



REGION 1

NEW ENGLAND REGIONAL LABORATORY
NORTH CHELMSFORD, MA 01863

Date: July 15, 2024

Subject: Reconnaissance and Sampling Inspection Report
Clean Water Act – National Pollutant Discharge Elimination System
Worcester, MA

From: Anna Hatke, Inspector
Laboratory Services and Applied Science Division (LSASD)
Field Services Branch (FSB)

Reviewed
By: Jerome Keefe, Investigations Team Leader
LSASD-FSB

To: Todd Borci, Manager
Enforcement and Compliance Assurance Division (ECAD)
Water Compliance Section 1

CC: Douglas Koopman, Inspector
ECAD

I. Facility Information

- A. *Facility Name:* City of Worcester, MA
- B. *Facility Location:* Worcester, MA
- C. *Facility Contact:* Jay J. Fink, Commissioner, Dept. of Public Works and Parks, dpw@worcesterma.gov, (508) 929-1300
- D. *NPDES Permit ID:* MAS010002 (MS4)

II. Background Information

- A. ***Date/Start time of Reconnaissance inspection:*** 05/16/2024 11:02
 - B. *Weather conditions:* Rainy, approx. 57°F
 - C. *USEPA Representatives:* Anna Hatke, Michelle Coombs
 - D. *State/Local Representatives:* N/A
-
- A. ***Date/Start time of sampling inspection:*** 05/028/2024 09:45
 - B. *Weather conditions:* Sunny, approx. 70°F

C. USEPA Representatives: Anna Hatke, Michelle Coombs

D. State/Local Representatives: N/A

E. Federally Enforceable Requirements Investigated: Stormwater discharges and certain non-stormwater discharges from the Worcester, MA Municipal Separate Storm Sewer Systems (MS4) are authorized by the National Pollutant Discharge Elimination System (NPDES) General Permit for the Discharge of Stormwater from Small MS4 (hereinafter, the Permit), issued by the Environmental Protection Agency (EPA) Region 1. The City obtained coverage under the Permit with NPDES Permit ID MAS010002.

F. Pollutants Sampled: Pharmaceuticals and Personal Care Products (PPCPs), E. coli/Enterococcus, Ammonia (nitrogen), Total Chlorine, and Surfactants

III. Disclaimer:

Unless otherwise noted, this report describes conditions at the facility/property as observed by EPA inspector(s), and/or through records provided to and/or information reported to EPA inspector(s) by facility representatives and as understood by the inspector(s). This report may not capture all operations or activities ongoing at the time of the inspection. This report does not make final determinations on potential areas of concern. Nothing in this report affects EPA's authorities under federal statutes and regulations to pursue further investigation or action.

IV. Type and Purpose of Inspection(s)

The purpose of the reconnaissance inspection was to locate stormwater outfalls which discharge into Coal Mine Brook, O'Hara Brook, Fitzgerald Brook, and Lake Quinsigamond, while noting appearance, presence of flow, and access requirements for one or more sampling inspections.

The purpose of the compliance sampling inspection was to identify potential illicit connections or illegal discharges within the Worcester, MA MS4 that may adversely impact the water quality in Coal Mine Brook, O'Hara Brook, Fitzgerald Brook, and Lake Quinsigamond. Samples were collected from 7 locations in accordance with the FSB Investigations Team Stormwater Program Plan.

V. Permittee Details

The City of Worcester occupies approximately 38.5 square miles in Worcester County, MA approximately 39 miles east of Boston, MA. The city shares borders with the municipalities of Holden and West Boylston to the north, Shrewsbury and North Grafton to the east, Millbury and Auburn to the south, Paxton, and Leicester to the west. According to the 2020 U.S. Census, the population of Worcester, MA was 206,518.

VI. 05/16/2024 Reconnaissance Inspection Summary

On May 16, 2024, Anna Hatke, Nafisah Ali, and Tori Macleod ("the EPA Inspection Team") conducted an unannounced reconnaissance inspection of the Worcester, MA MS4 at the locations described in Section VIII, including locations described under the map of the sample locations. They were not accompanied by any city or state representatives. The inspection started near 616

Plantation St, Worcester, MA at approximately 11:02. At the time of the inspection, the weather was rainy and approximately 57 °F.

According to the National Weather Service (NWS) for the Worcester Regional Airport (KORH) the last precipitation event prior to the inspection occurred on May 14, 2024, with 0.47 inches recorded. There was precipitation recorded within the 72 hours before the inspection of 0.02 inches on May 12, 2024. According to the NWS, in the month (to date) of May, the area observed 2.61 inches of rain, which is approximately 146% of the 30-year normal value of 1.78 inches. According to the US Drought Monitor, as of May 16, 2024, Worcester County is experiencing no drought conditions.

VII. 05/28/2024 Sampling Inspection Summary

On May 28, 2024, the EPA Inspection Team conducted an unannounced compliance sampling inspection of the Worcester, MA MS4 at the locations described in Section VIII. They were not accompanied by any city or state representatives. The inspection started near 616 Plantation St, Worcester, MA at approximately 9:45. At the time of the inspection, the weather was partly sunny and approximately 70 °F.

According to the National Weather Service (NWS) for the Worcester Regional Airport (KORH) the last precipitation event prior to the inspection occurred on 05/28/2024 with 0.00 inches recorded. There was precipitation recorded within the 72 hours before the inspection, on May 27, 2024, of 0.66 inches. According to the NWS, in the month (to date) of May, the area observed 7.01 inches of rain, which is approximately 220% of the 30-year normal value of 3.19 inches. According to the US Drought Monitor, as of May 28, 2024, Worcester County is experiencing no drought conditions.

