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Rebuild by Design Meadowlands: Designing for Implementation

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HURRICANE SANDY

1,700 HOMEOWNERS SUSTAINED DAMAGE
3,500 RESIDENTS HAD TO BE EVACUATED
REBUILD BY DESIGN: COMPETITION & AWARD
U.S. DEPARTMENT OF HOUSING & URBAN DEVELOPMENT

- Original RBD Concept
- Protect: Flood Protection
- Connect: Transportation Improvements
- Grow: Re-Development
- Cost Estimate (Competition Cost) Phase 1: $850M+

COMPETITION LENSES
REBUILD BY DESIGN COMPETITION & AWARD
PILOT AREA 1 AWARDED

- HUD awarded State of New Jersey only $150M for Phase 1 Pilot Area
- Project must be functional and completed by September 2022
REBUILD BY DESIGN COMPETITION & AWARD

5 MUNICIPALITIES

Pilot Area 1

- 5,500 Acres
- 16,000 Residents
- Teterboro Airport
- Regional Transportation Corridors
- Regional Warehouse and Distribution Centers
1. Construct a complete project that functions with **INDEPENDENT UTILITY** to meet purpose & need without relying on future projects.

2. Use only **AVAILABLE FUNDS** without relying on future funding.

3. Construct a fully-functional project by **SEPTEMBER 2022**

4. Project must have a **POSITIVE BENEFIT COST RATIO**
THE TEAM
THE TEAM
RESILIENCE THROUGH PARTNERING

AECOM
HDR
Dewberry
Stevens Institute of Technology
HR&A
New Meadowlands LLC
MatrixNewWorld
Remora Consulting
Robinson
RFI
PROJECT AREA CHALLENGES
EXISTING FLOODPLAIN

- 98% OF THE PROJECT AREA IS WITHIN THE 100-YEAR FLOODPLAIN
PROJECT AREA CHALLENGES

SEA LEVEL RISE BY 2075

- **SEA LEVEL IS ESTIMATED TO RISE BETWEEN 1.2 – 2.4 FEET IN THE PROJECT AREA**

- **STORM SURGE IS ESTIMATED TO INCREASE 0.8-1.6 FEET**
PROJECT AREA CHALLENGES

1. Challenges from MAJOR STORM SURGE Flooding

2. Challenges from FREQUENT RAIN Flooding
The Meadowlands sits at a low elevation relative to sea level. Protection from tidal influence and storm surge is limited. Some existing storm infrastructure is under-performing and needs to be updated, or more frequently maintained.

- Low Elevation: Existing flooding conditions and buildings constructed at low elevations are problematic for future sea level rise.
- Under Performing Infrastructure: Some conveyances are underperforming and existing pump stations must function at half or two-thirds capacity.
- Failing Berms: Existing berm heights do not protect against flooding.
- Inadequate Ditches + Drainage System: Existing ditches and drainage systems are undersized and poorly maintained.
- Filled Historical Wetlands: Historically, wetlands were filled, reducing capacity.
PROJECT AREA NEEDS

- **INSUFFICIENT PROTECTION**
  - Existing protection from tidal surge is limited, which can result in severe flooding

- **INSUFFICIENT DRAINAGE**
  - The existing drainage system proves to be insufficient during flood events

- **FREQUENT STORMS**
  - Severe interior flooding can occur multiple times a year due to frequent rain storms

- **WATER QUALITY**
  - Runoff flows directly into the storm system untreated
THE MEADOWLANDS - THREE ALTERNATIVES

Alternative 1: Storm Surge Flooding

Alternative 2: Frequent Rain Flooding

Alternative 3: Storm Surge & Frequent Rain Flooding
DEVELOPING A PREFERRED ALTERNATIVE
COMMUNITY ENGAGEMENT

EXECUTIVE STEERING COMMITTEE & CITIZENS ADVISORY GROUP

EXECUTIVE STEERING COMMITTEE (ESC)
- NJ Department of Environmental Protection (NJDEP) Commissioner
- Department of Housing & Urban Development (HUD) Representative
- Rebuild By Design (RBD) Project Management (PM) Team
  - NJ Department Environmental Protection (NJDEP)
  - AECOM (Consultant)
- Local Mayors and other representatives
- New Jersey Sports & Exhibition Authority (NJSEA)
- Berger-Hill Joint Venture (Consultant/Third Party Reviewer)
- Bergen County

CITIZEN ADVISORY GROUP (CAG)
- Community Representatives
- Vulnerable Population Representatives

ENVIRONMENTAL IMPACT STATEMENT OUTREACH
- Stakeholder Outreach
- Pertinent Federal/State/Local/Agencies
- Federally Recognized Native American Tribes

