Resilient communities

How can a spatial framework contribute to resilient flood-risk protection, while improving the living quality of communities?
PRESENTATION SET UP

1 CONTEXT

2 ANALYSES

3 ADAPTIVE FRAMEWORK

4 KEY DESIGN LOCATION

5 REFLECTION
### CONTEXT

The effect a short storm has on the living quality of the communities on the long term.

*SOURCE: [http://www.telegraph.co.uk/Hurricane-Sandy-of-destruction.html](http://www.telegraph.co.uk/Hurricane-Sandy-of-destruction.html), 2013.*

## PROBLEM STATEMENT

The lack of means and expertise of inhabitants to protect themselves against flood-risk.

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<thead>
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<th>CONTEXT AND ORIENTATION</th>
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<th>Problem statement</th>
<th>Role of the urbanist</th>
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PROBLEM STATEMENT

Large scale protection measures from higher governmental levels could also have a negative impact on both ecology and the living quality of communities.
ROLE OF THE URBANIST

Complex waterfronts within the city, all with different qualities, threats and opportunities.
ROLE OF THE URBANIST

Urbanism is the field of expertise needed to integrate site specific conditions, ecological issues and the living quality of communities with protection measures.

FOCUS ON ONE ISSUE
AIM OF PROJECT

A spatial design that will decrease the **flood-risk** while increasing the **living quality** of communities.

- Protection measures *adapted to the context* of the communities
- By increasing the **social and spatial quality** of the different communities

A **flexible strategy** on location that will form the **framework** for development.

**Design on a key location** will **provide knowledge** for development of other flood-prone communities.
LOCATION: Coney Island

Heavily impacted by hurricane Sandy

Diversity of communities

Different types of water hazards

### 1. CONTEXT AND ORIENTATION

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**KEY DESIGN LOCATION: Coney Island Creek**

Most vulnerable communities  Most exposed to flood-risk  Serves a greater area

RESEARCH QUESTIONS

Main research question

How can a spatial framework contribute to resilient flood-risk protection, while improving the living quality of communities?
RESEARCH QUESTIONS

Sub research questions

1. What type of water hazards contribute to flood-risk (a), and which contribute to flood-risk of the communities of Coney Island (b)?

2. What elements of a community make it vulnerable to flood-risk (a), and how vulnerable are the communities of Coney Island (b)?

3. What are resilient measures against flood-risk (a), and how can they be implemented in the context of Coney Island (b)?

4. How can flood-risk protection measures increase the ecological quality of the area (a), and how could this contribute to the ecological quality of Coney Island (b)?

5. What is the distinction between the communities of Coney Island?

6. How can the spatial quality benefit from flood-risk protection measures (a), and how can they contribute to the spatial quality of Coney Island (b)?

7. What is the role of self-organization of communities to create a resilient flood-risk management system?

8. What principles of the design of Coney Island can be used for future development of flood-prone communities?
2. ANALYSES:

**THEMES**
- Flood-risk
- Ecological quality
- Quality of life
- Reference studies

**ANALYSES**

**FINDINGS**

**DEFINITION OF FLOOD-RISK**

\[
(Flood)\text{risk} = \text{Probability} \times \text{Consequence}
\]

- **Flood event**
  - Increased by sea level rise
  - More frequent and intense storms

- **Effect of flooding**
  - Increased by higher vulnerability of area
  - Increased by assets and people at risk

- **Decreased by protection measures**
  - Examples: Heighten levees
  - Storm surge barriers
  - Restoration of dunes

- **Decreased by reducing vulnerability**
  - Examples: Increasing quality of public space to stimulate social activities.
  - Relocation of vulnerable assets

SEA LEVEL RISE

The flexibility and adaptivity of a strategy is more important than a high safety level.

FLOOD RISK PROTECTION REQUIREMENTS

Workings of a storm surge

EXPOSURE TO STORM SURGES

The shape of the bay, angle of the slope and typology of the waterfront are most important factors.
DESIGN HEIGHT / SAFETY LEVEL

Category 4 hurricane
Category 3 hurricane
Category 2 hurricane
Category 1 hurricane
Sea Level Rise
Tidal range

DESIGN HEIGHT ON LOCATION

Coney Island most exposed at the northern side due to the shape of the waterfront.