The sampling locations described in Section VIII were field screened using test kits for ammonia (nitrogen), surfactants, and total chlorine. In-situ measurements for specific conductivity, salinity, and temperature were also measured using a YSI water quality meter and recorded. Field data were recorded on field data sheets. Samples were delivered to and analyzed for E. coli, Enterococcus, and PPCPs at the EPA New England Regional Laboratory (NERL) in North Chelmsford, MA. Table 1 below summarizes the sampling and analytical data.

VIII. Description of Sampling Locations (in order of collection time)

Photographs depicting each sample location are included in Appendix A of this report.

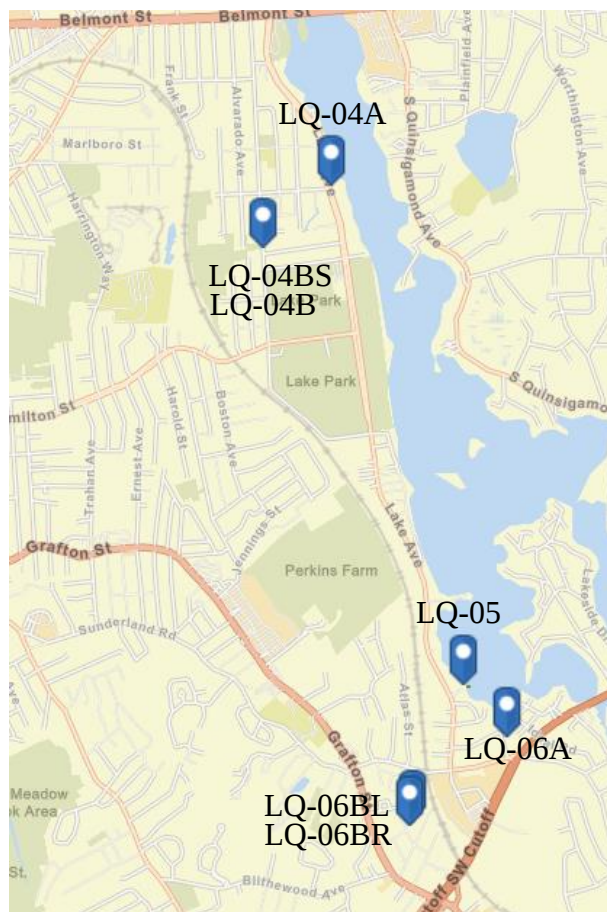
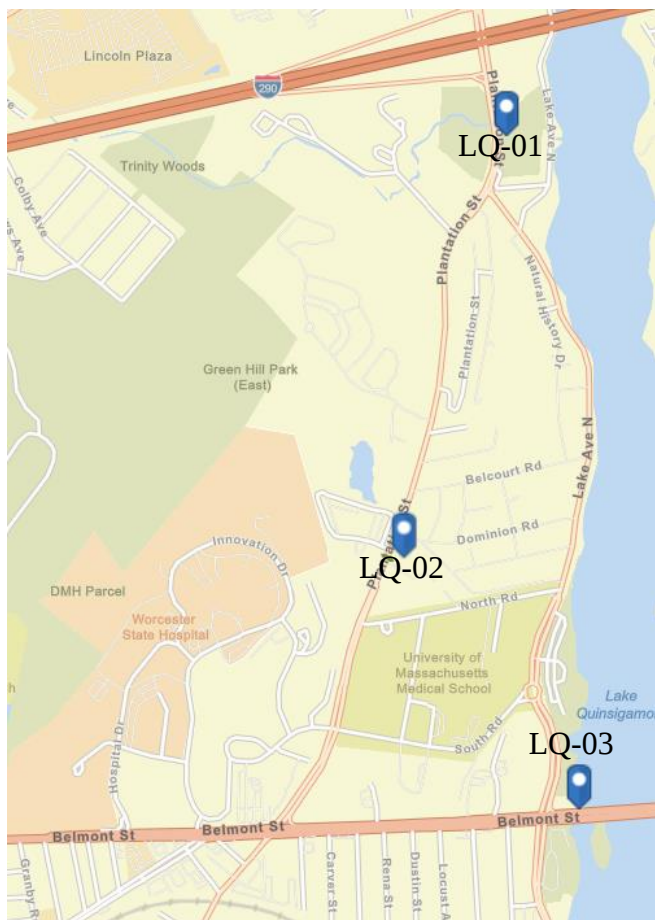
- **LQ-01:** One of two circular concrete outfalls on either side of a large rectangular culvert, approximately 3 feet in diameter located at 616 Plantation Street. Discharge flow was approximately 20 gallons per minute (“gpm”) into Coal Mine Brook. Sample was collected at the mouth of the right-side outfall, looking up-stream. A light sewage and musty odor was detected. Color was clear and turbidity was low. No floatables were observed. Dark green algae growth was observed on the inside of the concrete pipe. Trash was observed in the stream directly downstream of the outfall. Outfall sampled was chosen based on the Worcester, MA stormwater sewer system map.
- **LQ-02:** One circular concrete outfall located at the base of a stone wall beside a construction site, approximately 4 feet in diameter located at 382 Plantation Street.

Discharge flow was approximately 5 gpm into an unnamed stream/brook. Sample was collected at the mouth of the outfall. A musty odor was detected. Color was clear and some particulate matter was observed. Foam clusters were observed coming from the mouth of the outfall. The outfall was three-quarters submerged.

