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REPORT

June 30, 2022

CITY OF
Chelsea
MASSACHUSETTS

Mill Creek Water Quality Improvement Project

Volume I of III: Non-Point Source Pollution Assessment

View of Mill Creek from 88 Clinton Street, Chelsea, MA – future location of City park.

This project was funded by the Fiscal Year 2022 Coastal Pollutant Remediation (CPR) Grant Program awarded by the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs Office of Coastal Zone Management.

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1.0 INTRODUCTION

The City of Chelsea has a strong desire to undertake a collaborative, iterative, and multidisciplinary planning and implementation approach to create a clean Mill Creek and meet its legal, ethical, and moral obligations to its residents. In the near-term, the goal is to improve degraded ecological habitat, reduce pollution entering the Creek, broaden public access to the waterfront, and create connected recreational areas. In a densely developed Environmental Justice community that has limited open space, enhancements along this waterfront are critical to the community's vitality.

Solutions for Mill Creek will ultimately require significant coordination, capital expenditures, and operation and maintenance efforts that address both non-point source pollution and point source pollution simultaneously, will necessitate stakeholder engagement and input, and will integrate with the City's obligations and competing priorities.

This report serves to further previous work (specifically, the Mystic River Restoration Project – Mill Creek Restoration Assessments (funded by a Fiscal Year (FY) 2018 MassBays Healthy Estuaries Grant), overlap with other ongoing pollution reduction efforts in the City (e.g., elimination of sanitary sewer overflows, combined sewer separation, elimination of combined sewer overflows, finding and removing illicit discharges and connections to the drainage system, and any contaminated site cleanups), and collaborate with ongoing placemaking (e.g., new park at 88 Clinton Street, greenways planning and connectivity, etc.) by addressing non-point source pollution in the Mill Creek Watershed.

Half a century after the Clean Water Act became law in 1972, the residents of Chelsea still do not have access to the promised swimmable and fishable waters. In the same year, the citizens of Commonwealth amended the Massachusetts Constitution to include the ninety-seventh Article of Amendment which provides: "The people shall have the right to clean air and water, freedom from excessive and unnecessary noise, and the natural, scenic, historic, and esthetic qualities of their environment; and the protection of the people in their right to the conservation, development and utilization of the agricultural, mineral, forest, water, air and other natural resources is hereby declared to be a public purpose." The people of Chelsea have been waiting 50 years for these promises to be kept. Mill Creek represents a systemic failure by all levels of government to an environmental justice community.

1.1 Coastal Pollutant Remediation (CPR) Grant Program

The work for this project was generously funded by an Office of Coastal Zone Management (CZM) Coastal Pollutant Remediation (CPR) Grant. The CPR Grant Program was "established in 1994 by the Massachusetts Legislature to help communities identify and improve water quality impaired by nonpoint source (NPS) pollution. The goal of the CPR Grant Program is to provide funding to Massachusetts municipalities to assess and treat stormwater pollution from impervious surfaces and to design and construct commercial boat waste pumpout facilities."[1] The following provides additional clarification on nonpoint vs. point source pollution as defined by the U.S. Environmental Protection Agency:[2]

[1] https://www.mass.gov/service-details/coastal-pollutant-remediation-cpr-grant-program
[2] https://www.epa.gov/nps/basic-information-about-nonpoint-source-nps-pollution#overview

- Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. Nonpoint source pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. Nonpoint source pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters. Technically, the term “nonpoint source” is defined to mean any source of water pollution that does not meet the legal definition of “point source” in section 502(14) of the Clean Water Act.
- The term “point source” means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.” This term does not include agricultural storm water discharges and return flows from irrigated agriculture.

Although diffuse runoff is generally treated as nonpoint source pollution, runoff that enters and is discharged from conveyances such as those described above is treated as a point source discharge and hence is subject to the permit requirements of the Clean Water Act. Discharges to Mill Creek from the City of Chelsea, City of Revere, City of Everett, Massachusetts Department of Transportation (MassDOT), and Department of Conservation and Recreation (DCR) are regulated through the National Pollutant Discharge Elimination System (NPDES) permit program, through general permits and enforcement mechanisms, issued by U.S. EPA Region 1. Those discharges are held to a specific set of standards

In contrast, nonpoint sources are not subject to Federal permit requirements. The distinction between nonpoint sources and diffuse point sources is sometimes unclear. Generally speaking, nonpoint sources would be considered pollution on the land surface that is captured by runoff and snowmelt. In Chelsea, once it enters the drainage system that has a discrete point of discharge, it becomes point source pollution and is regulated by the NPDES program. Examples of nonpoint source pollution in and around Mill Creek include:

- Excess fertilizers, herbicides and insecticides from residential areas
- Oil, grease and toxic chemicals from urban runoff and energy production
- Sediment from improperly managed construction sites
- Salt from winter anti- and de-icing practices
- Bacteria and nutrients from pet and animal wastes
- Atmospheric deposition
- Streambank and shoreline erosion

1.2 Mill Creek

As shown in Figure 1-1, Mill Creek falls within the Mystic River Watershed and serves as a boundary between the cities of Chelsea and Revere. As described by the Mystic River Watershed Association (MyRWA), “the Mystic River Watershed covers 76 square miles or roughly 1% of the land area of Massachusetts. It includes all the land area that drains into the Mystic River. Its headwaters begin in Reading, MA and form the Aberjona River, then flow into the Upper Mystic Lake in Winchester. From the Lower Mystic Lake, the Mystic River flows through Arlington, Somerville, Medford, Everett, Chelsea, Charlestown, and East Boston before emptying into Boston Harbor."[3] Mill Creek itself is a tidally influenced tributary to the Chelsea River and ultimately discharges to the Mystic River and Boston Harbor.

