FY18 Proposed Capital Improvement Budget

December 14, 2016
FY18 Proposed CIP

- Last year of five-year capital spending Cap
- FY18 Proposed CIP complies with the Cap requirements
- Focus on Asset Protection and Long-Term Redundancy
- Metropolitan Tunnel Redundancy
- MWRA continues to reduce debt levels
## FY18 Proposed CIP - FY14-18 Base-Line Cap

<table>
<thead>
<tr>
<th>FY14-18 Base-Line Cap</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
<th>FY17</th>
<th>FY18</th>
<th>Total FY14-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected Expenditures</td>
<td>$142.5</td>
<td>$147.6</td>
<td>$149.3</td>
<td>$141.8</td>
<td>$136.8</td>
<td>$718.0</td>
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<tr>
<td>Contingency</td>
<td>7.6</td>
<td>9.5</td>
<td>10.1</td>
<td>9.8</td>
<td>9.3</td>
<td>46.1</td>
</tr>
<tr>
<td>Inflation on Unawarded Construction</td>
<td>0.8</td>
<td>4.2</td>
<td>8.4</td>
<td>11.1</td>
<td>13.5</td>
<td>37.9</td>
</tr>
<tr>
<td>Less: Chicopee Valley Aqueduct Projects</td>
<td>(5.0)</td>
<td>(2.2)</td>
<td>(1.4)</td>
<td>(1.3)</td>
<td>(0.4)</td>
<td>(10.3)</td>
</tr>
<tr>
<td>FY14-18 Base-Line Cap</td>
<td>$145.8</td>
<td>$159.1</td>
<td>$166.4</td>
<td>$161.3</td>
<td>$159.1</td>
<td>$791.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FY18 Proposed</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
<th>FY17</th>
<th>FY18</th>
<th>Total FY14-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected Expenditures</td>
<td>$102.2</td>
<td>$103.6</td>
<td>$95.1</td>
<td>$142.9</td>
<td>$169.5</td>
<td>$613.3</td>
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<tr>
<td>Contingency</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>7.6</td>
<td>9.8</td>
<td>17.4</td>
</tr>
<tr>
<td>Inflation on Unawarded Construction</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Less: I/I Program</td>
<td>0.0</td>
<td>(17.5)</td>
<td>(13.6)</td>
<td>(18.8)</td>
<td>(19.0)</td>
<td>(69.0)</td>
</tr>
<tr>
<td>Less: Water Loan Program</td>
<td>0.0</td>
<td>1.4</td>
<td>5.3</td>
<td>(3.3)</td>
<td>(7.5)</td>
<td>(4.0)</td>
</tr>
<tr>
<td>Less: Chicopee Valley Aqueduct Projects</td>
<td>(5.6)</td>
<td>(1.2)</td>
<td>(0.4)</td>
<td>(0.1)</td>
<td>(0.7)</td>
<td>(8.0)</td>
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<tr>
<td>FY18 Proposed FY14-18 Spending</td>
<td>$96.6</td>
<td>$86.3</td>
<td>$86.4</td>
<td>$128.2</td>
<td>$152.2</td>
<td>$549.7</td>
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</table>

<table>
<thead>
<tr>
<th>FY18 Proposed vs. FY14-18 Base-Line Cap</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
<th>FY17</th>
<th>FY18</th>
<th>Total FY14-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected Expenditures</td>
<td>($40.3)</td>
<td>($43.9)</td>
<td>($54.2)</td>
<td>$1.1</td>
<td>$32.7</td>
<td>($104.7)</td>
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<tr>
<td>Contingency</td>
<td>(7.6)</td>
<td>(9.5)</td>
<td>(10.1)</td>
<td>(2.2)</td>
<td>0.6</td>
<td>(28.7)</td>
</tr>
<tr>
<td>Inflation on Unawarded Construction</td>
<td>(0.8)</td>
<td>(4.2)</td>
<td>(8.4)</td>
<td>(11.1)</td>
<td>(13.5)</td>
<td>(37.9)</td>
</tr>
<tr>
<td>Less: I/I Program</td>
<td>0.0</td>
<td>(17.5)</td>
<td>(13.6)</td>
<td>(18.8)</td>
<td>(19.0)</td>
<td>(69.0)</td>
</tr>
<tr>
<td>Less: Water Loan Program</td>
<td>0.0</td>
<td>1.4</td>
<td>5.3</td>
<td>(3.3)</td>
<td>(7.5)</td>
<td>(4.0)</td>
</tr>
<tr>
<td>Less: Chicopee Valley Aqueduct Projects</td>
<td>(0.6)</td>
<td>0.9</td>
<td>1.0</td>
<td>1.2</td>
<td>(0.2)</td>
<td>2.3</td>
</tr>
<tr>
<td>FY14-18 Cap ($ Change)</td>
<td>($49.2)</td>
<td>($72.7)</td>
<td>($80.0)</td>
<td>($33.1)</td>
<td>($7.0)</td>
<td>($242.0)</td>
</tr>
</tbody>
</table>
• Proposed Expenditures: $169.5M

