MWRA Wastewater Advisory Committee

BWSC's Climate Change Strategies

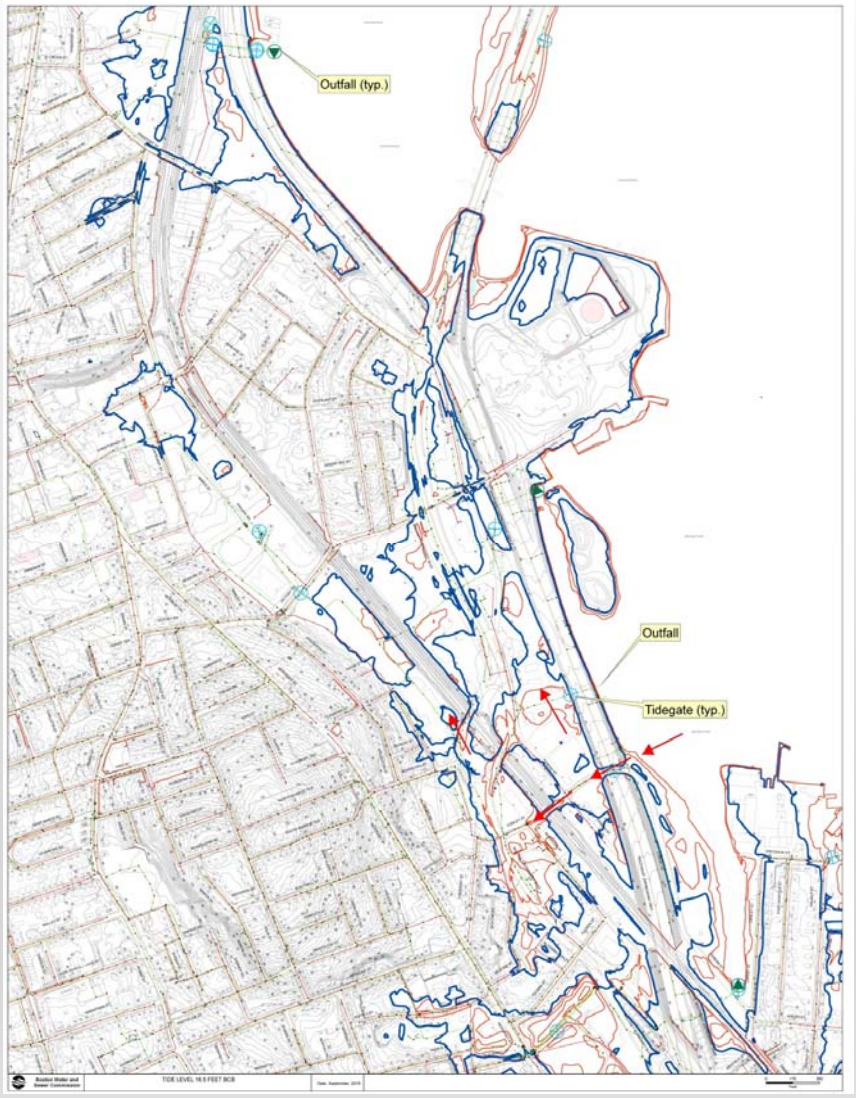
May 7, 2021

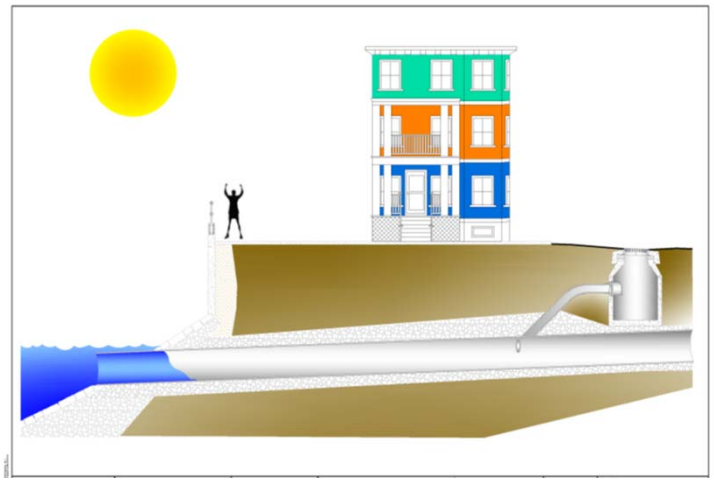
Charlie Jewell
Director of Planning and Sustainability

BWSC Collection System

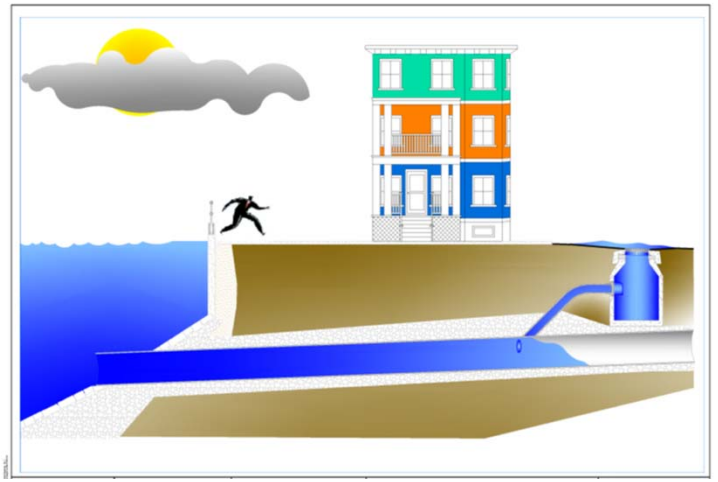
- 1,536 miles of sewer and drain pipes
- (156 miles combined, 710 miles sanitary, 670 miles storm drain)
- Sewers range from 8 inch to 108 inch
- Drains range from 12 inch to 240 x 186 inch
- 9 pump stations
- 586 outfalls total
- 201 tidegates
- 50,605 manholes

Outfall Screening

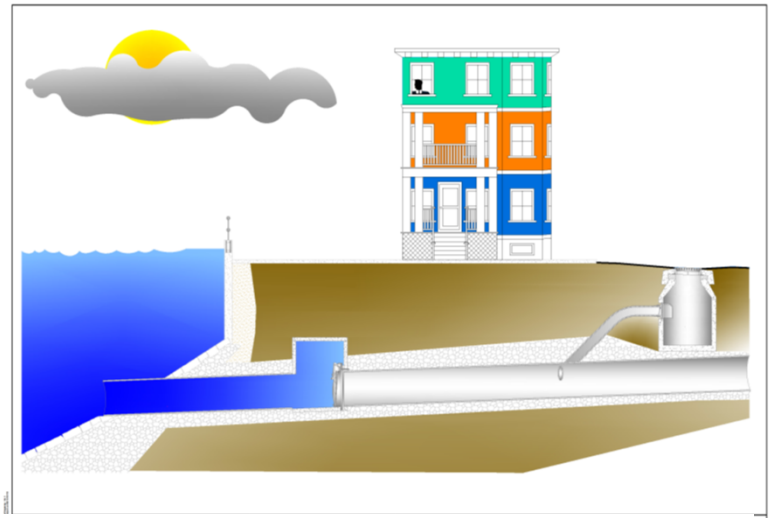




Storm Drain Outfall at Low Tide



Storm Drain Outfall at High Tide without Tide Gate



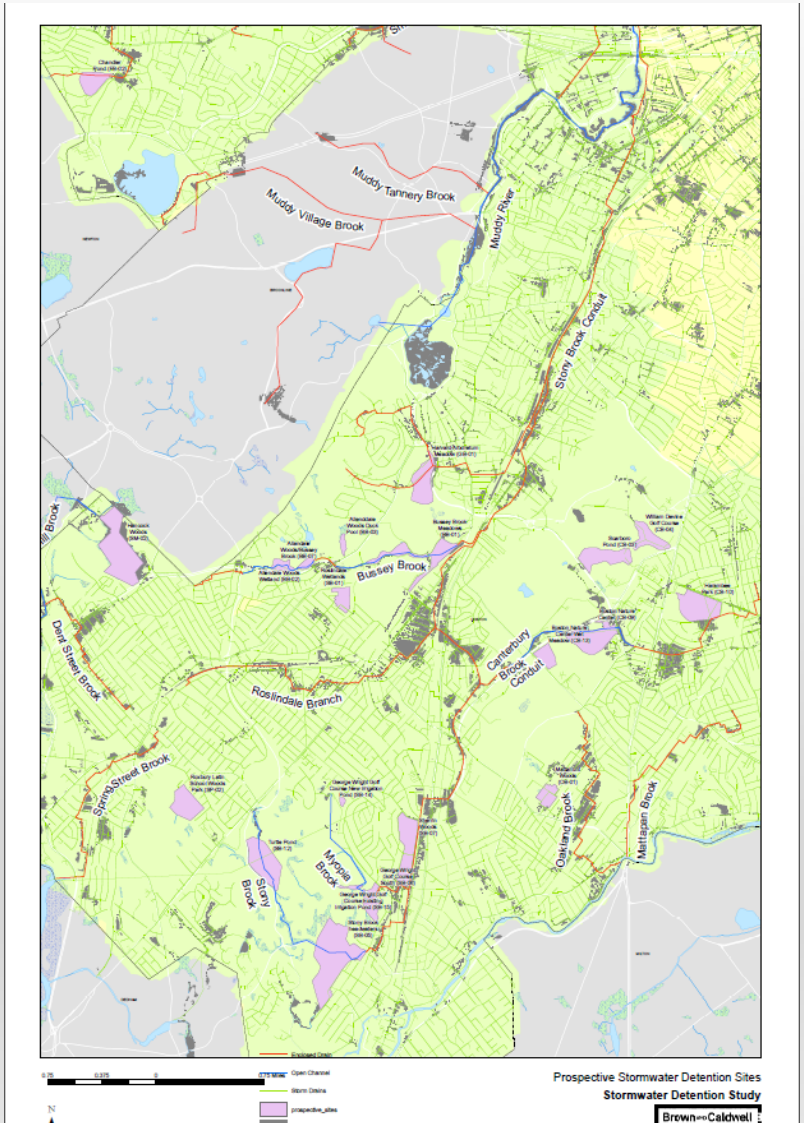
Storm Drain Outfall at High Tide with Tide Gate