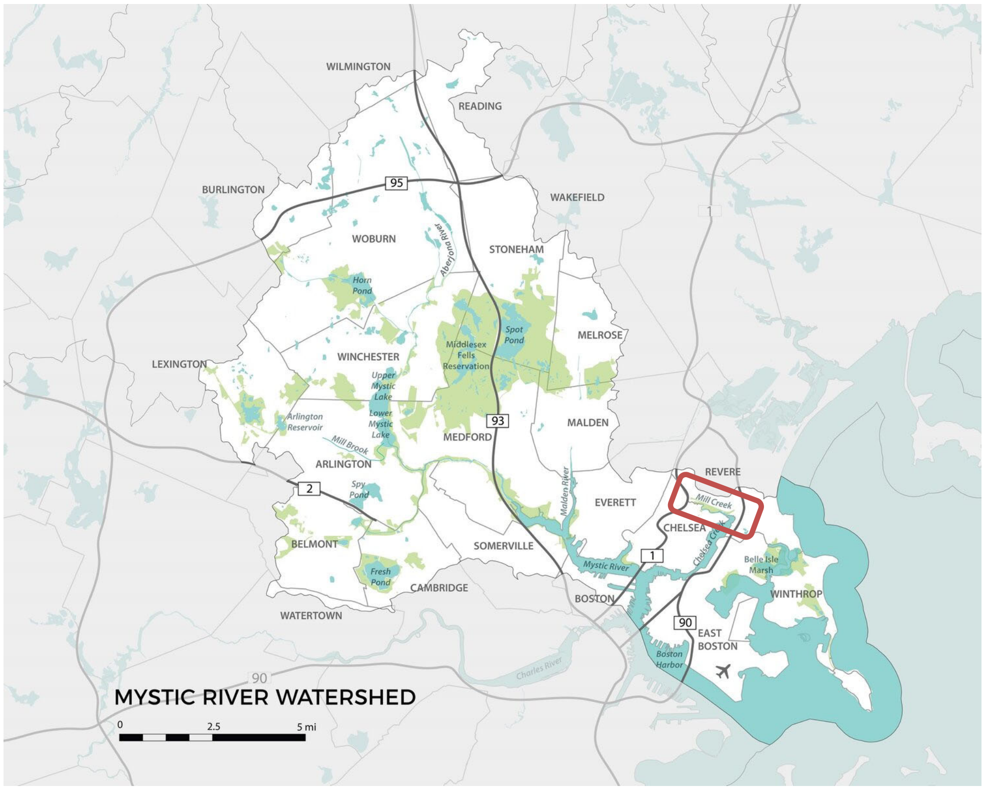


Figure 1-1: Mystic River Watershed and Mill Creek
Source: Mystic River Watershed Association, https://mysticriver.org/maps

Ecologically, the Creek functions as Chelsea's largest and most biodiverse salt marsh, however, the marsh that remains is only a small fraction of its historical area. Most of the marsh was largely filled and developed in the mid-1900s for industry, roadways, and housing as shown in Figure 1-2.

The Mill Creek catchment area is defined by the slopes of four glacial drumlins exceeding 150 feet in height and five smaller hills. The lowlands between these points of elevation consist mostly of urban fill and areas of poor drainage with high water tables.

[3] https://mysticriver.org/maps

Figure 1-2: Area surrounding Mill Creek 1946 (Left) vs 2012 (Right)
Source: Horsley Whitten Mill Creek Restoration Assessments – July 2019, (EDR, 2015)

As a result, water quality in Mill Creek has suffered, and the now developed area around the creek is prone to flooding, as show in Figure 1-3.

