Placeholder for Video
“DEP Jamaica Bay SD”

Video will loop until Presentation Begins
Jamaica Bay & Tributaries
Combined Sewer Overflow
Long Term Control Plan

Alternatives and Recommended Plan
Public Meeting

Jamaica Bay Wildlife Refuge Visitor Center
April 18, 2018
<table>
<thead>
<tr>
<th></th>
<th>Topic</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Welcome and Recap of LTCP Process</td>
<td>Mikelle Adgate</td>
</tr>
<tr>
<td>2</td>
<td>Water Quality, Baseline Conditions and Performance Gap</td>
<td>Keith Mahoney</td>
</tr>
<tr>
<td>3</td>
<td>Evaluation of Grey Alternatives</td>
<td>Keith Mahoney</td>
</tr>
<tr>
<td>4</td>
<td>Evaluation of Watershed Based Alternatives</td>
<td>John McLaughlin</td>
</tr>
<tr>
<td>5</td>
<td>Recommended Plan</td>
<td>Pinar Balci</td>
</tr>
<tr>
<td>4</td>
<td>Discussion and Q&amp;A Session</td>
<td>All</td>
</tr>
<tr>
<td>5</td>
<td>Next Steps</td>
<td>Mikelle Adgate</td>
</tr>
</tbody>
</table>
Welcome & Recap of LTCP Process

Mikelle Adgate
Senior Policy Advisor
DEP
What is a LTCP and CSO Consent Order?

Long Term Control Plan (LTCP)

identifies appropriate CSO controls to achieve applicable water quality standards
consistent with the Federal CSO Policy and Clean Water Act

CSO Consent Order

an agreement between NYC and DEC that settles past legal disputes without prolonged litigation
DEC requires DEP to develop LTCPs and mitigate CSOs
OneNYC identifies alleviating flooding in Southeast Queens as a priority initiative.

The 10 Year Capital Budget allocates $1.7 billion over the next decade to plan and begin full sewer buildout and to provide short term relief wherever possible.

Full build-out requires approximately 450 miles of new storm sewers, and upgrade 260 miles of sanitary sewers and 30 miles of combined sewers over many years.
Strategy:
Build early action storm sewers in flood prone areas as quickly as possible

Process Overview:
1. Accelerate scoped projects scheduled for future construction
2. Use complaint data to prioritize projects
3. Complete wet and dry weather site investigations to identify root causes
4. Design and construct site-specific solutions
Jamaica Bay Historical Context

- Loss of over 20 freshwater streams spatially distributed around the perimeter of Jamaica Bay.
- Over 12,000 acres of the original 16,000 acres of wetlands have been lost.
- Bay historically shallow, ~12 ft to 20 ft and has been dredged to 40 ft to 50 ft in some locations.
- Tidal exchange has been altered and constriction of the western end due to the natural extension of the western spit by nearly 16,000 ft (three miles) over the last 200 years.
- Significant alterations to the natural attenuating features of the watershed have resulted in vast expanses of impervious surfaces.
Public Comments Received

1. Interest in GI and Ecological Enhancements
2. Concerns of Impacts of Disinfection
3. Updates on SEQ Sewer Separation/Redevelopment Area
4. Interest in Sustainability and Resiliency Issues
Water Quality, Baseline Conditions and Performance Gap

Keith Mahoney, P.E.
Director of Water Quality Planning
DEP – BEDC
6 Urban CSO Tributaries
- Paerdegat Basin
- Fresh Creek
- Hendrix Creek
- Spring Creek
- Bergen Basin
- Thurston Basin

Sewer System
- 20 CSO Outfalls (▲)
- 149 MS4 Outfalls

4 Wastewater Treatment Plants (◉)
- Jamaica, 26th Ward, Rockaway, Coney Island

2 CSO Facilities (◯)
- Spring Creek, Paerdegat

Significant stormwater discharge in area

<table>
<thead>
<tr>
<th>Drainage Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Acres</td>
</tr>
<tr>
<td>Served by Combined Sewers</td>
</tr>
</tbody>
</table>
Waterbody Classifications

Legend

Water Quality Classifications
- Class SB
- Class I

Brooklyn
Queens

Bergen Basin
Thurston Basin

Spring Creek
Hendrix Creek
Fresh Creek
Paerdegat Basin

Jamaica Bay
Rockaway
Atlantic Ocean
### Waterbody Classifications & WQ Standards

#### CLASS SB
**Bathing**

The best usages of Class SB waters are **primary and secondary contact** recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival.