NEW TIDE GATES
MT. WASHINGTON AVE

Outfall Inventory – 586 – Commission GIS

- BPRD – 5
- BWSC - 271
- CAT - 1
- DCR - 53
- DOT - 27
- MBTA - 1
- MHD - 29
- Milton - 1
- MPA - 11
- MWRA - 15
- Private - 172

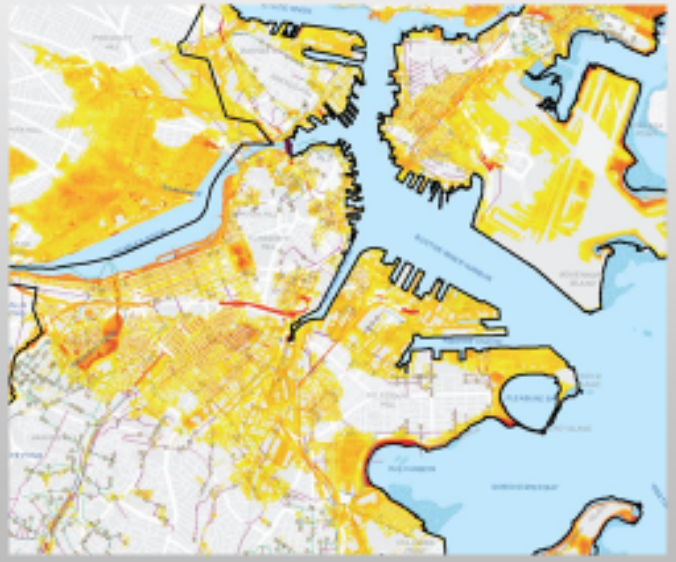
Stormwater Detention

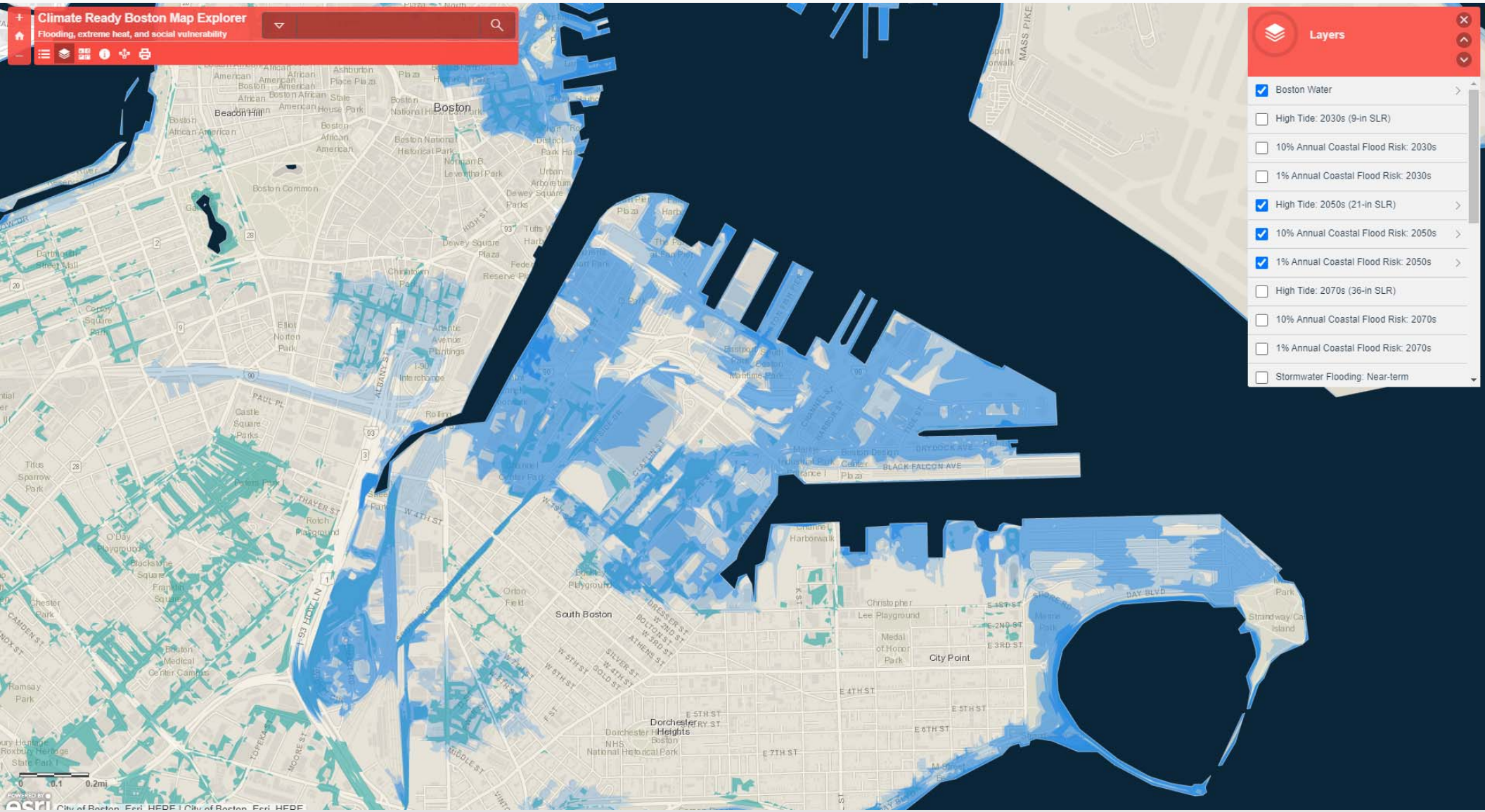


CHALLENGE:
RISKS OF FLOODING WITH SEA LEVEL RISE AND STORM SURGE – YEAR 2060

YEAR 2060 RAIN
SEA LEVEL RISE, NO STORM SURGE

YEAR 2060 RAIN
SEA LEVEL RISE, WITH STORM SURGE




Climate Ready Boston Map Explorer
Flooding, extreme heat, and social vulnerability
Layers
Boston Water
High Tide: 2030s (9-in SLR)
10% Annual Coastal Flood Risk: 2030s
1% Annual Coastal Flood Risk: 2030s
High Tide: 2050s (21-in SLR)
10% Annual Coastal Flood Risk: 2050s
1% Annual Coastal Flood Risk: 2050s
High Tide: 2070s (36-in SLR)
10% Annual Coastal Flood Risk: 2070s
1% Annual Coastal Flood Risk: 2070s
Stormwater Flooding: Near-term
Boston
Beacon Hill
South Boston
City Point
Dorchester Heights
0 0.1 0.2mi

Inundation Model - Project Overview

1. Develop 2D model that will estimate and graphically display inundation information using most current projections available.
2. Model will allow identification of land area, buildings and roads impacted by major events.
3. Model can be used as an early warning tool to pre-evacuate potentially impacted areas.
4. Estimate the projected depth and duration of inundation
5. Estimate potential population impacted
6. Identify critical facilities impacted by inundation
7. Utilize model as a collaboration tool with other agencies with data available and accepted by other entities
8. Have the information Peer Reviewed by outside entity.

2030 Storms

GARR September 9th,1999, w/ 2030 SLR

GARR June 12th,1998, w/ 2030 SLR

GARR August 2nd, 2017, w/ 2030 SLR

Airmass 2-year w/ 2030 SLR

Airmass 10-year w/ 2030 SLR

Frontal 10-year w/ 2030 SLR

Tropical 10-year w/ 2030 SLR

Frontal 50-year w/ 2030 SLR

Nor'easter 10-year w/ 2030 SLR

Nor'easter 50-year w/ 2030 SLR

Nor'easter 50-year w/ 2030 SLR + 100-year storm surge

Tropical 100-year w/ 2030 SLR +100-year storm surge

Nor'easter 100-year w/ 2030 SLR + 100-year storm surge

Tropical 500-year w/ 2030 SLR + 500-year storm surge

2070 Storms

GARR September 9th,1999, w/ 2070 SLR

GARR June 12th,1998, w/ 2070 SLR

GARR August 2nd, 2017 w/ 2070 SLR

Airmass 2-year w/ 2070 SLR

Airmass 10-year w/ 2070 SLR

Frontal 10-year w/ 2070 SLR

Tropical 10-year w/ 2070 SLR

Frontal 50-year w/ 2070 SLR

Nor'easter 50-year w/ 2070 SLR + 100-year storm surge

Nor'easter 100-year w/ 2070 SLR + 500-year storm surge

Tropical 100-year w/ 2070 SLR +100-year storm surge

Tropical 500-year w/ 2070 SLR + 500-year storm surge

GARR – Gauge-Adjusted Radar Rainfall
Airmass – summer thunderstorm
Frontal Storms – advancing warm or cold airmasses
Tropical – Hurricanes
Nor'easters – Nor'easters