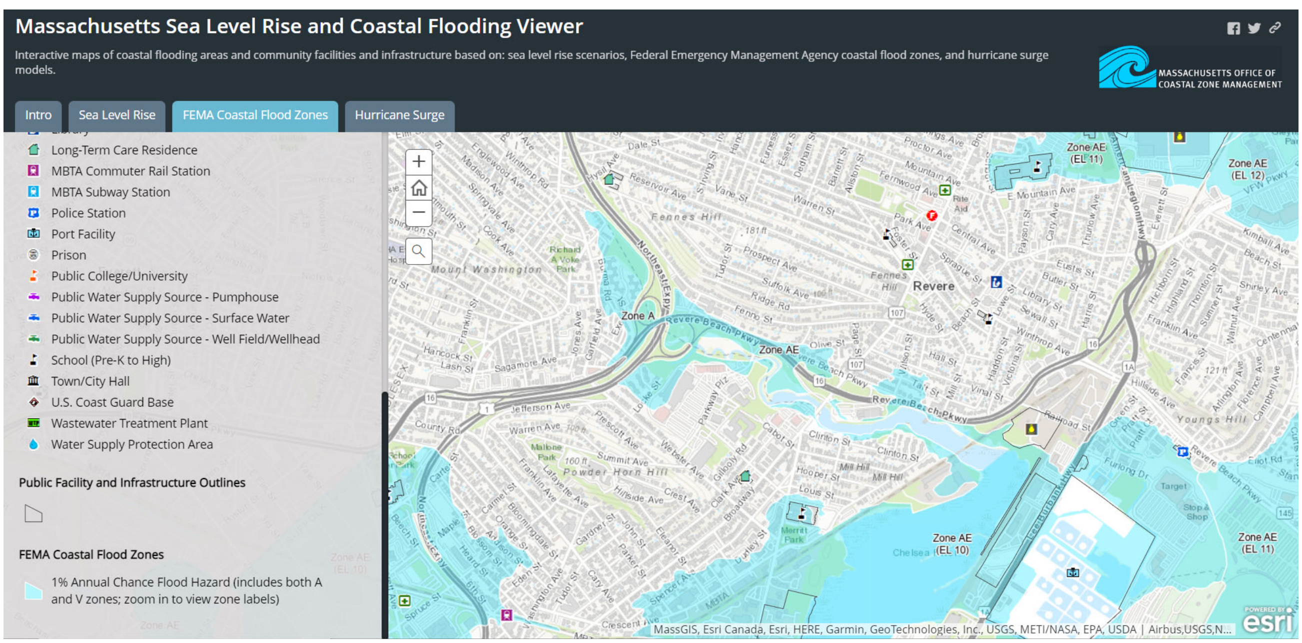


Figure 1-3: Existing 100 Year Flood Zones
Source: Massachusetts Sea Level Rise and Coastal Flooding Mapper
https://www.mass.gov/service-details/massachusetts-sea-level-rise-and-coastal-flooding-viewer

1.3 Overview of Current Mill Creek Water Quality

Today, the Mill Creek marsh system is bordered by dense residential areas to the north, west, and southeast, commercial development to the south, a major state road along the north edge of the waterway (Revere Beach Parkway) and a highway transecting its headwaters (Route 1). Multiple roadways cross the creek. Discharges to Mill Creek from Chelsea, Revere, and Everett come from highly modified urbanized drainage areas that have adjusted natural topography to capture land that may not naturally or historically been conveyed to Mill Creek. In addition, there are MassDOT and DCR jurisdictional areas that discharge stormwater directly to Mill Creek. Nonpoint source pollution from urbanized land cover and stormwater runoff, coupled with illicit discharges and connections to the drainage system itself and potential sanitary sewer overflows, contribute to the Creek's continued inability to meet primary and secondary contact recreation goals and achieve water quality standards.

As defined by the Commonwealth of Massachusetts Surface Water Quality Standards (314 CMR 4.00)[4], Mill Creek is an SB waterbody. Class SB waters "are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. These waters shall have consistently good aesthetic value."

As documented in the Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2022 Reporting Cycle[5], Mill Creek (Segment ID MA71-08) is not meeting the designated uses of the Water Quality Standards. It is considered to have impairments due to fecal coliform bacteria, contaminants in fish and/or shellfish, and PCBs in fish tissue. It is considered a Category 5 impaired waterbody which means that a Total Maximum Daily Load, or pollution budget, is necessary to restore the waterbody to achieving its designated uses. A Final Pathogen TMDL for the Boston Harbor, Weymouth-Weir, and Mystic Watersheds was approved in October 2018 (Control Number 157.1, ATTAINS Action ID R1_MA_2019_01).[6] This his document provides a framework to address bacterial pathogens and other fecal-related pollution in surface waters of Massachusetts. Pathogens refers to the set of indicator bacterial organisms that includes fecal coliform, Escherichia coli (E. coli), and enterococci, and represent a threat to human health and the environment. Specifically, the TMDL identifies sources the pathogens and defines expectations for limiting contamination to restore the waterbodies to meeting water quality standards[6]

[4] https://www.mass.gov/regulations/314-CMR-4-the-massachusetts-surface-water-quality-standards#current-regulation

[5] https://www.mass.gov/doc/final-massachusetts-integrated-list-of-waters-for-the-clean-water-act-20182020-reporting-cycle/download

[6] https://www.mass.gov/doc/final-pathogen-tmdl-report-for-the-boston-harbor-weymouth-weir-and-mystic-watersheds/download

Mill Creek was given a water quality grade of 'F' by the U.S. EPA in 2020.[7] Since calendar year 2014, EPA, in coordination with MyRWA, has utilized an enhanced, more locally-specific analysis of water quality in the Mystic River Watershed to better illuminate environmental conditions for the public. EPA and MyRWA issue grades for each segment of the watershed, totaling 14 separate stretches of river and its tributaries. The Mystic River Watershed Annual Report Card grades are based upon water quality data provided by MyRWA's baseline monitoring program, as well as data collected by the Massachusetts Water Resources Authority (MWRA). Each month, a group of trained MyRWA volunteers in the Mystic Monitoring Network (MMN) gather water quality samples from fifteen representative sites throughout the watershed. These samples are sent to a laboratory and analyzed for bacteria, nutrients and other valuable indicators. MyRWA staff assesses the data for quality assurance and make the information available to any interested party. The annual grade is a measure of how frequently bacteria levels in these samples meet the state water quality standards for boating and swimming. In addition, the MWRA collects water quality samples as part of multiple programs throughout the watershed. The inclusion of approximately 19 MWRA locations is a key part of the expanded grading program. The MyRWA and MWRA data are compared to state standards. The Commonwealth of Massachusetts has standards of 235 and 1260 E. coli per 100 ml of water as acceptable levels for swimming and boating, respectively, in fresh water, and standards of 104 and 350 enterococci per 100 ml of water as acceptable levels for swimming and boating, respectively, in salt water. The grades are calculated based on the percentage of days during dry and wet weather that bacteria levels at each of the sampling sites meet Massachusetts Department of Environmental Protection (MassDEP) water quality standards for swimming and boating. An average between the overall percentages that water quality met criteria for swimming and boating for each location is calculated. The current year's percentage is averaged with the prior two years to produce the "rolling" three-year average. A "F" means the average is less than 40%. Mill Creek has been the only segment within the Mystic watershed that has consistently been assigned an "F".

