SHAPING PUBLIC SPACE THROUGH RESILIENCY
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MLA Program
Objective 1
Gain a holistic approach to resiliency strategic planning from both a physical and social infrastructure perspective

Objective 2
Define design and performance criteria for both physical infrastructure systems as well as community based social interdependencies

Objective 3
Identify the essential kit of parts for green stormwater infrastructure and other resilient and sustainable technologies

Objective 4
Understand the opportunities for incorporation and integration of these systems/technologies into the design of architectural and public space amenities
As growing communities transform into vibrant places where people live, work, and play, the public spaces supporting that growth must be just as dynamic while maintaining preparedness for the unknown and the unexpected. They must be both physically and socially resilient.
Hoboken Northwest Resiliency Park
Gain a holistic approach to resiliency strategic planning from both a physical and social infrastructure perspective
Hoboken Master Plan identifies former BASF site as future parkland

Green Infrastructure Strategic Plan identifies former BASF site as future resiliency park

Rebuild by Design advances former BASF site as part of Delay, Store, Discharge strategy

City of Hoboken acquires former BASF property and opens Northwest Pop-Up Park

NHSA incorporates Northwest Resiliency Park in CSO Reduction Long Term Control Plan
Map 4: Open Space Concept
Physical Infrastructure Planning
Figure 1.2.1 (Timeline of Development and Ownership)

1897

Figure 1.2.2 (1897 photograph of Hoboken meadows)
Source: Rutgers University Community Repository

1890

Figure 1.2.3 (1890 topographic map showing marsh extent)
Source: New York Public Library Digital Collections
Figure 1.2.4 (1967 photograph of northwest Hoboken)
Source: Rutgers University Community Repository

Figure 1.2.5 (1930 aerial image)
Source: New Jersey Geographical Information Network

Figure 1.2.6 (2017 photograph of Pop-Up Park)

Figure 1.2.7 (2015 aerial image)
Source: New Jersey Geographical Information Network
Option 1

Option 2

Resist - Alternative 3
Existing Structures
Delay, Store, Discharge

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

Image Credit: Rebuild By Design Hudson River Final Environmental Impact Statement
COMBINED SEWER SYSTEM AND FLOODING

LOCAL STREET FLOODING

COMBINED SEWER OVERFLOWS
STORMWATER MANAGEMENT STRATEGIES

- LOCAL STREET FLOODING
- GREEN INFRASTRUCTURE TO MANAGE ON-SITE STORMWATER
- GREEN INFRASTRUCTURE TO ABSORB RUNOFF FROM SURROUNDING STREETS
- SUBSURFACE STORAGE FOR AT LEAST 1 MILLION GALLONS TO RELIEVE SEWER SYSTEM
- COMBINED SEWER OVERFLOWS

Image Credit: OLIN & ELP Associates
Social Infrastructure Planning
Sample Model pieces:
Stormwater Best Management Practices (BMPs)

- Topography (3D)
- Topography (2D)
- Consolidated Carried Soil
- UnderGround Detention
- Trees
- Shade Structure
- Play Structure
- Permeable Paving
- Bio-Retention
- Cisterns
- Above Ground Storage

Sample Session Outcome:
Integrated above and below grade components
What features would you like to see in your park?

- Trees: 727
- Bathrooms: 712
- Shade structures: 659
- Drinking fountains: 545
- Seating: 533
- Bike parking: 475
- Food/Cafe: 510
- Lighting: 477
- Native plants: 424
- Flexible event space: 415
- Spray/fountain water feature: 409
- Community gardens: 400
- Athletic fields: 389
- Play areas: 382
- Swimming pool: 501
- Native plants: 424
- Flexible event space: 415
- Spray/fountain water feature: 409
- Community gardens: 400
- Athletic fields: 389
- Play areas: 382

Low demand:
- Games: 257
- Rock/net climbing: 224
- Surface/wading water feature: 207
- Bike rental: 194
- Environmental education: 157
- Car parking: 132
- Bleachers: 77
Must-Haves

NATURE
• Natural Elements
• Gardens
• Shade Trees
• Quiet escapes

ATHLETICS/FITNESS
• Multi-use Athletic Field
• Fitness Loop & Equipment
• Basketball Court

CULTURE
• Civic Terrace/Events
• Park Building/Cafe/Community Room
• Flexible Open Space
• Comfort Amenities
• Safety

PLAY
• Multi-generational/All ages
• Accessible & Inclusive
Define design and performance criteria for both physical infrastructure systems as well as community based social interdependencies
**DRY WEATHER CONDITIONS**

In dry weather, combined sewage is conveyed to the NHSA treatment plant before discharge.

**WET WEATHER CONDITIONS**

In wet weather, combined sewage overflows directly to the Hudson River and floods local neighborhoods.

**FREQUENT CSO EVENTS**

**CSO EVENTS REDUCED**

One million gallons of storage at Northwest Resiliency Park will help reduce combined sewage overflows and local flooding.