Baseline Simulations Completed

Model Scenario	Dur. (hr)	Depth (in)	Return Period (yr)	Speed (mph)	Dominant Azimuth°	Coastal Boundary Condition #1	Coastal Boundary Condition #2	Hyetograph Shape
1) Airmass	6	1.83	2	25.0	66.0°	2030 SLR	2070 SLR	
2) Airmass	6	3.20	10	25.0	66.0°	2030 SLR	2070 SLR	
3) Nor'easter	48	5.84	10	21.1	270.0°	2030 SLR	2070 SLR	
4) Nor'easter	48	8.46	50	21.1	270.0°	2030 SLR	100-year storm surge + 2070 SLR	
5) Nor'easter	48	9.58	100	21.1	270.0°	100-year storm surge + 2030 SLR	500-year storm surge + 2070 SLR	
6) Frontal	72	6.34	10	26.4	56.3°	2030 SLR	2070 SLR	
7) Frontal	72	9.15	50	26.4	56.3°	2070 SLR	2070 SLR	
8) Tropical	48	5.84	10	24.8	270.0°	2030 SLR	2070 SLR	
9) Tropical	48	9.58	100	24.8	270.0°	100-year storm surge + 2030 SLR	100-year storm surge + 2070 SLR	
10) Tropical	48	13.9	500	24.8	270.0°	500-year storm surge + 2030 SLR	500-year storm surge + 2070 SLR	
11) August 2, 2017	9	3.44	200[2]	N/A[1]	N/A[1]	2030 SLR	2070 SLR	
12) June 12, 1998	43	6.77	10	N/A[1]	N/A[1]	2030 SLR	2070 SLR	
13) September 10, 1999	17	4.7	10	N/A[1]	N/A[1]	2030 SLR	2070 SLR	

- Stalled hurricane (like Dorian) also simulated
- Testing to assess Fort Point Channel resiliency options also completed

Model Scenarios

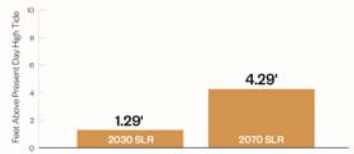
www.bwscstormviewer.com

Thunderstorm

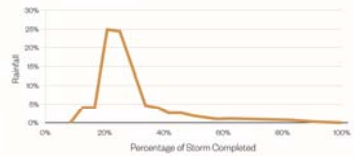
Storm Motion

Storm Direction: **66.0 degrees | Northeast**
Speed: **25 miles per hour**

Sea Level Rise (SLR)



Storm Accumulation

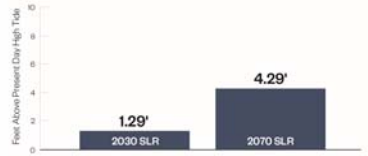


Frontal

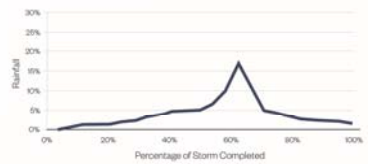
Storm Motion

Storm Direction: **56.3 degrees | Northeast**
Speed: **26.4 miles per hour**

Sea Level Rise (SLR)



Storm Accumulation

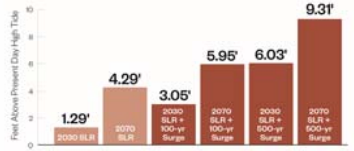


Tropical

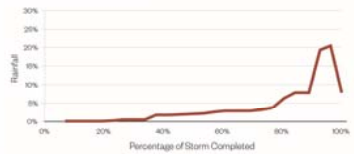
Storm Motion

Storm Direction: **270.0 Degrees | West**
Speed: **24.8 miles per hour**

Sea Level Rise (SLR) and Storm Surge



Storm Accumulation

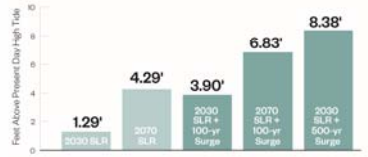


Nor'easter

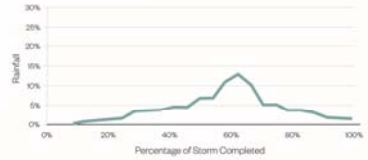
Storm Motion

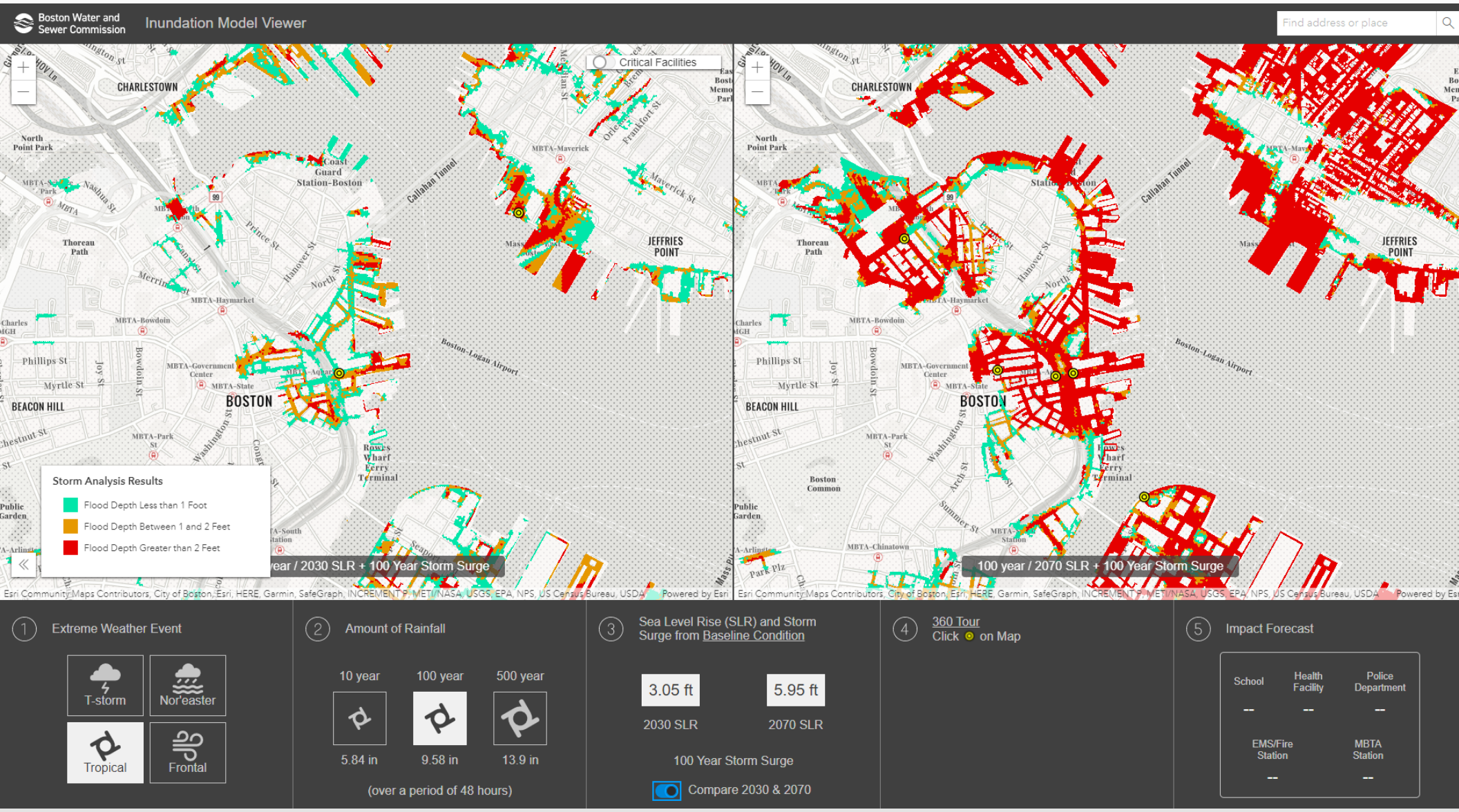
Storm Direction: **270.0 Degrees | West**
Speed: **21.1 miles per hour**

Sea Level Rise (SLR) and Storm Surge



Storm Accumulation





1 Extreme Weather Event

T-storm | Nor'easter | Tropical | Frontal

2 Amount of Rainfall

10 year	100 year	500 year
5.84 in	9.58 in	13.9 in

(over a period of 48 hours)