<table>
<thead>
<tr>
<th>Waterbody</th>
<th>Class</th>
<th>Dissolved Oxygen (mg/L)</th>
<th>Fecal Coliform* (cfu/100 mL)</th>
<th>Total Coliform* (cfu/100 mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jamaica Bay</td>
<td>SB</td>
<td>≥ 4.8 (daily average) ≥ 3.0 (acute, never less than)</td>
<td>Monthly Geometric Mean ≤ 200</td>
<td>Monthly Median ≤ 2,400 and 80% ≤ 5,000</td>
</tr>
<tr>
<td>Tributaries</td>
<td>I</td>
<td>≥ 4.0 (acute, never less than)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### CLASS I
**Boating/Fishing**

The best usages of Class I waters are **secondary contact** recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival.

---

**CSO LTCP Goals and Targets:**

- Seasonal Bacteria Compliance
- Annual Dissolved Oxygen Compliance
- Time to Recovery for Bacteria of ≤ 24 hours
- Floatables Control

*(NYCRR Part 703.3)*

**(NYCRR Part 703.4)**

---

On March 21, 2018, DEC publicly noticed a revision to the water quality standards and classifications for certain waterbodies.
<table>
<thead>
<tr>
<th>Recommended Project</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>26th Ward WWTP Drainage Area Sewer Cleaning</td>
<td>Completed in 2010</td>
</tr>
<tr>
<td>Hendrix Creek Canal Dredging</td>
<td>Completed in 2012</td>
</tr>
<tr>
<td>Spring Creek Auxiliary WWTP Upgrade</td>
<td>In Operation Since 2007</td>
</tr>
<tr>
<td>Warnerville Pump Station and Force Main</td>
<td>In Operation Since 2009</td>
</tr>
<tr>
<td>Paerdegat Basin CSO Facility</td>
<td>In Operation Since 2011</td>
</tr>
<tr>
<td>Shellbank Destratification</td>
<td>In Operation Since 2012</td>
</tr>
<tr>
<td>Bending Weirs</td>
<td>In Operation Since 2017</td>
</tr>
<tr>
<td>New Parallel Sewer West Interceptor</td>
<td>Construction Completed in 2016</td>
</tr>
<tr>
<td>Bergen Basin Lateral Sewer</td>
<td>Projected Completion: 2021</td>
</tr>
<tr>
<td>26th Ward WWTP Wet Weather Stabilization</td>
<td>Projected Completion: 2018</td>
</tr>
<tr>
<td>26th Ward High Level Storm Sewers</td>
<td>Projected Completion: 2022</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$1.03 Billion</td>
</tr>
</tbody>
</table>

1) New Parallel Sewer West Interceptor will go into operation once the Bergen Basin Lateral Sewer has been completed
GI Program in Jamaica Bay

Current CSO Commitments (~$300M)

GI Baseline CSO Reductions: ~83 MGY

CSO Planned Reductions toward 2030 Goal: 133 MGY
## Modeled Jamaica Bay CSO AAOVs

### Model Calculated CSO Statistics (2008 Typ. Year)

<table>
<thead>
<tr>
<th>Location</th>
<th>Outfalls</th>
<th>CSO Volume (MG)</th>
<th>Activation Frequency</th>
<th>Location</th>
<th>Outfalls</th>
<th>CSO Volume (MG)</th>
<th>Activation Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre-WWFP</td>
<td>LTCP Baseline</td>
<td>Pre-WWFP</td>
<td>LTCP Baseline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thurston Basin</td>
<td>JAM-005/007</td>
<td>707</td>
<td>608</td>
<td>73</td>
<td>73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bergen Basin</td>
<td>JAM-003</td>
<td>478</td>
<td>122</td>
<td>48</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>JAM-003A</td>
<td>275</td>
<td>278</td>
<td>49</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>JAM-006</td>
<td>22</td>
<td>3</td>
<td>38</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td>775</td>
<td>403</td>
<td>49</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Creek²</td>
<td>26W-005</td>
<td>242</td>
<td>337</td>
<td>6</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hendrix Creek</td>
<td>26W-004</td>
<td>114</td>
<td>110</td>
<td>31</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh Creek</td>
<td>26W-003</td>
<td>342</td>
<td>303</td>
<td>15</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paerdegat Basin²</td>
<td>Tank Overflow</td>
<td>-</td>
<td>576</td>
<td>-</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CI-004, 005, 006</td>
<td>1,396</td>
<td>40</td>
<td>51</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td>1,396</td>
<td>616</td>
<td>51</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jamaica Bay</td>
<td>Rockaway Outfalls¹</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td>3,576</td>
<td>2,377</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Rockaway CSOs do not activate during the typical 2008 rainfall year.
2) The Spring Creek AWWTP and the Paerdegat Basin CSO Facility provide floatables control and settling prior to overflow of storms exceeding the tank storage capacity.

