REBUILD BY DESIGN

- RESIST
- DELAY
- STORE
- DISCHARGE

HUDSON RIVER

RECOMMENDATION OF THE PREFERRED ALTERNATIVE

September 8, 2016
ALTERNATIVE 3

Option 1

Option 2

Resist - Alternative 3
Existing Structures
Delay, Store, Discharge

*For more information on Alternative 3, please see the project boards

REBUILD BY DESIGN HUDSON RIVER: RESIST • DELAY • STORE • DISCHARGE

Dewberry

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Meeting Agenda

Introduction

Project Status

Preferred Alternative / Alternatives Recap

Alternatives Analysis

- Flood Risk Reduction
- Socioeconomics / Built Environment
- Benefit Cost Analysis
- Maintenance / Operations and Construction
- Environmental Impacts

Preferred Alternative

Takeaways / Next Steps

Q&A
Rebuild by Design Vision

RESIST

DELAY

STORE

DISCHARGE
How are we soliciting community input in this project phase?

- CAG Meetings
- Public Meetings
- Workshops

PUBLIC INVOLVEMENT
WHY DO WE NEED THE PROJECT?

The project area is at risk from storm surge events and heavy rainfall that results in flooding.
Coastal flood model demonstrating the concern of coastal storm surge during Superstorm Sandy.

Model depicts “No Action Alternative” (NAA). Estimates future flood (coastal) event if Project is not built.

- Assumes Long Slip will be built
- Assumes Newport development will be built
What Happens During a Rainfall Flood Event?

Rainfall model depicting a 5-year rainfall event (high-tide) “No Action Alternative.”

Model estimates future flood (rainfall) event if Project is not built.

Model assumes Hoboken and NHSA’s existing on-going initiatives WILL be built:

- Southwest Park
- H1 and H5 Pump Stations
- Washington Street Rain Garden
- City Hall Green Infrastructure
We are here

Cost Estimate BCA

Environmental impacts

Modelling

June – Dec 2015

Dec 2015 – Feb 2016

July – Sept 2016

Data Collection

Concept Development

Elements of RBD

Toolkit

Suitability Assessment

Concepts

A

B

C

D

E

Alternatives

1

2

3

Preferred Alternative

Cost Estimate BCA

Environmental Impacts

Screening Criteria

Concept Development Principles

Parameters of RBD

Themes

REBUILD BY DESIGN HUDSON RIVER: RESIST DELAY STORE DISCHARGE

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State of New Jersey Department of Environmental Protection
<table>
<thead>
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<td>- Minimal impact to waterfront access and views</td>
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Alternative 3

ALT-3
ALTERNATIVE 3

Option 1
Option 2

Resist - Alternative 3
Existing Structures
Delay, Store, Discharge

*For more information on Alternative 3, please see the project boards

REBUILD BY DESIGN HUDSON RIVER: RESIST • DELAY • STORE • DISCHARGE

Dewberry • DEPARTMENT OF ENVIRONMENTAL PROTECTION
East Alleyway

Parking: 41 Spaces

14th St.

Bloomfield St.

Washington St.
Delay, Store, Discharge

OVERALL STRATEGY

Legend:
- Catchment Area
- Municipal Boundaries
- Study Area
- Ferry Lines

REBUILD BY DESIGN HUDSON RIVER: RESIST DELAY STORE DISCHARGE

State of New Jersey DEPARTMENT OF ENVIRONMENTAL PROTECTION
Delay, Store, Discharge

UNDERGROUND WATER STORAGE UNIT

TYPICAL CONDITION
Alternative 2
ALTERNATIVE 2

*For more information on Alternative 2, please see the project boards
Alternative 1
ALTERNATIVE 1

*For more information on Alternative 1, please see the project boards
Independence Court Waterfront
Review of Matrix Results

- Flood Risk Reduction
- Socioeconomics and Built Environment
- Benefit Cost Analysis
- Construction / Maintenance and Operations
- Environmental Impacts
## Review of Matrix Results - Alternative 3

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Flooding Icon" /></td>
<td>Alternative 3 provides substantial flood risk reduction (85% of the community and majority of critical facilities).</td>
</tr>
<tr>
<td><img src="image" alt="Amenities Icon" /></td>
<td>Alternative 3 provides amenities while minimizing impacts to the built environment.</td>
</tr>
<tr>
<td><img src="image" alt="Cost/Benefit Icon" /></td>
<td>Alternative 3 has the highest Benefit/Cost Ratio of all the alternatives.</td>
</tr>
<tr>
<td><img src="image" alt="Construction Icon" /></td>
<td>Alternative 3 has the lowest construction cost of all the Alternatives.</td>
</tr>
<tr>
<td><img src="image" alt="Disposal Icon" /></td>
<td>Alternative 3 will require the least amount of disposal of soils.</td>
</tr>
</tbody>
</table>
Flood Risk Reduction
Alternative 3 provides substantial flood risk reduction:

