

### STAFF SUMMARY

**TO:** Board of Directors  
**FROM:** Frederick A. Laskey, Executive Director *Frederick A. Laskey*  
**DATE:** September 13, 2023  
**SUBJECT:** Storm Impacts on MWRA's Wastewater System and Receiving Waters

**COMMITTEE:** Wastewater Policy & Oversight

INFORMATION  
 VOTE

Betsy Reilley, Ph.D., Director, Environmental Quality  
 Lisa Bina, P.E., Deputy Director, Waterworks  
 Preparer/Title

*David W. Coppes*  
 David W. Coppes, P.E.  
 Chief Operating Officer

*This summer has brought historically high levels of precipitation to the service area with back-to-back and high intensity storms. These rain events have resulted in high levels of Combined Sewer Overflow discharges and blended flows at Deer Island Wastewater Treatment Plant. These events also have impacts on drinking water quality in our reservoirs.*

**RECOMMENDATION:**

For information only

**DISCUSSION:**

The Boston area has experienced a number of high intensity unpredictable wet weather storm events this summer resulting in this July being the second wettest on record (pushing July of 2021 into third place). Current cumulative rainfall amounts to date are only four inches below the wettest year on record, which occurred in 1954. As shown on Figure 1, monthly cumulative totals during the summers of 2021 and 2023 are similar and trend only slightly below levels in 1954. Although current rainfall amounts are similar to that of 1954, the type of storms that the Boston area has experienced this summer is very different from the 1954 storm events; 1954 was a year with three Category 3 hurricanes crossing through the Boston area, severely impacting the coastline with heavy rainfall. In contrast, there have been no hurricanes to date this summer, mainly thunderstorms with concentrated areas of downpours. Cumulative totals for 2022 are also shown on Figure 1 to highlight the drastic year-to-year variation. In 2022, the Boston area recorded one of the driest summers in 138 years.

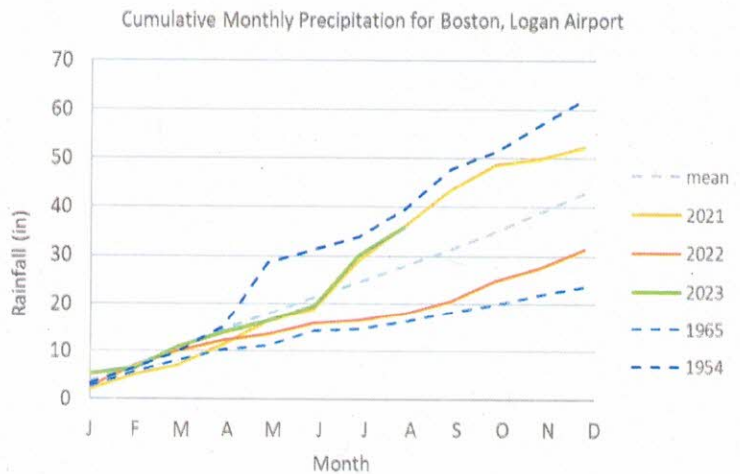


Figure 1: Monthly Cumulative Average Logan Airport

The average yearly rainfall in the metropolitan Boston area is approximately 43 inches, which is typically well distributed throughout the year and is consistent throughout the service area. The year to date total at Logan Airport is 36 inches. However, this total varies dramatically throughout the service area. This year has brought high intensity storms that are not well distributed with unpredictable travel paths. Even within MWRA's service area, rainfall totals have varied as much as three inches, from one end of the service area to another, for a single storm event. This is clearly shown on Figure 2 from the National Weather Service, which shows the rainfall totals for August 8. As thunderstorms like this approach the service area, the path of the heavy band of rainfall can be variable and can also decrease or increase in size.

