MWRA’s Pragmatic Approach to Climate Change Adaptation

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• Adaptation:
  – Understand the Potential Impacts
  – Mitigate Impacts
  – Create Resiliency

• Mitigation:
  – Reduce Greenhouse Gases
  – Contribute to the Common Good
  – Reduce Costs
  – Improve Environmental Footprint
  – Improve Public Perception
MWRA Service Area

- MWRA provides wholesale water and wastewater services to over 2.5 million customers in 61 communities.
- On average, MWRA delivers about 200 million gallons per day to its water customers.
- MWRA collects and treats an average of 350 million gallons of wastewater per day, with a peak capacity of 1.2 billion gallons.
Our Mission in Short

• Adequate, Reliable Supply of High Quality Drinking Water
• Environmentally Responsible Collection, Treatment and Disposal of Wastewater

• Drink with Confidence
• Flush with Pride

• All Accomplished Affordably
• Under All Circumstances
Adaptation For Sea Level Rise In The Design of Deer Island WWTP
Deer Island plant fully protected
- 100-year flood
- 1.9-foot sea level rise
- Wave runup of 14 feet on east side and 2 feet on west side

On-site power plant ensures uninterrupted power supply

Nut Island headworks in Quincy similarly designed for sea level rise
A Rising Sea Impacts The Hydraulics Of The Outfall Tunnel

- The effluent from the sewage treatment plant is discharged by gravity to the 9.5 mile

- To maintain hydraulic capacity, plant process tank elevation raised 1.9 feet and tunnel diameter was up-sized from 24 feet to 24.25 feet
Over time, more models and finer resolution - make use of the additional detail
Large Reservoir to Yield + More Precipitation = Plenty of High Quality Water
Water System Not Threatened by More Intense Storms

- 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).
- 85% of water delivered by gravity
- All drinking water pump stations and storage tanks above flooding elevation.
Examples of Dam Improvements
Wachusett New Crest Gate

Installation of a crest gate greatly enhances discharge operations.
Sea-Level Rise Is Already With Us
Trend For Boston Inner Harbor, NOAA Tidal Gage #8443970 (1921 - 2013)

Annual trend 0.01 ft/year
Annual trend 0.009 ft/year
Monthly Highest Tide Level
Mean Sea Level

Data source:
http://tidesandcurrents.noaa.gov/data_menu.shtml?bdate=19210101&edate=20130511&wl_sensor_hist=W5&relative=&datum=6&unit=1&shift=g&stn=8443970+Boston%2C+MA&type=Historic+Tide+Data&format=View+Data
Super storm Sandy Was a Wakeup Call for Many
How Did Sandy Measure Up?

BOSTON

NEW YORK

NOAA/NOS/CO-OPS
Preliminary Water Level (ft) vs. Predicted Plot
8443979 Boston, MA
From 2012/10/29 - 2012/10/30

NOAA/NOS/CO-OPS
Preliminary Water Level (ft) vs. Predicted Plot
8518750 Battery, NY
From 2012/10/29 - 2012/10/30

4.6ft

11' above MSL

9' higher than normal high tide.
Impact of Global Warming: 100 Year Storm and Sea Level Rise In Year 2100.

Data sources: Flooded area IPCC, ground elevations determined by LIDAR.
21 Of MWRA Coastal Sewer Facilities Are Within 15 Feet Of Mean Sea Level
Hurricane Sandy Impacts On NY/ NJ Water Utilities

- Many water utilities lost power due to lack of generators

- NYC water was safe to drink, but surrounding counties in NY and NJ had do not use advisories, or boil water notices

- Passaic Valley was forced to release billions of gallons of raw or partially treated sewage into New York Bay over several weeks
Benchmarks For Evaluating Facilities

- 100 year flood as determined by FEMA (current regulatory requirement).
- 100 year flood + 2.5ft (NYC DEP, BHA).

Additionally
- 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?