3 Sea Level Rise (SLR) and Storm Surge from Baseline Condition

3.05 ft	5.95 ft
2030 SLR	2070 SLR

100 Year Storm Surge

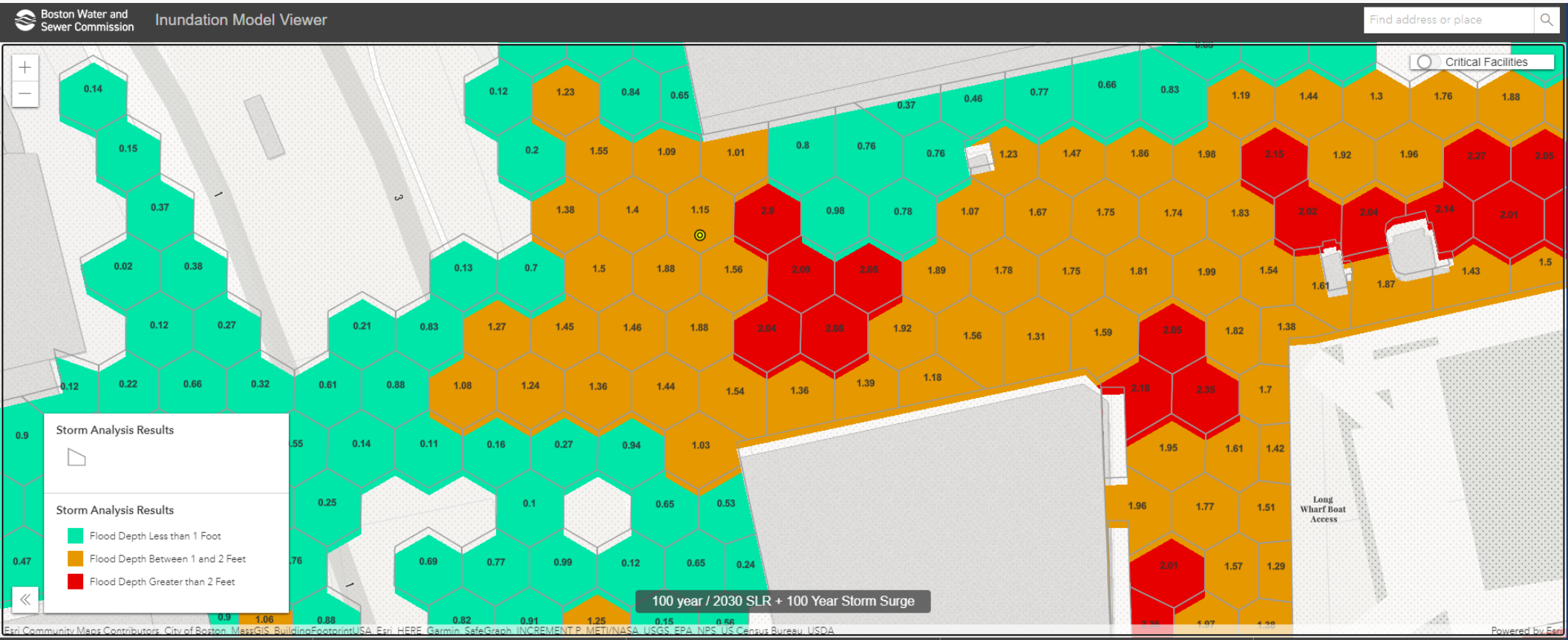
Compare 2030 & 2070

4 360 Tour
Click on Map

5 Impact Forecast

School	Health Facility	Police Department
--	--	--

EMS/Fire Station	MBTA Station
--	--



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3.05 ft	5.95 ft
2030 SLR	2070 SLR

100 Year Storm Surge

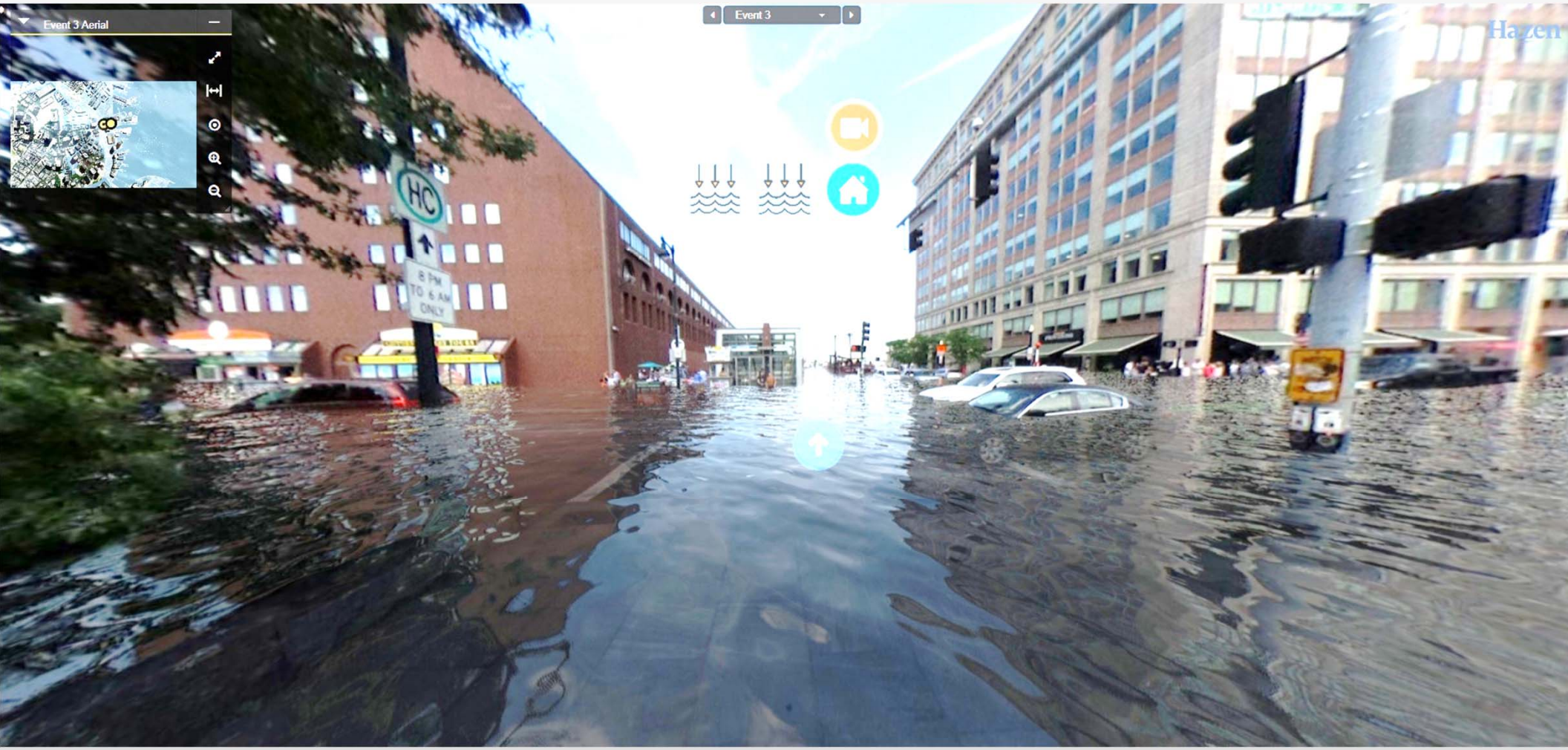
Compare 2030 & 2070

4 360 Tour
Click on Map

5 Impact Forecast

School	Health Facility	Police Department
45	28	8

EMS/Fire Station	MBTA Station
13	18


Event 3 Aerial
Event 3
Hazen
HC
6 PM
TO 6 AM
ONLY

Inundation Overview

Sea Level Rise
- 2030
- 2070

Neighborhood: All

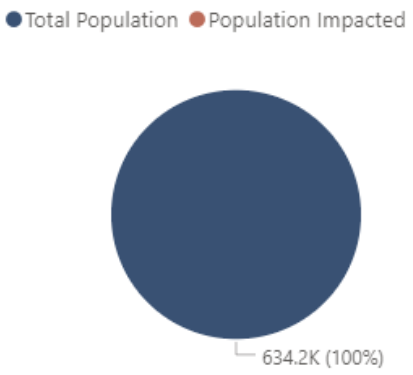
Critical Facility Type: All

Hazen

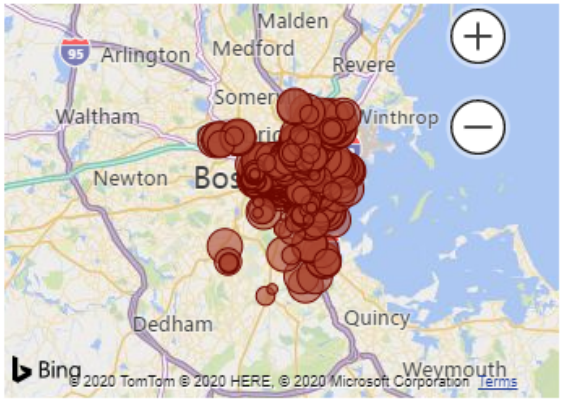
Storm Summary

Storm	Population Impacted	Critical Facilities Impacted	Cumulative Facilities Risk Level
August 2017 Event (2030 SLR)	19,749	38	1113
August 2017 Event (2070 SLR)	56,695	115	8658
Frontal (10-yr w/ 2030 SLR)	6,666	25	1321
Frontal (10-yr w/ 2070 SLR)	45,861	106	8944
Frontal (50-yr w/ 2030 SLR)	11,327	32	1482
Frontal (50-yr w/ 2070 SLR)	50,138	113	9205
Hurricane Dorian	24,221	64	1904
June 1998 Event (2030 SLR)	60,841	170	4876
June 1998 Event (2070 SLR)	90,832	232	13070
Nor'easter (100-yr w/ 2030 SLR & 100-yr surge)	41,392	101	6589
Nor'easter (100-yr w/ 2070 SLR & 500-yr surge)	140,387	322	34542
Nor'easter (10-yr w/ 2030 SLR)	5,422	16	974
Nor'easter (10-yr w/ 2070 SLR)	45,772	105	8899
Nor'easter (50-yr w/ 2030 SLR & 100-yr surge)	38,708	96	6405
Nor'easter (50-yr w/ 2030 SLR)	11,069	29	1429
Nor'easter (50-yr w/ 2070 SLR & 100-yr surge)	128,242	273	25459
Nor'easter (50-yr w/ 2070 SLR)	45,021	104	8601
September 1999 Event (2030 SLR)	28,546	66	1919
September 1999 Event (2070 SLR)	65,041	137	9438
Thunderstorm (10-yr w/ 2030 SLR)	72,053	179	5673
Thunderstorm (10-yr w/ 2070 SLR)	100,707	239	12966
Thunderstorm (2-yr w/ 2030 SLR)	20,848	68	1812
Thunderstorm (2-yr w/ 2070 SLR)	54,673	143	9235
Tropical (100-yr w/ 2030 SLR & 100-yr surge)	39,121	121	4992
Tropical (100-yr w/ 2070 SLR & 100-yr surge)	80,989	196	17332
Tropical (10-yr w/ 2030 SLR & 10-yr surge)	7,483	23	849
Tropical (10-yr w/ 2070 SLR & 10-yr surge)	50,097	117	9395
Tropical (500-yr w/ 2030 SLR & 500-yr surge)	105,138	254	19897