Image Credit: E&LP Associates
1 Million Gallons of Stormwater Storage
SUB-SURFACE STORAGE OPTIONS
CHAMBERS/ARCHES/TANKS/PIPES

Size:
3’ to 6’ deep

Units/Mill. Gallons:
Varies per technology

Surface Coverage
0.53 Ac to 1.0 Ac

Evaluation Criteria:
• Space Efficiency
• Watertight Feasibility
• Cost
• Structural Support Requirements
• Buoyancy Requirements
• Spatial Configuration Flexibility
• Ease of Installation
• Ease of Maintenance
• Environmental Cap Impacts

Units/ 1.2 Mill. Gal
Varies per technology

Surface Coverage
0.63 Ac to 1.25 Ac

Concrete Chambers

Concrete Arches

Raintanks
DETENTION OPTION 1
CONCRETE CHAMBERS

Size:
Height - 5’
Width - 1’-1” to 5’-8”

Units/Mill. Gallons:
234 Units

Surface Coverage:
.67 Acres

Cost
1 million gallon
$970,000
(including Material, Freight, and Installation)

Maintenance:
Inspection
- Should be done at least 2-3 days after most recent rain event
- Sediment pole to measure and document the amount of silt at each manhole location
- Inspect each pipe opening to ensure that the silt level or any foreign objects are not blocking pipes

Maintenance Procedures
- Completely cleaned whenever sediment occupies more than 30% of the original designed system volume
- Use vacuum truck to remove clarified water above the sediment layer
- Utilize manhole on opposite ends of StormTrap
- Use sewer jetting equipment on one end to force water in the same row from one end to the opposite side that contains the vacuum hose
- Repeat for each row

Weight/ Support/ Buoyancy:
- Heavy concrete – will most likely need support

Additional Features:
- Minimum 6” cover
- HS-20, HS-25, and fire truck loading
- Quick and efficient installation
- Durable, reinforced, high-strength concrete
- Option for watertight system
- Manufactured in a National Precast Concrete Association (NPCA) certified facility

Units/ 1.2 Mill. Gal
281 Units

Surface Coverage
.80 Acres

Cost
1.2 Million gallon
$1,165,000
(including Material, Freight, and Installation)
DETENTION OPTION 2
STACKABLE RAINTANKS

Size:
3’ x 1.5’ x 3’ (L x W x H)

Units/Mill. Gallons:
10,208 Units

Surface Coverage
1.055 Acres (1 layer)
0.527 Acres (2 layer)

Units/1.2 Mill. Gal
12,250 Units

Surface Coverage
1.265 Acres (1 layer)
0.633 Acres (2 layer)

Cost
$440,000 (1 Mill. Gal)
$528,000 (1.2 Mill. Gal)

Maintenance

Inspection
• Inspect all observation ports, inflow, and outflow connections and discharge areas
• Identify and log any sediment and debris accumulation, system backup, or discharge rate changes
• If there is a sufficient need for cleanout, contact a local cleaning company for assistance

Cleaning
• Using a vacuum pump truck, evacuate debris from the inflow and outflow points
• Flush the system with clean water, forcing debris from the system
• Repeat until no debris is evident

Weight/Support/Buoyancy:
• Each unit 33.1 lbs
• 1-million-gallon system 337,893 lbs = 169 tons
  One layer = 7.56 lb/SF
  Two layer = 14.71 lb/SF
• 1.2-million-gallon system 407,472 lbs = 203 tons
  One layer = 7.39 lb/SF
  Two layer = 14.78 lb/SF
• Tie down system required for buoyancy

Additional features:
• Option for watertight system
• Utilized for detention, infiltration, capture, and reuse
• Configured in any shape and location
• High-void (97%), high-strength, affordable
• Installed storage assumes 6” stone below, 12” stone above (40% porosity)
• Require minimum cover of 24” for load rating
• Made of PVC columns and polypropylene (PP) side panels
• Designed to resist loads calculated in accordance with AASHTO Load and Resistance Factor Design Bridge Design manual
• Adequate resistance factor for HS-20 and HS-25 loads
DETENTION OPTION 3
PIPES + GRAVEL BED

Size:
Pipe Diameter: 6’

Units/Mill. Gallons:
4,900 LF Pipe

Surface Coverage
1.0 acres

Units/ 1.2 Mill. Gal
6,000 LF Pipe

Surface Coverage
1.25 acres

Cost
Pending

Maintenance:
• Manhole riser sections with ladders can facilitate any access and scheduled maintenance

Weight/Support/Buoyancy:
• Approximately 42.9 lbs/ft
• Total weight 1-million-gallon system: 210,038 lbs = 105 tons
• Total weight 1.2-million-gallon system: 259,459 lbs = 130 tons