WORKSHOPS/MEETINGS WITH CAG & ESC
NEWSLETTERS/FLYERS/WEBSITES
PUBLIC SCOPING MEETINGS AT NOTICE OF INTENT
PUBLIC HEARING AT DEIS
COMMUNITY ENGAGEMENT
EARLY CONSULTATION + CONTINUED INVOLVEMENT

- 15 Public Meetings in 20 months
- Real-time Concept Development
- Real-time Environmental Analysis
- Real-time Feasibility / Scenario Testing
COMMUNITY ENGAGEMENT
GRAPHIC COMMUNICATION TOOLS

<table>
<thead>
<tr>
<th>STRUCTURAL WALL UNIT</th>
<th>40-60</th>
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<tr>
<td>BENCH UNIT</td>
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<td>PLANTER UNIT</td>
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<td>AMPHITHEATER UNIT</td>
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<td>CANOPY UNIT</td>
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BASIC WALL STUDIES

BENCH STUDIES

BENCH + PLANTER STUDIES
PHYSICAL COMMUNICATION TOOLS

COMMUNITY ENGAGEMENT
COMMUNITY ENGAGEMENT

PHYSICAL COMMUNICATION TOOLS
STORM SURGE FLOODING

ALTERNATIVE 1
ALTERNATIVE 1 STORM SURGE

APPROACH & GOALS

+ INFRASTRUCTURE
Connecting to high points to reduce construction costs and minimize grading

+ ECOLOGY
Minimize disturbance, consider habitat improvements to fragmented systems, and creation of new ecological zones

+ PARKS
As a co-benefit to flood reduction, the project seeks to connect existing public parks as well as provide new park space
CANTILEVER WALKWAY
CONCEPT DIAGRAMS

RESIDENTIAL PASSAGE
Cantilevered Walkway

FLUVIAL WETLAND PARK
A Flooded View of the Park
ALIGNMENT DEVELOPMENT – FLUVIAL PARK

CENTRAL HACKENSACK NORTH

APPLYING THE “KIT OF PARTS”
- A berm system turns into a public space under Route 46
- The berm system allows for inundation on the river’s side during a flood event
ALIGNMENT DEVELOPMENT – FLUVIAL PARK CONNECTION
CENTRAL HACKENSACK NORTH
ALIGNMENT DEVELOPMENT – FLUVIAL PARK CONNECTION
CENTRAL HACKENSACK NORTH
CANTILEVER WALKWAY

CONCEPTUAL RENDERING FOR ILLUSTRATIVE PURPOSES

• The Cantilever Walkway combines flood protection and public access

1 Public walk
2 Modular planter
3 Cantilever access
4 Recreational space
CANTILEVER WALKWAY

CONCEPTUAL RENDERING FOR ILLUSTRATIVE PURPOSES

- The Cantilever Walkway combines flood protection and public access

1. Public walk
2. Modular planter
3. Cantilever access
4. Recreational space
FLOOD PROTECTION
CONCEPTUAL RENDERING FOR ILLUSTRATIVE PURPOSES

- The entire structure is built up to a 7'NAVD88 elevation

1 Flood protection system
2 Newly-created tidal wetland
VIEWING PLATFORM & SHEET PILE
CONCEPTUAL RENDERING FOR ILLUSTRATIVE PURPOSES

- Sheet pile is a cost effective material used in the southeast
- Public viewing platforms were integrated into the system

1. Viewing deck
2. Wetland
FLOOD PROTECTION
CONCEPTUAL RENDERING FOR ILLUSTRATIVE PURPOSES

- Sheet pile wraps around viewing platform to form the flood protection system
ALTERNATIVE 1 STORM SURGE - PLAN

- Provides protection from a storm surge to elevation 7’ NAVD88 (approximately a 50-yr storm)
- Provides community co-benefits through water access & multifunctional wall elements
- Positive Benefit Cost Ratio greater >1
- Revised Feasibility-level concept cost exceeds $150M
FREQUENT RAIN FLOODING

ALTERNATIVE 2
ALTERNATIVE 2 FREQUENT RAIN FLOODING

APPROACH & GOALS

+ INFRASTRUCTURE
Enhance & restore channels to improve capacity to convey stormwater

+ ECOLOGY
Native plantings and naturalized channel edges provide habitat and improve water quality

+ PARKS
New park spaces slowing runoff & improve water quality
ALTERNATIVE 2 FREQUENT RAIN FLOODING - ANALYSIS
20 SUB-BASINS

