# City of Chattanooga

**Mayor Tim Kelly**

February 28, 2023

VIA CERTIFIED MAIL

Mr. Richard Elliott
Environmental Engineer
Clean Water Enforcement Branch
US EPA-Region 4
61 Forsyth Street, SW
Atlanta, GA 30303

**Re:** ***United States of America et. al. v. City of Chattanooga, No. 1:12-cv-0024***
**Annual Report No. 10 – January 2022 to December 2022**

Dear Mr. Elliott:

On behalf of the City of Chattanooga, Tennessee ("City"), and in accordance with the Consent Decree entered by the United States District Court for the Eastern District of Tennessee (Southern Division), on April 24, 2013, in the case styled the United States of America et. al. v. City of Chattanooga, No. 1:12-cv-0024 ("Consent Decree"), we are submitting to both the Environmental Protection Agency ("EPA") and the Tennessee Department of Environment and Conservation ("TDEC") the tenth annual report required pursuant to paragraph 40 of the Consent Decree. This report is also being submitted in accordance with the letter from Denise Diaz, dated September 16, 2013, establishing the dates for reporting under the Consent Decree.

> *I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering such information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.*

Please let me know if you have any questions regarding our submittal.

Sincerely,

Mark Heinzer
Mark Heinzer (Feb 27, 2023 20:58 EST)

Mark Heinzer, P.E.
Interim Director, Wastewater Department

Enclosure

cc: Karl Fingerhood, Esq., US DOJ
Chief, Environmental Enforcement Section, US DOJ
Chief, Clean Water Enforcement Branch, US EPA Region 4
Paul Schwartz, Esq., US EPA
Sohnia Hong, Office of the Attorney General
Enforcement Coordinator, Water Pollution Control, TDEC
Brandi Prewitt, TN Clean Water Network
Adam Sowatzka, Esq., King & Spalding
Mike Marino, P.E., Jacobs Engineering
Xavier Pedeux, P.E., Jacobs Engineering

# Annual Report No. 10

# January 1 - December 31, 2022

*Prepared for*

## Environmental Protection Agency and Tennessee Department of Environment and Conservation

City of Chattanooga
Wastewater Department
Consent Decree Program
Case No. 1:12-cv-00245

*Prepared by*

## City of Chattanooga
Wastewater Department

*Submitted by*

Jacobs

Jacobs Engineering Group Inc.
Consent Decree Program Manager

Chattanooga, Tennessee
February 28, 2023

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## Tables



## Figures

# Acronyms and Abbreviations

| | |
|---|---|
| AOP | Additional Operational Plan |
| BOD | Biochemical Oxygen Demand |
| CAP | Capacity Assurance Program |
| CD | Consent Decree |
| CMOM | Capacity, Management, Maintenance and Operations |
| CSOTF | Combined Sewer Overflow Treatment Facility |
| DO | Dissolved Oxygen |
| EPA | Environmental Protection Agency |
| FOG | Fats, Oils, and Grease |
| FSE | Food Service Establishment |
| IJA | Inter-Jurisdictional Agreement |
| ISS | Interceptor Sewer System |
| KPI | Key Performance Indicator |
| MBWWTP | Moccasin Bend Wastewater Treatment Plant |
| MBEC | Moccasin Bend Environmental Campus |
| MG | Million Gallons |
| MH | Manhole |
| N/A | Not Applicable |
| No. | Number |
| NOAA | National Oceanic and Atmospheric Administration |
| NPDES | National Pollutant Discharge Elimination System |
| PCCMP | Post Construction Compliance Monitoring Program |
| PM | Preventive Maintenance |
| PS | Pump Station |
| SORP | Sewer Overflow Response Protocol |
| SSO | Sanitary Sewer Overflow |
| TDEC | Tennessee Department of Environment and Conservation |
| TSS | Total Suspended Solids |

| | |
|---|---|
| WQS | Water Quality Standards |

# 1.0 Introduction

## 1.1 Purpose

On April 24, 2013, the City of Chattanooga ("City") entered into a Consent Decree with the United States and the State of Tennessee, in the case styled *United States of America et. al. v. City of Chattanooga, No. 1:12-cv-00245* ("CD"). Pursuant to Section IX of the CD, the City is required to submit annual reports on a yearly basis to the Environmental Protection Agency ("EPA") and Tennessee Department of Environment and Conservation ("TDEC"). Chattanooga has prepared this report to satisfy the reporting requirements found in Paragraph 40 of the CD, which covers the period from January 1, 2022 through December 31, 2022 ("Reporting Period"). This report is also being submitted in accordance with the letter from Denise Diaz, dated September 16, 2013, establishing the dates for the reporting under the CD.

## 1.2 Requirements

As detailed in Section IX of the CD, the City is required to report a summary of Capacity, Management, Operations and Management ("CMOM") Program as implemented or modified pursuant to the CD, including a comparison of actual performance with any performance measures that have been established. Additionally, the 1st five annual reports included a trends analysis of the number, volume, duration, and cause of Chattanooga's Sanitary Sewer Overflow ("SSO") events for a 24-month rolling period, updated to reflect the SSO events that occurred during the previous 12-month period. Since the 6th annual report, this trends analysis covers SSO events spanning a 5-year rolling period.