Population Impacted

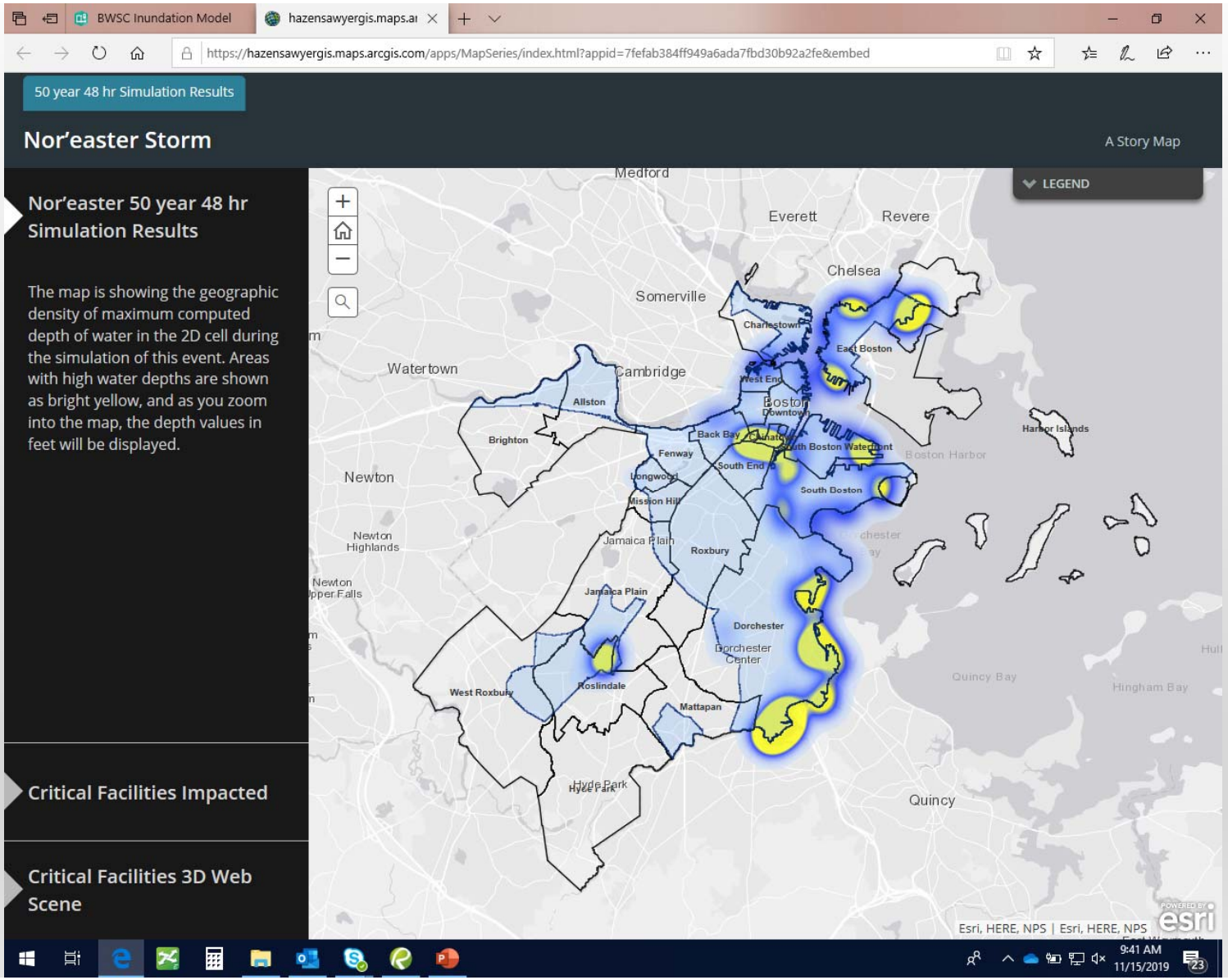


Critical Facilities Mapping



Critical Facility Impacts

Critical Facility	Max Duration (hrs)	Max Depth (ft)	Avg Depth (ft)	Risk Level
Emergency Ctr	**80.7**	**16.0**	**3.0**	**4**
Boston Public Library	34.5	3.4	1.5	4
Charlestown Community Center	12.2	6.7	1.5	4
Condon Community Center	33.8	6.4	1.9	4
Curley Community Center	68.2	16.0	3.9	4
Grove Hall Community Center	3.5	0.5	0.2	2
Harborside Community Center - Umana Barnes	80.7	14.2	2.8	4
Kent Community Center	66.8	6.8	1.4	4
Leahy-Holloran Community Center	65.7	10.6	2.5	4
Orchard Gardens Community Center	3.5	1.0	0.1	3
Paris Street Community Center	67.8	10.0	2.3	4
The Hurley School	33.2	12.3	2.7	4
Total	**86.7**	**30.0**	**2.4**	**4**


BWSC Inundation Model
hazensawyergis.maps.ar
https://hazensawyergis.maps.arcgis.com/apps/MapSeries/index.html?appid=7fefab384ff949a6ada7fbd30b92a2fe&embed
50 year 48 hr Simulation Results
Nor'easter Storm
A Story Map
Nor'easter 50 year 48 hr Simulation Results
The map is showing the geographic density of maximum computed depth of water in the 2D cell during the simulation of this event. Areas with high water depths are shown as bright yellow, and as you zoom into the map, the depth values in feet will be displayed.
Critical Facilities Impacted
Critical Facilities 3D Web Scene
LEGEND
Medford
Everett
Revere
Chelsea
Somerville
Charlestown
East Boston
Watertown
Cambridge
West End
Boston
Downtown
Allston
Brighton
Back Bay
Fenway
South Boston Waterfront
Harbor Islands
Boston Harbor
South End
Longwood
South Boston
Mission Hill
Newton
Newton Highlands
Jamaica Plain
Roxbury
Newton Upper Falls
Dorchester
Dorchester Center
Roslindale
West Roxbury
Mattapan
Quincy Bay
Hingham Bay
Hyde Park
Quincy
Esri, HERE, NPS | Esri, HERE, NPS
9:41 AM
11/15/2019

Climate Ready Boston – Coastal Barriers

- East Boston
- Charlestown
- Seaport
- Fort Point Channel
- Dorchester

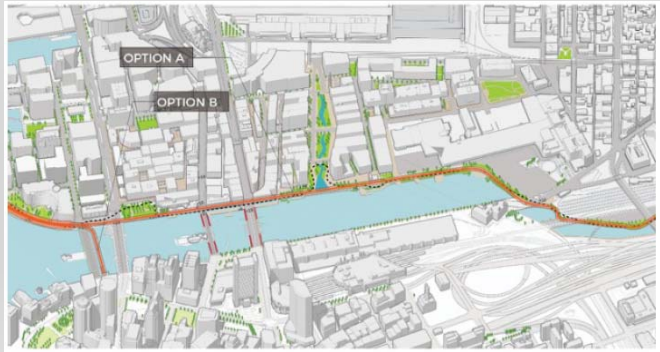


Figure 11 Coastal Resilience Alignment Options for Fort Point Channel (Source: *Coastal Resilience Solutions for South Boston* (2018))