- Analyzed 20 sub-basin areas in the hydrologic model

A: UPPER EAST RISER  
B: MIDDLE EAST RISER  
C: LOWER EAST RISER  
D: UPPER WEST RISER 1  
E: UPPER WEST RISER 2  
F: MIDDLE WEST RISER  
G: LOWER WEST RISER  
H: UPPER LOSEN SLOTE 1  
I: UPPER LOSEN SLOTE 2  
J: MOONACHIE  
K: CARLSTADT  
L: INDIAN LAKE  
M: MAIN STREET  
N: DEPEYSTER CREEK  
O: LOWER LOSEN SLOTE  
P: UPPER HACKENSACK  
Q: MIDDLE HACKENSACK 1  
R: MIDDLE HACKENSACK 2  
S: LOWER HACKENSACK  
T: BERRY’S CREEK

--- Sub-basin boundary
• Runoff flows to lower elevations, into creeks or ditches and is conveyed eventually into the Hackensack River or Berry’s Creek

• We listened to the community members and used their input to map areas of frequent flooding

**Floods in regular event**

**Floods in heavy event**

**Floods in major event**

**Primary conveyance direction**

**Sub-basin**
ALTERNATIVE 2 FREQUENT RAIN FLOODING

CONCEPT DIAGRAMS

OPEN SPACE
Managing Water + Providing Open Space

STREET IMPROVEMENTS
Walkable Streets + Bike Lanes
ALTERNATIVE 2 FREQUENT RAIN FLOODING

CONCEPT DIAGRAMS

REVIVING THE DITCH
Option 1: Extend the Riparian Corridor

- New Public Access
- Stormwater Piped from Sewers within Sub-Basin
- Pedestrian Trail
- Restored Riparian Corridor
- New Wetlands Increase Contiguous Wetland Area
- Improved Wildlife Habitat
- Surface Flow is Slowed and Treated in Wetland Shelf

REVIVING THE DITCH
Option 2: Daylight and Enhance the Ditch

- Stormwater is Slowed and Treated in Wetland Shelf
- Vegetated Wetland
- Water is Piped In
- No Standing Water
- Educational Component

Stormwater is Slowed and Treated in Wetland Shelf

AECOM
ALTERNATIVE 2 FREQUENT RAIN FLOODING
CONCEPTUAL KIT OF PARTS

CHANNELS (IMPROVE WETNESS)
Channels can be elevated and restored to increase stormwater capacity. They can also be retrofitted and landscaped. A few improvements include:
- Native vegetation
- Filter media
- Raised bed insect xenia
- Pond berms
- Deepening
- Native vegetation
- Water control
- Flow control
- Natives & improved open space

SETTLING BASIN & FOREBAY
Settling basins are generally used to treat stormwater before it enters the drainage system. They are typically located at the beginning of the process. The following improvements are similar to those described above:
- Build up basin
- Increase capacity
- Off-line detention basin
- Pond berms
- Native vegetation
- Water control
- Natives & improved open space

FLOWPATHS
The improvements are constructed to move water from precipitation to another efficiently and as part of the course of water through a system. Stormwater BMPs include:
- Upstream interception
- Downstream interception
- Force main
- Force main & backflow prevention
- Force main & backflow prevention

PONDS & BERMING
Ponds may be included along the channels in order to increase their stormwater storage capacities.

DEFICIENT UNDEVELOPED (OPTIONAL)
-

NATIVE VEGETATION
-

OPEN LAMP

PERMEABLE SURFACE

NATURAL PLANTING

FORCE MAIN

OFF CHANNEL BRIDGE

OFF-channel storage refers to areas where stormwater can be stored when the capacity of the drainage system is exceeded. This type of storage can take various forms, including retention basins, underground vaults, and flood control.
THE PREFERRED ALTERNATIVE

ALTERNATIVE 3 – STORM SURGE & FREQUENT RAIN FLOODING
ALTERNATIVE 3 – HYBRID

APPROACH & GOALS

+ INFRASTRUCTURE
Structural Flood Reduction and local drainage infrastructure improvements

+ ECOLOGY
Minimize ecological disturbance and improve habitat within channels, streets, and parks

+ PARKS
Green infrastructure provides additional flood reduction & improves existing public parks
ALTERNATIVE 3 – THE PREFERRED
A PLAN FOR BOTH CHALLENGES

Stormwater Management
1. East Riser Channel Improvements + Enhanced Wetland Open Space
2. Green Infrastructure + Enhanced Existing Open Space
3. Force Main + Public Facility Improvements
4. Green Infrastructure + Enhanced Open Space
5. GI Improvements to Existing Park + 3 New Wetland / Open Spaces

Storm Surge Protection
1. Existing Riverwalk
2. Sheet Pile Cantilever
3. Berms at Fluvial Park
4. Cantilever Walkway
5. Sheet pile or Floodwall
6. Surge Barrier
The Build Plan represents a feasible project that can be constructed by 2022. Components include flood reduction strategies to address frequent rain flooding.