# 2.0 CMOM Programs

The City has completed the development of its CMOM program pursuant to Paragraph 20 of the CD. As of the end of the last Reporting Period, all nine (9) of the nine CMOM programs have been developed by Chattanooga, submitted to TDEC and EPA, and approved. Table 2-1 on the following page summarizes the status of the CMOM Programs, including updates and key performance indicators ("KPIs") related to implementation of those that have received EPA approval.

**Table 2-1**
**CMOM Program Summary**

| January 1, 2022 - December 31, 2022 | | | | | | |
|---|---|---|---|---|---|---|
| **CMOM Program** | **CMOM Program Status** | **CD Reference** | **CMOM Program KPI** | **CMOM KPI Purpose** | **Established Performance Measure** | **Actual Measured Performance** |
| Sewer Overflow Response Protocol ("SORP") | Approved by EPA and TDEC 5/29/2014 | Section VI, Paragraph 20(a)(ii) | Maintain records of all sanitary sewer overflow ("SSO") responses and response times | Reduce response times to respond to SSOs to reduce SSO impacts | Reduce SSO response time to within one hour after notification of event | Average SSO response time for 2022 was ~13.5 minutes |
| Sewer Overflow Response Protocol ("SORP") | Approved by EPA and TDEC 5/29/2014 | Section VI, Paragraph 20(a)(ii) | Provide notice to TDEC as required by National Pollutant Discharge Elimination ("NPDES") Permit within 24 hours of being made aware of an SSO event | Improve timeliness of SSO reporting to TDEC | Notify TDEC of SSO events within 24 hours after being made aware of event | All 24-hour reports were made to TDEC within the 24-hour time period |
| Gravity Line Preventive Maintenance Program | Approved by EPA and TDEC 12/3/2014 Updated and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(d) | Annual Chemical Root Control Footage | Reduce the impacts of roots on system performance | Treat 50,000 feet/year | 52,505 feet were treated in 2022 |
| Gravity Line Preventive Maintenance Program | Approved by EPA and TDEC 12/3/2014 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(d) | Footage of Pipeline Hydraulically Cleaned During the Calendar Year | Improve the gravity system performance | Clean 1,000,000 feet/year | Cleaned 1,738,602 feet in 2022 |

**Table 2-1**
**CMOM Program Summary**

| January 1, 2022 - December 31, 2022 | | | | | | |
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| **CMOM Program** | **CMOM Program Status** | **CD Reference** | **CMOM Program KPI** | **CMOM KPI Purpose** | **Established Performance Measure** | **Actual Measured Performance** |
| Gravity Line Preventive Maintenance Program | Approved by EPA and TDEC 12/3/2014 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(d) | Number of MACP Level 1 Manhole Inspections During the Calendar Year | Complete Level 1 inspections to improve system performance | 1,000/year until 2017 and then 2,000/year | 3,062 Level 1 inspections completed in 2022 |
| Gravity Line Preventive Maintenance Program | Approved by EPA and TDEC 12/3/2014 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(d) | Number of MACP Level 2 Manhole Inspections During the Calendar Year | Complete Level 2 inspections to improve system performance | 900/year until 2017 and then 500/year | 51 Level 2 inspections completed in 2022 |
| Gravity Line Preventive Maintenance Program | Approved by EPA and TDEC 12/3/2014 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(d) | The Number of SSOs caused by the build-up of debris, sediment, roots, and grease in the collection system | Measure effectiveness of gravity maintenance program | A reduction in maintenance-related SSOs | There were 35 SSOs associated with blockages in 2022 as compared to 37 in 2021 (a slight reduction) |

**Table 2-1**
**CMOM Program Summary**

| January 1, 2022 - December 31, 2022 | | | | | | |
|---|---|---|---|---|---|---|
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| Gravity Line Preventive Maintenance Program | Approved by EPA and TDEC 12/3/2014 Revised and Revised by EPA 9/25/2017 | Section VI, Paragraph 20(d) | Footage of pipelines and frequency that preventive maintenance hydraulic cleaning is performed | Complete gravity line maintenance to improve system performance | Preventive Hydraulic Line Cleaning Frequency Maximum ft.<br><br>2 months – 25,000 ft.<br>4 months – 50,000 ft.<br>6 months – 50,000 ft.<br>8 months – 50,000 ft.<br>12 months- 225,000 ft.<br>18 months- 250,000 ft.<br>36 months- 350,000 ft. | Preventive Hydraulic Line Cleaning Frequency Actual ft.<br><br>2 months- 0 ft.<br>4 months- 0 ft.<br>6 months- 64,777 ft.<br>8 months- 54,506 ft.<br>12 months- 1,315,969 ft.<br>18 months- 1,664,029 ft.<br>36 months- 2,780,717 ft. |
| Fats, Oils, and Grease (“FOG”) Management Program | Approved by EPA and TDEC 7/21/2015 | Section VI, Paragraph 20(c) | Number of FOG-related SSOs | Measure FOG program effectiveness | Yearly Reduction in FOG-related SSOs | There were 9 SSOs associated with grease blockages; this is a reduction of 1 grease related SSO from the previous year |