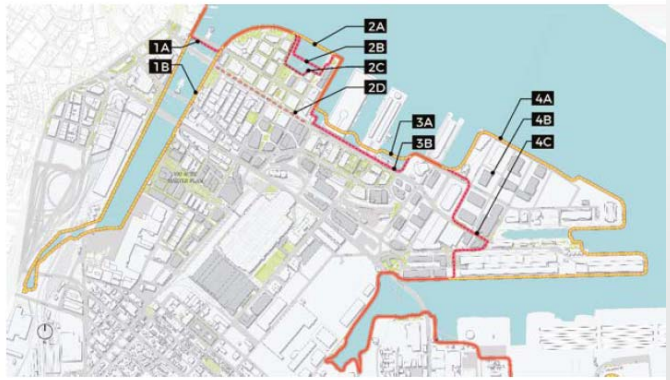
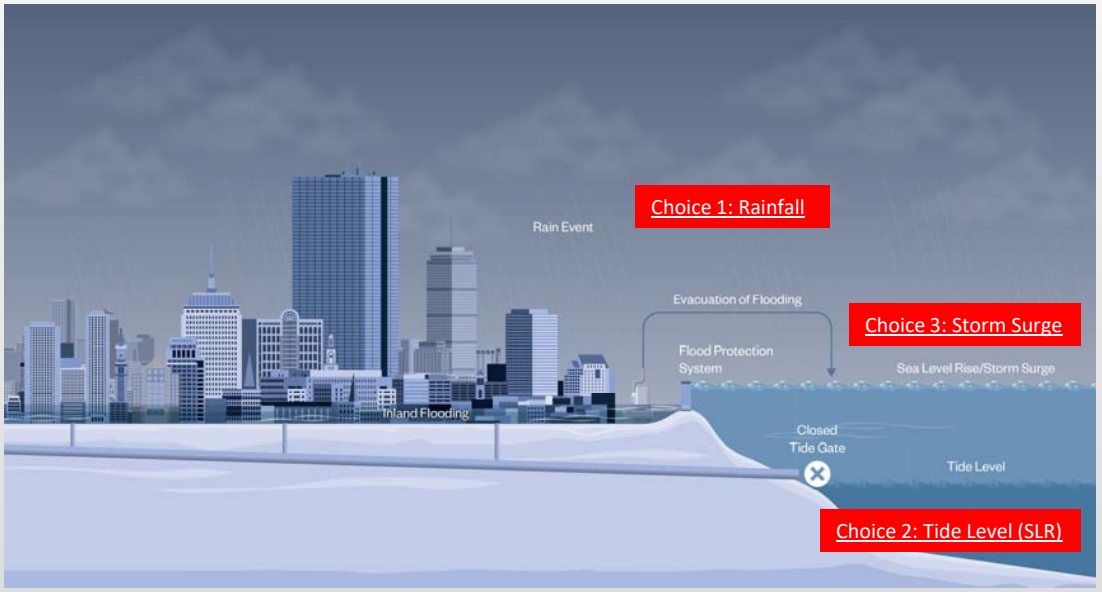


Figure 6 Alignment options presented in *Coastal Resilience Solutions for South Boston* (Source: *Coastal Resilience Solutions for South Boston* (2018))

Figure 14 - Coastal Resilience Alignment Options for Seaport Boulevard (Source: *Coastal Resilience Solutions for South Boston* (2018))

Coastal Stormwater Discharge Analysis - Project Objectives

- Identify BWSC infrastructure impacted by:
  - Sea level rise
  - Storm surge
  - Other adaptations (like Climate Ready Boston)
- Develop conceptual designs to ensure reliable stormwater discharge
  - Designs may include holistic "strategies"



Need to evaluate performance considering:

1 & 2: Rainfall and Sea Level Rise ("routine" conditions)

3: Storm surge (nor'easter or tropical event)

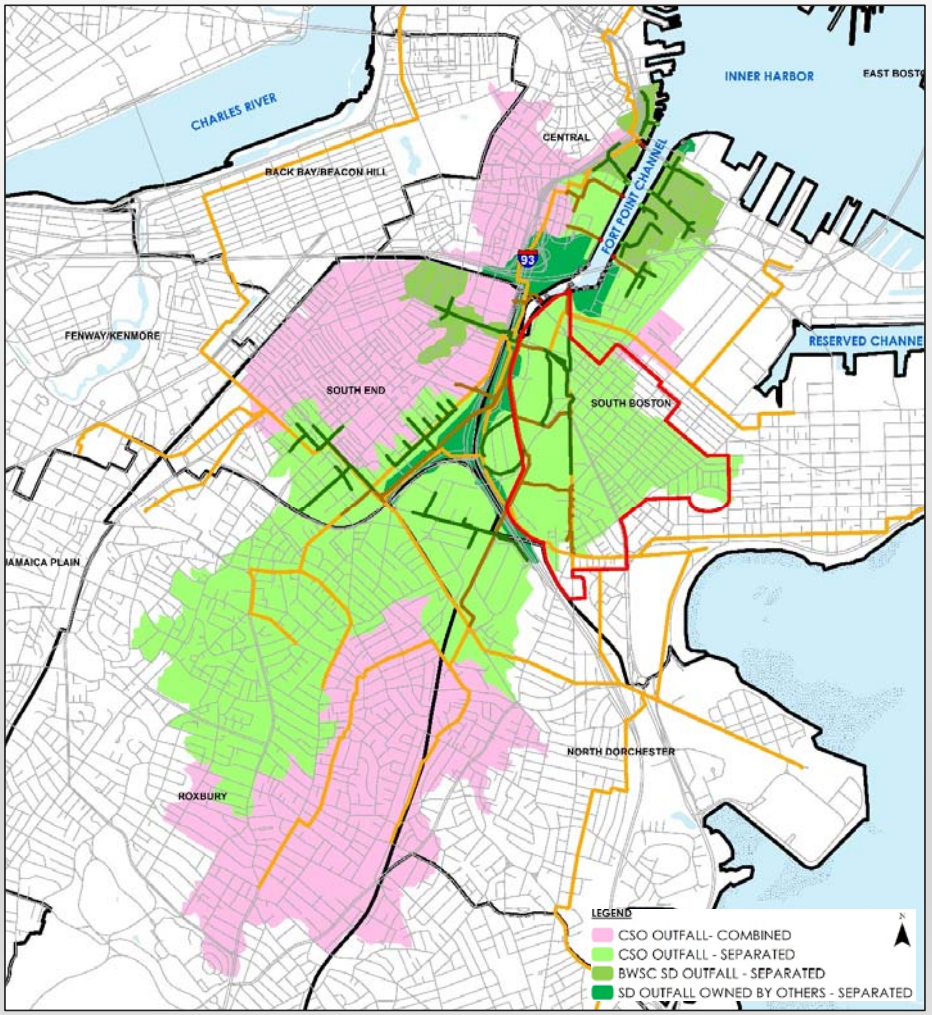
Protect BWSC's core function: stormwater discharge