• Proposed Contract Awards: $203M
FY18 Proposed CIP – Proposed FY18 Expenditures

- Total Proposed FY18 Expenditures: $169.5 million
  - Wastewater: $83.2 million
  - Waterworks: $76.1 million
  - Business and Operations: $10.2 million
## FY18 Proposed CIP – Future CIP Spending and Planning Projections

<table>
<thead>
<tr>
<th></th>
<th>FY17 Final Remaining Balance</th>
<th>FY18 Proposed Remaining Balance</th>
<th>$ Change</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Wastewater</td>
<td>$1,216.6</td>
<td>$1,241.2</td>
<td>$24.6</td>
<td>2.0%</td>
</tr>
<tr>
<td>Total Waterworks</td>
<td>$1,867.9</td>
<td>$2,027.5</td>
<td>$159.6</td>
<td>8.5%</td>
</tr>
<tr>
<td>Business &amp; Operations Support</td>
<td>$45.6</td>
<td>$38.8</td>
<td>$(6.8)</td>
<td>-14.9%</td>
</tr>
<tr>
<td>Total MWRA</td>
<td>$3,130.2</td>
<td>$3,307.4</td>
<td>$177.2</td>
<td>5.7%</td>
</tr>
</tbody>
</table>

- $3.3 billion in future CIP spending beginning in FY17
- $122.5 million in new projects in FY18 Proposed CIP
- $54.8 million for schedule changes and revised cost estimates
Total New Projects Added in FY18: $122.5 million

- Waterworks: $85.1 million
- Wastewater: $37.4 million
### FY18 Proposed CIP – Top New Projects

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 50 &amp; 57 Water Pipeline and Sections 19/20/21 Sewer Rehabilitation:</td>
<td>$22.3 million</td>
</tr>
<tr>
<td>Chestnut Hill Emergency Pump Station Improvements</td>
<td>$18.3 million</td>
</tr>
<tr>
<td>Quabbin Administration Building Rehabilitation</td>
<td>$15 million</td>
</tr>
<tr>
<td>Nut Island Headworks Odor Control and HVAC Improvements</td>
<td>$10 million</td>
</tr>
<tr>
<td>Tops of Shafts Interim Improvements Construction</td>
<td>$6.1 million</td>
</tr>
</tbody>
</table>
• Section 50 & 57 Water Pipeline and Sections 19/20/21 Sewer Rehabilitation: $22.3 million
FY18 Proposed CIP – Top New Projects

- Chestnut Hill Emergency Pump Station Improvements: $18.3 million
FY18 Proposed CIP – Top New Projects

• Quabbin Administration Building Rehabilitation: $15 million
FY18 Proposed CIP – Top New Projects

- Nut Island Headworks Odor Control and HVAC Improvements: $10 million
• Tops of Shafts Interim Improvements Construction: $6.1 million
## FY18 Proposed CIP – Change from Court-Ordered Mandates to Asset Protection and Water Redundancy

<table>
<thead>
<tr>
<th>CIP Category</th>
<th>FY09-13</th>
<th>FY14-18</th>
<th>FY19-23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Protection</td>
<td>30.1%</td>
<td>51.2%</td>
<td>62.5%</td>
</tr>
<tr>
<td>Carroll WTP</td>
<td>4.7%</td>
<td>2.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Water Redundancy</td>
<td>16.3%</td>
<td>20.1%</td>
<td>28.1%</td>
</tr>
<tr>
<td>CSO</td>
<td>38.2%</td>
<td>10.8%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Other</td>
<td>10.7%</td>
<td>15.9%</td>
<td>8.6%</td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