**Table 2-1**
**CMOM Program Summary**

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|---|---|---|---|---|---|---|
| **CMOM Program** | **CMOM Program Status** | **CD Reference** | **CMOM Program KPI** | **CMOM KPI Purpose** | **Established Performance Measure** | **Actual Measured Performance** |
| Fats, Oils, and Grease ("FOG") Management Program | Approved by EPA and TDEC 7/21/2015 | Section VI, Paragraph 20(c) | Number of annual inspections vs the total number of Food Service Establishments ("FSEs") | Measure FOG Program Workload | 100% | 46.9%[1] |
| Fats, Oils, and Grease ("FOG") Management Program | Approved by EPA and TDEC 7/21/2015 | Section VI, Paragraph 20(c) | Number of annual Noncompliance Notifications vs the total inspections | Evaluate the FOG Program effectiveness | Below 15% | 4.9% of total inspections yielded a non-compliance notification |
| Fats, Oils, and Grease ("FOG") Management Program | Approved by EPA and TDEC 7/21/2015 | Section VI, Paragraph 20(c) | FOG Hot Spots | Reduce the number of FOG hot spot areas | Reduce linear footage by 10% | 5.87% reduction[2] |
| Fats, Oils, and Grease ("FOG") Management Program | Approved by EPA and TDEC 7/21/2015 | Section VI, Paragraph 20(c) | Number of FSEs Added Annually | Measure FOG program effectiveness | Have every existing FSE included in Program so only new ones are added | 17 FSEs were added during the reporting period |

[1] Measured performance was not met due to staffing shortages throughout 2022.

[2] The City is implementing changes to the way this KPI is being tracked and calculated. These changes will be applied to the 2023 calendar year.

**Table 2-1**
**CMOM Program Summary**

| January 1, 2022 - December 31, 2022 | | | | | | |
|---|---|---|---|---|---|---|
| **CMOM Program** | **CMOM Program Status** | **CD Reference** | **CMOM Program KPI** | **CMOM KPI Purpose** | **Established Performance Measure** | **Actual Measured Performance** |
| Fats, Oils, and Grease ("FOG") Management Program | Approved by EPA and TDEC 7/21/2015 | Section VI, Paragraph 20(c) | Annual FOG Management Program Update Completed on Time | Improve FOG program effectiveness | Complete Annually | 100% |
| Fats, Oils, and Grease ("FOG") Management Program | Approved by EPA and TDEC 7/21/2015 | Section VI, Paragraph 20(c) | Number of Pretreatment Program Employees Trained on FOG Management Program | Improve employee program knowledge through training | 100% | 100% |
| Pump Station Operations Program | Approved by EPA and TDEC 10/22/2015 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(e) | Pump Station ("PS") Operational Checks | Improve pump station performance | 95% adherence to PS/CSOTF visit schedule | 100% completed on time |
| Pump Station Preventive Maintenance Program | Approved by EPA and TDEC 3/17/2015 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(f) | Preventive Maintenance ("PM") Completion Schedule | Measure PM program effectiveness | 95% adherence to PM schedule | 85.7% completed on time[3] |
| Pump Station Preventive Maintenance Program | Approved by EPA and TDEC 3/17/2015 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(f) | Number of Preventable Work Orders | Measure work order program effectiveness | Less than 5 preventable work orders per month | Total of 16 and average of 1.33 preventable work orders per month in 2022, compared to 1.75 per month in 2021 |

[3] Measured performance was not met due to staffing shortages throughout 2022.

**Table 2-1**
**CMOM Program Summary**

| January 1, 2022 - December 31, 2022 | | | | | | |
|---|---|---|---|---|---|---|
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| Pump Station Preventive Maintenance Program | Approved by EPA and TDEC 3/17/2015 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(f) | Track Work Orders Found Via PM Activities | Evaluate effectiveness of the PM program | Track the number of CMs generated as a result of a PM | 14.1% for 2022 overall (156 CMs and 1106 PMs) |
| Pump Station Preventive Maintenance Program | Approved by EPA and TDEC 3/17/2015 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(f) | Track the Age of Work Orders | Improve work order process | No work orders older than 6 months | Average of 34 work orders older than 6 months in 2022 (2.9% of total work orders) |
| Pump Station Preventive Maintenance Program | Approved by EPA and TDEC 3/17/2015 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(f) | Percentage of Emergency Work Orders | Track the reliability of the City assets | Less than 10% of the work orders are emergencies | Emergency work orders were 0.17% of total work orders written |
| Pump Station Preventive Maintenance Program | Approved by EPA and TDEC 3/17/2015 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(f) | Work Orders Awaiting Parts | Improve work order program | No Work Orders Older than 30 days Awaiting Parts | Average of 14 work orders older than 30 days awaiting parts (14% of total work orders)[4] |
| Pump Station Preventive Maintenance Program | Approved by EPA and TDEC 3/17/2015 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(f) | Work Backlog | Measure work order program effectiveness | Not more than 6 weeks of work | 78% of work orders written were closed within the allotted time period to complete |

[4] Measured performance was not met due to long lead times with ordering parts for making necessary repairs throughout 2022.