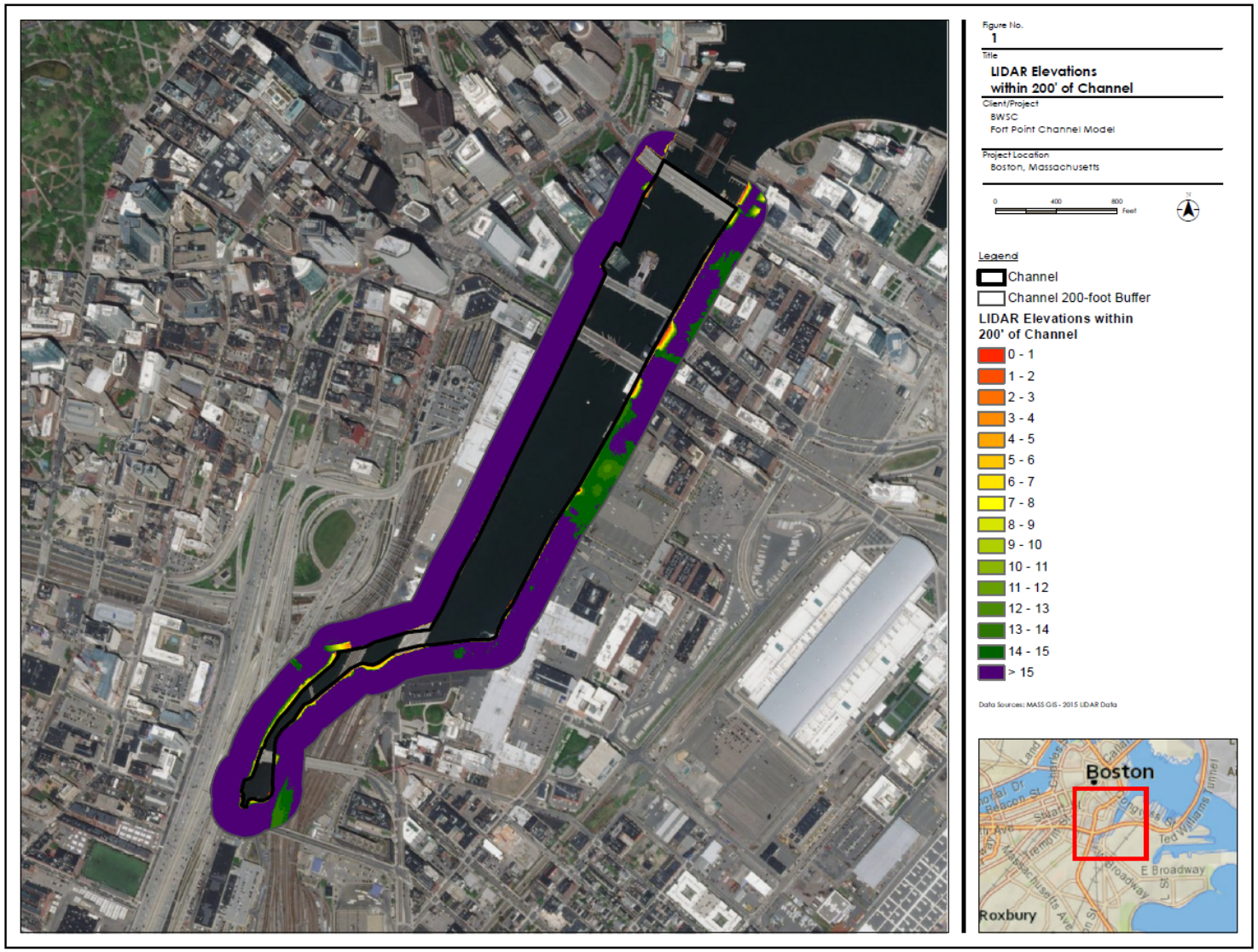
FPC Tributary Area – 2030

9% of Boston falls within FPC Watershed

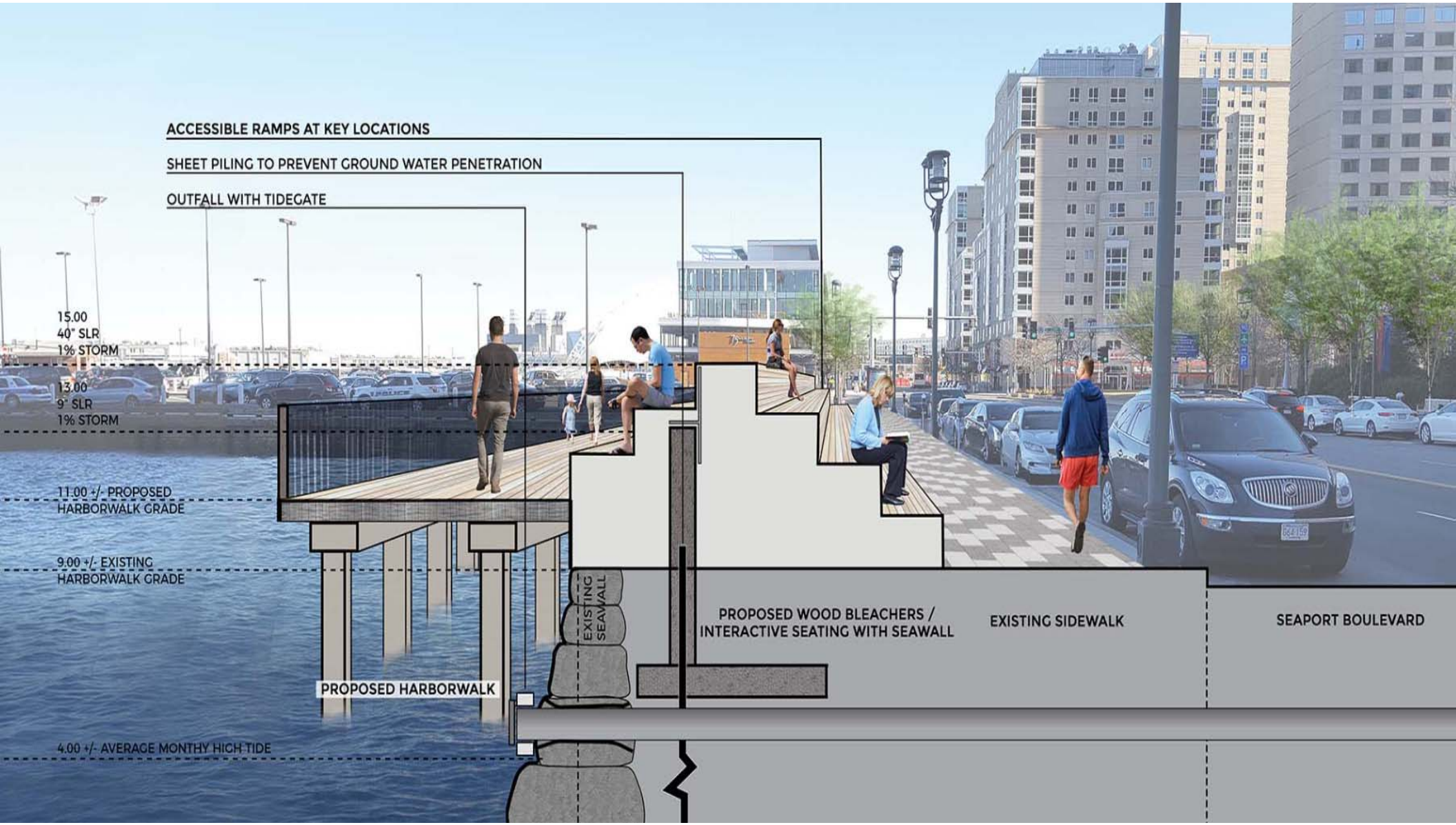
Tributary Areas:

Combined Areas	1,232
Separated Areas	1,674
Total Area	**2,906**

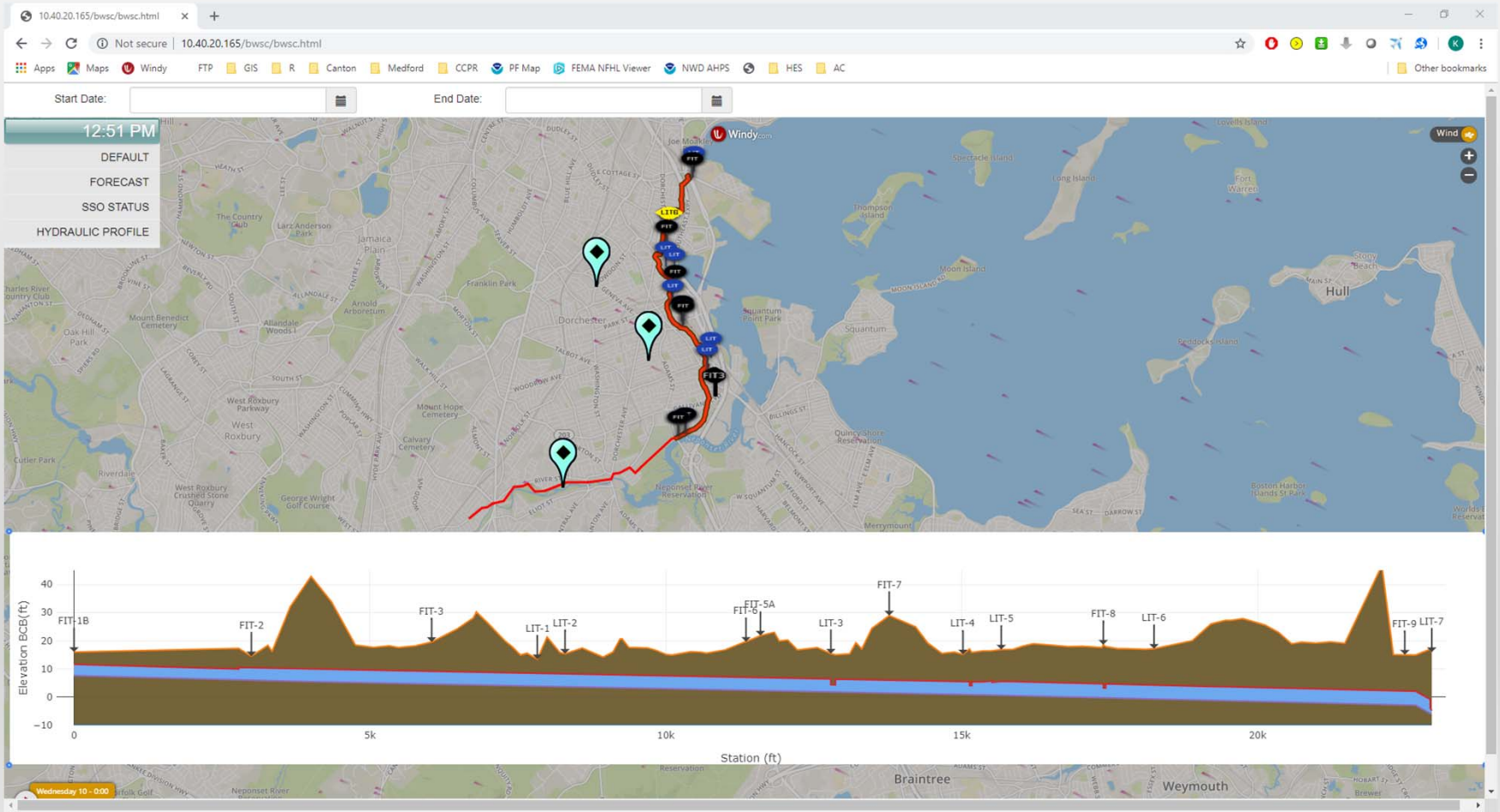




Fort Point Channel

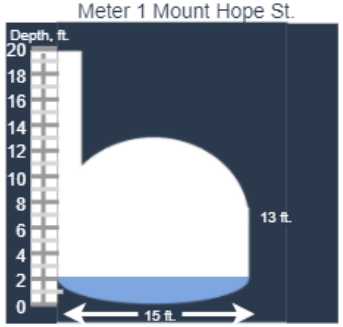

ACCESSIBLE RAMPS AT KEY LOCATIONS
SHEET PILING TO PREVENT GROUND WATER PENETRATION
OUTFALL WITH TIDEGATE
15.00
40" SLR
1% STORM
13.00
9" SLR
1% STORM
11.00 +/- PROPOSED
HARBORWALK GRADE
9.00 +/- EXISTING
HARBORWALK GRADE
4.00 +/- AVERAGE MONTHY HIGH TIDE
PROPOSED HARBORWALK
EXISTING SEAWALL
PROPOSED WOOD BLEACHERS /
INTERACTIVE SEATING WITH SEAWALL
EXISTING SIDEWALK
SEAPORT BOULEVARD

Smart Sewers

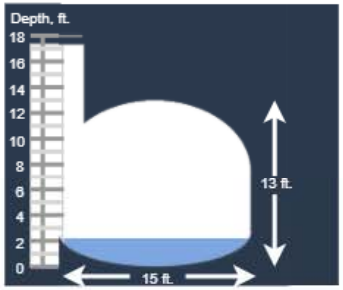


Boston Stony Brook Map Overview

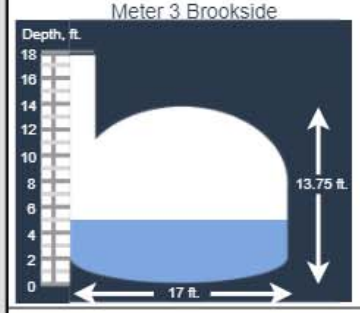
Meter 1 Mount Hope St.