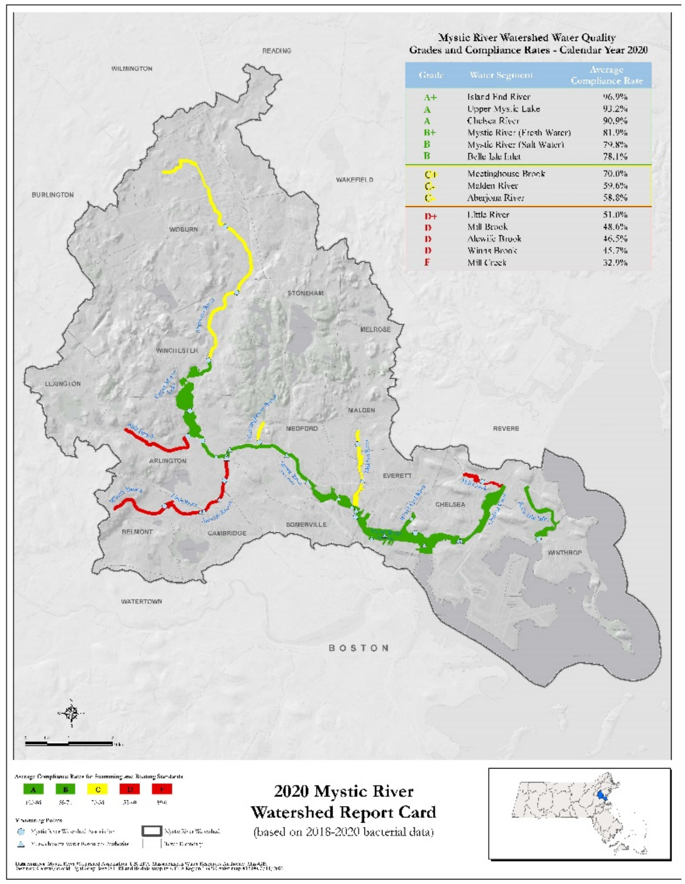


Figure 1-4: 2022 Mystic River Watershed Report Card

Source: U.S. EPA

.https://www.epa.gov/system/files/documents/2021-07/mystic-river-report-card-map-2020.pdf

[7] https://www.epa.gov/mysticriver/mystic-river-watershed-report-cards

Year	Compliance Rate	Letter Grade
2014	32%	F
2015	34%	D-
2016	33.5%	F
2017	31.3%	F
2018	36.1%	F
2019	41.3%	F
2020	32.9%	F

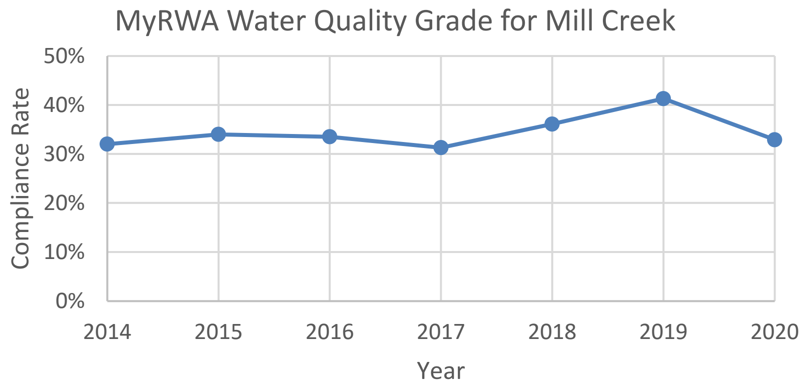


Figure 1-5: Mill Creek Water Quality Grades 2014 - 2020
Source: https://mysticriver.org/epa-grade

1.4 Relevant Work

The City, in collaboration with community-based organizations such as GreenRoots and MyRWA, is working to address the impacts of climate change, restore ecological habitats, and expand the local network of open space, with Mill Creek as a central focus. Decades of environmental advocacy led by GreenRoots have resulted in the addition of a waterfront playground, linear park, and restored wetland areas along the creek. In 2012, stormwater management features were added to the Mace Public Housing around the intersection of Clinton Street and Mill Court. MyRWA and its contractors prepared a master restoration assessment for Mill Creek in 2019, yielding key strategies and projects to enhance water quality and potentially sediment transport. The report identified a range of issues that have led to Mill Creek's persistent impairments, including obstructions of tidal flow as well as past and ongoing inputs of pollutants into the creek. As of the date of this report, reconstruction of Broadway is underway; sewer and water construction was completed in October 2021 and roadway and drain is scheduled to begin construction in September 2022. The City has purchased 88 Clinton Street and is underway planning use of this parcel as a park. 1005 Broadway is being redeveloped and will provide improved stormwater management, street tree canopy, and some public open space at the intersection of Clinton Steet and Broadway. MyRWA and GreenRoots continue to envision 25 miles of connected paths, improvement of hundreds of acres of parkland, from the Mystic Lakes to Boston Harbor, as part of the Mystic Greenways Initiative. These, and other projects ongoing in the Mill Creek Watershed, collaborate with this nonpoint source pollution assessment project and are part of the long-term success of Mill Creek restoration.