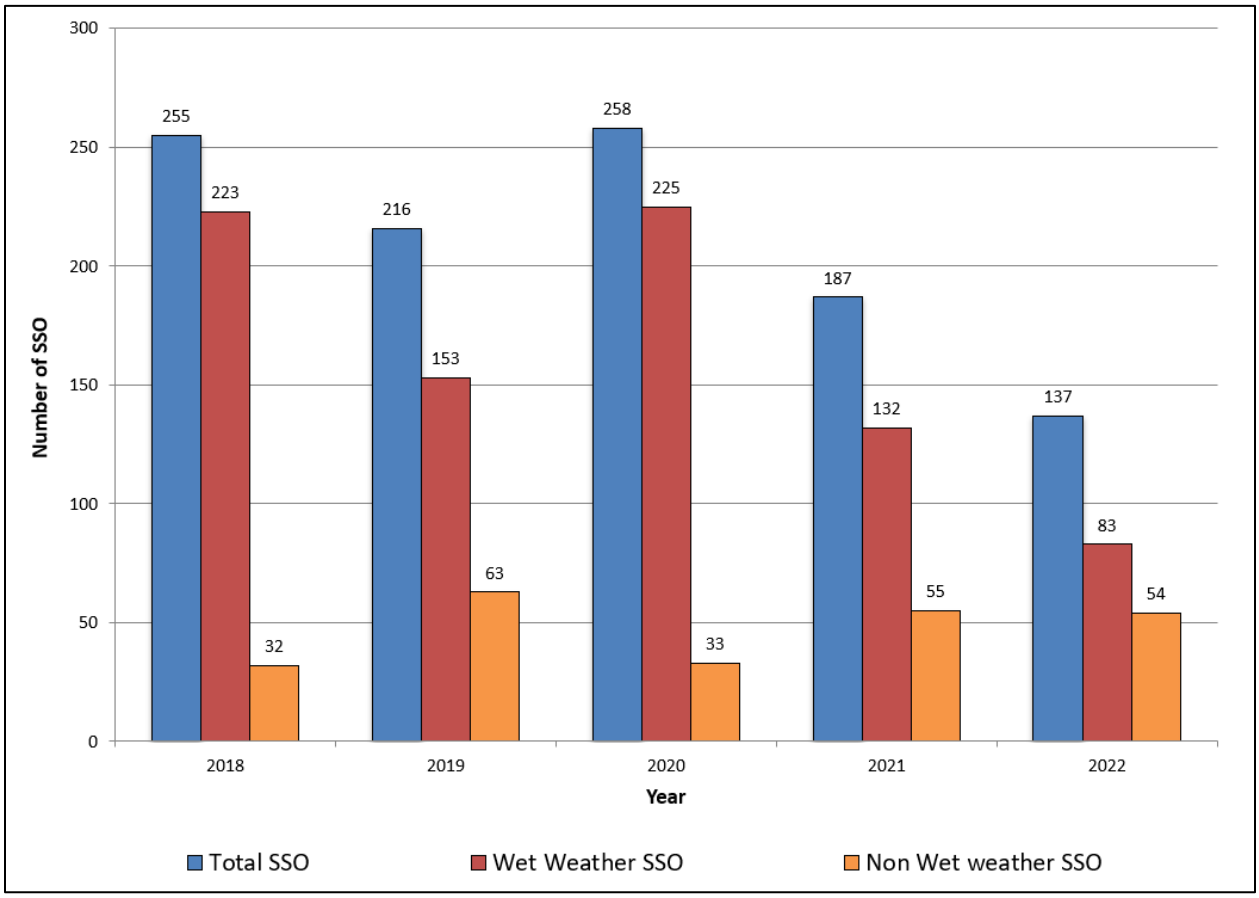
**Table 2-1**
**CMOM Program Summary**

| January 1, 2022 - December 31, 2022 | | | | | | |
|---|---|---|---|---|---|---|
| **CMOM Program** | **CMOM Program Status** | **CD Reference** | **CMOM Program KPI** | **CMOM KPI Purpose** | **Established Performance Measure** | **Actual Measured Performance** |
| Pump Station Preventive Maintenance Program | Approved by EPA and TDEC 3/17/2015 Revised and reapproved by EPA 9/25/2017 | Section VI, Paragraph 20(f) | Overtime as a Percent of Total Hours Worked | Improve pump station program by measuring overall overtime usage | Less than 5% | 7.8% OT |
| Capacity Assurance Program (“CAP”) | Approved by EPA and TDEC 10/13/2016 | Section VI, Paragraph 20(h) | Applicable CD components to be identified during program implementation | N/A | N/A | N/A |