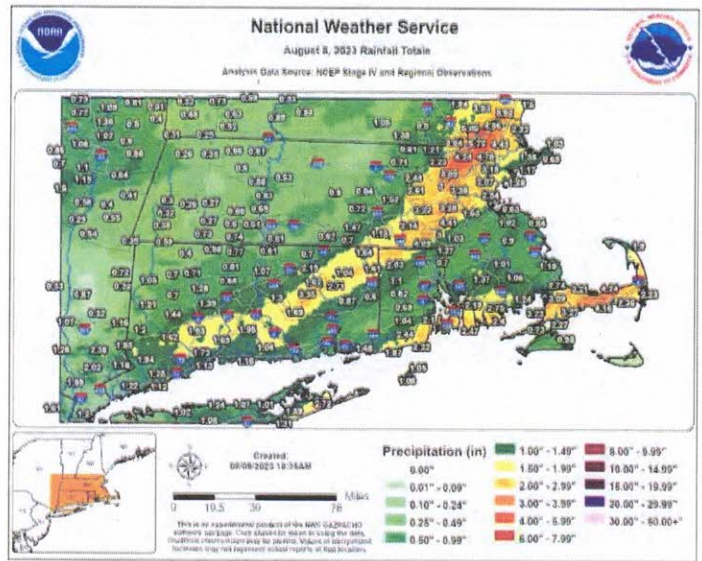


Figure 2: NWS August 8, 2023 Rainfall Totals

In addition to the variation in coverage, rainfall intensities have been well above average, resulting in shortened system response times. During the July 21 rain event, all three north system headworks facilities were choking, with all MWRA and MWRA/BWSC Combined Sewer Overflow (CSO) treatment facilities activated within two hours of the onset of rain. A similar response was seen during the rain event of August 8, within 45 minutes of the heavy rain entering the service area, system levels rapidly increased to the point where both Somerville Marginal and Prison Point CSO needed to be activated, along with the BOS019 Storage facility.

MWRA operations and maintenance staff have performed admirably during this difficult summer staffing the many facilities to assure reliable operations and providing appropriate public and regulatory notifications as required.

### Combined Sewer Overflows

As a result of the number, volume and intensity of rain events this summer, there have been numerous combined sewer overflow discharges. While the majority of CSO discharges receive partial treatment (disinfection and dechlorination) as the system becomes surcharged, untreated CSO discharges will also occur. This summer, there has been an estimated total of 361 mg of CSO discharges from MWRA and community systems; 81% of these discharges received treatment.

CSO Discharges by Basin July 1 - August 25, 2023

Basin	Volume, MG	% Treated
Alewife Brook	19.70	0% treated
Upper Mystic River	6.29	100% treated
Mystic/Chelsea Confluence	59.32	97% treated
Upper Charles	2.27	0% treated
Lower Charles	43.23	91% treated
Back Bay Fens	4.41	0% treated

Upper Inner Harbor	177.37	95% treated
Lower Inner Harbor	3.05	0% treated
Fort Point Channel	51.75	49% treated
Reserved Channel	0.88	0% treated
<b>TOTAL</b>	<b>360.89</b>	<b>81% treated</b>

*MWRA, BWSC, Cambridge, Somerville, and/or Chelsea CSOs*

*Blue text = MWRA, Cambridge, and/or Somerville (variance waters)*

*\* This flow, which includes both CSO and stormwater flow through MWR205A, is not included in the total as the CSO portion is already captured in the Mystic/Chelsea Confluence total.*

*Volume estimates for non-MWRA CSOs in August are approximate.*

The South Boston Storage Tunnel captured 67.5 MG (through August 29) of combined flow and stormwater this summer, protecting the beaches. While there were numerous postings at local beaches, the South Boston beaches from M Street to Pleasure Bay met all testing standards and were open to swimming every day.

### ***Public Notification, Beaches, and Water Quality***

Public notification of CSO and other sewage discharges has been required by MWRA, Somerville and Cambridge since 2020 under the Water Quality Standards Variances for the Charles River basin and Alewife Brook/Upper Mystic River. In 2022, additional public notification requirements applicable throughout Massachusetts were required by the Massachusetts Department of Environmental Protection. These new requirements also specified notification by local Boards of Health when discharges exceed a two-hour duration. Since 2022 was a dry year, there were very few notifications required by the local Boards of Health; during July and August 2022, there were 16 discharges exceeding two hours. However, during July and August 2023 to date, there have already been 44 discharges exceeding two hours (through August 25). The events that exceed two hours are frequently picked up by local news reporting.

In the Boston area, there are no beaches impacted by combined sewer overflows. However, stormwater has affected a number of beaches this year, resulting in red flag water quality postings by the Department of Public Health. Beaches that are impacted by stormwater include Constitution, Malibu, Tenean, and Wollaston beaches. This summer, the combination of beach postings, together with the high number of CSO discharges reported by the press, have resulted in incorrect assumptions that sewage discharges are impacting beach water quality in our area.