- **LQ-04BS**: In-stream sample of Fitzgerald Brook discharging into Lake Quinsigamond collected at 240 Coburn Avenue. The sample was collected approximately 5 feet from the Northern bank of the stream at the mouth of a stone culvert outflow approximately 50 feet downstream of LQ-04B. A sewage odor was detected. Color was clear-brown, and turbidity was low. Foam was observed coming out of the culvert and collecting in an eddy directly downstream. Dark brown algae growth was observed on the rocks and stream bed directly downstream of the culvert. Trash and grass clippings were observed in and around the stream directly downstream of the culvert.
- **LQ-04B**: A singular circular clay outfall approximately 1 foot located on the inside of a concrete stormwater conveyance structure on the East side of a stone wall culvert at 240 Coburn Avenue. Discharge flow was approximately <1 gpm into Fitzgerald Brook. Sample was collected at the mouth of the outfall. A smaller pipe adjacent to the outflow was observed with no flow. A sweet earthy smell was detected. Color was clear and turbidity was low. No floatables were observed. Dark brown algae growth was observed on the inside of the outfall pipe as well as on the bottom of the concrete conveyance structure. Trash and grass clippings were observed upstream of the outfall. A duplicate sample was taken at this outfall location.
- **LQ-05**: One of two circular concrete outfalls, approximately 2 feet in diameter located at 5 Suntaug Road. Discharge flow was approximately 2 gpm into Lake Quinsigamond. Sample was collected at the mouth of the left-side outfall, looking up-stream. A slight brackish and rank odor was detected. Color was clear and turbidity was low. No floatables were observed. Green algae growth was observed on the inside of the concrete pipe as well as the flume leading directly into Lake Quinsigamond. Outfall sampled was chosen based on the Worcester, MA stormwater sewer system map.
- **LQ-06BL**: One of two circular concrete outfalls on either side of a larger circular concrete culvert, approximately 3 feet in diameter located at 10 Crane Street. Discharge flow was approximately 1 gpm into an unnamed stream discharging into Lake Quinsigamond. Sample was collected at the mouth of the left-side outfall, looking up-stream. No notable odor was detected. Color was clear and some suspended particulates were observed. Off-white foam was observed coming from the outfall and collecting directly downstream of the outfall.
- **LQ-06BR**: One of two circular concrete outfalls on either side of a larger circular concrete culvert, approximately 1.5 feet in diameter located at 10 Crane Street. Discharge flow was approximately 5 gpm into an unnamed stream discharging into Lake Quinsigamond. Sample was collected at the mouth of the right-side outfall, looking up-stream. No notable odor was detected. Color was clear and some suspended particulates were observed. Foam was observed coming from the outfall and orange staining was observed on both the inside of the outfall pipe and on the rocks directly downstream of the outfall.

Map of Sample Locations

Note: the locations on the map were estimated using Google Earth and are used for display purposes only.



Note:

LQ-03: No flow

LQ-04A: No flow

LQ-06A: Outfall was 80% submerged and no flow was observed/ water was stagnant

Table 1: Summary of Sampling and Analytical Data

Location	Site ID	LQ-01	LQ-02	LQ-04BS	LQ-04B	LQ-05
	Sample Date	05/28/24	05/28/24	05/28/24	05/28/24	05/28/24
	Sample Time	9:59	10:42	11:53	12:20	13:00
Coordinates ¹ (decimal degrees)	North	42.2909	42.2803	42.2640	42.2641	42.2446
	West	-71.7600	-71.7638	-71.7592	-71.7592	-71.7472
YSI Meter	Salinity, ppt.	0.7	0.4	0.2	0.1	0.2
	Temperature, °C	16.5	21.6	15.0	13.1	17.4
	Conductivity, µS/cm	1363	784.0	428.3	177.3	376.4
Field Test Kits (mg/L)	Ammonia	0.20	0.25	0.25	0.25	0.25
	Total Chlorine	0.10	0.04	0.03	0.02	0.02
	Surfactants	0.40	0.25	0.25	0.25	0.25
Bacteria (MPN/100mL)	E. coli	2747	3466	9678	16	308
	Enterococcus	1674	1850	886	31	355
PPCPs (ng/L)	Cotinine	9.1	4.0	7.3	5.6	2.1
	Acetaminophen	530	3.7	260	ND	300
	Paraxanthine	50	2.2	43	53	21
	Atenolol	ND	ND	ND	ND	ND
	Caffeine	170	63	570	24	160
	Metoprolol	ND	ND	ND	ND	ND
	Diphenhydramine	2.5	ND	1.9	0.75	ND
	Carbamazepine	5.1	ND	0.77	ND	ND

Abbreviations and Notes:

1. The coordinates listed in Table 1 were derived from the map created in Google Earth, therefore the coordinates are estimates of the actual locations.

N/A: Not Analyzed

ND: Not Detected above Reporting Limit

E. Coli/Fecal Coliform: Red ≥ 10,000 col/100ml, Orange ≥ 1,260 col/100ml, Yellow ≥ 235 col/100ml, Black < 235 col/100ml

Enterococcus: Red ≥ 1,000 col/100ml, Orange ≥ 350, Yellow ≥ 61 col/100ml, Black < 61 col/100ml

NH₃: Red ≥ 6 mg/L, Orange ≥ 0.5 mg/L, Yellow ≥ 0.25 mg/L, Black < 0.25 mg/L

Cl₂: Red ≥ 1.0 mg/L, Orange ≥ 0.3 mg/L, Yellow ≥ 0.02 mg/L, Black < 0.02 mg/L

Surfactants: Red ≥ 1.0 mg/L, Orange ≥ 0.5 mg/L, Yellow ≥ 0.25 mg/L, Black < 0.25 mg/L (may give false positive at salinity greater than 1 ppt)

PPCPs: Red ≥ 100x the RL, Orange ≥ 10x the RL, Yellow ≥ 3x the RL; Black < 3x the RL*

*See Reporting Limit (RL) values for each compound in attached Laboratory Report for Source Tracking

EPA notes while there are currently no numerical standards to compare pharmaceutical results against, it is EPA's experience that acetaminophen is the single best bacterial source tracking compound of those listed above, and any detection of this compound may indicate a source of sanitary sewage. With respect to all of the above compounds, when a sanitary sewage source is present, depending on the type of source, distance from the sample location, and the strength of the source, concentrations of these compounds may range from the low ng/l range up to thousands of ng/L.