# 3.0 SSO Trends Analysis

The City conducted a trends analysis of the cause, duration, and volume of SSO events for the 60-month period spanning January 1, 2018 through December 31, 2022. Rainfall data collected during the same time period was included in the analysis to illustrate the effects of heavy, sustained rainfall on the occurrence, duration, and volume of the recorded SSO events. Figure 3-1 below provides a summary of SSO events by year for the reporting period:

**Figure 3-1**
SSO Events by Year




As illustrated in Figure 3-1, there was a downward trend in SSO events (-40%), including wet weather (-54%), while the non-wet weather SSOs increased (+36%), over the five-year period. During the same period, there was a downward trend in rainfall (-15%). The majority of SSO events during the reporting period were wet weather related (60%), followed by blockages (26%), as illustrated in Figure 3-2 that depicts SSO events by cause per quarter for the reporting period. The downward trend in wet weather SSO events shows a clear impact of the I/I reduction and capacity upgrade projects implemented under the Consent Decree Program.

Based on averaged data from the 13 rain gauges installed throughout Chattanooga, the observed rainfall in 2022 was 8% higher than normal. Significant wet weather events were observed throughout the year, including the three consecutive events that occurred between November 29 and December 15, 2022, with 9 inches of rainfall recorded over 2 weeks.

The Eastbank/Westbank outfall experienced overflows in 2022, but only because of the construction works in progress for the MBWWTP EQ Blower Replacement project at the Moccasin Bend Environmental Campus ("MBEC"). **The City notified TDEC of these construction projects early in a letter dated September 16, 2021**. This project has caused the available equalization volume to be reduced in half, the plant capacity to be limited, and the influent flow into the plant to be reduced by about 40 MGD. Construction is anticipated to be completed, however, in the second half of 2023. The hydraulic model confirmed that if the capacity had not been limited due to the construction, these SSOs would not occur. These Eastbank/Westbank SSO events due to ongoing construction at the plant are detailed in Table 3-1.

**Table 3-1**
SSO Attributed to Construction of MBWWTP EQ Blower Replacement project at MBEC

| Start Date | Start Time | Location | Source | Estimated Duration (hrs) | Estimated Volume (gal) | SSO Destination | Cause |
|---|---|---|---|---|---|---|---|
| 02-Jan-22 | 4:15 AM | 122 Rowland Gap Rd (West Bank) | West Bank | 13.6 | 623 | Tennessee River | Outfall Mechanical Failure + Construction at MBEC |
| 02-Jan-22 | 3:45 PM | End of MLK BLVD (East Bank) | East Bank | 2.2 | 70,188 | Tennessee River | Construction at MBEC |
| 03-Feb-22 | 8:05 PM | End of MLK BLVD (East Bank) | East Bank | 8.2 | 874,000 | Tennessee River | Construction at MBEC |
| 03-Feb-22 | 8:10 PM | 122 Rowland Gap Rd (West Bank) | West Bank | 13.0 | 2,443,000 | Tennessee River | Construction at MBEC |
| 23-Feb-22 | 2:45 AM | End of MLK BLVD (East Bank) | East Bank | 46.2 | 9,519,000 | Tennessee River | Construction at MBEC |
| 23-Feb-22 | 2:45 AM | 122 Rowland Gap Rd (West Bank) | West Bank | 47.5 | 22,100,000 | Tennessee River | Construction at MBEC |
| 09-Mar-22 | 8:25 AM | End of MLK BLVD (East Bank) | East Bank | 1.4 | 70,000 | Tennessee River | Construction at MBEC |
| 09-Mar-22 | 8:30 AM | 122 Rowland Gap Rd (West Bank) | West Bank | 0.8 | 12,000 | Tennessee River | Construction at MBEC |
| 23-Mar-22 | 10:05 AM | End of MLK BLVD (East Bank) | East Bank | 1.7 | 85,000 | Tennessee River | Construction at MBEC |