Additional Features:
• Watertight fit to project requirements
• Minimum cover 1’
• Steel Reinforced (80 ksi) Polyethylene Technology
  • Provides maximum load carrying capabilities with allowable cover limits (30-50’)
• In accordance with ASTM F2562 and AASHTO MP-20
• Strength does not diminish over time or temperature
• Resistant to corrosive effluent
• Available with soil tight, steel reinforced high performance, and welded coupler joint options

Size:
Pipe Diameter: 6’

Units/Mill. Gallons:
4,900 LF Pipe

Surface Coverage
1.0 acres

Units/ 1.2 Mill. Gal
6,000 LF Pipe

Surface Coverage
1.25 acres

Cost
Pending

Maintenance:
• Manhole riser sections with ladders can facilitate any access and scheduled maintenance

Weight/Support/Buoyancy:
• Approximately 42.9 lbs/ft
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• In accordance with ASTM F2562 and AASHTO MP-20
• Strength does not diminish over time or temperature
• Resistant to corrosive effluent
• Available with soil tight, steel reinforced high performance, and welded coupler joint options

Size:
Pipe Diameter: 6’

Units/Mill. Gallons:
4,900 LF Pipe

Surface Coverage
1.0 acres

Units/ 1.2 Mill. Gal
6,000 LF Pipe

Surface Coverage
1.25 acres

Cost
Pending

Maintenance:
• Manhole riser sections with ladders can facilitate any access and scheduled maintenance

Weight/Support/Buoyancy:
• Approximately 42.9 lbs/ft
• Total weight 1-million-gallon system: 210,038 lbs = 105 tons
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• Minimum cover 1’
• Steel Reinforced (80 ksi) Polyethylene Technology
  • Provides maximum load carrying capabilities with allowable cover limits (30-50’)
• In accordance with ASTM F2562 and AASHTO MP-20
• Strength does not diminish over time or temperature
• Resistant to corrosive effluent
• Available with soil tight, steel reinforced high performance, and welded coupler joint options
DETENTION OPTION 4
CONCRETE ARCHES

Size:
8' x 20' (LxW)
4'-8" Ht

Units/Mill. Gallons:
250 units

Surface Coverage
0.9 acres

Units/1.2 Mill. Gal
280 LF

Surface Coverage
1.1 acres

Cost
Pending

Maintenance
Installation
• With proper excavation and prepared base – one unit can be set every 5 minutes
• 50,000 CF of storage per day
• Including cover and backfill

Inspection
• Frequency of inspections vary on local site conditions
• Visual inspection recommended annually
• Depth of sediment accumulates to 4 inches – cleanout is recommended

Maintenance
• Provides worker access from distribution boxes that extend from grade to the inside of the installed arch
• Removal of sediment and debris from inside the structure
• Cleanout recommended via vacuum truck
• Manhole riser sections with ladders can facilitate any access and scheduled maintenance

Weight/Support/Buoyancy:
• 1-million-gallon storage system
  4,818,446 lbs = 2,409 tons
• 1.2-million-gallon storage system
  5,782,128 lbs = 2,891 tons

Additional Features:
• Option for watertight system
• Minimum cover: 12" to final grade
• Loading: HS-25 load rating
• Minimum 5,000 psi compressive strength
• Best applied to sites with restrictions such as
  High groundwater tables
  Minimum separation between the top of the underground structure and the finished grade
  Shallow invert elevations

Image Credit: E&LP Associates
## ANALYSIS PROCESS

<table>
<thead>
<tr>
<th>Model</th>
<th>Space Efficiency</th>
<th>Watertight Feasibility</th>
<th>Cost</th>
<th>Structural Support Requirements</th>
<th>Buoyancy Requirements</th>
<th>Spatial Configuration Flexibility</th>
<th>Ease of Installation</th>
<th>Ease of Maintenance</th>
<th>Environmental Cap Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Chambers</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
<td>+</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Stackable Raintanks</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Pipe + Gravel Bed</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
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<tr>
<td>Concrete Arches</td>
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<td>+++</td>
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<td>+++</td>
<td>+++</td>
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<tr>
<td>Surface Storage</td>
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<td>+++</td>
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<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

*Suboptimal*  
*Average*  
*Optimal*  

Image Credit: E&LP Associates
Reduce Nuisance Flooding
GREEN STORMWATER INFRASTRUCTURE (GSI) CAN EFFECTIVELY MANAGE SMALL RAINFALL EVENTS OF 1” OR LESS.