- 85% of community receives flood reduction from Coastal Surge (Resist)
- All critical facilities protected except one fire station (1313 Washington Street)
- 14,000 people receive rainfall flood reduction benefits (from Delay, Store, Discharge)
NAA AND ALTERNATIVE 3 WITH 100-YEAR COASTAL STORM SURGE

85% OF POPULATION NO LONGER FLOODS

shows resist feature alignment

REBUILD BY DESIGN HUDSON RIVER: RESIST DELAY STORE DISCHARGE

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NAA AND ALTERNATIVE 2 WITH 100-YEAR COASTAL STORM SURGE

86% OF POPULATION NO LONGER FLOODS
NAA AND ALTERNATIVE 1 WITH 100-YEAR COASTAL STORM SURGE

98% OF POPULATION NO LONGER FLOODS

Filled Long Slip Canal

Washington Street

Hoboken Terminal

Weehawken Cove

shows resist feature alignment
Proposed underground detention facilities with green/open space on ground surface with discharge features such as pumps to manage rainfall runoff volume

**BASF site**
- Manages rainfall runoff for approx. 55 acres

**NJ Transit site**
- Manages rainfall runoff for approx. 15 acres

**Block 10 site**
- Manages rainfall runoff for approx. 8 acres

**ROW Green/Grey Infrastructure Practices**
- Total of 61 sites to manage street drainage for approx. 13 acres
COMPARISON OF FLOoding AREAS WITH 5-YEAR / HIGH TIDE - NAA AND PROPOSED DSD

Baseline Conditions (NAA)

- Washington Street Rain Gardens
- City Hall GI Project
- H1 Pump Station
- Southwest Park

Proposed DSD Alternative

- BASF Site
- NJ Transit Site
- Block 10 Site

LEGEND
- WET WEATHER PUMP STATION
- DRAINAGE AREA
- ROW GREEN / GREY INFRASTRUCTURE
- ESTIMATED FLOODED AREA
<table>
<thead>
<tr>
<th>Flood Risk Reduction</th>
<th>ALT-1</th>
<th>ALT-2</th>
<th>ALT-3</th>
</tr>
</thead>
</table>
|                      | - Reduces flood risk to 98% of population  
                       - All critical facilities protected | - Reduces flood risk to 86% of population  
                       - One critical facility remains exposed (Fire station) | - Reduces flood risk to 85% of population  
                       - One critical facility remains exposed (Fire station) |
Socioeconomics and Built Environment
Socioeconomics and Built Environment

Alternative 3 provides amenities while minimizing impacts to the built environment:

- Approximately 7 acres of new/improved park space
- Minimal impact to waterfront access
- Least number of gates required
- Reduces flood risk for Environmental Justice communities from coastal surge and rainfall flooding
Coastal Flooding and Environmental Justice

Greatest number of EJ populations receive flood reduction benefits

Slightly fewer number of EJ populations receive flood risk reduction benefits compared to Alt-1
Rainfall Flooding and Environmental Justice

Legend
- Study Area
- Municipal Boundary
- Hudson-Bergen Light Rail (HBLR)
- Minority Block Groups
- Hispanic Block Groups
- Population (Over 75) Block Groups
- Households in Poverty Census Tracts
- Families with Children in Poverty Census Tracts
- Area of Reduced Flooding (Based on 5-Year Storm Model)

ALT-1
48.1 acres flood during NAA (5-year rainfall):
- All receive rainfall flood reduction

ALT-2
- 35.5 acres no longer flood at all

ALT-3
Alternatives Analysis Screening Criteria

- View Corridors
- Waterfront Access
- Park Space
- Connectivity/Circulation
Alt. 3 Overview

View Corridors | Waterfront Access | Park Space | Connectivity/Circulation
--- | --- | --- | ---
Recreational impacts | No Waterfront access impact | N/A | 0 Parking Impacted, 3 Gates
**Cove Park**

- Boathouse
- View Deck
- Beach
- Playground
- Lawn
- Multi-Game Court
- Sliding Gate