- Low – Facilities that only have flooding potential in one of the Hurricane Scenarios (Categories 1, 2, 3, and 4 as determined by the SLOSH model)
- Minimal – Facilities that have a very low likelihood of flooding
- Maximum – Facility that floods in a 100 year event
- High – Facilities that are within 1 foot of flooding in a 100 year event or essential facility that floods in a 100 year plus 2.5 ft event
- Moderate – Facilities that flood or are within 1 foot of flooding in a 100 year plus 2.5ft event

The table below shows the ranking, name, town, and risk level for various facilities:

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Name</th>
<th>Town</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chelsea Creek Screenhouse</td>
<td>Chelsea</td>
<td>Maximum</td>
</tr>
<tr>
<td>2</td>
<td>Braintree-Weymouth Pump Station</td>
<td>Quincy</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>South Boston CSEO Tunnel Ventilation Building</td>
<td>Boston</td>
<td>High</td>
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<tr>
<td>4</td>
<td>Squantum Pump Station</td>
<td>Quincy</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Pelletizing Plant</td>
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<td>High</td>
</tr>
<tr>
<td>6</td>
<td>Chelsea Creek Headworks</td>
<td>Chelsea</td>
<td>High</td>
</tr>
<tr>
<td>7</td>
<td>Somerville Marginal CSO Facility</td>
<td>Somerville</td>
<td>Moderate</td>
</tr>
<tr>
<td>8</td>
<td>Alford St Facility</td>
<td>Boston</td>
<td>Moderate</td>
</tr>
<tr>
<td>9</td>
<td>Mystic River Gatehouse</td>
<td>Somerville</td>
<td>Moderate</td>
</tr>
<tr>
<td>10</td>
<td>South Boston CSEO Pump Station</td>
<td>Boston</td>
<td>Moderate</td>
</tr>
<tr>
<td>11</td>
<td>Alewife Creek Pump Station</td>
<td>Somerville</td>
<td>Moderate</td>
</tr>
<tr>
<td>12</td>
<td>Charlestown Navy Yard Facility</td>
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<tr>
<td>13</td>
<td>Chelsea Facility</td>
<td>Chelsea</td>
<td>High</td>
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<tr>
<td>14</td>
<td>Chelsea Maintenance Facility</td>
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<tr>
<td>15</td>
<td>Houghs Neck Pump Station</td>
<td>Quincy</td>
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</tr>
<tr>
<td>16</td>
<td>Quincy Pump Station</td>
<td>Quincy</td>
<td>Moderate</td>
</tr>
<tr>
<td>17</td>
<td>Union Park Detention &amp; Treatment Facility</td>
<td>Cambridge</td>
<td>Moderate</td>
</tr>
<tr>
<td>18</td>
<td>Cottage Farm CSO Facility</td>
<td>Boston</td>
<td>Moderate</td>
</tr>
<tr>
<td>19</td>
<td>Caruso Pump Station</td>
<td>Boston</td>
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<td>20</td>
<td>Wiggins Pump Station</td>
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<tr>
<td>21</td>
<td>DeLauro Pump Station</td>
<td>Boston</td>
<td>Low</td>
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<tr>
<td>22</td>
<td>Columbus Park Headwork's</td>
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<tr>
<td>23</td>
<td>Somerville Sampling Building</td>
<td>Somerville</td>
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<tr>
<td>24</td>
<td>Prison Point CSO Facility</td>
<td>Cambridge</td>
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<tr>
<td>25</td>
<td>Hingham Pump Station</td>
<td>Hingham</td>
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<tr>
<td>26</td>
<td>Ward Street Headworks</td>
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<tr>
<td>27</td>
<td>Little Mystic Channel CSO Facility</td>
<td>Boston</td>
<td>Minimal</td>
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<tr>
<td>28</td>
<td>Intermediate Pump Station</td>
<td>Weymouth</td>
<td>Minimal</td>
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<tr>
<td>29</td>
<td>Deer Island</td>
<td>Winthrop</td>
<td>Minimal</td>
</tr>
<tr>
<td>30</td>
<td>Nut Island Headworks</td>
<td>Quincy</td>
<td>Minimal</td>
</tr>
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Facilities Impact Summary