SOURCE: Map by author, 2014.
Information from: http://sealevel.climatecentral.org/surgingseas/NYC
ECOLOGICAL QUALITY

A mix of different habitats all related to the mix of sweet and salt water.

DYNAMIC PROCESSES
Natural processes over time

SOURCE: Map by author, 2014.
DYNAMIC PROCESSES

Current gradual processes

- Erosion of beach
- Sewage outflow results in the pollution of the creek.
- Less suppletion due to destruction of marshlands.

SOURCE: Map by author, 2014.
QUALITY OF LIFE IN CONEY ISLAND

Quality of life within the communities of Coney Island
2. ANALYSES: Flood-risk  Ecological quality  Quality of life  Reference studies  Main findings

USE OF THE PUBLIC SPACE

0 250 1000 m

Road used by inhabitants
Every day public functions
Leisure / tourism
Point of interest
Parking used by inhabitants
Parking used by tourists
Subway station
Beach
Park
MAIN ISSUES WITHIN THE URBAN FABRIC

Disconnection between communities
MAIN ISSUES WITHIN THE URBAN FABRIC

Disconnection with the waterfront
MAIN ISSUES WITHIN THE URBAN FABRIC

Underuse of public space
2. ANALYSES: Flood risk  Ecological quality  Quality of life  Reference studies  Main findings

URBAN FABRIC
Historical growth of the communities

SOURCE: Map by author, 2014.
### DIVERSITY OF CONEY ISLAND

<table>
<thead>
<tr>
<th>Area</th>
<th>Flood-risk</th>
<th>Ecological quality</th>
<th>Quality of life</th>
<th>Reference studies</th>
<th>Main findings</th>
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**SOURCE:** Diagrams by author, 2014.
### INTERPRETATION OF SPATIAL QUALITY

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<th>Social</th>
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<th>Cultural</th>
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**Analyses:**
- Flood-risk
- Ecological quality
- Quality of life

**Reference studies**

**Main findings**

*SOURCE: Kwaliteit in meervoud' by Habiform (Hooimeijer et al., 2001).*
MAIN FINDINGS

Need to be taken into account in the strategy

- Natural processes can provide flexibility towards flood-risk.
- Design conditions to create new habitats.
- Adapted to the context of the communities.
- Increasing social quality decreases flood-risk.
3. ADAPTIVE FRAMEWORK

CONCEPT
The rhythm of Coney Island

SOURCE: Flexible and fitting to the timeframe of the issues involved. Diagram by author, 2014.
DEVELOPMENT PRINCIPLES

- Revive
- Frame
- Anchor
- Unique
- Add green
- Take over
- Reorient
- Unify
- Bridge
- Link
- Mix
- Activate
- Fill
- Reach
- Thread

PHASING

2014, Restoring the natural processes

- Place ribs to decrease the energy of a storm surge
- Dig out underused public space to supply coastline
- Constructed wetland system to increase ecological quality
- Natural waterfront edge to increase public use.

SOURCE: Map by author, 2014.
PHASING
2014-2030, Urban Interventions

Wetlands serve as green connectors between old communities and waterfront.

Extending reintroduced marshlands into the communities.

Extending these communities towards the accessible and natural waterfront.

New focus points will be developed to increase the use of the waterfront.

SOURCE: Map by author, 2014.
PHASING

2030, Maintaining the balance

Combination of sweet and salt water create variety in habitats.

Sand motor counteracts erosion of shoreline.

SOURCE: Map by author, 2014.
ADAPTIVE URBAN FRAMEWORK

3. ADAPTIVE FRAMEWORK: Concept  Development principles  Phasing  Strategy

Water depth <10m  Water depth 10 - 20m  Water depth >20m
Parking  Urbanized area  Elevated subway tracks
Urbanized area  Buildings  Parkway
Elevated subway tracks  Parkway  Tree line
Park / recreation  Main currents  Design height 2014 (3m)
Design height 2030 (3.5m)  To be linked areas / evacuation routes  To be realized in phase 1
To be realized in phase 2
IMPROVEMENTS IN THE URBAN FABRIC

- Extending reintroduced marshlands into the communities
- Connecting communities with the waterfront
- Creating a natural route through Coney Island

New focal points well connected and within walking distance of each other.