### TABLE 2.1

<table>
<thead>
<tr>
<th>Storm Duration</th>
<th>3 month Storm</th>
<th>1 Year Storm</th>
<th>2 Year Storm</th>
<th>10 Year Storm</th>
<th>100 Year Storm</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 hr</td>
<td>1.70 in</td>
<td>2.73 in</td>
<td>3.30 in</td>
<td>4.97 in</td>
<td>8.14 in</td>
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</tbody>
</table>

### TABLE 2.2

<table>
<thead>
<tr>
<th>Drainage Area Name</th>
<th>3-yr Peak Flow (cfs)</th>
<th>3-yr Volume (cf)</th>
<th>1-yr Peak Flow (cfs)</th>
<th>1-yr Volume (cf)</th>
<th>2-yr Peak Flow (cfs)</th>
<th>2-yr Volume (cf)</th>
<th>10-yr Peak Flow (cfs)</th>
<th>10-yr Volume (cf)</th>
<th>100-yr Peak Flow (cfs)</th>
<th>100-yr Volume (cf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXDA B103 L 7-26</td>
<td>1.80</td>
<td>6,168</td>
<td>3.03</td>
<td>10,683</td>
<td>3.68</td>
<td>13,095</td>
<td>5.79</td>
<td>21,009</td>
<td>8.97</td>
<td>32,979</td>
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<tr>
<td>EXDA B107 L1</td>
<td>6.69</td>
<td>22,901</td>
<td>11.25</td>
<td>39,668</td>
<td>13.66</td>
<td>48,622</td>
<td>21.51</td>
<td>78,008</td>
<td>33.32</td>
<td>122,453</td>
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<tr>
<td>EXDA B113 L1</td>
<td>1.08</td>
<td>3,701</td>
<td>1.82</td>
<td>6,410</td>
<td>2.21</td>
<td>7,857</td>
<td>3.48</td>
<td>12,606</td>
<td>5.38</td>
<td>19,787</td>
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<tr>
<td>EXDA Adjacent ROW</td>
<td>5.59</td>
<td>19,053</td>
<td>9.59</td>
<td>33,551</td>
<td>11.72</td>
<td>41,347</td>
<td>18.67</td>
<td>67,044</td>
<td>29.13</td>
<td>106,049</td>
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<tr>
<td>EXDA</td>
<td>15.16</td>
<td>51,822</td>
<td>25.69</td>
<td>90,313</td>
<td>31.26</td>
<td>110,921</td>
<td>49.45</td>
<td>178,667</td>
<td>76.81</td>
<td>281,268</td>
</tr>
</tbody>
</table>

Image Credit: E&LP Associates
### Runoff Rate Comparison
**TABLE 2.3**
Comparing EXDA Block 103 Lot 7-26 to Required Reduction Factors

<table>
<thead>
<tr>
<th>Storm</th>
<th>Pre-development Runoff</th>
<th>Storm Required Reduction Factors</th>
<th>Allowable Runoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-year</td>
<td>3.68 CFS</td>
<td>50%</td>
<td>&lt;1.84 CFS</td>
</tr>
<tr>
<td>10-year</td>
<td>5.79 CFS</td>
<td>75%</td>
<td>&lt;4.34 CFS</td>
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<tr>
<td>100-year</td>
<td>8.97 CFS</td>
<td>80%</td>
<td>&lt;7.176 CFS</td>
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</tbody>
</table>

### Runoff Rate Comparison
**TABLE 2.4**
Comparing EXDA Block 103 Lot 7-26 to Required Reduction Factors

<table>
<thead>
<tr>
<th>Storm</th>
<th>Pre-development Runoff</th>
<th>Storm Required Reduction Factors</th>
<th>Allowable Runoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-year</td>
<td>13.66 CFS</td>
<td>50%</td>
<td>&lt;6.83 CFS</td>
</tr>
<tr>
<td>10-year</td>
<td>21.51 CFS</td>
<td>75%</td>
<td>&lt;16.13 CFS</td>
</tr>
<tr>
<td>100-year</td>
<td>33.32 CFS</td>
<td>80%</td>
<td>&lt;26.66 CFS</td>
</tr>
</tbody>
</table>

### Runoff Rate Comparison
**TABLE 2.5**
Comparing EXDA Block 103 Lot 7-26 to Required Reduction Factors

<table>
<thead>
<tr>
<th>Storm</th>
<th>Pre-development Runoff</th>
<th>Storm Required Reduction Factors</th>
<th>Allowable Runoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-year</td>
<td>2.21 CFS</td>
<td>50%</td>
<td>&lt;1.12 CFS</td>
</tr>
<tr>
<td>10-year</td>
<td>3.48 CFS</td>
<td>75%</td>
<td>&lt;2.61 CFS</td>
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<tr>
<td>100-year</td>
<td>5.38 CFS</td>
<td>80%</td>
<td>&lt;4.30 CFS</td>
</tr>
</tbody>
</table>
Balance Cut-Fill
EXISTING ASPHALT CAP

Impermeable asphalt cap prevents rainfall and water runoff from reaching contaminants below the park.

Contaminants below asphalt cap cannot be released into the air or come in contact with people.

CONSOLIDATION & VEGETATIVE CAP

Capping with at least 2 feet of soil and vegetation prevents rainfall and water runoff from reaching contaminants below the park.

Contaminants are consolidated to create park features while making room for water storage. The vegetative cap prevents contaminants from being released into the air or coming in contact with people.