Components that were not selected for the Build Plan became elements of a Future Plan. These elements could be implemented by others over time as new funding sources become available.
ALTERNATIVE 3 - BUILD PLAN
FREQUENT FLOOD REDUCTION

1. Pump station + Channel Improvements + New Park
2. Green Infrastructure + New Park
3. Pump Station + Force Main + Public Facility Improvements
4. Green Infrastructure
5. Park Improvements + 1 New Park + Green Infrastructure

Stormwater Management Features
- East Riser: Channel Improvements + Enhanced Wetland Open Space
- Avanti Park: Street Green Infrastructure + Enhanced Open Space
- Losen Slote: Force Main + Public Facility Improvements
- Green Infrastructure + Enhanced Wetland Open Space
- GI Improvements to Willow Lake Park + 1 New Wetland / Open Space along Hackensack River
EAST RISER CHANNEL IMPROVEMENTS
FLOOD REDUCTION BENEFITS

- Channel conveyance improvements below Moonachie Ave with a new pump station
- New wetland eco-park with ~12,000 SF of integrated green infrastructure and ~129,000 SF of wooded and emergent wetland to improve storage and water quality
EAST RISER CHANNEL IMPROVEMENTS
FLOOD REDUCTION CO-BENEFITS

- Channel conveyance improvements include habitat restoration with native vegetation.
- New wetland eco-park is part of the flood reduction system, but also offers benefits in the form of habitat, environmental education, and recreation space.
GREEN INFRASTRUCTURE & PARK IMPROVEMENTS

CONCEPTUAL RENDERING

- Wetland enhancement, improves storage and treatment capacities, and improves public recreation opportunity

1. Elevated boardwalk
2. Channel improvements
3. Shallow emergent marsh
4. Native vegetation
LOSEN SLOTE DRAINAGE IMPROVEMENTS
FLOOD REDUCTION & CO-BENEFITS

- New pump station within the residential area of the stream
- Stormwater discharges via a 36" force main to the downstream Losen Slote marsh
- Energy dissipation structure limits erosion at discharge points
- Street green infrastructure collects water and filters total suspended solids
CIVIC LOCATIONS
FLOOD REDUCTION BENEFITS

- Multiple improvements are proposed at public facilities in Little Ferry such as bioswales and underground storage trenches.

- Improvements are planned for the following facilities: Little Ferry Library, Little Ferry Municipal Building, Memorial Middle School, Washington Elementary, and Robert Craig Elementary.
AVANTI PARK
CONCEPTUAL RENDERING

- Bioretention systems capture and filters 1.25 inches of rainfall in two hours through planting media
- New retention areas create room for additional water storage
- Undeveloped land becomes public park and productive ecosystem

1. Boardwalk foundation
2. Headwall & inlet pipe
3. Energy dissipator
4. Native planting
5. Integrated seating
Co-benefits to the municipal buildings include improvements near community buildings, such as opportunities for education, community outreach and involvement, and new habitat.
- Permeable paving and rain gardens collect and filters 1.25 inches of rainfall in two hours through planting media.

- Green infrastructure can be an educational opportunity for schools and public buildings.

- Greener streets improve habitat, create safer streets, and improve visual quality of the street.

**Diagram Elements:**

1. Permeable paver
2. Bioretention
3. Grass and concrete permeable paver
WILLOW LAKE & RIVERSIDE PARKS

FLOOD REDUCTION BENEFITS

- Reduce sedimentation into the drainage system & slows water movement
- Improvements to Willow Lake include approximately 65,000 SF of new native planting and low meadow and approximately 1,200 SF of rain gardens
- A new public open space on the Hackensack River includes approximately 5,700 SF of restored riparian wetland and approximately 30,000 SF of native planting and bioswales
Co-benefits to the new and improved Little Ferry open spaces include new walking trails, space for recreation, water access, new habitat, and visual improvements.
WILLOW LAKE PARK IMPROVEMENTS
CONCEPTUAL RENDERING

- Green infrastructure system would be sized to capture and treat 1.25 inches of rainfall in two hours
- Stone chimneys provided outlet for ponding water to reach stone storage
- Improvements to Willow Lake Park enhance water quality and user experience

1. Permeable paving
2. Stone chimney
3. Native planting
4. Recreation space
5. Existing playground
BUILD PLAN CONSTRUCTION COST
FEASIBILITY-LEVEL COST BREAKDOWN

100% MEETS PROJECT PURPOSE & NEED

85% GREY INFRASTRUCTURE AND CHANNEL IMPROVEMENTS

15% GREEN INFRASTRUCTURE AND PARK IMPROVEMENTS
QUESTIONS?
THANK YOU