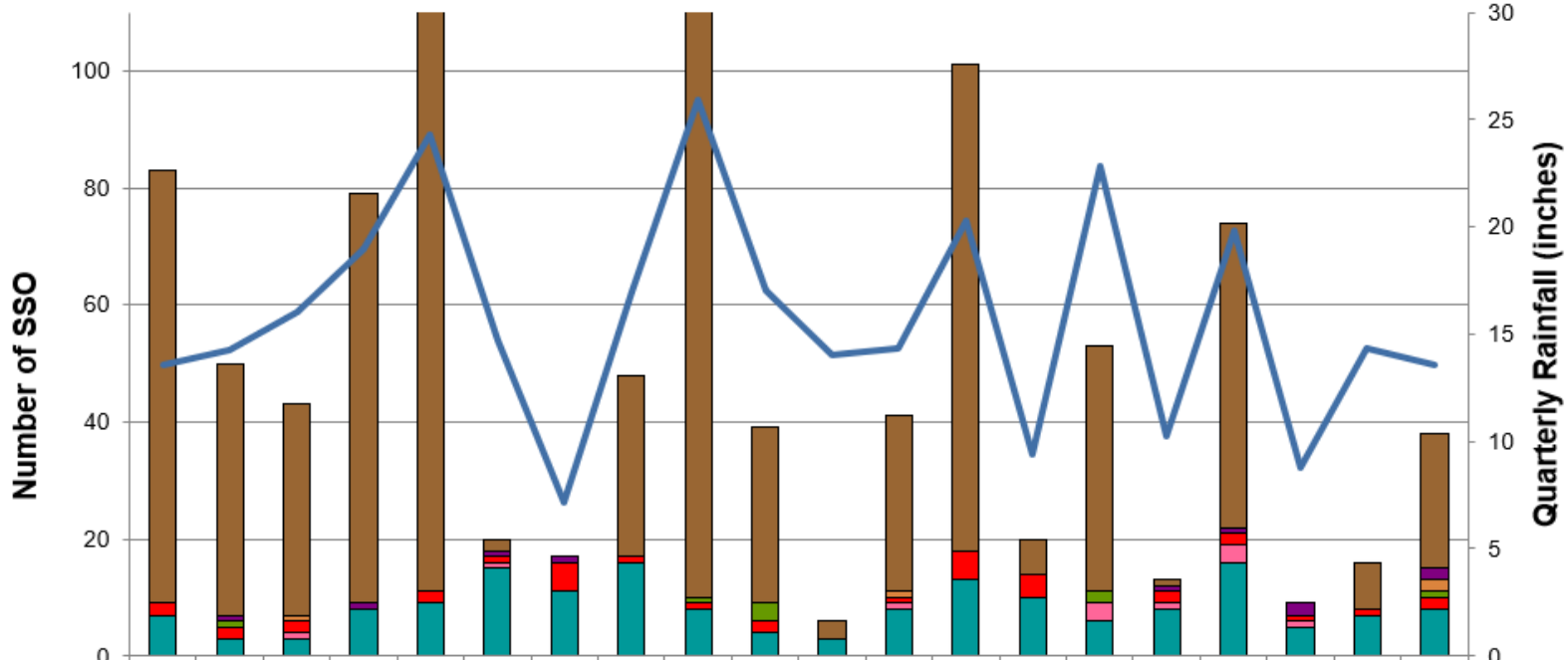
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 23-Mar-22 | 10:00 AM | 122 Rowland Gap Rd (West Bank) | West Bank | 4.2 | 433,000 | Tennessee River | Construction at MBEC |
| 01-Aug-22 | 3:40 PM | 122 Rowland Gap Rd (West Bank) | West Bank | 0.03 | 50 | Tennessee River | Pump Station Capacity+ Construction at MBEC |
| 05-Dec-22 | 11:15 PM | End of MLK BLVD (East Bank) | East Bank | 10.1 | 701,872 | Tennessee River | Construction at MBEC |
| 06-Dec-22 | 1:15 AM | 122 Rowland Gap Rd (West Bank) | West Bank | 4.8 | 45,688 | Tennessee River | Construction at MBEC |
| 14-Dec-22 | 5:45 PM | End of MLK BLVD (East Bank) | East Bank | 12.2 | 735,000 | Tennessee River | Construction at MBEC |
| 14-Dec-22 | 6:40 PM | 122 Rowland Gap Rd (West Bank) | West Bank | 15.8 | 75,000 | Tennessee River | Construction at MBEC |

Figure 3-3 depicts total SSO events and rainfall accumulation per quarter. Looking at the overall, five-year, quarterly trends, there has been a 60% reduction in the number of SSO since 2018, while the rainfall has decreased by 15%.

Figure 3-4 depicts cumulative SSO duration and rainfall accumulation per quarter or the sum of the durations of each SSO event that was recorded per quarter for the reporting period. There is a very significant decreasing trend in cumulative SSO duration in the 5-year span (-83%), showing significant reduction of I/I in the system.

Figure 3-5 depicts cumulative SSO volume and rainfall accumulation per quarter or the sum of the volumes of each SSO event that was recorded per quarter for the reporting period. Looking at the overall, five-year, quarterly trends, there has been a decrease in rainfall by 15% and at the same time, a significant reduction in total SSO volume by -96%; this decrease in volume is mostly due to the reduction in Eastbank/Westbank overflow occurrences and volume. With the start of operation of the Wet Weather Storage Phases 1-3 at Hamm Rd, and completion of the MBWWTP EQ Blower Replacement project in the second half of 2023, the Eastbank/Westbank overflow is anticipated to be eliminated of wet weather events up to the 2-year 24-hour design storm. The reduction in SSO volume shows the significant impact of I/I reduction and capacity upgrade projects completed under the Program.