1.5 Project Goals & Scope

The overall goal of this project is to move toward improving water quality in Mill Creek by gaining a clearer understanding of the sources that contribute bacteria and other contaminants to the waterbody, and strategically planning appropriate best management practices, including green infrastructure, to address the identified issues. Some specific objectives include

- Build on previous community planning
- Analyze pollutant sources and runoff pathways
- Prioritize structural and non-structural best management practices

- Develop a conceptual design for two proposed measures, including preliminary cost estimates and permitting considerations
- Strengthen partnership with the City of Revere, relevant state agencies, and local nonprofits

The path to restoring Mill Creek to a fishable, swimmable estuary will take many years and requires the commitment of federal, state, and local agencies. In the near term, the City's goal is to stop the dumping of raw sewage into the creek and improve Mill Creek's water quality grade to a "B" or better, allowing for recreational use and a thriving marsh habitat along the creek.

The scope of this CPR Grant is to complete a nonpoint source pollutant assessment to identify the sources and pathways of bacteria and other pollutants entering Mill Creek. The assessment includes a field investigation of the area surrounding Mill Creek and the outfalls in the Mill Creek watershed. A prioritized list of potential sites to implement best management practices (BMPs) is developed, and two sites from this list are chosen for the development of 50% designs for green infrastructure projects to treat bacteria and other pollutants entering Mill Creek. The City also developed and distributed education and outreach material related to water quality in Mill Creek and the proposed BMPs in partnership with MyRWA and GreenRoots.

At the onset of this project, it was assumed by the team that the primary issues affecting water quality in Mill Creek were nonpoint sources and sediment load. This project was designed to investigate and mitigate these nonpoint sources. Monthly sampling at sites within the creek by MyRWA was increased to determine in which stretch pollutants were being introduced. Concurrently, a set of data of sampling results measured at known outfalls, reported over the past decade was analyzed. These data indicate that the primary sources of contamination are likely not non-point sources, but rather point sources, i.e., municipal outfalls. These data are summarized in the graph in Figure 1-5. The methodology for obtaining these data and detailed analysis are presented further in Section 2.2 and Appendix D of this report.