Network of improved slow traffic connections.

Improved / new center, 500 meters walking distance
4. KEY DESIGN LOCATION

LOCATION: Flood-risk  Ecological quality  Quality of life  Composition  Phasing  Interpretation of design

IN-DEPTH ANALYSIS

CREATING SYNERGIES

QUALITY OF LIFE
Great potential
QUALITY OF LIFE

Inaccessible for the public
4. KEY DESIGN LOCATION: Flood-risk

FLOOD-RISK
Storm surge run up

SOURCE: Map by author, 2014.
CONCEPT
Decrease the run up distance and energy of a storm surge

Physical resistance

Frictional resistance

rules of thumb

Position of the ribs in the Creek

\[ S = s \times (100\% - p) \times (100\% - f_{\text{plants}}) \times \frac{w_{\text{forest}}}{500} \times (100\% - f_{\text{trees}}) \times \frac{w_{\text{land}}}{50} \]

\( s = \) Storm surge height at impact in meters (3,00m in 2015, 3,50m in 2015-2030, and 4,00m after 2030)
\( p = \) percentage of energy loss due to physical resistance (30%)
\( n = \) number of ribs in between storm surge and communities.
\( f_{\text{plants}} = \) percentage of energy loss due to plants (10%)
\( w_{\text{land}} = \) width of land above average sea level in meters
\( f_{\text{trees}} = \) percentage of energy loss due to plants (10%)
\( w_{\text{forest}} = \) width of forest in meters.

Safety level = height of surge after protection measures in meters
### DESIGN

Position of the ribs in the Creek

**SOURCE:** Map by author, 2014.
ECOLOGICAL QUALITY

Causes of pollution

SOURCE: Map by author, 2014.
CONCEPT
Replacing CSO and storm water pipes with constructed wetland filters.

DESIGN

Constructed wetland filters.

SOURCE: Map by author, 2014.
**DESIGN**

Constructed wetland filters.

**The closed basin constructed wetland**

- **Bushy Beardgrass**
- **Cinnamon fern**
- **Great Bullrush**
- **Smooth Cordgrass**
- **Narrow-leaved Cattail**
- **Duckweed**
- **Sea Arrowgrass**
- **Bushy Beardgrass**
- **Sea Lavender**

**Basin 2:** A small, dense basin filled entirely with sunflowers to filter the most heavy metals out of the water.

Pump to prevent dryfall of basins.
CONCEPT

Shaping the coastline in relation to the tidal height

Low salt marshland | High salt marshland | Tidal woodlands | Pine Barrens

Maritime grasslands | Maritime forest

DESIGN
Combination of sweet and salt water

SOURCE: Map by author, 2014.
PLANT CATALOGUE
Species that work on multiple levels.
PHASE 1:
2014, restoring the natural processes

SOURCE: Map by author, 2014.
2015: DESIGN

Different species of plants protect against wave forces and erosion.

PHASE 2:
2015-2030, Urban Interventions

SOURCE: Map by author, 2014.
2015-2030: DESIGN

Different conditions result in a variety of habitats.
DESIGN
Activate the waterfront.
DESIGN

Leisure landscape

SOURCE: Map by author, 2014.
COMPOSITION

Connecting communities with waterfront, city with marshland.

SOURCE: Map by author, 2014.
PHASE 3:
2030, Maintaining the balance

SOURCE: Map by author, 2014.
By using natural processes, synergy between flood-risk protection, ecological quality and quality of live is created. This results in a design that is flexible and can adapt to future needs and demands.
DESIGN

View from the ferry towards the new urban waterfront.

Ferry terminal extends into marshland.

Differentiation of the public functions around the waterfront.

SOURCE: Map by author, 2014.
DESIGN

View from the existing communities towards the new residential area and waterfront.

**SOURCE:** Map by author, 2014.
DESIGN

View towards the new urban waterfront and ferry terminal
REFLECTION

Adaptivity and flexibility of the strategy

Addressing multiple themes and timeframes

Good understanding of the existing natural processes
5. REFLECTION: process

PROCESS

Use of the results in other flood prone communities.

The methodology used shows the location, type of intervention or timeframe where a design can improve multiple issues at once.

Resilient communities

How can a spatial framework contribute to resilient flood-risk protection, while improving the living quality of communities?

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