Image Credit: E&LP Associates & OLIN
FLOOD PROOFING

Wet floodproofing for park storage building or shade structure

Dry floodproofing for Park occupiable building

BFE + FB

Image Credit: nArchitects
DESIGN FLOOD ELEVATION
Sustainable SITES Certification
The City of Hoboken is pursuing SITES certification for the Northwest Resiliency Park. The SITES Rating system aligns with the scope of the project, and also provides a framework for achieving sustainability goals.

- Ecosystem services framework
- Operations and maintenance
- Performance monitoring

SITES-certified landscapes help reduce water demand, filter and reduce stormwater runoff, provide wildlife habitat, reduce energy consumption, improve air quality, improve human health and increase outdoor recreation opportunities.

SITES certification is based on a point system: the number of points that a project earns determines the certification level it receives.

<table>
<thead>
<tr>
<th>Certification Level</th>
<th>Points</th>
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</thead>
<tbody>
<tr>
<td>SITES Certified</td>
<td>70 - 84</td>
</tr>
<tr>
<td>SITES Silver</td>
<td>85 - 99</td>
</tr>
<tr>
<td>SITES Gold</td>
<td>100 - 134</td>
</tr>
<tr>
<td>SITES Platinum</td>
<td>135 +</td>
</tr>
</tbody>
</table>

1: Site Context
2: Pre-Design Assessment
3: Water
4: Soils + Vegetation
5: Materials
6: Human Health and Wellbeing
7: Construction
8: Operations + Maintenance
9: Education + Performance
10: Innovation

Image Credit: OLIN
### Northwest Resiliency Park

**Figure 4.6.3 (Projected Scorecard)**

**Image Credit:** OLIN

<table>
<thead>
<tr>
<th>Function</th>
<th>Credit</th>
<th>Description</th>
<th>Points</th>
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<tbody>
<tr>
<td><strong>SITE CONTEXT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONTEXT P1.1 Limit development on farmland</td>
<td>Yes</td>
<td>Limit development on farmland</td>
<td>2 to 3</td>
</tr>
<tr>
<td>CONTEXT P1.2 Protect Floodplain Functions</td>
<td>Yes</td>
<td>Protect Floodplain Functions</td>
<td>2</td>
</tr>
<tr>
<td>CONTEXT P1.3 Conserve aquatic ecosystems</td>
<td>Yes</td>
<td>Conserve aquatic ecosystems</td>
<td>2</td>
</tr>
<tr>
<td>CONTEXT P1.4 Conserve habitats for threatened and endangered species</td>
<td>Yes</td>
<td>Conserve habitats for threatened and endangered species</td>
<td>2</td>
</tr>
<tr>
<td>CONTEXT C1.5 Redevelop degraded sites</td>
<td>Yes</td>
<td>Redevelop degraded sites</td>
<td>4</td>
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<tr>
<td>CONTEXT C1.6 Locate projects within existing developed areas</td>
<td>Yes</td>
<td>Locate projects within existing developed areas</td>
<td>4</td>
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<tr>
<td>CONTEXT C1.7 Connect to multi-modal transit networks</td>
<td>Yes</td>
<td>Connect to multi-modal transit networks</td>
<td>4</td>
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<tr>
<td><strong>SITE DESIGN - HUMAN HEALTH + WELL-BEING</strong></td>
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<td></td>
<td></td>
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<tr>
<td>HHWB C6.1 Protect and maintain cultural and historic places</td>
<td>Yes</td>
<td>Protect and maintain cultural and historic places</td>
<td>2</td>
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<tr>
<td>HHWB C6.2 Provide optimum site accessibility, safety, and wayfinding</td>
<td>Yes</td>
<td>Provide optimum site accessibility, safety, and wayfinding</td>
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</tr>
<tr>
<td>HHWB C6.3 Promote equitable site use</td>
<td>Yes</td>
<td>Promote equitable site use</td>
<td>2</td>
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<tr>
<td>HHWB C6.4 Support mental restoration</td>
<td>Yes</td>
<td>Support mental restoration</td>
<td>2</td>
</tr>
<tr>
<td>HHWB C6.5 Support physical activity</td>
<td>Yes</td>
<td>Support physical activity</td>
<td>2</td>
</tr>
<tr>
<td>HHWB C6.6 Support social connection</td>
<td>Yes</td>
<td>Support social connection</td>
<td>2</td>
</tr>
<tr>
<td>HHWB C6.7 Provide on-site food production</td>
<td>Yes</td>
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<td>HHWB C6.8 Reduce light pollution</td>
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<td>HHWB C6.9 Encourage fuel efficient and multi-modal transportation</td>
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<td>HHWB C6.10 Minimize exposure to environmental tobacco smoke</td>
<td>Yes</td>
<td>Minimize exposure to environmental tobacco smoke</td>
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<td>HHWB C6.11 Support local economy</td>
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<td><strong>SITE DESIGN - WATER</strong></td>
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<td>Yes</td>
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<td>WATER P3.2 Reduce water use for landscape irrigation</td>
<td>Yes</td>
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<td>WATER C3.3 Manage precipitation beyond the baseline</td>
<td>Yes</td>
<td>Manage precipitation beyond the baseline</td>
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<td>WATER C3.4 Reduce outdoor water use</td>
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<td>WATER C3.5 Design functional stormwater features as amenities</td>
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<td><strong>SITE DESIGN - SOIL + VEGETATION</strong></td>
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<td>SOIL + VEG C4.9 Reduce urban heat island effects</td>
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<td>SOIL + VEG C4.10 Use vegetation to minimize building energy use</td>
<td>Yes</td>
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**Total Points:** 78

