Venice, Italy
Flip Up (Spillway) Gates

Thames River, UK
Rotating Gates

Providing Integrated Solutions for a Resilient Coney Island Creek
Long-Term Flood Protection

Opening Size

**No Opening**
- Passive Flood Protection is most reliable
- Most cost-effective
- Connection across Creek
- Minimal O&M
- Pumps needed for WQ

**Narrow Opening**
- Combination of passive and mechanical parts
- Cost-effective
- Connection across Creek is feasible with non-nav.
- O&M required to maintain and operate mechanical components
- Pumps needed for WQ

**Wide Opening**
- Most mechanical parts; least reliable
- Most expensive option
- Connection across Creek is feasible with non-nav.
- Most O&M required
- Least impact on WQ and aquatic habitat

FOR BOTH “WEST” AND “EAST” ALIGNMENTS
Ecological Considerations for Barrier

- Minimize impacts based on opening size, footprint, alignment
- East Alignment preferred:
  - **Decreases** substrate and habitat disturbance
  - **Avoids** existing aquatic habitat value
  - **Lessens** impact on water flow throughout Creek
  - Provides more opportunities for restoration
Ecological Opportunities for Programming

Maritime Forest / Shrubland

Beach / Dune

Fishing

Salt Marsh

Boat Launch

Passive Parkland

Providing Integrated Solutions for a Resilient Coney Island Creek
Ecological Enhancement Opportunities

Preliminary Draft and Under Review

Providing Integrated Solutions for a Resilient Coney Island Creek
Water Quality in Coney Island Creek
Water Quality Existing Conditions

- Overall water quality is limited by the confined nature of the Creek, low tidal flushing, background concentrations and illicit discharges.
- Receiving waterbody for 1 CSO outfall and 10 stormwater outfalls operated by the City.
- Designated as a Class I Waterbody by New York State best used for secondary contact recreation and fishing.
Water Quality Projected Conditions

• Completion of Avenue V Pumping Station Upgrade is expected to reduce CSO volumes by 87%

• Dissolved oxygen expected to improve

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<th>CSO Volume (million gallons in a typical year)</th>
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<td>Baseline (without upgrade)</td>
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<td>100</td>
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<td>50</td>
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Baseline (without upgrade) Projected (with upgrade)
Water Quality Modeling Study Area

Providing Integrated Solutions for a Resilient Coney Island Creek
Water Quality Scenarios Modeled

- Tidal Elevations
- Tidal Flushing
- Salinity
- Bacteria
- Dissolved Oxygen
Water Quality Results – Dissolved Oxygen
Vertically Averaged Hourly Concentrations (mg/L)

Providing Integrated Solutions for a Resilient Coney Island Creek
Water Quality Results – Dissolved Oxygen
Vertically Averaged Hourly Concentrations (mg/L)
Water Quality Modeling Results Summary

- Tidal flushing is restored after opening of barrier
- DO concentrations decrease rapidly when barrier is closed, but anticipated to rapidly increase with flushing once barrier is open
- Minimizing period when tidal barrier is closed would reduce adverse impacts on water quality
  - Tidal barrier would only be closed under emergency conditions and short duration testing periods
  - Water quality impacts are short term and mostly associated with wet weather discharges when barrier is closed
Water Quality and Ecology Recommendations

• Smaller footprint of barrier would reduce scale of disturbance to ecological resources

• Alignment within interior of Creek is beneficial as mouth of Creek is a more ecologically diverse habitat
  
  • Ecological conditions decreases further upstream in terms of the substrate, habitat, and relative values of aquatic life

• Wide gate opening is preferable to preserve tidal flushing

• Closing Creek off for wetland creation is not feasible due to drainage and storage considerations
COSTS AND BENEFITS
## Parametric Costs for Measures in Coney Island

<table>
<thead>
<tr>
<th>Flood Protection Measure</th>
<th>Cost per LF (2014 USD)</th>
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<tbody>
<tr>
<td>Bulkhead</td>
<td>8K – 10K</td>
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<tr>
<td>Revetment</td>
<td>4K- 5K</td>
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<tr>
<td>Floodwall</td>
<td>10K – 15K</td>
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<tr>
<td>Levee</td>
<td>4K – 6K</td>
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<tr>
<td>Living Shoreline</td>
<td>6K- 8K</td>
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<tr>
<td>In-water Barrier</td>
<td>300- 500K</td>
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<tr>
<td>Road Gates</td>
<td>10K</td>
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</table>
Quantifying the Benefits of Flood Protection

Who would be protected?

- **49,900** Residents
- **9,100** Seniors
- **29,300** Low-Income Residents
- **10,000** Employees

What would be protected?