### Graph

- **BEFORE** (3,576 MGY)
- **AFTER** (2,377 MGY)

34% CSO Volume Reduction

**CSO Discharge Volume (MGY)**

- **Pre-WWFP**
- **LTCP Baseline**

**Recommended Gray/Green Projects**

- CI-004,005,006
- Tank Overflow
- 26W-003
- 26W-004
- JAM-003
- JAM-005/007
- JAM-003A
- JAM-006
### Modeled Stormwater Baseline AAOVs

#### Model Calculated SW Statistics (2008 Typical Year)

<table>
<thead>
<tr>
<th>Waterway</th>
<th>Total (MG)</th>
<th>DEP MS4 (MG)</th>
<th>SW³ (MG)</th>
<th>Airport (MG)</th>
<th>Direct⁴ (MG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jamaica Bay¹</td>
<td>6,688</td>
<td>2,483</td>
<td>1,241</td>
<td>957</td>
<td>2,007</td>
</tr>
<tr>
<td>Bergen Basin</td>
<td>3,278</td>
<td>2,838</td>
<td>116</td>
<td>302</td>
<td>22</td>
</tr>
<tr>
<td>Thurston Basin</td>
<td>814</td>
<td>-</td>
<td>381</td>
<td>372</td>
<td>61</td>
</tr>
<tr>
<td>Fresh Creek</td>
<td>520</td>
<td>215</td>
<td>273</td>
<td>-</td>
<td>32</td>
</tr>
<tr>
<td>Hendrix Creek</td>
<td>112</td>
<td>36</td>
<td>42</td>
<td>-</td>
<td>34</td>
</tr>
<tr>
<td>Spring Creek</td>
<td>141</td>
<td>26</td>
<td>38</td>
<td>-</td>
<td>77</td>
</tr>
<tr>
<td>Paerdegat Basin</td>
<td>309</td>
<td>196</td>
<td>113</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Head of Bay (Nassau Co.)</td>
<td>6,468</td>
<td>35</td>
<td>49</td>
<td>141</td>
<td>6,243</td>
</tr>
<tr>
<td>Other Tributaries²</td>
<td>362</td>
<td>326</td>
<td>36</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total³</strong></td>
<td><strong>18,692</strong></td>
<td><strong>6,155</strong></td>
<td><strong>2,289</strong></td>
<td><strong>1,772</strong></td>
<td><strong>8,476</strong></td>
</tr>
</tbody>
</table>

#### Notes:
1. Grassy Bay, Hassock Creek, Grass Hassock Channel, Shell Bank Creek, Mill Basin and Rockaway are included with Jamaica Bay.
2. Other tributaries include Hawtree and Shellbank Basins.
3. Stormwater (SW) consists of all outfalls except for DEP MS4 and airport stormwater sources.
4. Direct drainage consists of all remaining drainage areas not tributary to defined CSO, MS4 and SW subcatchments.
### Gap Analysis (Existing WQ Criteria: Jamaica Bay – Class SB, Tributaries – Class I)

<table>
<thead>
<tr>
<th>Waterbody (Monitoring Station)</th>
<th>Existing Criteria - Fecal Coliform (^1) (Percent Attainment)</th>
<th>Dissolved Oxygen (^2) (Percent Attainment)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual (Monthly GM ≤ 200 cfu/100 mL)</td>
<td>Recreational Season (Monthly GM ≤ 200 cfu/100 mL)</td>
</tr>
<tr>
<td></td>
<td>LTCP Baseline</td>
<td>100% CSO Control</td>
</tr>
<tr>
<td>Thurston Basin (TBH2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>78%</td>
<td>83%</td>
<td>88%</td>
</tr>
<tr>
<td>Thurston Basin (TB9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>91%</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Bergen Basin (BB5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49%</td>
<td>57%</td>
<td>68%</td>
</tr>
<tr>
<td>Bergen Basin (BB7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Hendrix Creek (HC1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Spring Creek (SP1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fresh Creek (FC1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>86%</td>
<td>91%</td>
<td>93%</td>
</tr>
<tr>
<td>Paerdegat Basin (PB2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Jamaica Bay (J5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