**SITE CERTIFICATION LEVELS**

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<tr>
<th>Level</th>
<th>Description</th>
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<td>Gold</td>
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<tr>
<td>Silver</td>
<td>Not 100% confident</td>
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<tr>
<td>Bronze</td>
<td>Project is unable to achieve these credit points</td>
<td>10</td>
</tr>
<tr>
<td>Platinum</td>
<td>Innovation or exemplary performance</td>
<td>130</td>
</tr>
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</table>
Identify the essential kit of parts for green stormwater infrastructure and other resilient and sustainable technologies
**Bio-Retention**

Bio-retention features are surface level vegetated depressions for water storage and infiltration. These BMPs are flexible in their layout, materials, soil profiles, and outlet controls. A typical profile for a bio-retention system will consist of planting and a mulch layer, planting soil, a pea gravel or choker course, and then uncompacted existing soils. Depending on subsurface soil and groundwater conditions they can be designed with an underdrain layer to provide additional below grade storage to supplement the initial surface depression. The footprint size and depth of a bio-retention system can vary greatly from small raingardens with 12 inches of planting soil and no underdrainage to large 4' deep basins with 24-36” planting soils and an underdrainage system accommodating shrub and small tree planting. Bio-retention features are suitable to providing stormwater quantity control, groundwater recharge, and quality control as they have a 90% TSS removal efficiency.

![Figure 4.4.2 Bioretention Section](image1)

**Bio-swales**

Bio-swales are a specific type of bio-infiltration feature that functions as a conveyance and water quality measure, but is not suited to stormwater volume storage or quantity control. Swales are surface level vegetated depressions that are sloped along their center line to convey water from one point to another. These BMPs are flexible in their layout, materials, soil profiles, and outlet controls. A typical profile for a bio-swale will consist of planting, planting soil, and uncompacted existing soils. In certain instances a swale can be designed with a flat bottom to provide some stormwater quantity control. In this case, they should be designed with an underdrain layer to provide additional below grade storage.

![Figure 4.4.3 Bio-Swale section](image2)
Pervious Pavement

Pervious pavement provides the same structural support as conventional pavement, while allowing stormwater runoff to drain through the pavement profile to a subsurface storage bed below. The subgrade storage below the pavement may be designed as a conventional subsurface infiltration or detention system where the depth of the storage bed may vary depending on the quantity control required of the system. The permeable pavement system itself typically includes porous asphalt, porous concrete, or permeable pavers. Additionally, reinforced turf, gravel, resin bonded materials and other synthetic surfaces may all be designed to create a porous surface. Constraints for this type of system include limitations of use in high-traffic areas or heavy industrial sites where heavy sediment and pollutant loading are a concern; finished surfaces should not slope greater than 4% in order to avoid creating unusable storage volume, and frequent maintenance including vacuuming is required to maintain the porosity of the surface.

Stormwater Planter

A curb bumpout stormwater planter is a specific type of bio-infiltration feature that functions as a storage and water quality measure directly adjacent to a roadway. The surface of the feature is sunken adjacent to the roadway edge and separated by the roadside curb. Curb-cuts, depressed curbs, or other opening in the face of the curb are required to allow runoff to enter the system. A typical profile for a stormwater planter will consist of vegetation, planting soil, a stone underdrain and storage layer and uncompacted existing soils. Other components that are essential to these systems are energy dissipation and sediment removal at the designed curb openings. A method of slowing down runoff from the roadway and allowing sediment to be trapped for maintenance must be integrated into the overall design of the system. Stormwater planters can provide quantity control in small storm events and water quality treatment in all storm events.
Cisterns are water storage tanks, located either above or below grade, used to capture and reuse stormwater runoff. This process is often referred to as Rainwater Harvesting. Cisterns may capture water from roof areas or ground level surfaces and are sized to accommodate the required demand of the system for which the captured water is being reused. During reuse, captured water may be gravity fed or pumped to the location of intended reuse. As permitted by local building codes, water may be used for irrigation, toilet flushing, exterior washing (building facades, sidewalks), or make-up water for mechanical systems, and ornamental non-drinking water fountains. In addition, to water reuse, cisterns may be designed as a hybrid system and provide extra storage for detention and quantity control.
Tree Trench