- Substantial completion of court-ordered CSO program
- Asset Protection and Redundancy are the principal drivers of future capital expenditures
• Preserve the condition of assets
  – Asset Protection in CIP
  – Day to Day Maintenance in CEB
## FY18 Proposed CIP – Top Construction Projects ($ in 000s)

<table>
<thead>
<tr>
<th>Project</th>
<th>Subphase</th>
<th>FY18 Proposed Spending</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Asset Protection</td>
<td>Chelsea Creek Headworks Upgrades</td>
<td>$18,215</td>
</tr>
<tr>
<td>Cosgrove Tunnel Redundancy</td>
<td>Wachusett Aqueduct Pump Station</td>
<td>$15,896</td>
</tr>
<tr>
<td>NIH Redundancy &amp; Storage</td>
<td>Section 89 &amp; 29 Redundancy Phase 1C and Phase 2.</td>
<td>$15,448</td>
</tr>
<tr>
<td>SEH Redundancy &amp; Storage</td>
<td>Redundancy Pipeline Section 111 Phase 1, 2 and 3</td>
<td>$13,146</td>
</tr>
<tr>
<td>Facility Asset Protection</td>
<td>Alewife Brook Pump Stn Rehab</td>
<td>$5,795</td>
</tr>
<tr>
<td>DI Treatment Plant Asset Protection</td>
<td>HVAC Equipment Replacement</td>
<td>$4,978</td>
</tr>
<tr>
<td>DI Treatment Plant Asset Protection</td>
<td>NMPS &amp; WTF Butterfly Valve Replacement</td>
<td>$3,499</td>
</tr>
<tr>
<td>DI Treatment Plant Asset Protection</td>
<td>WTF VFD Replacement</td>
<td>$3,085</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$80,062</strong></td>
</tr>
<tr>
<td>% of Total FY 18 proposed MWRA Spending</td>
<td></td>
<td><strong>47.2%</strong></td>
</tr>
</tbody>
</table>
Alewife Brook Pump Station Rehabilitation

FY18 Budget: $5.8M
Total Contract: $12.6M
NTP: January 2016
SC: May 2018
Chelsea Creek Headworks Upgrades

- Estimated Cost: $18.2M
- Estimated Completion: $72.9M
- Estimated Completion Date: 2020
- Estimated Timeframe: 2016
Deer Island Treatment Plant: Top 3 Spenders FY 18 Budget: $12.6M

- HVAC Equipment Replacement
  FY 18 Budget: $5.0M
  • Total Contract: $29.5M
  • NTP: April 2017
  • SC: August 2020

- North Main Pump Station and Winthrop Terminal
  Butterfly Valve Replacement
  FY 18 Budget: $3.5M
  • Total Contract: $17.5M
  • NTP: June 2014
  • SC: June 2017

- Winthrop Terminal VFD Replacement
  FY 18 Budget: $3.1M
  • Total Contract: $11.9M
  • NTP: June 2016
  • SC: March 2020
Wachusett Aqueduct Pump Station:

FY 18 Budget: $15.9M
Total Contract: $53.0M
NTP: March 2016
SC: February 2019
Northern Intermediate High
Section 89 & 29 Redundancy:

FY 18 Budget: $15.5M
NTP: December 2016
SC: December 2019
FY18 CIP – FY18 Top Spenders - Redundancy