1. Fecal coliform attainment is based upon 10 year model runs utilizing CSO and SW concentrations reflective of the LTCP stormwater sampling program.
2. Dissolved oxygen attainment is based upon a typical year 2008 model run.
3. Water quality attainment projections assume that illicit connections have been eliminated.
4. Stations TBH2 and BB5 are located within portions of Thurston and Bergen Basins that are restricted from public access by Homeland Security.
## Gap Analysis (Potential Future WQ Criteria: Jamaica Bay – Class SB, Tributaries – Class I)

<table>
<thead>
<tr>
<th>Waterbody (Monitoring Station)</th>
<th>Existing Criteria – Enterococcus&lt;sup&gt;1&lt;/sup&gt; (Percent Attainment)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rolling 30-day GM ≤ 30 colonies/100 mL</td>
</tr>
<tr>
<td></td>
<td>LTCP Baseline</td>
</tr>
<tr>
<td>Thurston Basin (TBH2)</td>
<td>56%</td>
</tr>
<tr>
<td>Thurston Basin (TB9)</td>
<td>84%</td>
</tr>
<tr>
<td>Bergen Basin (BB5)</td>
<td>22%</td>
</tr>
<tr>
<td>Bergen Basin (BB7)</td>
<td>89%</td>
</tr>
<tr>
<td>Hendrix Creek (HC1)</td>
<td>✔️</td>
</tr>
<tr>
<td>Spring Creek (SC1)</td>
<td>✔️</td>
</tr>
<tr>
<td>Fresh Creek (FC1)</td>
<td>✔️</td>
</tr>
<tr>
<td>Paerdegat Basin (PB2)</td>
<td>✔️</td>
</tr>
<tr>
<td>Jamaica Bay (J5)</td>
<td>✔️</td>
</tr>
</tbody>
</table>

1) Enterococcus attainment is based upon 10 year model runs utilizing CSO and SW concentrations reflective of the LTCP stormwater sampling program.
2) Water quality attainment projections assume that illicit connections have been eliminated.
3) Stations TBH2 and BB5 are located within portions of Thurston and Bergen Basins that are restricted from public access by Homeland Security.
### Gap Analysis for Time to Recover

*(Fecal Coliform Threshold 1000 cfu/100 ml)*

<table>
<thead>
<tr>
<th>Storm Size</th>
<th>Percent of Total No. of Storms</th>
<th>Mean Time to Recover (Hours)</th>
<th>Thurston Basin (TBH2)</th>
<th>Thurston Basin (TB9)</th>
<th>Bergen Basin (BB5)</th>
<th>Bergen Basin (BB7)</th>
<th>Hendrix Creek (HC1)</th>
<th>Spring Creek (SC1)</th>
<th>Fresh Creek (FC1)</th>
<th>Paerdegat Basin (PB2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Base</td>
<td>No CSO</td>
<td>Base</td>
<td>No CSO</td>
<td>Base</td>
<td>No CSO</td>
<td>Base</td>
<td>No CSO</td>
</tr>
<tr>
<td>&lt;0.1”</td>
<td>44%</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;0.1” - 0.4”</td>
<td>25%</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>&gt;0.4” - 0.8”</td>
<td>15%</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>26</td>
<td>22</td>
<td>8</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>&gt;0.8” - 1.0”</td>
<td>5%</td>
<td>30</td>
<td>15</td>
<td>17</td>
<td>11</td>
<td>36</td>
<td>33</td>
<td>17</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>&gt;1.0” - 1.5”</td>
<td>6%</td>
<td>38</td>
<td>29</td>
<td>31</td>
<td>18</td>
<td>43</td>
<td>38</td>
<td>21</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>&gt;1.5”</td>
<td>5%</td>
<td>46</td>
<td>43</td>
<td>36</td>
<td>31</td>
<td>38</td>
<td>36</td>
<td>23</td>
<td>16</td>
<td>21</td>
</tr>
</tbody>
</table>

1) Mean Time to Recover (TTR) reflect the model predicted conditions at the head of each waterbody where the TTRs tend to be the highest, except for Thurston and Bergen Basins where TTRs for additional stations are provided.