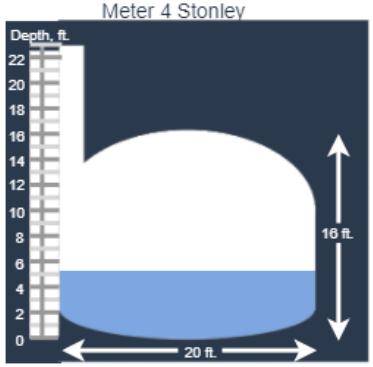
Meter 2 Catherine St.



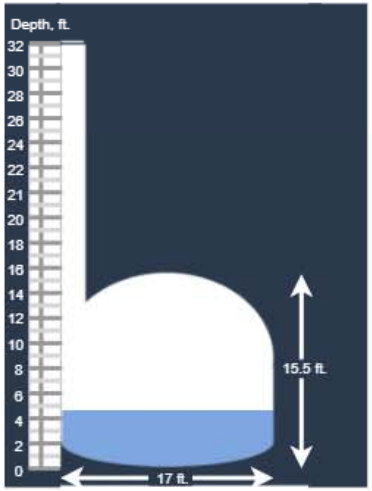
Meter 3 Brookside



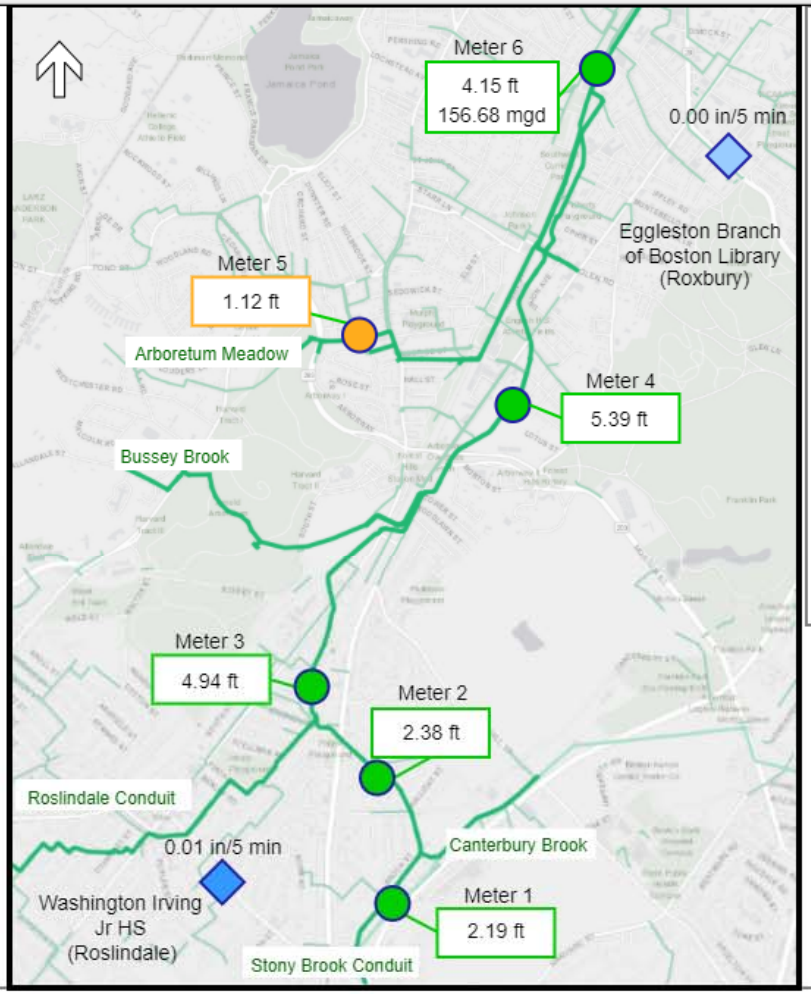
Meter 4 Stonley



Meter 6 Marbury Terrace



Note: Drawings are not to scale



Legend

Reset Zoom

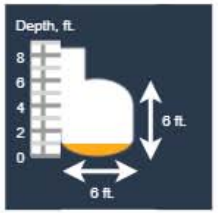
Level Monitoring Data

- No Data
- < 80 % Capacity
- > 80 % Capacity or < 8 ft. freeboard
- Surcharged

Rainfall Accumulation

- No Data
- 0 in
- 0.01-0.5 in
- 0.5-1.0 in
- > 1.0 in

Meter 5 St Joseph and Woodman



2020-08-22 11:30

2020-08-24 11:30

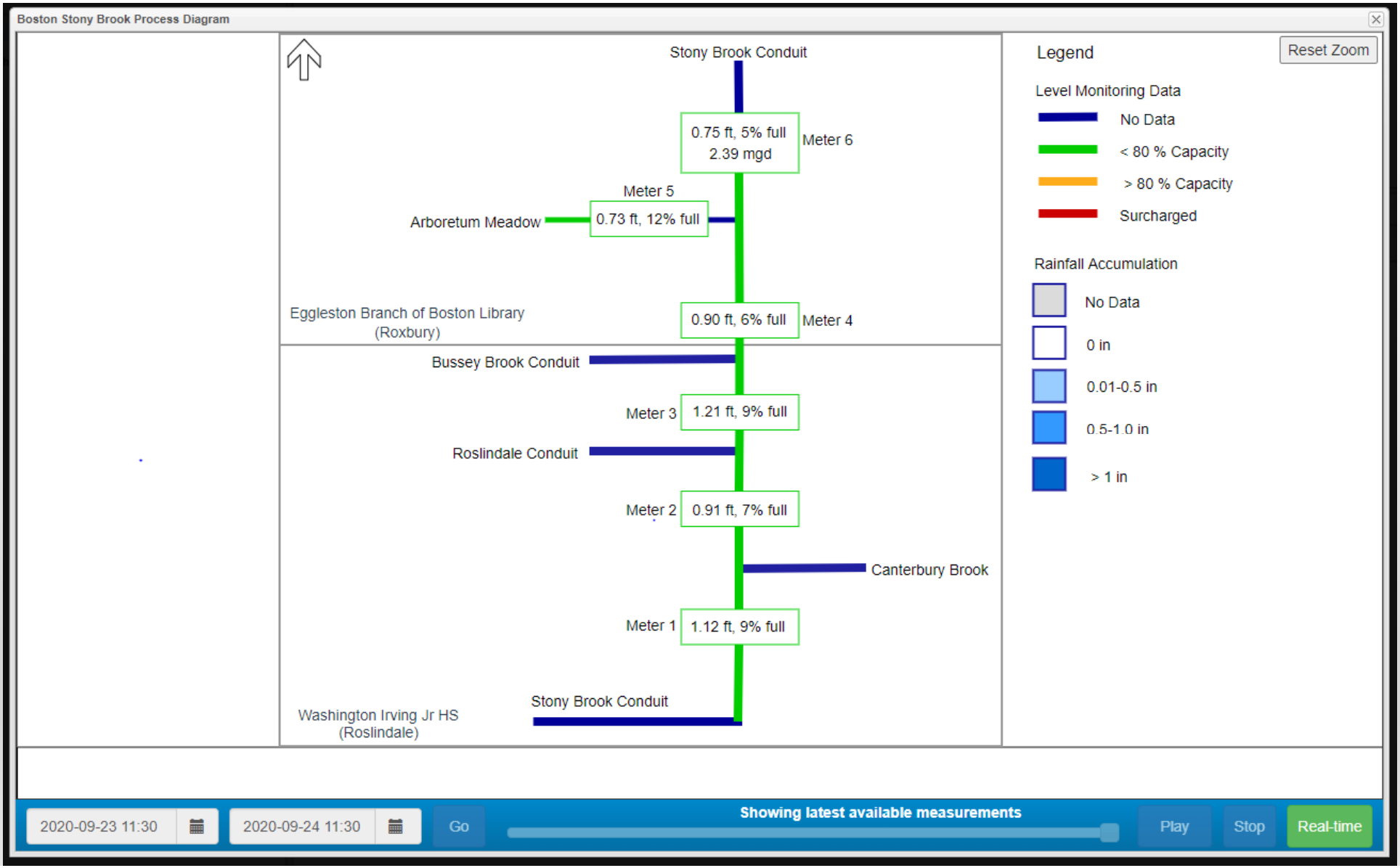
Go

2020-08-23 18:10

Play

Stop

Historic


Boston Stony Brook Process Diagram
Stony Brook Conduit
0.75 ft, 5% full
2.39 mgd
Meter 6
Meter 5
Arboretum Meadow
0.73 ft, 12% full
Eggleston Branch of Boston Library
(Roxbury)
0.90 ft, 6% full
Meter 4
Bussey Brook Conduit
Meter 3
1.21 ft, 9% full
Roslindale Conduit
Meter 2
0.91 ft, 7% full
Canterbury Brook
Meter 1
1.12 ft, 9% full
Stony Brook Conduit
Washington Irving Jr HS
(Roslindale)
Legend
Reset Zoom
Level Monitoring Data
No Data
< 80 % Capacity
> 80 % Capacity
Surcharged
Rainfall Accumulation
No Data
0 in
0.01-0.5 in
0.5-1.0 in
> 1 in
2020-09-23 11:30
2020-09-24 11:30
Go
Showing latest available measurements
Play
Stop
Real-time

Questions

JewellC@bwsc.org