



Climate Resiliency at MWRA

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November 1, 2019



Changing Precipitation Quantity and Patterns

- Currently, we average 104 rain events per year with an average of 44 inches of rainfall
- Models suggest we'll see longer dry spells with shorter, heavier rain
- An overall modest increase in total rainfall
- Flooding during the January and March Nor'easters in 2018 impeded access to several MWRA facilities



No Longer A Theory: State Street, Boston – March 2018



AP/CityLab



Charlestown Navy Yard – March 2018





Eastern Avenue, Chelsea – March 2018





Shirley Street, Winthrop – March 2018





Nut Island, Quincy – March 2018





Preparing for Climate Change: Drinking Water System Is In Good Shape

- Quabbin Reservoir, Belchertown
 - 65 miles west of Boston
 - Elevation 528 feet
- Wachusett Reservoir, Clinton
 - 35 miles west of Boston
 - Elevation 395 feet
- Water treatment plant is in Marlborough
- 85% of water delivered by gravity
- Lowest elevation of a water tank is 192 feet above sea level





Significant Investment in Dams

- All MWRA dams, dikes, spillways and appurtenances are inspected routinely by licensed dam safety engineers and are in good condition
- MWRA has spent over \$22 million on dam safety projects
- Quabbin and Wachusett spillways have been improved to be able to discharge the probable maximum flood



Quabbin Spillway Rehab





Wachusett Spillway





Wachusett Crest Gate





Adaptation for Sea Level Rise In The Design of Deer Island Treatment Plant

- Deer Island plant fully protected
 - 100-year flood
 - 1.9-foot (0.6 meter) sea level rise
 - Wave run-up of 14 feet (4.3 meters) on east side and 2 feet (0.6 meter) on west side
 - Nut Island headworks in Quincy similarly designed for sea level rise





Deer Island On-Site Power Plant

- On-site power plant ensures uninterrupted power supply to keep the plant operating for up to 90 days





A Rising Sea Would Impact the Hydraulics of the Deer Island Outfall Tunnel

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





MWRA Coastal Facilities





MWRA's Chelsea Facility

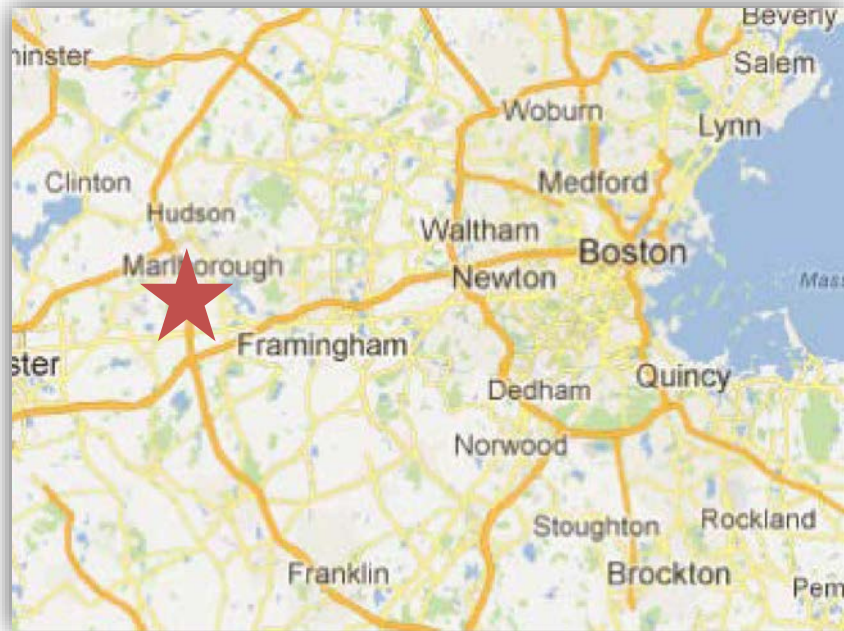
- Most of our staff and equipment is at our Chelsea Facility off of Eastern Avenue, across from the Chelsea Creek