2) Stations TBH2 and BB5 are located within portions of Thurston and Bergen Basins that are restricted from public access by Homeland Security.
Enterococcus Modeled Attainment (CSO)

Baseline vs 100% CSO Capture

Legend:
- CSO Outfall
- Storm Outfall
- WWTP Effluent Outfall
- 95 - 100% Attainment
- 90 - 95% Attainment
- 80 - 90% Attainment
- 70 - 80% Attainment
- 0 - 70% Attainment
Fecal Coliform Modeled Attainment (MS4)

Baseline vs 100% MS4 Capture

Legend
- ▲ CSO Outfall
- ▲ Storm Outfall
- ▲ WWTP Effluent Outfall
- ▪ 95 - 100% Attainment
- ▲ 90 - 95% Attainment
- ▲ 80 - 90% Attainment
- ▲ 70 - 80% Attainment
- ▪ 0 - 70% Attainment
Key Takeaways

- Overall, water quality in Jamaica Bay has improved dramatically.
- Water quality impairments are situated at the head-ends of Bergen and Thurston Basin:
  - Restricted waterbodies (JFK security)
  - 100% CSO reduction provides minimal water quality benefits
  - Significant stormwater inputs to Bergen
- Consideration of Completed and Ongoing Investments:
  - Existing Grey Infrastructure ($1.03B Committed)
  - Existing and Planned Green Infrastructure toward 2030 Goal ($300M Committed)
  - SE Queens Sewer Build-out ($1.7B Committed)
- Identified potential ecological enhancement projects and additional GI to provide benefits in lieu of further grey infrastructure.
Evaluation of Grey Alternatives

Keith Mahoney, P.E.
Director of Water Quality Planning
DEP – BEDC
1. Bacteria Source Component Analysis
   - CSO, stormwater and direct drainage

2. Gap Analysis for Water Quality Standard (WQS) Attainment
   - Calculate bacteria and dissolved oxygen for:
     - Baseline Conditions
     - 100% CSO Control Conditions

3. Assess Levels of CSO Control Necessary to Achieve WQS

4. Identify Technologies to Cost-Effectively Achieve the Required Level of CSO Control

Increasing CSO Reduction Potential

Sample Technologies:
- Storage
- Treatment
- System Optimization
- Source Control
### Jamaica LTCP Alternatives Toolbox

<table>
<thead>
<tr>
<th>Source Control</th>
<th>Additional GI</th>
<th>High Level Storm Sewers</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Optimization</td>
<td>Fixed Weir Modifications</td>
<td>Bending Weirs / Control Gates</td>
</tr>
<tr>
<td>CSO Relocation</td>
<td>Gravity Flow Tipping to Other Watersheds</td>
<td>Flow Tipping with Conduit/Tunnel and Pumping</td>
</tr>
<tr>
<td>Water Quality / Ecological Enhancement</td>
<td>Floatables Control</td>
<td>Environmental Dredging</td>
</tr>
<tr>
<td>Treatment &lt;br&gt; <strong>Satellite:</strong></td>
<td>Outfall Disinfection</td>
<td>Retention Treatment Basin (RTB)</td>
</tr>
<tr>
<td><strong>Centralized:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>In-System</td>
<td>Shaft</td>
</tr>
</tbody>
</table>

**Completed or Underway Per WWFP**
- Completed/Underway Per WWFP & Identified for Evaluation
- CSO Controls Identified for Evaluation

[Diagram with various water management strategies and their categorizations]
Alt. B-2d1: Parallel Interceptor to 50 MGD PS at WWTP

<table>
<thead>
<tr>
<th>CSO Capture</th>
<th>Description of Alternative</th>
<th>Construction Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>34%</td>
<td>Parallel Sewer from Regulators JA-03 and JA-14 to 50 MGD PS at Jamaica WWTP</td>
<td>$180 M</td>
</tr>
</tbody>
</table>

**Benefits**
- Captures and conveys CSO from JAM-003/003A to the Jamaica WWTP for treatment
- Isolates CSO to reduce impacts to West Interceptor

**Challenges**
- Limited improvement in Bergen Basin WQ attainment
- Property acquisitions and permitting
Alt. B-2d2: Parallel Interceptor to 50 MGD RTB at WWTP

### Description of Alternative
- **CSO Capture**: 63%
- **Description of Alternative**: Parallel Sewer from Regulators JA-03 and JA-14 to 50 MGD RTB at Jamaica WWTP
- **Construction Cost**: $618 M