**View Corridors**
- Residential impacts

**Waterfront Access**
- No Waterfront access impact

**Park Space**
- New Park Space

**Connectivity/Circulation**
- 0 Parking Impacted, 1 Gate
<table>
<thead>
<tr>
<th>View Corridors</th>
<th>Waterfront Access</th>
<th>Park Space</th>
<th>Connectivity/Circulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential impacts</td>
<td>No Waterfront access impact</td>
<td>N/A</td>
<td>0 Parking Impacted, 2-5 Gates</td>
</tr>
<tr>
<td>Retail/Dining impacts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>View Corridors</td>
<td>Waterfront Access</td>
<td>Park Space</td>
<td>Connectivity/Circulation</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------</td>
<td>------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Residential impacts</td>
<td>No Waterfront access impact</td>
<td>N/A</td>
<td>0 Parking Impacted, 1-3 Gates</td>
</tr>
<tr>
<td>Socioeconomics and Built Environment</td>
<td>ALT-1</td>
<td>ALT-2</td>
<td>ALT-3</td>
</tr>
<tr>
<td>--------------------------------------</td>
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</tr>
<tr>
<td></td>
<td>Most impact to waterfront access</td>
<td>Least impact to waterfront access</td>
<td>Least impact to waterfront access</td>
</tr>
<tr>
<td></td>
<td>Most impact to river and city views</td>
<td>Least impact to river and city views</td>
<td>Least impact to river and city views</td>
</tr>
<tr>
<td></td>
<td>Most opportunity for new/improved park amenities</td>
<td>Less opportunity for new/improved park amenities</td>
<td>Least opportunity for new/improved park amenities</td>
</tr>
<tr>
<td></td>
<td>29-31 gates</td>
<td>21-25 gates</td>
<td>19-23 gates</td>
</tr>
</tbody>
</table>
Benefit Cost Analysis
Benefit Cost Analysis

Alternative 3 has the highest Benefit/Cost Ratio of all the alternatives
## Comparison of Benefit-Cost Analysis Results

<table>
<thead>
<tr>
<th>Build Alternative</th>
<th>Benefit-Cost Ratio (BCR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALT-1</td>
<td>2.21</td>
</tr>
<tr>
<td>ALT-2</td>
<td>3.83</td>
</tr>
<tr>
<td>ALT-3</td>
<td>3.94</td>
</tr>
<tr>
<td>Benefit Cost Analysis</td>
<td>ALT-1</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td>Most expensive, lowest BCR</td>
</tr>
</tbody>
</table>
Maintenance / Operations and Construction
Alternative 3 has the lowest construction cost of all the Alternatives

- Lowest construction cost
- Lowest estimated annual maintenance cost
### Maintenance / Operations and Construction

<table>
<thead>
<tr>
<th>Resist Feature: Operations and Maintenance Annual Cost (Estimate, $M)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ALT-1</strong></td>
</tr>
<tr>
<td><strong>ALT-1</strong></td>
</tr>
<tr>
<td><strong>ALT-2</strong></td>
</tr>
<tr>
<td><strong>ALT-2</strong></td>
</tr>
<tr>
<td><strong>ALT-3</strong></td>
</tr>
<tr>
<td><strong>ALT-3</strong></td>
</tr>
</tbody>
</table>

O&M will be further refined at the next phase of the project. Currently, the DSD O&M is estimated at 1% of the construction costs.
Constructability - Potential Private Property Easement

Legend

- Study Area
- Proposed Resist Structure
  - Proposed Underground Tank
- Proposed Underground Piping
- Municipal Boundary
- Hudson-Bergen Light Rail (HBLR)
- Potential Private Property Easement

ALT-1
- 15 properties with potential easements
- Approx. 4,860-4,600 feet of utility relocation

ALT-2
- 6 properties with potential easements
- Approx. 2,300-2,060 feet of utility relocation

ALT-3
- 6 properties with potential easements
- Approx. 1,280-1,030 feet of utility relocation
<table>
<thead>
<tr>
<th>Construction / Maintenance and Operations</th>
<th>ALT-1</th>
<th>ALT-2</th>
<th>ALT-3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Most expensive annual cost</td>
<td>Less expensive annual cost</td>
<td>Least expensive annual cost</td>
</tr>
<tr>
<td></td>
<td>Greatest amount of utility impacts</td>
<td>Less amount of utility impacts</td>
<td>Least amount of utility impacts</td>
</tr>
<tr>
<td></td>
<td>15 properties w/potential easements</td>
<td>6 properties w/potential easements</td>
<td>6 properties w/potential easements</td>
</tr>
</tbody>
</table>
Environmental Impacts
Environmental Impacts

All three alternatives have varying degrees of environmental impacts.