Table 1: Summary of Sampling and Analytical Data, cont.

Location	Site ID	LQ-06BL	LQ-06BR
	Sample Date	05/28/24	05/28/24
	Sample Time	13:48	13:50
Coordinates ¹ (decimal degrees)	North	42.2387	42.2387
	West	-71.7506	-71.7506
YSI Meter	Salinity, ppt.	0.1	0.2
	Temperature, °C	14.2	14.4
	Conductivity, µS/cm	211.8	40.36
Field Test Kits (mg/L)	Ammonia	0.15	0.25
	Total Chlorine	0.00	0.00
	Surfactants	0.25	0.25
Bacteria (MPN/100mL)	E. coli	39	8
	Enterococcus	31	ND
PPCPs (ng/L)	Cotinine	ND	1.4
	Acetaminophen	ND	ND
	Paraxanthine	ND	2.9
	Atenolol	ND	ND
	Caffeine	ND	14
	Metoprolol	ND	ND
	Diphenhydramine	ND	ND
	Carbamazepine	ND	0.41

Abbreviations and Notes:

1. The coordinates listed in Table 1 were derived from the map created in Google Earth, therefore the coordinates are estimates of the actual locations.

N/A: Not Analyzed

ND: Not Detected above Reporting Limit

E. Coli/Fecal Coliform: Red $\geq 10,000$ col/100ml, Orange $\geq 1,260$ col/100ml, Yellow ≥ 235 col/100ml, Black < 235 col/100ml

Enterococcus: Red $\geq 1,000$ col/100ml, Orange ≥ 350 col/100ml, Yellow ≥ 61 col/100ml, Black < 61 col/100ml

NH₃: Red ≥ 6 mg/L, Orange ≥ 0.5 mg/L, Yellow ≥ 0.25 mg/L, Black < 0.25 mg/L

Cl₂: Red ≥ 1.0 mg/L, Orange ≥ 0.5 mg/L, Yellow ≥ 0.02 mg/L, Black < 0.02 mg/L

Surfactants: Red ≥ 1.0 mg/L, Orange ≥ 0.5 mg/L, Yellow ≥ 0.25 mg/L, Black < 0.25 mg/L (may give false positive at salinity greater than 1 ppt)

PPCPs: Red ≥ 100 x the RL, Orange ≥ 10 x the RL, Yellow ≥ 3 x the RL; No Pink < 3 x the RL*

*See Reporting Limit (RL) values for each compound in attached Laboratory Report for Source Tracking

EPA notes while there are currently no numerical standards to compare pharmaceutical results against, it is EPA's experience that acetaminophen is the single best bacterial source tracking compound of those listed above, and any detection of this compound may indicate a source of sanitary sewage. With respect to all of the above compounds, when a sanitary sewage source is present, depending on the type of source, distance from the sample location, and the strength of the source, concentrations of these compounds may range from the low ng/l range up to thousands of ng/L.

IX. Appendix

Appendix A: Photograph Log

X. Attachments

Attachment A: Laboratory Report for PPCPs (Source Tracking) Analysis

Attachment B: Laboratory Report for E. coli Analysis

Attachment C: Laboratory Report for Enterococcus Analysis

End of Report

Appendix A
Photograph Log



Photo 1: LQ-01 (photo taken 05/28/2024 at approx. 9:59) Stream located near 616 Plantation St, discharging into Coal Mine Brook, upstream of Lake Quinsigamond. Sample point is indicated by a red X.



Photo 2: LQ-02 (photo taken 05/28/2024 at approx. 10:42) Outfall located near 382 Plantation Street, discharging into the unnamed stream uphill of Lake Quinsigamond. Sample points are indicated by a red X.



Photo 3: LQ-04BS (photo taken 05/28/2024 at approx. 11:53) Stream located near 240 Coburn Ave, is Fitzgerald Brook which discharges into Lake Quinsigamond. In-stream Sample points are indicated by a red X.



Photo 4: LQ-04B (photo taken 05/28/2024 at approx. 12:20) Outfall located near 240 Coburn Ave, discharging into Fitzgerald Brook which discharges into Lake Quinsigamond. Sample points are indicated by a red X.



Photo 5: LQ-05 (photo taken 05/28/2024 at approx. 13:00) Outfall located near 5 Suntaug Road, discharging into Lake Quinsigamond. Sample points are indicated by a red X.



Photo 6: LQ-06BL (photo taken 05/28/2024 at approx. 13:48) Outfall located near 10 Crane Street, discharging into an unnamed stream that discharges into Lake Quinsigamond. Sample points are indicated by a red X.



Photo 7: LQ-06BR (photo taken 05/28/2024 at approx. 13:50) Outfall located near 10 Crane Street, discharging into the unnamed stream that discharges into Lake Quinsigamond. Sample points are indicated by a red X.

Attachment A
Laboratory Report for
Source Tracking Analysis

Author: LSASD Laboratory Services Branch
Pages: 16

Attachment B
Laboratory Report for
E. coli Analysis

Author: LSASD Laboratory Services Branch
Pages: 4

Attachment C
Laboratory Report for
Enterococcus Analysis

Author: LSASD Laboratory Services Branch
Pages: 4

End of Report



United States Environmental Protection Agency
Laboratory Services and Applied Science Division
11 Technology Drive
North Chelmsford, MA 01863-2431

Microbiology Laboratory Report

June 25, 2024

Anna Hatke
US EPA New England R1

Project Number: 24050041
Project: Lake Quinsigamond Worcester, MA MS4
Analysis: E. Coli Defined Substrate
Analyst: Jack Paar

Date Samples Received by the Laboratory: 05/29/2024

Analytical Procedure:

All samples were received and logged in by the laboratory according to the USEPA New England Laboratory SOP for Sample Log-in.