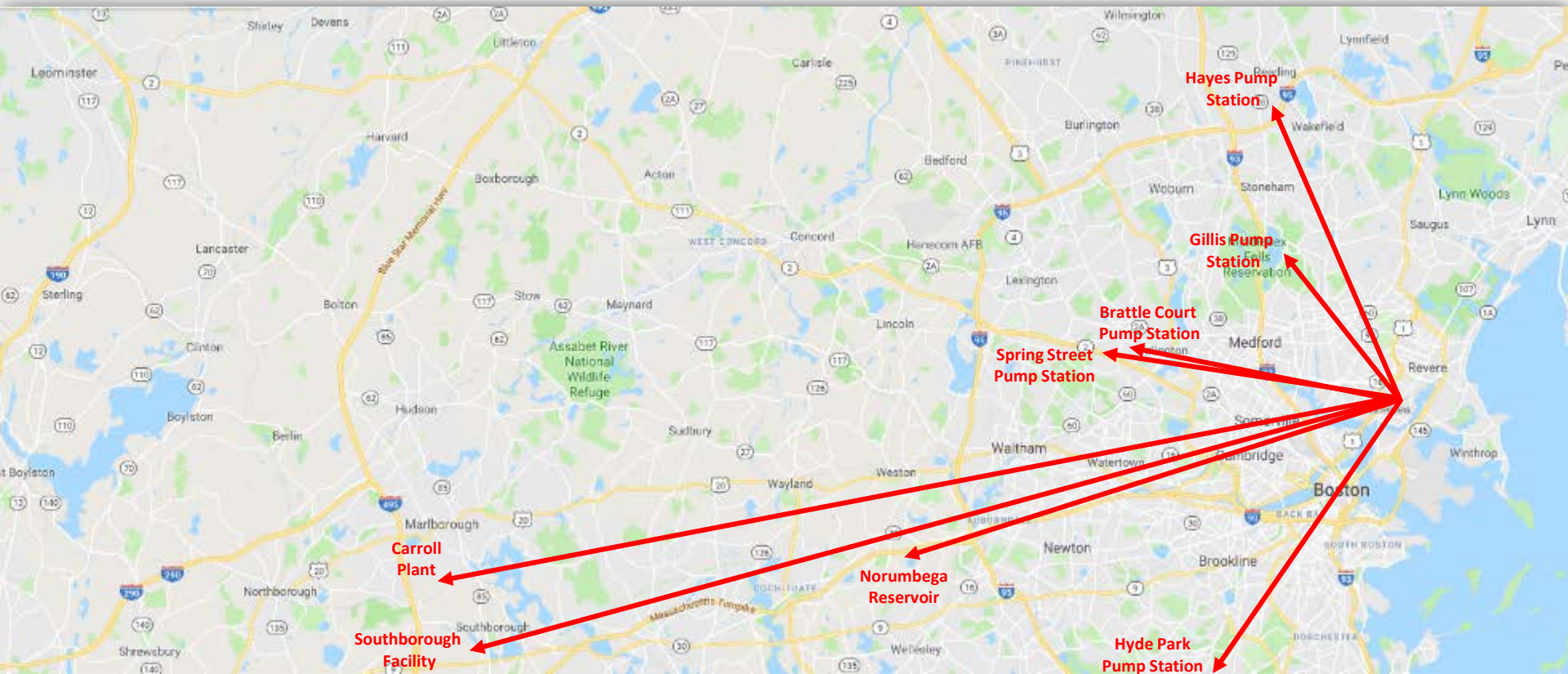
Plans in Place to Pre-deploy Staff to Higher Ground

- Back-up water and wastewater operations control center created at Carroll Treatment Plant in Marlborough





Plans to Pre-deploy Staff and Equipment to Higher Ground





Benchmarks For Evaluating Facilities

- 100 year flood as determined by FEMA
- 100 year flood + 2.5 feet (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



MWRA's Approach

- Short-term
 - At-risk buildings are being fitted with temporary flood barriers
 - Expanding fuel storage at wastewater stations
- Long-term
 - Facility rehabilitation on a 20-year cycle
 - Future rehabilitation contracts will include protection measures
- May have to speed things up