Tree trenches are a method of subsurface infiltration or detention that incorporates tree plantings in linear elements. This practice is most often employed along sidewalks and roadways but can also be used in other configurations such as groves or bosques of trees in large paved areas. A tree trench is configured by connecting at least two individual tree pits with a continuous gravel trench. Runoff from an adjacent roadway or other paved surface may enter the tree pit via a curb cut or subgrade from a nearby inlet. The entire trench should have storage pipes and an overflow pipe/outlet at the bottom of the stone storage bed to pass excess runoff back into the main sewer system in the adjacent street. Tree trenches can provide quantity control, water quality treatment, and groundwater recharge depending on subsurface soil conditions.
Understand the opportunities for incorporation and integration of these systems/technologies into the design of architectural and public space amenities
Must-Haves

**NATURE**
- Natural Elements
- Gardens
- Shade Trees
- Quiet escapes

**ATHLETICS/FITNESS**
- Multi-use Athletic Field
- Fitness Loop & Equipment
- Basketball Court

**CULTURE**
- Civic Terrace/Events
- Park Building/Cafe/Community Room
- Flexible Open Space
- Comfort Amenities
- Safety

**PLAY**
- Multi-generational/All ages
- Accessible & Inclusive
WHAT FEATURES WOULD YOU LIKE TO SEE IN YOUR PARK?

- TREES: 727
- BATHROOMS: 712
- SHADE STRUCTURES: 659
- DRINKING FOUNTAINS: 545
- SEATING: 533
- BIKE PARKING: 475
- FOOD/CAFE: 510

- LIGHTING: 477
- TREES: 727
- SHADE STRUCTURES: 659
- DRINKING FOUNTAINS: 545
- SEATING: 533
- BIKE PARKING: 475
- FOOD/CAFE: 510

- PASSIVE SPACE: 332
- NATIVE PLANTS: 424
- FLEXIBLE EVENT SPACE: 415
- SPRAY/FOUNTAIN WATER FEATURE: 409
- COMMUNITY GARDENS: 400
- ATHLETIC FIELDS: 389
- PLAY AREAS: 382

- SWIMMING POOL: 501
- LIGHTING: 477
- NATIVE PLANTS: 424
- FLEXIBLE EVENT SPACE: 415
- SPRAY/FOUNTAIN WATER FEATURE: 409
- COMMUNITY GARDENS: 400
- ATHLETIC FIELDS: 389
- PLAY AREAS: 382

- MULTI USE TRACK: 370
- PICNIC/GRILL AREAS: 367
- TRAILS: 362
- FITNESS STATIONS: 358
- PASSIVE SPACE: 332
- DOG PARK: 293
- MINI GOLF: 295
- COMMUNITY CENTER: 260

- GAMES: 237
- ROCK/NET CLIMBING: 224
- SURFACE/WADING WATER FEATURE: 207
- BIKE RENTAL: 194
- ENVIRONMENTAL EDUCATION: 157
- CAR PARKING: 132
- BLEACHERS: 77

BASIC AMENITIES

LOW DEMAND
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<th>EVALUATING FEATURES</th>
<th>IN HIGH DEMAND</th>
<th>ENGAGES MANY PEOPLE PER SQUARE FOOT</th>
<th>MULTI-GENERATIONAL</th>
<th>MULTI-USE/MULTI-SEASON</th>
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Developing Design Alternatives
CROSS-PARK CONNECTIVITY

MULTI-USE LOOP TRAIL

MULTI-USE ATHLETIC FIELD:
Flexible lawn can accommodate 105 ft x 135ft Soccer Field (U10) with 10ft perimeter offset, live lawn, no fencing

NATURE + ECOLOGY

COLLECTS PARK + STREET STORMWATER

MULTIPLICITY OF SPACES + EXPERIENCES

12TH ST CLOSED; 13 STREET NARROWED
1/4 ACRE ADDED TO PARK

PARK BUILDING:
2990 SF INTERIOR
7010 SF CANOPY/SHaded AREA
TERRACE + TRAILS: CONCEPTUAL WATER SYSTEMS

- Underground storage & reuse/recycling
- Surface capture & treatment

Image Credit: E&LP Associates and OLIN
CROSS-PARK CONNECTIVITY

WALKING PATHS

MULTI-USE ATHLETIC FIELD:
- 165ft x 300ft soccer field (HS)
- Little league baseball field (200ft outfield)

NATURE + ECOLOGY

COLLECTS PARK + STREET STORMWATER

MULTIPlicity OF SPACES + EXPERIENCES

12TH ST CLOSED
MADISON, JEFFERSON, 13TH ST NARROWED
1/2 ACRE ADDED TO PARK

PARK BUILDING:
- 3625 SF INTERIOR
- 7075 SF COVERED AREA

Image Credit: OLIN
FOREST + FIELDS

underground storage & reuse/recycling

surface capture & treatment

Image Credit: E&LP Associates and OLIN
FOREST + FIELDS

- NHSA Stormwater Inflow
- Stormwater Gardens
- Fountain Amphitheater
- Outlet to Pump House
- 1 Million Gallon Underground Stormwater Storage
- Pump House Integrated into Park Building