Sample preparation and analysis was done following the EPA Region I SOP, TC/ECColilert4.

Data were reviewed in accordance with the internal verification procedures described in the EPA New England LSASD Biology QA Plan.

Results relate only to the items tested or to the samples as received by the Laboratory. This analytical report shall not be reproduced except in full, without written approval of the laboratory.

If you have any questions please call me at 617-918-8604.

Sincerely,

Jack A. Paar, III
Biology Laboratory Manager

24050041ECMM

Water Microbiology Laboratory
Data Qualifier Codes

J = Estimate
H = Exceeds holding time
I = Exceeds incubation time
At = Atypical overgrowth
S = Lost sample
V = Insufficient sample volume
TNTC = Too numerous to count
MB = Media blank
+++ = Positive control
- - - = Negative control
SP = Spiked Sample
L = Estimated, result below reporting limit (RL)
ND = Not Detected, result less than RL
D = Lab Duplicate
P = Plate counts outside preferred range
FDUP = Field Duplicate collect time not specified on Chain of Custody. Field duplicate
LIMS default time = 12:00AM

24050041ECMM

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1 - NEW ENGLAND
LABORATORY SERVICES BRANCH
Lake Quinsigamond Worcester, MA MS4
E. Coli Defined Substrate

Matrix: Stormwater

Sample Number	Lab ID	Date/Time of Collection	Date/Time of Analysis	Compound	Concentration MPN/100 mL	RL MPN/100 mL	Qualifier
LQ-01	AC13257	05/28/24 9:59 am	05/28/24 3:30 pm	E. Coli Defined Substrate	2747	4	
LQ-02	AC13258	05/28/24 10:42 am	05/28/24 3:30 pm	E. Coli Defined Substrate	3466	4	
LQ-04BS	AC13259	05/28/24 11:53 am	05/28/24 3:30 pm	E. Coli Defined Substrate	9678	4	
LQ-04B	AC13260	05/28/24 12:20 pm	05/28/24 3:30 pm	E. Coli Defined Substrate	16	4	
LQ-05	AC13261	05/28/24 1:00 pm	05/28/24 3:30 pm	E. Coli Defined Substrate	308	4	
LQ-06BL	AC13262	05/28/24 1:48 pm	05/28/24 3:30 pm	E. Coli Defined Substrate	39	4	
LQ-06BR	AC13263	05/28/24 1:50 pm	05/28/24 3:30 pm	E. Coli Defined Substrate	8	4	

Number of Samples: 7



United States Environmental Protection Agency
Laboratory Services and Applied Science Division
11 Technology Drive
North Chelmsford, MA 01863-2431

Microbiology Laboratory Report

June 25, 2024

Anna Hatke
US EPA New England R1

Project Number: 24050041
Project: Lake Quinsigamond Worcester, MA MS4
Analysis: Enterococcus in Water
Analyst: Jack Paar

Date Samples Received by the Laboratory: 05/29/2024

Analytical Procedure:

All samples were received and logged in by the laboratory according to the USEPA New England Laboratory SOP for Sample Log-in.

Sample preparation and analysis was done following the EPA Region I SOP, ECA Enterolert3.

Data were reviewed in accordance with the internal verification procedures described in the EPA New England LSASD Biology QA Plan.

Results relate only to the items tested or to the samples as received by the Laboratory. This analytical report shall not be reproduced except in full, without written approval of the laboratory.

If you have any questions please call me at 617-918-8604.

Sincerely,

Jack A. Paar, III
Biology Laboratory Manager

24050041ENTERO

Water Microbiology Laboratory
Data Qualifier Codes

J = Estimate
H = Exceeds holding time
I = Exceeds incubation time
At = Atypical overgrowth
S = Lost sample
V = Insufficient sample volume
TNTC = Too numerous to count
MB = Media blank
+++ = Positive control
- - - = Negative control
SP = Spiked Sample
L = Estimated, result below reporting limit (RL)
ND = Not Detected, result less than RL
D = Lab Duplicate
P = Plate counts outside preferred range
FDUP = Field Duplicate collect time not specified on Chain of Custody. Field duplicate
LIMS default time = 12:00AM

24050041ENTERO

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1 - NEW ENGLAND
LABORATORY SERVICES BRANCH
Lake Quinsigamond Worcester, MA MS4
Enterococcus in Water

Matrix: Stormwater

Sample Number	Lab ID	Date/Time of Collection	Date/Time of Analysis	Compound	Concentration MPN/100mL	RL MPN/100mL	Qualifier
LQ-01	AC13257	05/28/24 9:59 am	05/28/24 3:30 pm	Enterococcus in Water	1674	10	
LQ-02	AC13258	05/28/24 10:42 am	05/28/24 3:30 pm	Enterococcus in Water	1850	10	
LQ-04BS	AC13259	05/28/24 11:53 am	05/28/24 3:30 pm	Enterococcus in Water	886	10	
LQ-04B	AC13260	05/28/24 12:20 pm	05/28/24 3:30 pm	Enterococcus in Water	31	10	
LQ-05	AC13261	05/28/24 1:00 pm	05/28/24 3:30 pm	Enterococcus in Water	355	10	
LQ-06BL	AC13262	05/28/24 1:48 pm	05/28/24 3:30 pm	Enterococcus in Water	31	10	
LQ-06BR	AC13263	05/28/24 1:50 pm	05/28/24 3:30 pm	Enterococcus in Water	ND	10	

Number of Samples: 7

CHAIN OF CUSTODY RECORD

[illegible]

Distribution: Original Accompanies Shipment. Copy to Coordinator Field Files.