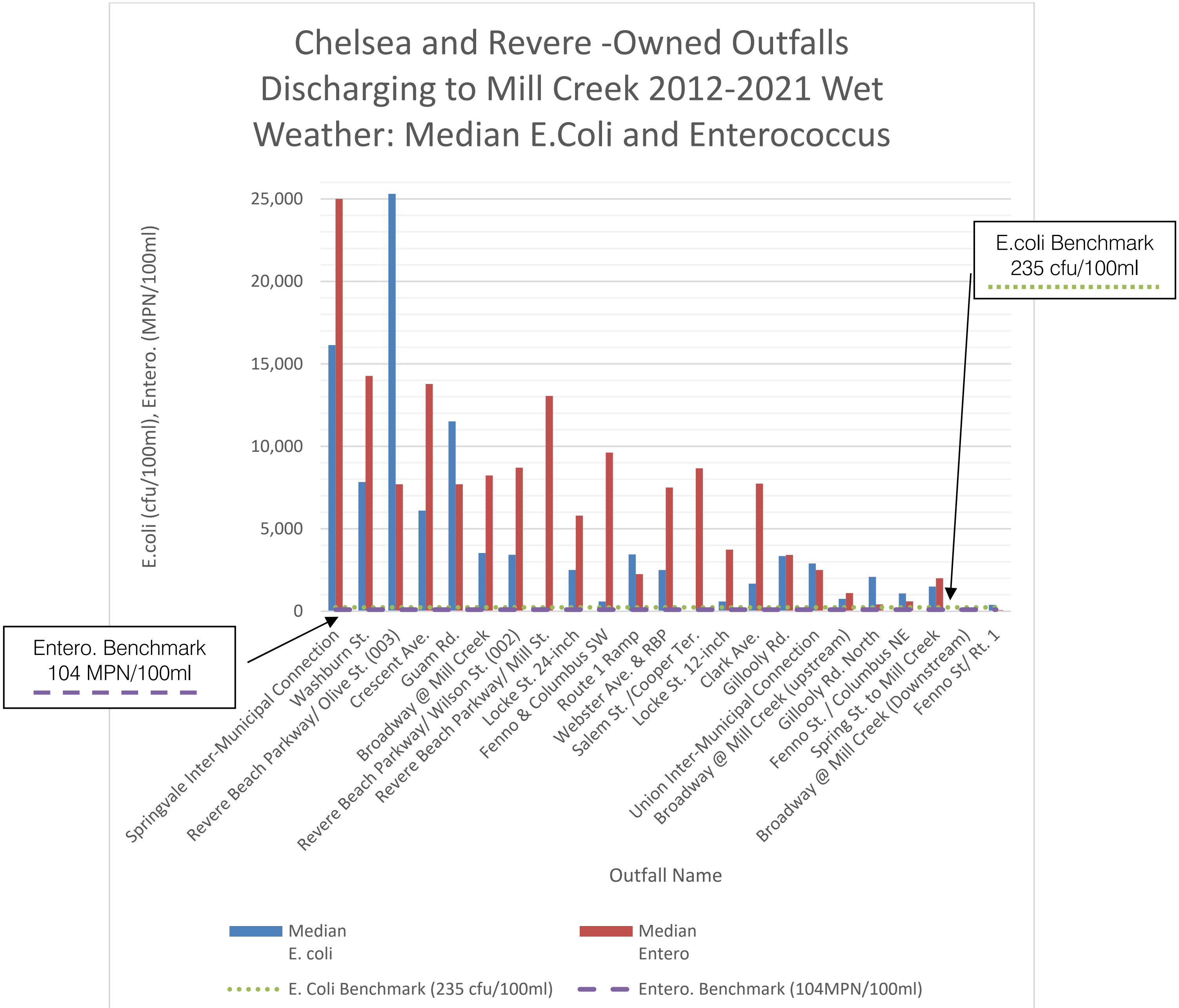


Figure 1-6: Pathogen Concentrations Discharging to Mill Creek 2012-2021

The data show that bacterial concentrations at the outfalls typically exceed Water Quality Standards, labeled “Benchmark” in Figure 1-5, by greater than an order of magnitude and in some cases by more than two orders of magnitude. This high level of contamination prevents the finding of any non-point signal within the “noise” of raw sewage discharges.

2.0 NONPOINT SOURCE POLLUTANT ASSESSMENT

As discussed in Chapter 1, nonpoint source pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into ground water, lakes, rivers, wetlands, and coastal waters like Mill Creek. Examples of nonpoint source pollution in and around Mill Creek may include:

- Excess fertilizers, herbicides and insecticides from residential areas
- Oil, grease and toxic chemicals such as heavy metals from urban runoff
- Sediment from improperly managed construction sites
- Salt from winter anti- and de-icing practices
- Bacteria and nutrients from pet and animal wastes[8]
- Atmospheric deposition
- Streambank and shoreline erosion
- Thermal pollution from impervious surfaces such as streets and rooftops

This assessment builds off the work completed in and recommendations contained within the *2019 Mystic River Restoration Project – Mill Creek Restoration Assessments, FY18 MassBays Healthy Estuaries Grant Program ("2019 Mystic River Restoration Project").*

2.1 Defining the Mill Creek Watershed

Two of the key recommendations from the 2019 Mystic River Restoration Project that this project intended to address are:

1. Locate and assess all remaining outfalls in Mill Creek, obtaining information about existing conditions, dimensions, materials and impacts at the creek.
2. Verify stormwater subcatchments and drainage areas contributing to the outfalls at Mill Creek.

The following discusses the process used to locate outfalls discharging to Mill Creek and determine the subcatchments and total drainage area each outfall contributes to the Creek. Section 2.2 discusses pollutants entering Mill Creek based on both historic sampling information and theoretical land use loading estimates for non-point source pollutants.

2.1.1 Outfalls Discharging to Mill Creek

The 2019 Mystic River Restoration Project identified a number of outfalls discharging to Mill Creek but did not identify ownership. In addition, it was unclear if this work captured *all* outfalls from Chelsea, Revere, MassDOT, and DCR. There are also two known interconnections from the City of Everett to the Chelsea drainage system that needed to be included.

Weston & Sampson used GIS mapping from the City of Chelsea, Revere, DCR[9], and MassDOT[10], as well as figures from the 2019 Mystic River Restoration Project to generate an outfall basemap for field investigations, outfall inventory, and catchment development. For the 2019 Mystic River Restoration

[8] In coastal waterbodies, in some cases, bacteria growth can occur in drainage system pipes that are tidally influenced, due to the presence of natural conditions.

[9] http://vhb.maps.arcgis.com/apps/webappviewer/index.html?id=1fffa8d7b9e144e793dcffb0445846e2

[10] https://geo-massdot.opendata.arcgis.com/datasets/MassDOT::storm-discharge-point/explore?location=42.405254%2C-71.021637%2C16.59

Project, Horsley Witten observed 12 outfalls that discharge to Mill Creek between the Broadway Bridge and the MBTA bridge. As stated in that assessment, the outfalls were observed for composition material, dimension, sediment and/or debris accumulation, and surrounding area conditions. Weston & Sampson routinely visits the City of Chelsea and City of Revere municipal outfalls, as well as the interconnections from the City of Everett, as part of sampling completed for Municipal Separate Storm Sewer System (MS4) General Permit and enforcement order compliance. To supplement the 2019 inventory and the routine Weston & Sampson work, additional field observations were performed. Weston & Sampson and City staff on June 6, 2022 to June 7, 2022 completed field observation to inventory outfalls that discharged directly to Mill Creek and had not been previously located or observed during the City of Chelsea's semi-annual sampling. This field work was conducted to triage outfall catchments and to determine outfall pipe conditions, sedimentation, and scour. Many of the outfalls could not be located due to vegetation and lack of access. The outfall inventory in Appendix A summarizes the field observations.

The outfall inventory is attached in Appendix A of this report. Through this investigation, Weston & Sampson has determined that approximately 87 outfalls discharge to Mill Creek. Table 2-1 shows a summary of outfalls by ownership.