Flood Elevations At Chelsea Creek



Southwest Facility View



Backup Generator



Flood Elevations At Chelsea Creek Headworks





New Flood Control Measures Are Being Added





Chelsea Headworks



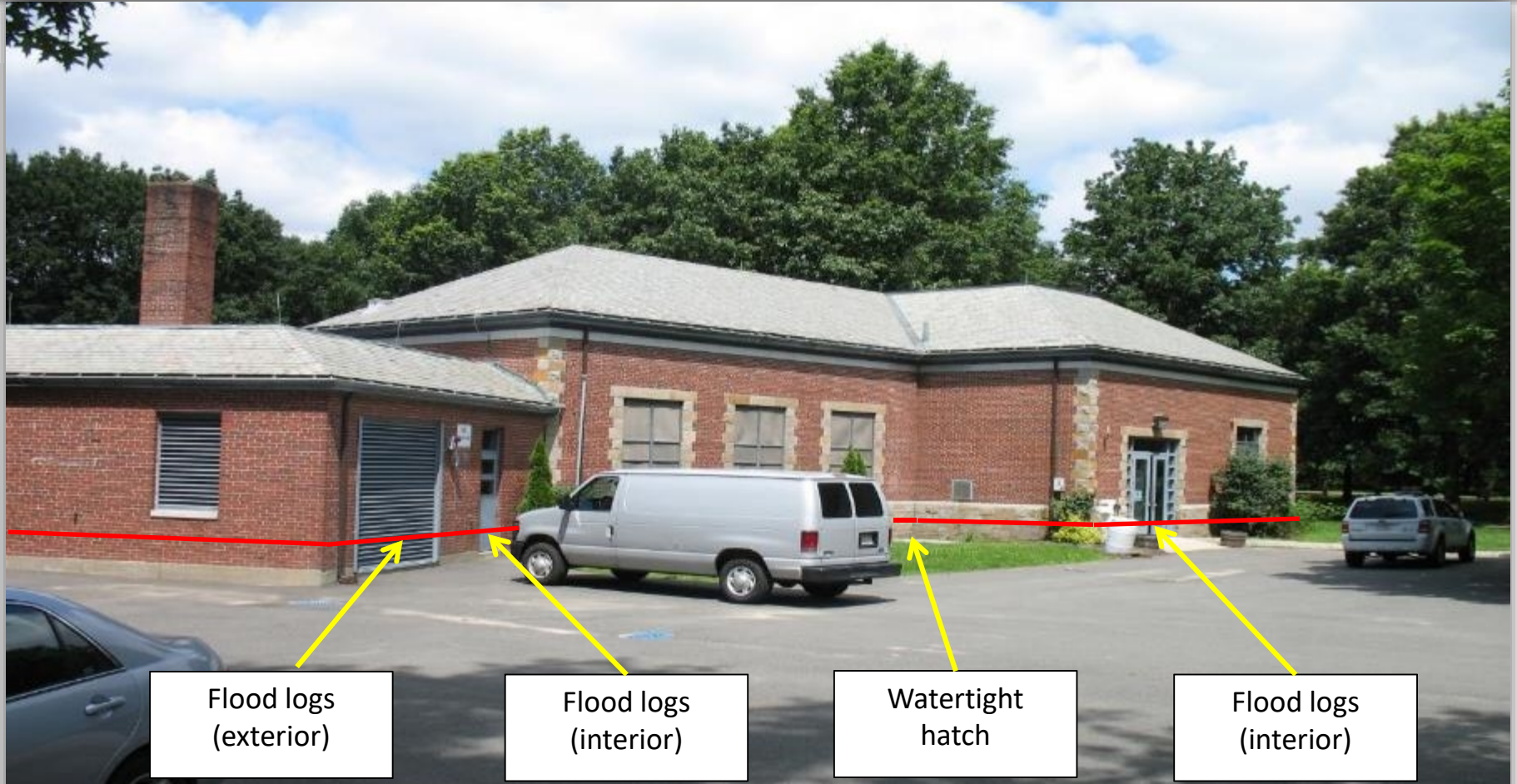


Chelsea Headworks





Alewife Brook Pump Station



Flood logs
(exterior)

Flood logs
(interior)

Watertight
hatch

Flood logs
(interior)



Alewife Brook Pump Station





Alewife Brook Pump Station





Infiltration and Inflow Funding for Member Communities

- 191 miles of sewer Cured-In-Place Pipe liner installed
- 160 miles of sewer replaced
- 6,804 manholes rehabilitated/sealed





Coordinating With Other Agencies to Learn and Share

- Metro Mayors Coalition
- EEA Municipal Vulnerability Preparedness Program
- City of Boston
- Mystic River Watershed Association
- Boston Harbor Now



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