FSBFORM-CHAINCUSTODY1
Revision 1
05/16/2022

Laboratory Report

June 12, 2024

Anna Hatke
US EPA New England R1

Project Number: 24050040
Project: Lake Quinsigamond Worcester, MA MS4
Analysis: HPLC/MS/MS Source Tracking Analysis
EPA Chemist: Peter Philbrook

Date Samples Received by the Laboratory: 05/29/2024

Analytical Procedure:

All samples were received and logged in by the laboratory according to the USEPA New England Laboratory SOP for Sample Log-in.

Sample preparation and analysis was done following the EPA Region I SOP, LSBSOP-LCMS_STA3.

The SOP is based on an EPA Regional Analytical Method developed at the EPA New England Laboratory.

Data were reviewed in accordance with the internal verification procedures described in the EPA New England Quality Manual for NERL.

Results relate only to the items tested or to the samples as received by the Laboratory. This analytical report shall not be reproduced except in full, without written approval of the laboratory.

If you have any questions please call me at 617-918-8340 .

Sincerely,

24050040\$STA

Qualifiers:

RL = Reporting limit

ND = Not Detected above Reporting limit

NA = Not Applicable due to high sample dilutions or sample interferences

NC = Not calculated since analyte concentration is ND.

J = Estimated value

J1 = Estimated value due to MS recovery outside acceptance criteria

J2 = Estimated value due to LFB result outside acceptance criteria

J3 = Estimated value due to RPD result outside acceptance criteria

J4 = Estimated value due to LCS result outside acceptance criteria

E = Estimated value exceeds the calibration range

L = Estimated value is below the calibration range

B = Analyte is associated with the lab blank or trip blank contamination. Values are qualified when the observed concentration of the contamination in the sample extract is less than 10 times the concentration in the blank.

R = No recovery was calculated since the analyte concentration is greater than four times the spike level.

P = The confirmation value exceeded 35% difference and is less than 100%. The lower value is reported.

C = The identification has been confirmed by GC/MS.

A = Suspected Aldol condensation product.

N = Tentatively identified compound.

Lake Quinsigamond Worcester, MA MS4

HPLC/MS/MS Source Tracking Analysis

Client Sample ID:	LQ-01	Lab Sample ID:	AC13249
Date of Collection:	5/28/2024	Matrix:	Stormwater
Date of Preparation:	5/29/2024	Amount Prepared:	500 mL
Date of Analysis:	6/04/2024	Percent Solids:	N/A
Dry Weight Prepared:	N/A	Extract Dilution:	1
Wet Weight Prepared:	N/A	pH:	N/A

CAS Number	Compound	Concentration ng/L	Dilution	RL ng/L	Qualifier
486-56-6	Cotinine	9.1	1	0.40	
103-90-2	Acetaminophen	530	1	2.0	
611-59-6	Paraxanthine	50	1	2.0	
29122-68-7	Atenolol	ND	1	2.0	
58-08-2	Caffeine	170	1	4.0	
56392-17-7	Metoprolol	ND	1	2.0	
58-73-1	Diphenhydramine	2.5	1	0.40	
298-46-4	Carbamazepine	5.1	1	0.40	

Surrogate Compounds	Recoveries (%)	QC Ranges
Phentermine-D5	71	37 - 113
Diphenhydramine-D3	64	8 - 114

Comments:

Lake Quinsigamond Worcester, MA MS4

HPLC/MS/MS Source Tracking Analysis

Client Sample ID:	LQ-02	Lab Sample ID:	AC13250
Date of Collection:	5/28/2024	Matrix:	Stormwater
Date of Preparation:	5/29/2024	Amount Prepared:	500 mL
Date of Analysis:	6/04/2024	Percent Solids:	N/A
Dry Weight Prepared:	N/A	Extract Dilution:	1
Wet Weight Prepared:	N/A	pH:	N/A

CAS Number	Compound	Concentration ng/L	Dilution	RL ng/L	Qualifier
486-56-6	Cotinine	4.0	1	0.40	
103-90-2	Acetaminophen	3.7	1	2.0	
611-59-6	Paraxanthine	2.2	1	2.0	
29122-68-7	Atenolol	ND	1	2.0	
58-08-2	Caffeine	63	1	4.0	
56392-17-7	Metoprolol	ND	1	2.0	
58-73-1	Diphenhydramine	ND	1	0.40	
298-46-4	Carbamazepine	ND	1	0.40	

Surrogate Compounds	Recoveries (%)	QC Ranges
Phentermine-D5	61	37 - 113
Diphenhydramine-D3	57	8 - 114

Comments:

Lake Quinsigamond Worcester, MA MS4

HPLC/MS/MS Source Tracking Analysis

Client Sample ID:	LQ-04BS	Lab Sample ID:	AC13251
Date of Collection:	5/28/2024	Matrix:	Stormwater
Date of Preparation:	5/29/2024	Amount Prepared:	500 mL
Date of Analysis:	6/04/2024	Percent Solids:	N/A
Dry Weight Prepared:	N/A	Extract Dilution:	1
Wet Weight Prepared:	N/A	pH:	N/A

CAS Number	Compound	Concentration ng/L	Dilution	RL ng/L	Qualifier
486-56-6	Cotinine	7.3	1	0.40	
103-90-2	Acetaminophen	260	1	2.0	
611-59-6	Paraxanthine	43	1	2.0	
29122-68-7	Atenolol	ND	1	2.0	
58-08-2	Caffeine	570	1	4.0	
56392-17-7	Metoprolol	ND	1	2.0	
58-73-1	Diphenhydramine	1.9	1	0.40	
298-46-4	Carbamazepine	0.77	1	0.40	