Table 2-1: Summary of Outfalls Discharging to Mill Creek

Outfall Owner	Total Count	Notes
City of Chelsea	13	From City GIS
City of Everett	2	Interconnections to City of Chelsea
City of Revere	3	From City GIS
MassDOT	30	
DCR	15	Some DCR outfalls may actually be MassDOT outfalls based on roadway jurisdiction
Private	14	
Unknown	2	
Suspected City of Chelsea	2	Found during field investigations
Suspected DCR	1	
Suspected MassDOT	5	
Total	87	

2.1.2 *Catchment Delineations*

Weston & Sampson used available information to estimate the catchment, or area of land, that drains to each outfall for the City of Chelsea, City of Revere, and City of Everett. The following resources were used to estimate preliminary catchments:

- June 2006 City of Chelsea Map of Existing Sewer System
- June 2019 Outfall Ranking Map for the City of Everett included in the Illicit Discharge Detection and Elimination Plan[11]

[11] https://cityofeverett.com/wp-content/uploads/2021/10/Vol-2-Illicit-Discharge-Detection-and-Elimination-IDDE-Plan.pdf

- August 2015 Proposed IDDE Investigation Program Supplemental CWMP/CSMP for the City of Revere, included with the Notice of Intent for MS4 General Permit coverage[12]

For Chelsea, Weston & Sampson used GIS tools and analysis to estimate catchment areas starting with the June 2006 map, but adjusting based on topography, flow of water, mapped drainage features and connectivity, all supplemented with field work and ground truthing. For Everett and Revere, the catchments determined from the source documents listed above were used without adjustment. No catchments were specifically developed for MassDOT or DCR drainage systems, as those systems are discharging stormwater and sediment from Route 1 and Revere Beach Parkway.

Figure 2-1 provides an overview of the catchments. The figure in Appendix B provides details on the catchments. The maps included in Appendix C show each catchment in greater detail. Table 2-2 provides additional detail about each catchment area.

Figure 2-1: Overview of Catchments for Stormwater System Discharging to Mill Creek

[12] https://www3.epa.gov/region1/npdes/stormwater/ma/tms4noi/revere.pdf

Table 2-2: Summary of Catchments

						Drainage			Sewer	
Catchment Name	Catchment Location	Ownership	Catchment Area (Acres)	Impervious Area (Acres)	% Impervious Area	Length of Pipe (LF)	Number of Catch Basins	Number of Drain Manholes	Length of Separated Sewer (LF)	Length of Combined Sewer (LF)
Broadway @ Mill Creek	Chelsea	Chelsea	6.0	5.6	94%	930	10	7	0	1,260
Clark Ave.	Chelsea	Chelsea	11.1	10.1	91%	1,700	12	7	530	1,810
Crescent Ave.	Chelsea	Chelsea	5.0	3.9	79%	540	6	5	-	1,190
Fenno & Columbus SW	Chelsea	Chelsea	19.6	0.0	0%	2,610	14	10	1,820	2,330
Gillooly Rd.	Chelsea	Chelsea	16.1	8.9	55%	1,270	9	12	1,510	730
Gillooly Rd. North[13]	Chelsea	Chelsea	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Guam Rd.[14]	Chelsea	Chelsea	51.6	25.9	50%	9,360	62	42	4,070	6,690
Locke St. 12-inch[15]	Chelsea	Chelsea	31.7	24.8	78%	3,030	16	10	1,710	2,490
Locke St. 24-inch[15]	Chelsea	Chelsea	31.7	24.8	78%	3,030	16	10	1,710	2,490
Route 1 Ramp	Chelsea	Chelsea	5.6	3.3	59%	4,200	11	12	550	470
Washburn St.	Chelsea	Chelsea	5.5	4.1	74%	640	5	4	220	1,230
Webster Ave. & RBP[16]	Chelsea	Chelsea	118.8	75.2	63%	20,010	123	100	5,790	19,130
Springvale Inter-Municipal Connection	Everett	Everett	317.3	182.1	57%	Unknown	Unknown	Unknown	54,370	130
Union Inter-Municipal Connection	Everett	Everett	78.7	49.3	63%	Unknown	Unknown	Unknown	16,600	20
Broadway @ Mill Creek (Downstream) – SWOF3411	Revere	Suspected DCR	50.0	28.7	57%	10,010	80	41	9,260	0
Revere Beach Parkway/ Mill St. – SWOF4046	Revere	Suspected DCR	8.0	5.1	64%	1,080	12	1	1,890	0
Revere Beach Parkway/ Olive St. (003) – SWOF3019	Revere	Suspected DCR	7.2	3.2	45%	1,180	9	10	1,020	0
Revere Beach Parkway/ Wilson St. (002) – SWOF3016	Revere	Suspected DCR	36.4	21.9	60%	8,990	82	25	7,800	0
Fenno St/ Rt. 1 – SWOF7158	Revere	MassDOT	22.4	10.4	46%	5,140	40	20	4,260	0
Broadway @ Mill Creek (Upstream) – SWOF5696	Revere	Revere	1.7	0.8	47%	420	11	4	-	1,260
Fenno St. / Columbus NE – SWOF4699	Revere	Revere	113.2	68.3	60%	22,130	213	38	23,850	190
Spring St. to Mill Creek – SWOF6176	Revere	Revere	2.7	1.2	46%	650	7	5	730	-

[13] The GIS data does not precisely show connectivity to the Gillooly Road North Outfall such that no catchment area can confidently be associated with this outfall.
[14] The Guam Rd. Catchment is reported separately from the Union Inter-Municipal Connection subcatchment which feeds into it.
[15] It is unclear in the GIS and from preliminary field investigations which of the Locke St. 12-inch and 24-inch outfalls is connected to the associated catchment area. Characteristics of this catchment are shown identically for both outfalls.
[16] The Webster Ave. & RBP Catchment is reported separately from the Springvale Inter-Municipal Connection subcatchment which feeds into it.