Image Credit: E&LP Associates and OLIN
Northwest Resiliency Park Concept Design

CROSS-PARK CONNECTIVITY

MULTI-USE LOOP TRAIL
1/2 mile

MULTI-USE ATHLETIC FIELD:
• High school soccer field (165ft x 300ft)
• Little league baseball field (200ft outfield)
• Youth lacrosse (35yds x 60yds and 40yds x 90yds)

NATURE + ECOLOGY

COLLECTS PARK + STREET STORMWATER

MULTIPLICITY OF SPACES + EXPERIENCES

12TH ST CLOSED
MADISON, JEFFERSON, 13TH ST NARROWED
1/4 acre added to park

PARK BUILDING:
2,465 SF Large Interior (Cafe)
930 SF Small Interior (Community Room)
9,425 SF Covered Area

Image Credit: OLIN
Northwest Resiliency Park Conceptual Water Systems

- Underground storage
- Surface capture & treatment
- Potential subsurface gravel storage

Image Credit: E&LP Associates and OLIN
Final Plan and Details
Planting
Lowlands

Image Credit: OLIN
Adams Street Entry Gardens + Great Lawn
Adams Street Entry Gardens
Lowland Gardens

Image Credit: OLIN
Planting Lowlands

**Lowland Layout**

- **0 ft**: Dense groundcover of grasses and sedges. Dynamic species with seasonal interest.
- **2 ft**: Tall grasses and perennials visually dominant.
- **4 ft**: WET
- **6 ft**: MESIC
- **8 ft**: DRY

**Herbaceous Layer**

- **0 ft**: Euphorhochium dubium ‘Little Joe’, Joe Pye Weed
- **2 ft**: Vernonia noveboracensis, New York Ironweed
- **4 ft**: Asclepias incarnata, Swamp Milkweed
- **6 ft**: Pennisetum alopecuroides, Fountain grass
- **8 ft**: Calamagrostis x acutiflora, Feather reed grass
- **10 ft**: Liatris spicata, Blazing star
- **12 ft**: Solidago rugosa, Roughleaf Goldenrod
- **14 ft**: Iris virginica, Southern Blue flag
- **16 ft**: Deschampsia cespitosa, Tufted Hair Grass
- **18 ft**: Juncus effusus ‘Quartz Creek’, Common Rush
- **20 ft**: Solidago sphacelata, Autumn Goldenrod
- **22 ft**: Calamintha nepeta, Calamint
- **24 ft**: Carex amphibola, Creek Sedge

**Image Credit:** OLIN
Planting Lowlands

SHRUB LAYER
Image Credit: OLIN
**Multi-Purpose Field**

**FIELD**
- Artificial Turf
- Colored striping for each sport
- Athletic Lighting
- 20' High Netting + 6' high rigid fence with gates
- Bleachers, moveable benches, and dugout shade structures
- Dedicated drop-off parking spots

**MULTIPLE SPORTS**
- 180ft X 300ft (60yd X 100yd)
  - High School Soccer
  - High School Lacrosse
- 60ft baselines + 200ft outfield
  - Little League Baseball
Multi-Purpose Field

MULTIPLE SPORTS
- 180ft X 300ft (60yd X 100yd) High School Soccer
- High School Lacrosse
- 60ft baselines + 200ft outfield Little League Baseball

FIELD
- Artificial Turf
- Colored striping for each sport
- Athletic Lighting
- 20' High Netting + 6' high rigid fence with gates
- Bleachers, moveable benches, and dugout shade structures
- Dedicated drop-off parking spots

Image Credit: OLIN
Madison Gardens + Play Valley
Play Valley
Play Valley
Madison Gardens + Play Valley

Image Credit: OLIN
Basketball Basin

Full Youth Basketball 42ft x 74ft

Image Credit: OLIN
Basketball Basin

- 6' high rigid fence with 2 gates
- 42'x74' full court youth basketball

Image Credit: OLIN
Basketball Basin - Flexible Uses
Madison Gardens + Play Valley

Image Credit: OLIN
Madison Garden + Learning Walk

Image Credit: OLIN
Client:
City of Hoboken

Stakeholders:
New Jersey Infrastructure Bank (I-Bank)
Hudson County
New Jersey Department of Environmental Protection
North Hudson Sewerage Authority

Design Team
E&LP Associates, Team Lead + Civil
OLIN, Landscape Architecture
nArchitects, Architecture
Silman, Structural
OLA, MEP
Excel Environmental, Environmental Remediation
Tillett, Lighting Design
Studio Ludo, Playground Design
Geodesign, Support of Excavation
Lynch & Associates, Irrigation
Delta Fountains, Fountain Design

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Villanova Urban Stormwater Partnership
October 17, 2019
QUESTIONS?