• Southern Extra High
  Section 111 Redundancy:
    FY 18 Budget: $13.1M
    NTP: July 2016
    SC: November 2019
• 49 FY18 Contract Awards
• Total Contract Value: $203.5 million
  – Wastewater: $151.7 million
  – Waterworks: $47.3 million
  – Business and Operations: $4.5 million
<table>
<thead>
<tr>
<th>Project</th>
<th>Subphase</th>
<th>Anticipated Contract Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI Treatment Plant Asset Protection</td>
<td>Clarifier Rehabilitation Phase 2 - Construction</td>
<td>$80.0</td>
</tr>
<tr>
<td>DI Treatment Plant Asset Protection</td>
<td>Gravity Thickener Rehabilitation</td>
<td>$14.5</td>
</tr>
<tr>
<td>Metropolitan Redundancy Interim Improvements</td>
<td>Metropolitan Redundancy Interim Design Construction Administration/Resident Inspection</td>
<td>$10.4</td>
</tr>
<tr>
<td>DI Treatment Plant Asset Protection</td>
<td>Switchgear Replacement - Construction</td>
<td>$8.0</td>
</tr>
<tr>
<td>Metropolitan Tunnel Redundancy</td>
<td>Conceptual Design Environmental Impact Report</td>
<td>$7.5</td>
</tr>
<tr>
<td>Wastewater Central Monitoring</td>
<td>Wastewater Supervisory Control and Data Acquisition System (SCADA)/Program Logic Controller (PLC) Upgrades</td>
<td>$7.0</td>
</tr>
<tr>
<td>Northern Low Service Rehab Section 8</td>
<td>Sec 57 Water &amp; 21/20/19 Sewer Design/Engineering Services During Construction/Resident Inspection</td>
<td>$4.8</td>
</tr>
<tr>
<td>DI Treatment Plant Asset Protection</td>
<td>Future South System Pump Station Variable Frequency Drives Replacements - Design</td>
<td>$4.8</td>
</tr>
<tr>
<td>Application Improvements Program</td>
<td>Enterprise Content Management</td>
<td>$4.0</td>
</tr>
<tr>
<td>Winsor Station Pipeline Improvements</td>
<td>Winsor Power Station Final Design/Construction Administration/Resident Inspection</td>
<td>$3.6</td>
</tr>
<tr>
<td><strong>Top Ten Awards for FY18</strong></td>
<td></td>
<td>$144.6</td>
</tr>
<tr>
<td><strong>49 Contract Awards Planned for FY18</strong></td>
<td></td>
<td>$203.5</td>
</tr>
</tbody>
</table>
Historic and Projected Capital Improvement Spending

Actual
FY04-16 Average
$155M/year

Projected
FY17-23
Average
$246M/year

$0
$100
$200
$300
$400
$500
$600
$700

$ Millions

FY96
FY97
FY98
FY99
FY00
FY01
FY02
FY03
FY04
FY05
FY06
FY07
FY08
FY09
FY10
FY11
FY12
FY13
FY14
FY15
FY16
FY17
FY18
FY19
FY20
FY21
FY22
FY23

Historic and Projected Capital Improvement Spending

- Actual
  - FY04-16 Average
    - $155M/year
- Projected
  - FY17-23
    - Average
      - $246M/year
Historic and Projected Capital Improvement Spending by Utility

Actual
FY04-16 Average
Waterworks $53M/year
Wastewater $97M/year

Projected
FY17-23 Average
Waterworks $107M/year
Wastewater $133M/year
Level of MWRA Indebtedness

MWRA Outstanding Indebtedness

As of June 30th

$7,000,000,000

$6,000,000,000

$5,000,000,000

$4,000,000,000

$3,000,000,000

$2,000,000,000

$1,000,000,000

$ -

• FY 19-23 is the next five-year CIP Cap period

• Master Plan Development

• Metropolitan Tunnel Redundancy
Next Steps

- Work with the Advisory Board
- Finalize FY18 CIP
- Submit FY18 Final CIP to Board of Directors for approval in June 2017
Sewer Sections 4, 5, 6, and 186 Study
Contract 7423

December 14, 2016
Project Limits
Services to be Provided

- Manned pipeline inspection, core samples
- Multisensor/ 3D Inspection
- Manhole Inspections
- Traffic and Environmental Assessments
- Hydraulic Capacity and Corrosivity
- Final Report outlining rehabilitation needs and recommended plan for rehabilitation including limits of work, flow handling, access points, costs
Procurement Process

- 1 Step RFQP
- 2 Proposals
- Selection Committee Recommends Hazen and Sawyer, P.C.
- $1,213,973.97
- December 2016 – March 2018
Deer Island Personnel Dock Rehabilitation
Contract 7168

December 14, 2016
Overview of the Floating Docks

- Originally 3 Floating Docks were in service during the Boston Harbor Clean-up and used to dock ferries transporting construction staff to/from Deer Island
- Currently 2 Floating Docks are in service used to dock Coast Guard boats, Spill Response, MWRA boats for Laboratory Staff use and Public Tour Ferries
- Temporary repairs occurred in the Summer of 2015 to patch holes on the deck
Floating Personnel Docks
Public Tour Ferry Docked
Overview Issues

• Floating docks are steel constructed with six air tight compartments. The deck is topped by a galvanized steel grating used as a walkway and includes handrails

• Due to the severe conditions the following issues have developed over time:
  • Severe deterioration of the steel deck and handrails
  • Steel collars attaching the docks to the pile guide are approaching failure
Prior to summer of 2015 repair
Scope of Work