### Benefits
- Captures and conveys CSO from JAM-003/003A to RTB
- Isolates CSO to reduce impacts to West Interceptor
- Staff familiar with RTB O&M
- Captures and conveys CSO from JAM-003/003A to RTB
- Isolates CSO to reduce impacts to West Interceptor
- Staff familiar with RTB O&M

### Challenges
- Limited improvement in Bergen Basin WQ attainment
- Property acquisitions and permitting

### Map Details
- **3,200 LF 96” Sewer**
- **1,400 LF**
- **New 50 MGD Pump Station and RTB**
- **Jamaica WWTP**
- **Howard Beach Branch Interceptor**
- **Bergen Basin**
- **JAMA II/III Interceptor**
- **JAMA I Interceptor**
- **West Interceptor**

### Legend
- CSO Outfall
- Regulator
- Pump Station
- Drop Shaft
- Screening and Grit Chamber
- Diversion Chamber
- Conveyance Sewer
- Effluent Line
- Influent Line
- CSO Outfall Sewer
- Interceptor
- Retention Treatment Basin
B-6: Bergen CSO Storage Tunnel

<table>
<thead>
<tr>
<th>Capture</th>
<th>Description of Alternative</th>
<th>Construction Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>25%</td>
<td>3,200 LF, 15 ft. dia. Single Barrel, 4 MG Tunnel</td>
<td>$340 M</td>
</tr>
<tr>
<td>50%</td>
<td>3,200 LF, 26 ft. dia. Single Barrel, 13 MG Tunnel</td>
<td>$380 M</td>
</tr>
<tr>
<td>75%</td>
<td>3,200 LF, 35 ft. dia. Single Barrel, 23 MG Tunnel</td>
<td>$449 M</td>
</tr>
<tr>
<td>100%</td>
<td>5,400 LF, 43 ft. dia. Double Barrel, 59 MG Tunnel</td>
<td>$608 M</td>
</tr>
</tbody>
</table>

Benefits
- Can provide high level of CSO capture and treatment
- Provides storage for control of wet weather peak flows from Regulators JA-03 and JA-14

Challenges
- Limited improvement in Bergen Basin WQ attainment
- Temporary relocation of parking and businesses during construction
## Bergen Basin – Retained Gray Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description</th>
<th>Remaining CSO Vol. (MG)</th>
<th>Percent Capture (%)</th>
<th>Frequency of Overflow</th>
<th>Fecal Coliform Recreation Season Attainment (%)</th>
<th>Construction Cost ($ Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-2d1</td>
<td>JAM 003/003A CSO to PS</td>
<td>242</td>
<td>34</td>
<td>16</td>
<td>71</td>
<td>$180 M</td>
</tr>
<tr>
<td>B-2d2</td>
<td>JAM 003/003A CSO to RTB</td>
<td>137</td>
<td>63</td>
<td>11</td>
<td>73</td>
<td>$618 M</td>
</tr>
<tr>
<td>B-6</td>
<td>4 MG CSO Tunnel to WWTP</td>
<td>277</td>
<td>25</td>
<td>20</td>
<td>70</td>
<td>$340 M</td>
</tr>
<tr>
<td></td>
<td>13 MG CSO Tunnel to WWTP</td>
<td>185</td>
<td>50</td>
<td>13</td>
<td>72</td>
<td>$380 M</td>
</tr>
<tr>
<td></td>
<td>23 MG CSO Tunnel to WWTP</td>
<td>92</td>
<td>75</td>
<td>6</td>
<td>74</td>
<td>$449 M</td>
</tr>
<tr>
<td></td>
<td>59 MG CSO Tunnel to WWTP</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>75</td>
<td>$608 M</td>
</tr>
</tbody>
</table>

Note: Each alternative consists of conveyances to divert CSO from JAM-003/003A to a dewatering pump station or RTB located at the Jamaica WWTP.
### Alt. T-6: Thurston CSO Tunnel - Replacement Interceptor

#### Capture

<table>
<thead>
<tr>
<th>Capture</th>
<th>Description of Alternative</th>
<th>Construction Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>25%</td>
<td>15,200 LF, 10.5 ft. dia., 9.8 MG Tunnel</td>
<td>$904 M</td>
</tr>
<tr>
<td>50%</td>
<td>15,200 LF, 11 ft. dia., 10.8 MG Tunnel</td>
<td>$913 M</td>
</tr>
<tr>
<td>75%</td>
<td>15,200 LF, 17 ft. dia., 25.8 MG Tunnel</td>
<td>$954 M</td>
</tr>
<tr>
<td>100%</td>
<td>15,200 LF, 28.5 ft. dia., 72.5 MG Tunnel</td>
<td>$1,204 M</td>
</tr>
</tbody>
</table>