- **5,900** Buildings
- **21,900** Residential Units
- **73** Acres of Parks & Open Space
- **960** Businesses
Outreach and Next Steps
Public Outreach To Date

- **April** - Community Meeting #1: Existing Conditions; Community Needs & Vision

- **May** – Coney Creek Committee: Shoreline Conditions Assessments; Water Quality modeling; Barrier Options; Outreach Planning

- **May 30th** – It’s My Estuary Day: Participated in event at Kaiser Park celebrating the relaunch as a Catalyst Site with Partnership for Parks

- **July 18th** – City of Water Day: Participated in event at Kaiser Park to raise awareness about NYC’s waterways
Public Outreach To Date

- July 21st – Community Board 13 Committee Presentation: Preliminary Findings; Upland Considerations; Outreach and Next Steps for Study
- July 23rd – Coney Creek Committee: Preliminary Findings; Upland Considerations; Outreach and Next Steps for Study; Community Meeting Planning
- August 6th - Community Meeting #2: Technical Analysis & Preliminary Recommendations; “Kit-of Parts”
Study Next Steps

→ Fall – Coney Creek Committee & Community meeting #3: Share Concept Design options; Refine Vision & Implementation Strategies

→ Advance short-term recommendations

→ Continue evaluation and case-making for long-term flood protection strategies

→ Coordinate study findings and recommendations with key City Agencies and other stakeholders including Coney Creek Committee

→ Refine ecological analyses in coordination with DEP, DEC and DPR

→ Advance Creek study in context of regional resiliency planning for City in coordination with Army Corps

Providing Integrated Solutions for a Resilient Coney Island Creek
Questions We’ve Heard

• Are the same areas protected if the barrier is East or West?
• Who would develop and construct the project?
• How is the barrier going to be operated and maintained?
• If the project were to be built, would the sediment contaminants get addressed?
• What role do wetlands or drainage play in the protection of Coney Island?
• Won’t a barrier in Coney Island Creek impact tidal flushing?
• Does that red line indicate a wall?
• How do I continue to be involved in the study?
Activity: Break-Out Groups

**Discussion:** Tool-Kit of Parts for flood protection

**Questions:**
1. What additional questions/clarification does this group have or need?
2. Which tools from “tool kit” do you prefer and why?
3. What would be one key feature/programming element you’d like to see in a resilient Coney Island Creek
Activity: Flood Protection “Kit of Parts” for Creek

- Vertical Wall
- Terraced Vertical Wall
- Vertical Structure with Promenade
- Terraced Levee
- Vertical Bulkhead + Knee Wall / Sloped Back
- Levee (2:1 Back Slope)
- Vertical Bulkhead / Sloped Back
- Levee (3:1 Back Slope)
Coastal Structures for Flood Protection

**Floodwalls**
- A vertical wall constructed of masonry or concrete to prevent flooding of adjacent land
- Typically does not require a lot of land to implement
- A reinforced concrete core is the principal structural element of the wall
- They can also be aesthetically altered with brick or other elements

**Levees**
- A man-made mound comprised of compacted soil to hold back water during storm events
- Typically take up more land to implement as wide cross section
- Can be designed to have pedestrian walkways or vehicular access on the crest (the top)

**Bulkheads**
- A vertical structure designed to protect upland adjacent land from the damages of wave action
- Typically does not require a lot of land to implement
- Also can be used to reinforce or prevent sliding of the soil/land
- Often made of steel, concrete, or timber

**Breakwaters**
- A man-made, offshore structure aligned parallel to the shore to help dissipate wave energy before the waves come onshore
- While it can help minimize wave heights, it would need to be used in conjunction with other measures to ensure flood protection
- Potential to add to aquatic habitat

**Coastal Wetlands**
- Comprised of low and high marsh, in large enough quantities they can help dissipate wave energy before the waves come onshore
- Also control erosion of the shoreline and function to capture pollutants in runoff during smaller rainfall events
- They serve as living spaces for birds and fish

Providing Integrated Solutions for a Resilient Coney Island Creek Coastal Structures for Flood Protection
Floodgate Typologies for Flood Protection

**Tainter Gate**
- Radial arm flood gate that controls water flow in a body of water
- Can be opened and closed quickly prior to a storm event
- Remains open during normal weather conditions
- Known for its use in: Rhode Island

**Barge Gate**
- A barge structure is placed into a structural frame prior to a storm event
- Allows the Creek to remain completely open to tidal exchange and navigation when not in use
- Requires manual labor to place barge
- Known for its use in: New Orleans

**Flip-Up/Buoyant Gate**
- Series of bottom-hinged, water-filled gates that are stored underwater and can be raised in the event of a storm
- Can be opened and closed quickly prior to a storm event
- Does not obstruct views, but also difficult to maintain underwater
- Not a proven technology in regions where tide gets very high
- Known for use in: Venice, Italy

**Sector Gate**
- Consists of two “leaves” that join at the center of the structure
- Can be opened and closed quickly prior to a storm event
- Require a large on-land footprint in order to store the leaves when not in use
- Known for use in: The Netherlands
Questions?