- 6 Sewer Facilities Likely Affected by a 100 Year Event.
- 9 Sewer and 3 Administration Facilities Likely Affected by a 100 Year + 2.5 feet Event.
- 7 Sewer Facilities Likely Affected by Hurricane Only.
- 5 Sewer Facilities Very Unlikely to be Affected.
- No Water Facility At Risk of Service Disruption.
Chelsea Screenhouse - Vulnerabilities

Southwest Facility View

Backup Generator
Chelsea Administration & Maintenance Facilities
Flood Inundation

FEMA 100 Year Flood Elevation + 2.5ft
Chelsea Administration & Maintenance Facilities

FEMA 100 Year Flood Elevation

FEMA 100 Year Flood Elevation + 2.5ft
Past Practice

- Low-lying facilities are protected with sandbags and pumps.
- Mobile generators are deployed in advance of storms.
- Increased staffing
Going Forward

• Short-term
  – At-risk buildings may be fitted with temporary flood barriers.

• Long-term
  – Future rehabilitation contracts will take sea level rise into account.
  – Consider moving important equipment to higher elevations.
Evaluated Several Flood Barrier Options
Alewife Pumping Station
Proposed Modifications
Planning to Avoid Inundation
Created SOPs To Redeploy Staff And Equipment To Higher Ground

- Staff and equipment redeployed to pre-determined locations in advance of storms.
- Back-up water and wastewater operations control center created at Carroll Treatment Plant in Marlborough.
Climate Change and The Planning Process

- MWRA Master Plan update process puts issues on the table for senior management and the Board of Directors to grapple with.
- Climate change is treated as an extra dimension in the assessment of infrastructure reinvestment.
- Climate change is also an input for the vulnerability analysis for extreme events (such as hurricane preparedness exercises) which identifies infrastructure fixes to provide extra resiliency.
- Think about all aspects whenever a facility is being evaluated or upgraded: use the investment cycle
Two Pronged Approach to a Long Term Concern

• Adaptation:
  – Understand the Potential Impacts
  – Mitigate Impacts
  – Create Resiliency

• Mitigation:
  – Reduce Greenhouse Gases
  – Contribute to the Common Good
  – Reduce Costs
  – Improve Environmental Footprint
  – Improve Public Perception
MWRA’s total demand - 210,800,000 kWh of electricity and 493,250 therms of natural gas. 
Equivalent to 18,500 homes, similar to town the size of Arlington.

MWRA’s costs for natural gas, electricity and diesel fuel
- $15 M (8.4% of total direct expenses) in FY02
- $20 million (9.9% of budget) in FY11
Renewable Energy at MWRA
Renewable Energy at Deer Island

- Deer Island currently self-generates approximately 25% of its electricity needs and more than half of the Island’s energy demand is provided by on-site, renewable generation – with more to come.
- Avoids purchase of about 5MG in fuel oil annually
- Approximately 33 MkWh/yr electricity production

![Deer Island Treatment Plant Energy Improvements](image-url)
Hydroelectric Power

- Cosgrove, Oakdale, Loring Rd, Deer Island
- Over 8MW Capacity
- Approximately 23 MkWh/yr electricity production
- Over $1.8M/yr savings and revenue
Wind Power

- Deer Island, Charlestown (DeLauri Pump Station)
- 2.8 MW Capacity
- Over 5 MWh/yr electricity production
- Approximately $575,000/yr savings and revenue
Solar Power

- Deer Island, CWTP
- Over 1200 kW Capacity
- Over 1.4 MkWh/yr electricity production
- Approximately $242,000/yr savings and revenue
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Questions or Comments?

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