- Cost of the project is $1,294,524.00
- Scope of work consist of:
  - Pressure wash, sand blast and coat the hull and deck
  - Replace hull and deck steel as determined by ultrasonic testing.
  - Replace the following: steel collars, handrails, walkway grating, rubber fender, hatches to compartments, gangway rails and light
  - Coat the existing pile guides
  - Replacement of flap gates nos. 9 and 10
  - Work to occur Jan-May 2017
Wachusett Aqueduct Pumping Station
Contract 7156, Amendment 3

December 14, 2016
Wachusett Aqueduct Pumping Station Location Plan

Pumping Station Site

Carroll WTP
Wachusett Aqueduct Pumping Station
• Pumping station construction is on-going
John J. Carroll Water Treatment Plant Guard House
Amendment 3 – New Work Includes:

- Change from secant pile to sheet pile support of excavation resulted in a credit, but required additional engineering time to evaluate and monitor installation.

- Front gate canopy design changes were required by the City of Marlborough to provide additional protection to the City’s water main.
Amendment 3 – New Work Includes:

• Change to photovoltaic system switchgear design was required by National Grid
• Power will now be used by the John J. Carroll Water Treatment Plant and will not be exported
• Review and additional permitting for soil disposal on Carroll Plant site
• Slab design review and changes due to H-pile alignment
• Pipe gallery dehumidification improvements
## Amendment 3 – New Work Summary

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Support of Excavation</td>
<td>$161,110</td>
</tr>
<tr>
<td>Change to the Carroll WTP Front Gate Canopy</td>
<td>$115,715</td>
</tr>
<tr>
<td>Change to the Photovoltaic System</td>
<td>$21,487</td>
</tr>
<tr>
<td>Other Changes:</td>
<td>$51,430</td>
</tr>
<tr>
<td>• Soil disposal</td>
<td></td>
</tr>
<tr>
<td>• Slab design for H-piles</td>
<td></td>
</tr>
<tr>
<td>• Pipe gallery dehumidification</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$349,742</strong></td>
</tr>
</tbody>
</table>

Saved $1.1 m in construction and six months
Massachusetts Water Resources Authority

Wachusett Aqueduct Pumping Station
Contract 7157, Change Order 5

December 14, 2016
• Redesign of Canopy Footings adjacent to the water main
• Vacuum Extraction for concrete pedestals and Concrete Cap
• Micro Piles
• Redesign of drainage to eliminate water main crossing
• Redesign of Verizon duct bank from underground to overhead
• Construction during low demand periods starting in March 2017
Change to the Proposed Drainage
Winter Access Driveway
## Change Order No. 5 – New Work Summary

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro Piles</td>
<td>$257,892</td>
</tr>
<tr>
<td>Change to the Proposed Drainage</td>
<td>$41,465</td>
</tr>
<tr>
<td>Winter Access Driveway</td>
<td>$37,521</td>
</tr>
<tr>
<td>Verizon Duct Bank Elimination</td>
<td>($8,839)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$328,039</strong></td>
</tr>
</tbody>
</table>
MWRA’s Climate Change Strategy:

Adapting to the Impacts of Climate Change and Sea Level Rise

December 14, 2016
Water System Not Threatened

• All MWRA dams, dikes, spillways and appurtenances are inspected routinely by licensed dam safety engineers and are in good condition
• Since 2006, MWRA has spent over $21 million on dam safety projects
• Quabbin and Wachusett spillways have been improved to be able to discharge the probable maximum flood (1 in 1000 years)
• All drinking water pump stations and storage tanks above flooding elevation
Examples of Dam Improvements: Wachusett Spillway

Wachusett Spillway capacity increased by lowering it 2 feet
Examples of Dam Improvements: Wachusett New Crest Gate

Installation of a crest gate greatly enhances discharge operations
Examples of Dam Improvements: Wachusett Auxiliary Spillway

New Wachusett Auxiliary Spillway constructed to pass flood discharge
• 100 year flood as determined by FEMA (current regulatory requirement)

• 100 year flood + 2.5ft (NYC DEP, BHA)

• Hurricane flooding levels as determined by FEMA’s SLOSH model (current evacuation planning recommendation) were reviewed

• Wave action (for facilities adjacent to FEMA Hazard Zone VE) was reviewed
## How Do Facilities Measure Up?