**Figure 3-2**
SSO Events by Cause




| | 1st Quarter 2018 | 2nd Quarter 2018 | 3rd Quarter 2018 | 4th Quarter 2018 | 1st Quarter 2019 | 2nd Quarter 2019 | 3rd Quarter 2019 | 4th Quarter 2019 | 1st Quarter 2020 | 2nd Quarter 2020 | 3rd Quarter 2020 | 4th Quarter 2020 | 1st Quarter 2021 | 2nd Quarter 2021 | 3rd Quarter 2021 | 4th Quarter 2021 | 1st Quarter 2022 | 2nd Quarter 2022 | 3rd Quarter 2022 | 4th Quarter 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total SSO | 83 | 50 | 43 | 79 | 131 | 20 | 17 | 48 | 172 | 39 | 6 | 41 | 101 | 20 | 53 | 13 | 74 | 9 | 16 | 38 |
| Wet Weather | 74 | 43 | 36 | 70 | 120 | 2 | 0 | 31 | 162 | 30 | 3 | 30 | 83 | 6 | 42 | 1 | 52 | 0 | 8 | 23 |
| PS Mechanical Failure | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 2 |
| PS Electrical Failure | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Power Failure | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 |
| Other | 2 | 2 | 2 | 0 | 2 | 1 | 5 | 1 | 1 | 2 | 0 | 1 | 5 | 4 | 0 | 2 | 2 | 1 | 1 | 2 |
| Defect(s) | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 1 | 3 | 1 | 0 | 0 |
| Blockage | 7 | 3 | 3 | 8 | 9 | 15 | 11 | 16 | 8 | 4 | 3 | 8 | 13 | 10 | 6 | 8 | 16 | 5 | 7 | 8 |
| Rainfall (in) | 13.60 | 14.28 | 16.01 | 18.93 | 24.28 | 14.75 | 7.13 | 16.99 | 25.95 | 17.03 | 14.01 | 14.37 | 20.31 | 9.43 | 22.86 | 10.22 | 19.79 | 8.79 | 14.31 | 13.58 |