#### Benefits
- Diverts CSO from JAM-005/007 to East Interceptor
- Relocates East Interceptor from Port Authority property

#### Challenges
- Limited improvement in Thurston Basin WQ attainment
- Property acquisitions and permitting
# Thurston Basin - Retained Gray Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Description</th>
<th>Remaining CSO Vol. (MG)</th>
<th>Percent Capture (%)</th>
<th>Frequency of Overflow</th>
<th>Fecal Coliform Attainment (rec. season) (%)</th>
<th>Construction Cost ($ Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-6</td>
<td>11 MG CSO Tunnel</td>
<td>306</td>
<td>50</td>
<td>6</td>
<td>67</td>
<td>$913 M</td>
</tr>
<tr>
<td></td>
<td>29 MG CSO Tunnel</td>
<td>153</td>
<td>75</td>
<td>2</td>
<td>71</td>
<td>$954 M</td>
</tr>
<tr>
<td></td>
<td>80 MG CSO Tunnel</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>75</td>
<td>$1,204 M</td>
</tr>
</tbody>
</table>

Note: Alternative T-6 consists of a CSO storage tunnel from JAM-005/007 to a dewatering pump station located at the Jamaica WWTP.

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Cost vs Fecal Coliform Attainment During Recreation Season (2008 Rainfall)

- **T-6: Tunnel for Thurston Basin 100% CSO Capture**
- **T-6: Tunnel for Thurston Basin 75% CSO Capture**
- **T-6: Tunnel for Thurston Basin 50% CSO Capture**
Evaluation of Watershed Based Alternatives

John McLaughlin
Managing Director, Ecological Services
DEP – BEPA
Environmental Benefits of Dredging

- Reduces odors by removing exposed organic deposits and improve benthic habitat.
- Recovered cross sectional area can improve tidal exchange and flushing for improved water quality.
- Produce a healthier system that can result in a more suitable habitat for fish and other wildlife.
Benefits of Ribbed Mussel Installation

- Similar filtration rates as oysters (5.1 liters per hour vs. 6.5 liters per hour with no attractive nuisance issues.

- Good candidate for nutrient bioextraction in highly impacted urban environments.

- Ribbed mussels feed on a wide range of particles suspended in the water column, including phytoplankton and bacteria.

- The use of ribbed mussels to improve water quality in Chesapeake Bay is being explored as a potential management practice.
Benefits of Tidal Wetland Restoration

- Remove nitrogen, increase dissolved oxygen and remove pathogens through various physical, chemical, and biological processes.
- Create habitat for juvenile fish and other marine organisms.
- Create recreational and educational opportunities for the public.
The Jamaica Bay Watershed Protection Plan: Precursor to the LTCP Conceptual Plan Proposal

Ecological Blueprint To Improve Water Quality and Habitat
Jamaica Bay Watershed Protection Plan

400+ years can make a difference....

Restoring functional and sustainable ecological connections is our goal...

However...

We need to understand that the current physical and ecological conditions are vastly different from the past and we need to establish realistic and achievable goals under the current setting.

Credit: Eric Sanderson and Ecobrookly.com
The first JBWPP with 127 strategies first issued in 2007 with an update in 2008 and then every two years thereafter with a focus on:

1. Water Quality
2. Restoration Ecology
3. Stormwater Management through Sound Land Use
4. Public Education and Outreach
5. Public Use and Enjoyment
6. Coordination and Implementation

Developed with Jamaica Bay stakeholder input as a “living document” and provide an adaptive management approach to understanding and resolving the issues facing the bay, today and in the future.

DEP will partner with the Science and Resiliency Institute at Jamaica Bay (SRIJB) for the October 2018 and the State of the Bay Symposium, including holding workshops with environmental stakeholder groups for their input.
Overview of Jamaica Bay WPP Efforts

- DEP will continue to be a local cost-sharing sponsor for additional Jamaica Bay ecological projects under the Hudson Raritan Estuary Ecosystem Restoration Feasibility Study (HRE).

- A robust ecologically (e.g., wetland and upland maritime) based perimeter watershed approach is required – similar to that of the Chesapeake Bay programs. Using natural systems for not only ecological improvements but to help meet regulatory water quality standards.