<table>
<thead>
<tr>
<th>Rank</th>
<th>Facility Name</th>
<th>Mitigation Actions Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PELLETSING PLANT</td>
<td>Barter around backup generator and transformers erected. (*)</td>
</tr>
<tr>
<td>2</td>
<td>HOGHS NECK PUMP STATION</td>
<td>Stop pump barriers installed in entryways. (*)</td>
</tr>
<tr>
<td>3</td>
<td>SQUANTUM PUMP STATION</td>
<td>Stop pump barriers installed in entryways. (*)</td>
</tr>
<tr>
<td>4</td>
<td>ALFORD ST FACILITY</td>
<td>Sandbags will be used for flood protection. Future work under review.</td>
</tr>
<tr>
<td>5</td>
<td>QUINCY PUMP STATION</td>
<td>Stop pump barriers installed in entryways. (*)</td>
</tr>
<tr>
<td>6</td>
<td>CHILESA CREEK SCREEN HOUSE</td>
<td>Installed retaining wall to protect generator and main power panel, stop log barriers at all doors and rol-up doors, pump pumps inside building, two isolation gates to protect facility raised ventilation bueror above required elevation, doored panels to protect windows to required elevation, all new electricity installed above required elevation where feasible.</td>
</tr>
<tr>
<td>7</td>
<td>BRANTRES-WENWORTH SCREEN HOUSE</td>
<td>Stop pump barriers installed in entryways. (*)</td>
</tr>
<tr>
<td>8</td>
<td>SOUTH BOSTON CSSO TUNNEL VENTILATION</td>
<td>Flood protection plan drafted, flood protection specs designed, requisition for materials purchase submitted.</td>
</tr>
</tbody>
</table>

*Projects have been prioritized from the top of the chart (most immediate risk) down through the rankings.*

*In some cases specifications are being revised due to more recent updates to the FEMA flood maps. Future modifications to protection measures will be made as necessary.*
Facilities Impact Summary

- 8 Sewer Facilities Likely Affected by a 100 Year Event
- 4 Sewer and 1 Administration Facilities Within One foot of a 100 Year Event
- 3 Sewer Facilities Affected by 100 plus 2.5 ft Event
- 3 Sewer Facilities Likely Affected by Hurricane Flooding
- 11 Sewer Facilities Unlikely Affected
- **No Water Facility At Risk of Service Disruption**
Flood Elevations At Chelsea Creek Headworks
Chelsea Administration and Maintenance Facilities

- FEMA 100 Year Flood Elevation
- FEMA 100 Year Flood Elevation + 2.5ft
LiDar Based Simulated Inundation of the Chelsea Area at 100 Year Plus 2.5 Feet Flood Level
Past Practice

- Low-lying facilities are protected with sandbags and pumps
- Mobile generators are deployed in advance of storms
- Increased staffing
• Back-up water and wastewater operations control center created at Carroll Treatment Plant in Marlborough
• Staff and equipment redeployed to pre-determined locations in advance of storms
• Install temporary flood barriers
• Purchased additional large, portable pumps
• Long-term capital rehabilitations include flood protection
MWRA Approach Going Forward – Long Term

• Will continue to monitor the latest science and predictions
• On average, we rehabilitate our facilities every 15 or 20 years
• Every future rehabilitation contract will take sea level rise into account
• Three significant rehabilitation projects were under design
  – Alewife Brook Pump Station
  – Chelsea Creek Headworks
  – Chelsea Screenhouse
• Amended each design to account for 2.5 feet of sea level rise
Alewife Brook Pump Station – Envelope Flood Protection Measures

- Raise berm to 115.6
- Flood logs (exterior)
- Install valve for landing drain
- Raise Electrical Equipment (interior)
- Flood logs (interior)
- Flood logs at berm to 115.6
Chelsea Screenhouse MCC room
Chelsea Screenhouse Screen room
MWRA Approach Going Forward – Short Term

- At-risk buildings fitted with temporary flood barriers
- Move electrical/computer equipment off the floor
Braintree Weymouth Hatch to Screen room
Squantum Pump Station Main Entrance
Flood Barrier Stop Plank Storage Cabinet
Big Bag Sand Bag System (Bags on-site)
Flood Panel Barrier (Demo at MWRA)
Tiger Dam (Demo at MWRA)
MegaSecur Watergate
Passive Flood Protection
MWRA is a Partner in the Metro Mayors Climate Mitigation Commitment