Surrogate Compounds	Recoveries (%)	QC Ranges
Phentermine-D5	84	37 - 113
Diphenhydramine-D3	75	8 - 114

Comments:

Lake Quinsigamond Worcester, MA MS4

HPLC/MS/MS Source Tracking Analysis

Client Sample ID:	LQ-04B	Lab Sample ID:	AC13252
Date of Collection:	5/28/2024	Matrix:	Stormwater
Date of Preparation:	5/29/2024	Amount Prepared:	500 mL
Date of Analysis:	6/04/2024	Percent Solids:	N/A
Dry Weight Prepared:	N/A	Extract Dilution:	1
Wet Weight Prepared:	N/A	pH:	N/A

CAS Number	Compound	Concentration ng/L	Dilution	RL ng/L	Qualifier
486-56-6	Cotinine	5.6	1	0.40	
103-90-2	Acetaminophen	ND	1	2.0	
611-59-6	Paraxanthine	53	1	2.0	
29122-68-7	Atenolol	ND	1	2.0	
58-08-2	Caffeine	24	1	4.0	
56392-17-7	Metoprolol	ND	1	2.0	
58-73-1	Diphenhydramine	0.75	1	0.40	
298-46-4	Carbamazepine	ND	1	0.40	

Surrogate Compounds	Recoveries (%)	QC Ranges
Phentermine-D5	78	37 - 113
Diphenhydramine-D3	71	8 - 114

Comments:

Lake Quinsigamond Worcester, MA MS4

HPLC/MS/MS Source Tracking Analysis

Client Sample ID:	LQ-04B DUP	Lab Sample ID:	AC13253
Date of Collection:	5/28/2024	Matrix:	Stormwater
Date of Preparation:	5/29/2024	Amount Prepared:	500 mL
Date of Analysis:	6/04/2024	Percent Solids:	N/A
Dry Weight Prepared:	N/A	Extract Dilution:	1
Wet Weight Prepared:	N/A	pH:	N/A

CAS Number	Compound	Concentration ng/L	Dilution	RL ng/L	Qualifier
486-56-6	Cotinine	5.8	1	0.40	
103-90-2	Acetaminophen	ND	1	2.0	
611-59-6	Paraxanthine	54	1	2.0	
29122-68-7	Atenolol	ND	1	2.0	
58-08-2	Caffeine	26	1	4.0	
56392-17-7	Metoprolol	ND	1	2.0	
58-73-1	Diphenhydramine	0.79	1	0.40	
298-46-4	Carbamazepine	ND	1	0.40	

Surrogate Compounds	Recoveries (%)	QC Ranges
Phentermine-D5	76	37 - 113
Diphenhydramine-D3	74	8 - 114

Comments:

Lake Quinsigamond Worcester, MA MS4

HPLC/MS/MS Source Tracking Analysis

Client Sample ID:	LQ-05	Lab Sample ID:	AC13254
Date of Collection:	5/28/2024	Matrix:	Stormwater
Date of Preparation:	5/29/2024	Amount Prepared:	500 mL
Date of Analysis:	6/04/2024	Percent Solids:	N/A
Dry Weight Prepared:	N/A	Extract Dilution:	1
Wet Weight Prepared:	N/A	pH:	N/A

CAS Number	Compound	Concentration ng/L	Dilution	RL ng/L	Qualifier
486-56-6	Cotinine	2.1	1	0.40	
103-90-2	Acetaminophen	300	1	2.0	
611-59-6	Paraxanthine	21	1	2.0	
29122-68-7	Atenolol	ND	1	2.0	
58-08-2	Caffeine	160	1	4.0	
56392-17-7	Metoprolol	ND	1	2.0	
58-73-1	Diphenhydramine	ND	1	0.40	
298-46-4	Carbamazepine	ND	1	0.40	

Surrogate Compounds	Recoveries (%)	QC Ranges
Phentermine-D5	66	37 - 113
Diphenhydramine-D3	66	8 - 114

Comments:

Lake Quinsigamond Worcester, MA MS4

HPLC/MS/MS Source Tracking Analysis

Client Sample ID:	LQ-06BL	Lab Sample ID:	AC13255
Date of Collection:	5/28/2024	Matrix:	Stormwater
Date of Preparation:	5/29/2024	Amount Prepared:	500 mL
Date of Analysis:	6/04/2024	Percent Solids:	N/A
Dry Weight Prepared:	N/A	Extract Dilution:	1
Wet Weight Prepared:	N/A	pH:	N/A

CAS Number	Compound	Concentration ng/L	Dilution	RL ng/L	Qualifier
486-56-6	Cotinine	ND	1	0.40	
103-90-2	Acetaminophen	ND	1	2.0	
611-59-6	Paraxanthine	ND	1	2.0	
29122-68-7	Atenolol	ND	1	2.0	
58-08-2	Caffeine	ND	1	4.0	
56392-17-7	Metoprolol	ND	1	2.0	
58-73-1	Diphenhydramine	ND	1	0.40	
298-46-4	Carbamazepine	ND	1	0.40	

Surrogate Compounds	Recoveries (%)	QC Ranges
Phentermine-D5	72	37 - 113
Diphenhydramine-D3	60	8 - 114

Comments:

Lake Quinsigamond Worcester, MA MS4

HPLC/MS/MS Source Tracking Analysis

Client Sample ID:	LQ-06BR	Lab Sample ID:	AC13256
Date of Collection:	5/28/2024	Matrix:	Stormwater
Date of Preparation:	5/29/2024	Amount Prepared:	500 mL
Date of Analysis:	6/04/2024	Percent Solids:	N/A
Dry Weight Prepared:	N/A	Extract Dilution:	1
Wet Weight Prepared:	N/A	pH:	N/A