**Figure 3-3**
Quarterly SSO Quantities

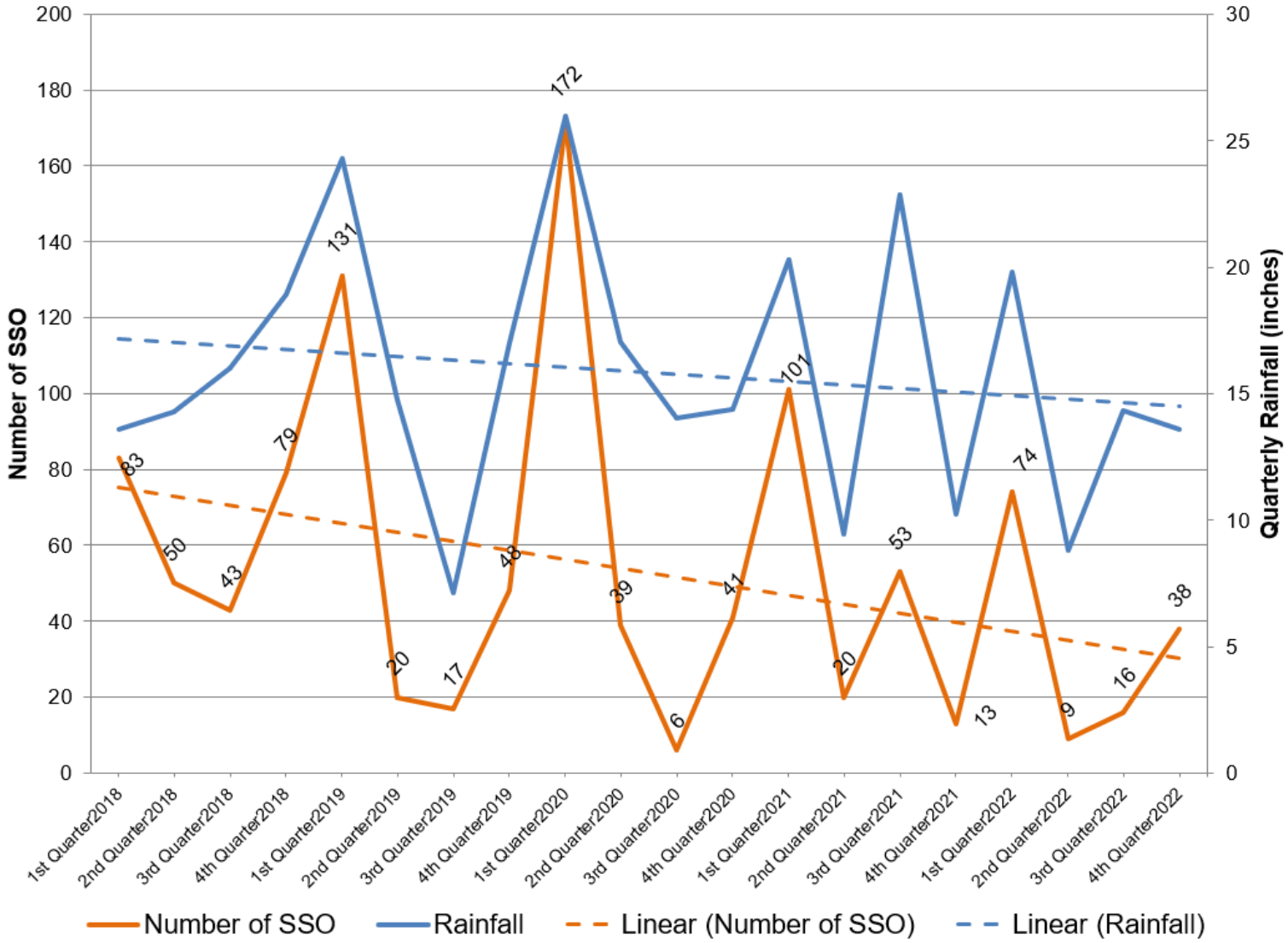


**Figure 3-4**
Quarterly SSO Durations

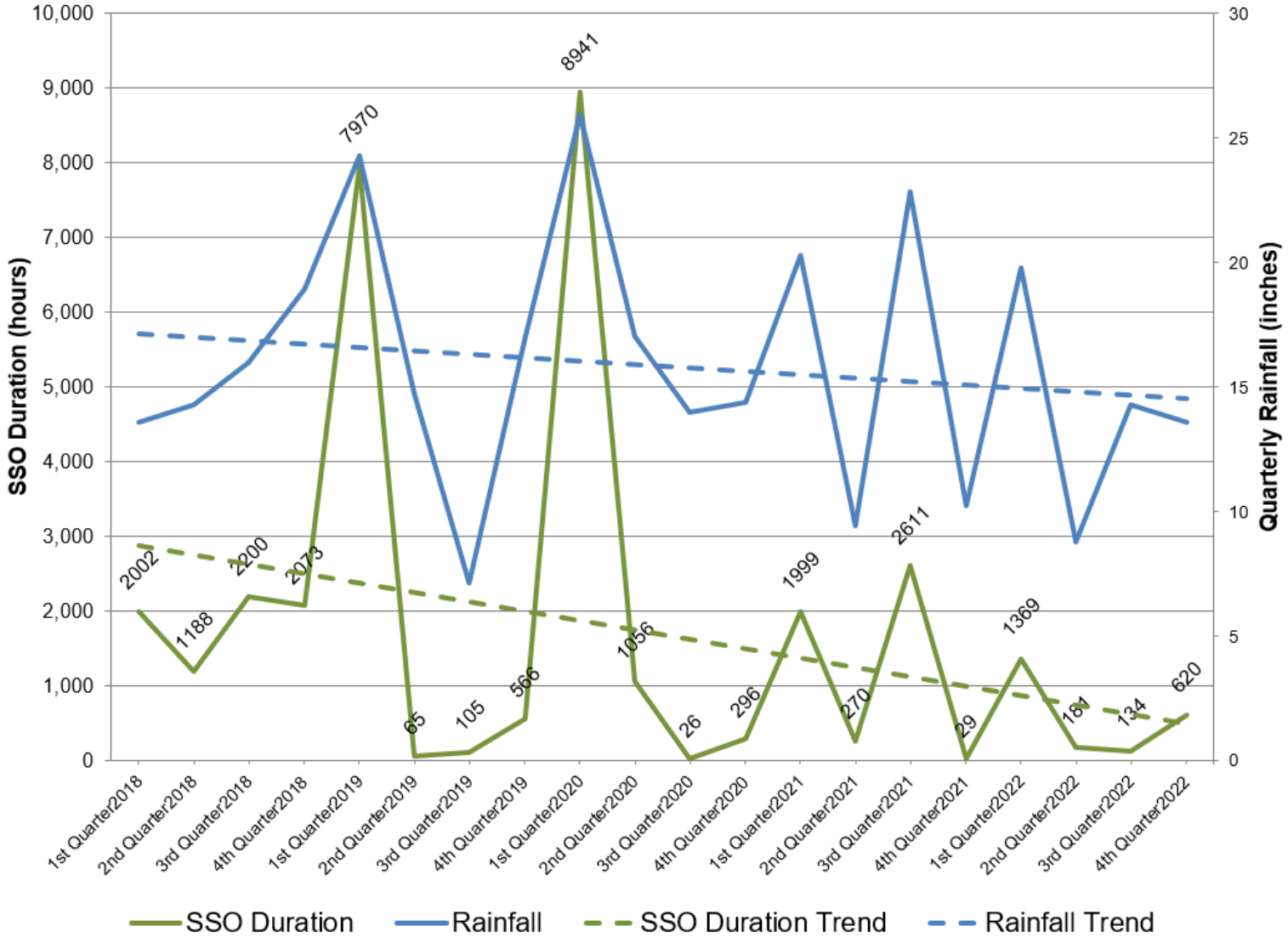


**Figure 3-5**
Quarterly SSO Volume