While sewage discharges are understandably of concern to the public, we know from modeling and water quality sampling that CSO has short-term impacts on water quality, given that CSO overflows only occur during the larger storms. CSO has elevated bacterial levels; but stormwater discharges also contain high levels of bacteria (though lower than untreated CSO discharges.) Because there is a much larger amount of stormwater compared to CSO discharges, stormwater contributes the highest loadings of bacteria into water bodies around Boston. Furthermore, the majority of CSO discharges receive disinfection treatment, which significantly reduces bacteria levels in those discharges below the levels in stormwater

The requirements of the Combined Sewer Overflow Program are documented in the Long-Term Control Plan and the Water Quality Standards Variances issued for the Charles River, Alewife Brook and Mystic River. Specifically, as part of the variances, there was a requirement to perform

receiving water quality modeling. These models for the rivers demonstrated that under “Typical Year” conditions:

- If CSOs were the only source of bacterial contamination to the rivers, the rivers would be in compliance with state water quality standards 97.9 to 99.9% of the time
- Even if CSOs were eliminated, water quality would still be impacted by stormwater. If stormwater were the only source of bacterial contamination, the rivers would be in compliance with state water quality standards only 48 to 64% of the time
- For the Charles River, the incoming flows over the Watertown Dam also contribute significantly to water quality impairments. (If upstream flows were the only source of bacterial contamination, the river would be in compliance only 59% of the time)
- Stormwater loadings account for 61 to 93% of bacteria in the rivers
- Stormwater is present in every storm (on average 90 rain events per year). CSOs are only present in the larger/more intense storms

### *Climate Change*

Changes to the pattern of rainfall will have impacts on the wastewater system; current climate forecasts predict longer periods of drought and periods of rain of increased intensity and volume. The higher the intensity of the rainfall, the more likely it is that more CSOs will discharge during the storm. Future planning for CSO control in the rivers will incorporate climate change projections.

### *Drinking Water Quality*

The anticipated patterns of precipitation will also affect drinking water systems. In the summer, MWRA uses the Quabbin Aqueduct to transfer water from Quabbin to Wachusett Reservoir for elevation control and for water quality purposes. The transfers usually start in May, as the Wachusett Reservoir begins to develop thermal stratification. If reservoir elevation control allows, higher transfer rates of 300 million gallons per day are ideal and are maintained through November. During the transfers, a Quabbin interflow develops within the water column, as it is colder and denser than the warmer surface water of Wachusett. This interflow will establish itself, travel across the reservoir to the Cosgrove Intake, and eventually to the John J. Carroll Water Treatment Plant, providing water quality benefits that include lower UV254 (a measure of reactive natural organic matter) than Wachusett water alone.

Since July, the summer precipitation events have reduced the ability to maintain higher Quabbin transfer flow rates. Additionally, system water demands have been lower this summer than in past years, resulting in a slower response with reservoir elevation control. Rain events increase the local tributary flows into Wachusett (with higher levels of organic matter), and this combined with less Quabbin flows, has resulted in a decrease in the water quality benefits from Quabbin Reservoir at the treatment plant.

In general, UV254 levels less than 0.06 absorbance per centimeter (Abs/cm) represent high quality water, and UV254 levels above this have impacts on treatment, including increased ozone demand, and chlorine demand and decay. Even with increases in chlorine dose, the decay of chlorine residuals can be significant as water travels through the community distribution systems. Going into the fall, we can anticipate increased coliform bacteria detections in our member community

systems as water demand decreases and water age increases before temperatures cool down for the winter.

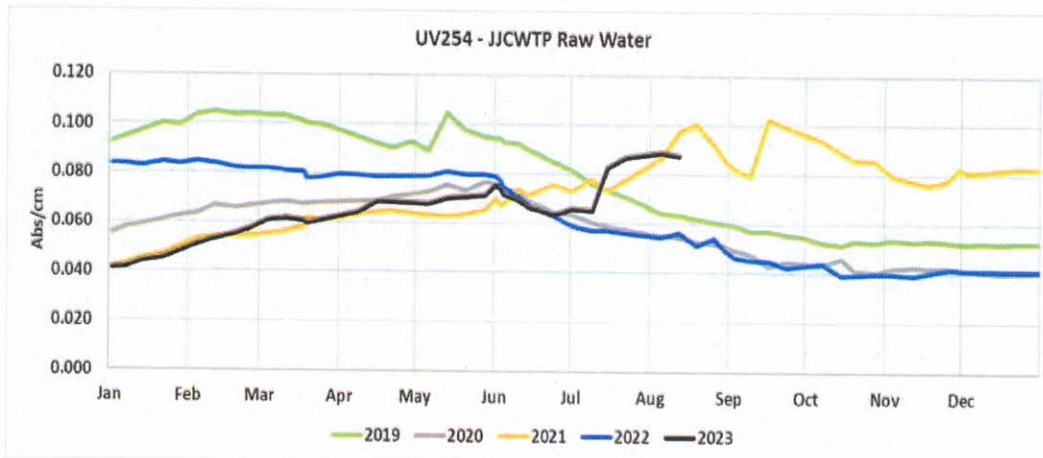


Figure 4: UV254 at Carroll Plant Raw Water Tap