- Over 26 individual efforts and $32M allocated over the last 10-years.

- Wetland research for pathogen reduction and dissolved oxygen improvements.

- Jamaica Bay is a “No Discharge Zone” and DEP maintains 3 Boat Pump Out facilities.
LTCP Recommended Plan

Pinar Balci
Assistant Commissioner
DEP – BEPA
LTCP Recommended Plan: Jamaica Bay Integrated Watershed Plan

- Dovetails with existing Jamaica Bay Watershed Protection Plan efforts and SE Queens Initiatives.

- Includes area wide expansion of Green Infrastructure to MS4 portion of Thurston and Bergen Tributaries of Jamaica Bay.

- Additional 50 acres of wetland and other coastal habitat restoration around the Bay perimeter (separate from the marsh island restoration)

- Nature-based features for biological water quality treatment through ribbed mussel installations in select tributaries (i.e., Bergen and Thurston Basins) but final locations to be identified with stakeholder input (~7 acres).

- Environmental dredging: Proposed location of head end of Bergen Basin but final locations to be identified with stakeholders input
New Area-wide ROW Contracts in Southeast Queens, tributary to Bergen and Thurston Basins

Implementation on Publicly Owned Sites
- Schools
- Public Housing
- Playgrounds/Parks

Additional GI Investment: Area-Wide ROW Contracts and Public Property Retrofits in Thurston and Bergen Basin MS4 Areas
Green Infrastructure – Baseline, Planned, and Additional Projects

Current Commitments (~$300M)

GI Baseline CSO Reductions: ~83 MGY

CSO Planned Reductions toward 2030 Goal: 133 MGY

LTCP Integrated Watershed Plan (~$245-290M)

Additional SW Volume Reductions: 129 MGY
Jamaica Bay Integrated Watershed Plan

Ecological Restoration Investments

Environmental Dredging: Proposed location head of Bergen Basin but final locations TBD

Ribbed Mussel Restoration: Up to 7 acres (Proposed Location- Bergen and Thurston Basins but final locations TBD)

Wetland and Other Habitat Restoration in Tributaries and Around the Bay (up to 50 acres around Bay perimeter). Separate from Marsh Island Restoration
LTCP Recommended Plan

HENDRIX CREEK
- No Additional Gray Projects
- Wetlands Restoration

SPRING CREEK
- Continued Operation of CSO Facility

FRESH CREEK
- No Additional Gray Projects
- Wetlands Restoration

PAERDEGAT BASIN
- Continued Operation of CSO Facility
- Wetlands Restoration

BERGEN BASIN
- No Additional Gray Projects
- Environmental Dredging
- Additional GI
- Ribbed Mussels

JAMAICA BAY
- (including Northern Channel, Inner Bay & Rockaway Shore)
- No Additional Gray Projects

THURSTON BASIN
- No Additional Gray Projects
- Additional GI
- Ribbed Mussels

JAMAICA BAY PERIMETER RESTORATION
- Shoreline Wetlands Restoration and Upland Shoreline Habitat Improvements up to 50 acres (separate from marsh island restoration)
Benefits

✓ Additional Green Infrastructure and stormwater management:

  • Area–wide ROW contracts; public property retrofits

✓ Increased protection against flooding

✓ Greater co-benefits for Brooklyn and Queens residents (urban heat island reduction and neighborhood greening)

✓ Increased adaptation measures for climate resiliency

✓ Increased protection from coastal flooding through wetland creation and restoration

✓ Improved overall water quality

✓ Increased habitat for wildlife through wetland protection
Next Steps

Mikelle Adgate
Senior Policy Advisor
DEP
It is possible....with your input...
Next Steps

➢ Public Comments will be accepted through May 14, 2018

➢ LTCP Submittal to NYSDEC by June 30, 2018

➢ Comments can be submitted to:
  • New York City DEP at: ltcp@dep.nyc.gov
Visit the informational tables tonight for handouts and poster boards with detailed information

Go to [www.nyc.gov/dep/ltcp](http://www.nyc.gov/dep/ltcp) to access:

- LTCP Public Participation Plan
- Presentation, handouts and poster boards from this meeting
- Links to Waterbody/Watershed Facility Plans
- CSO Order including LTCP Goal Statement
- NYC’s Green Infrastructure Plan
- Green Infrastructure Pilots 2011 and 2012 Monitoring Results
- NYC Waterbody Advisory Program
- Upcoming meeting announcements
- Other LTCP updates