- Alternative 3 will require the least amount of disposal of soils
- Alternative 3 (and Alternative 2) will impact the fewest noise receptors during construction.
Recognized Environmental Conditions

Legend:
- Study Area
- Proposed Resist Structure
- High Level Storm Sewer System
- Proposed Underground Tank
- Proposed Underground Piping
- Municipal Boundary
- Hudson-Bergen Light Rail (HBLR)
- NJDEP Mapped Historic Fill (REC 1)
- Current and Historic Rail Area (REC 2)
- REC Site Impacted by Chlorinated Solvents
- REC Parcels
- NJDEP Mapped Classification Exception Areas
- NJDEP Mapped Deed Notice Parcels

ALT-1
- 43-46 RECｓ
- Approx. 150,000 tons soil (total) potentially requiring off-site disposal

ALT-2
- 45-49 RECｓ
- Approx. 138,000 tons soil (total) potentially requiring off-site disposal

ALT-3
- 45-49 RECｓ
- Approx. 137,000 tons soil (total) potentially requiring off-site disposal
Environmental Permitting

Legend
- Study Area
- Municipal Boundary
- Hudson-Bergen Light Rail (HBLR)
- Positive Floodplain Benefit
- Bulkhead Replacement
- Permanent and Temporary Floodplain Impacts
- Freshwater Wetland Impact

ALT-1
- Potential minor impacts due to in-water work
  - Individual permits (USACE, NJDEP)

ALT-2
- Negligible impacts from outfalls
  - Nationwide Permit (USACE)
  - Individual Permits (NJDEP)

ALT-3
- Negligible impacts from outfalls
  - Nationwide Permits (USACE)
  - Individual Permits (NJDEP)
COMPARISON OF DIFFERENCES IN WATER DEPTH (IN INCHES) BETWEEN NAA THREE ALTERNATIVES IN THE NORTH STUDY AREA FOR THE 100-YEAR COASTAL STORM

**ALT-1**

**GREEN** shows decreases in flood depth in inches

**ALT-2**

**PINK** shows increases in flood depth in inches

**ALT-3**

**show** shows resist feature alignment
COMPARISON OF DIFFERENCES IN WATER DEPTH (IN INCHES) BETWEEN NAA THREE ALTERNATIVES IN THE SOUTH STUDY AREA FOR THE 100-YEAR COASTAL STORM

GREEN shows decreases in flood depth in inches

PINK shows increases in flood depth in inches

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REBUILD BY DESIGN HUDSON RIVER: RESIST DELAY STORE DISCHARGE

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DEPARTMENT OF ENVIRONMENTAL PROTECTION
Historic Architecture

Legend
- Study Area
- Municipal Boundary
- Hudson-Bergen Light Rail (HBLR)
- Historic Properties with Potential Adverse Affects
- Historic Districts

45 historic properties potentially impacted
65 historic properties potentially impacted
64 historic properties potentially impacted
Approx. 16.8 acres potentially impacted

Approx. 15.7 acres potentially impacted

Approx. 14.7 acres potentially impacted
Noise Receptors

Legend
- Study Area
- Municipal Boundary
- Hudson-Bergen Light Rail (HBLR)
- Proposed Resist Structure
- Proposed Underground Tank
- Proposed Underground Piping
- Noise Receptor - Parks
- Noise Receptor - Schools
- Noise Receptor - Places of Worship

ALT-1
- Schools: 4
- Parks: 13
- Places of Worship: 3

ALT-2
- Schools: 0
- Parks: 4
- Places of Worship: 2

ALT-3
- Schools: 0
- Parks: 4
- Places of Worship: 2
<table>
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<tr>
<th>Environmental Impacts</th>
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</tr>
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<tr>
<td></td>
<td>- Greatest amount of off-site soil disposal</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>- 2 properties potentially impacted (pursuant to land use regulations)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Less amount of off-site soil disposal</td>
<td></td>
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</tr>
<tr>
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Preferred Alternative
**Preferred Alternative**

| ALT-3 | - Provides a high degree of flood risk reduction while balancing public input, cost and urban amenities  
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|       | - Lowest annual maintenance cost  
|       | - Fewest number of gates  
|       | - Minimal impact to waterfront access and views |
Alternative 3 - Flyover
Key Takeaways

Alternative 3 is a technically feasible cost effective project that was recommended through the alternatives analysis.

1. **Contribute to Community Resiliency**
2. **Reduce Risks to Public Health**
3. **Contribute to On-going community efforts to reduce FEMA flood insurance rates**
4. **Deliver Co-benefits**
5. **Connectivity to the Waterfront**
6. **Activation of Public Space**
7. **Consider Impacts from Climate Change**

The Design efforts will continue into Final Design.
Next Steps


Public Hearing for DEIS  Jan. 2017

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