CAS Number	Compound	Concentration ng/L	Dilution	RL ng/L	Qualifier
486-56-6	Cotinine	1.4	1	0.40	
103-90-2	Acetaminophen	ND	1	2.0	
611-59-6	Paraxanthine	2.9	1	2.0	
29122-68-7	Atenolol	ND	1	2.0	
58-08-2	Caffeine	14	1	4.0	
56392-17-7	Metoprolol	ND	1	2.0	
58-73-1	Diphenhydramine	ND	1	0.40	
298-46-4	Carbamazepine	0.41	1	0.40	

Surrogate Compounds	Recoveries (%)	QC Ranges
Phentermine-D5	75	37 - 113
Diphenhydramine-D3	65	8 - 114

Comments:

Lake Quinsigamond Worcester, MA MS4

Laboratory Blank

Client Sample ID:	N/A	Lab Sample ID:	N/A
Date of Collection:	N/A	Matrix:	Stormwater
Date of Preparation:	5/29/2024	Amount Prepared:	500 mL
Date of Analysis:	6/04/2024	Percent Solids:	N/A
Dry Weight Prepared:	N/A	Extract Dilution:	1
Wet Weight Prepared:	N/A	pH:	N/A

CAS Number	Compound	Concentration ng/L	Dilution	RL ng/L	Qualifier
486-56-6	Cotinine	ND	1	0.40	
103-90-2	Acetaminophen	ND	1	2.0	
611-59-6	Paraxanthine	ND	1	2.0	
29122-68-7	Atenolol	ND	1	2.0	
58-08-2	Caffeine	ND	1	4.0	
56392-17-7	Metoprolol	ND	1	2.0	
58-73-1	Diphenhydramine	ND	1	0.40	
298-46-4	Carbamazepine	ND	1	0.40	

Surrogate Compounds	Recoveries (%)	QC Ranges
Phentermine-D5	71	37 - 113
Diphenhydramine-D3	65	8 - 114

Comments:

Lake Quinsigamond Worcester, MA MS4

MATRIX SPIKE (MS) RECOVERY

Sample ID: AC13256

PARAMETER	SPIKE ADDED ng/L	SAMPLE CONCENTRATION ng/L	MS CONCENTRATION ng/L	MS % REC	QC LIMITS (% REC)
Acetaminophen	120	ND	95.1	79	55 - 99
Atenolol	120	ND	106	88	24 - 160
Caffeine	240	14.0	208	81	34 - 131
Carbamazepine	24.0	0.41	23.8	98	61 - 107
Cotinine	24.0	1.4	20.0	78	48 - 112
Diphenhydramine	24.0	ND	17.6	73	17 - 112
Metoprolol	120	ND	105	88	31 - 137
Paraxanthine	120	2.9	109	88	41 - 132

Lake Quinsigamond Worcester, MA MS4

Laboratory Duplicate Results

Sample ID: AC13255

PARAMETER	SAMPLE RESULT ng/L	SAMPLE DUPLICATE RESULT ng/L	PRECISION RPD %	QC LIMITS
Acetaminophen	ND	ND	NC	50
Atenolol	ND	ND	NC	50
Caffeine	ND	ND	NC	50
Carbamazepine	ND	ND	NC	50
Cotinine	ND	ND	NC	50
Diphenhydramine	ND	ND	NC	50
Metoprolol	ND	ND	NC	50
Paraxanthine	ND	ND	NC	50

Lake Quinsigamond Worcester, MA MS4

Laboratory Fortified Blank (LFB) Results

PARAMETER	LFB AMOUNT SPIKED ng/L	LFB RESULT ng/L	LFB RECOVERY %	QC LIMITS %
Acetaminophen	120	94.9	79	45 - 106
Atenolol	120	93.2	78	33 - 129
Caffeine	240	167	70	41 - 120
Carbamazepine	24	24.5	102	63 - 108
Cotinine	24	18.9	79	55 - 106
Diphenhydramine	24	19.2	80	15 - 113
Metoprolol	120	89.2	74	41 - 122
Paraxanthine	120	98.0	82	52 - 115

Comments:

Samples in Batch: AC13249, AC13250, AC13251, AC13252, AC13253, AC13254, AC13255, AC13256

**US EPA REGION 1
SAMPLE RECEIPT CHECKLIST**

PROJ #: 24050040	RECEIPT DATE: 5/28/24
SURVEY NAME: Lake Quinsigamond LOCATION: Worcester, MA	REC'D BY: Laura Glowacki (ESAT)
OSC/PO: Anna Hatke	SITE ID: SUPERFUND: N

WERE SAMPLES SHIPPED? TRACKING #: _____ DATE/SENT: _____ NO. ☐ Hand Delivered ☒ COOLER TEMPERATURE UPON ARRIVAL ³⁵ _____ °C / NA	COMMENTS: Stormwater samples 8 \$STA Samples recieved on 5/28/29 and logged in on 5/29/24
CHAIN OF CUSTODY PRESENT? ☒ COMPLETE? ☒	
CUSTODY SEALS PRESENT ON COOLER? ☒ SAMPLES? ☒	
WERE SAMPLE CONTAINERS INTACT? ☒	
WAS SAMPLE PRESERVATION DOCUMENTED? ☒ COC ☒ Sample Container ☒	
APPROPRIATE SAMPLES VOLUME FOR REQUESTED ANALYSIS? ☒	
SAMPLES AND COC MATCH? ☒	
IF ANY PROBLEMS WAS PROJECT MANAGER NOTIFIED? BY WHOM? ³⁶ _____	
APPROPRIATE SAMPLE CONTAINERS? ☒	
SAMPLES WITHIN HOLDING TIMES? ☒	
ALL ANALYSIS SPECIFIED ON COC? ☒	
DATE/TIME OF COLLECTION ON COC ☒	
TURN-AROUND TIME: 4 weeks	