2.1.3 Overall Watershed

Based on the outfall mapping and the catchment delineation, Figure 2-2 shows the approximate extent of Mill Creek's watershed.

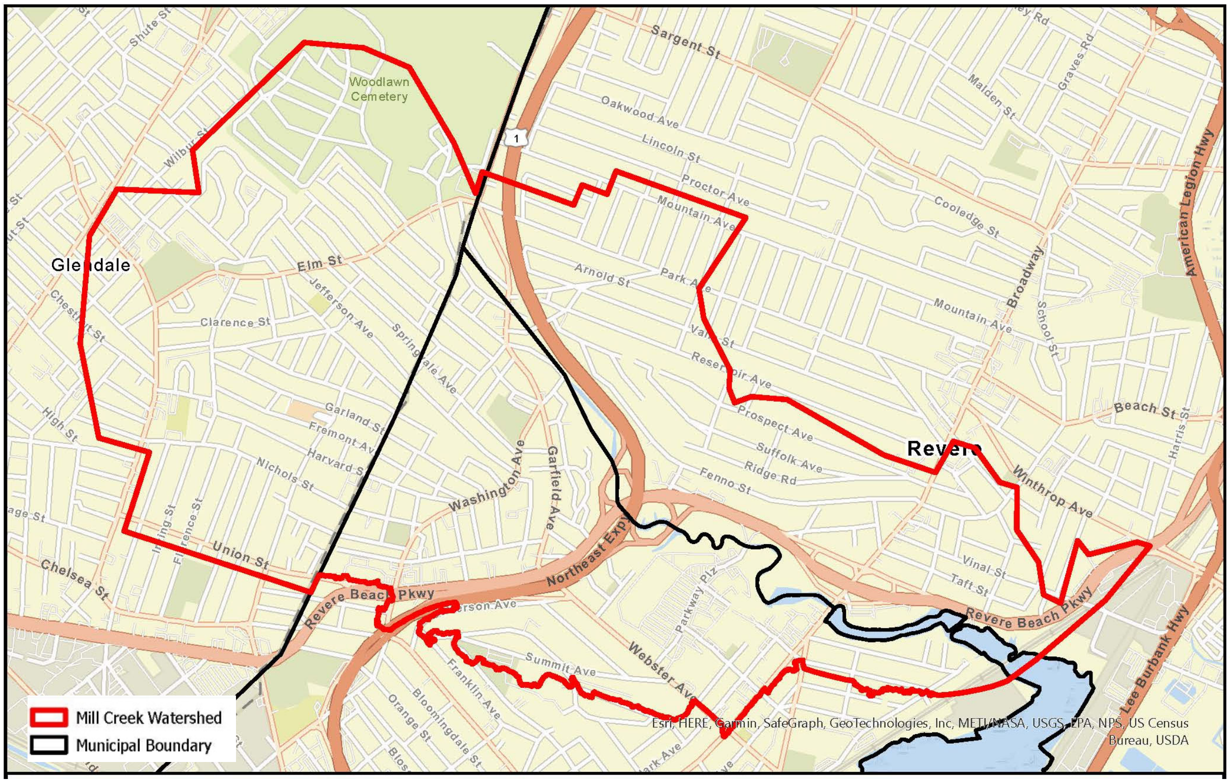


Figure 2-2: Mill Creek Watershed

2.2 Descriptions of Pollutants Entering Mill Creek

There are three sources of information that describe potential pollutants entering Mill Creek:

1. Historical outfall sampling data (point source pollution)
2. Theoretical loads based on land cover and estimated pollutants typical in urban stormwater runoff (nonpoint source pollution)
3. "Hotspots" based on visual observations (nonpoint source pollution)

The following presents an overview of information from these sources.

2.2.1 Outfall Sampling Data

Since 2006, the City of Chelsea and the City of Revere each have completed annual stormwater outfall monitoring and sampling of known city-owned outfalls in compliance with regulatory requirements. Throughout this time, Weston & Sampson has assisted Chelsea and Revere with their monitoring and sampling, including documenting observations, collecting samples from flowing outfalls, and aggregating and evaluating the results of laboratory data produced from the sampling. The memorandum included in Appendix D describes the stormwater sampling procedures employed and analysis of the City of Chelsea and City of Revere's sampling results from 2012 through 2021 as they pertain to the Mill Creek Water Quality Improvement Project.

The sampling, in compliance each City's enforcement order as well as the MS4 Permit, is performed during one wet weather and one dry weather period each year. Where flow is found, samples are collected and analyzed for Ammonia-N, E.Coli, Enterococcus, Specific Conductance, Surfactants, Temperature, Total Chlorine, and Salinity.

Generally, the following four catchments in the City of Chelsea have the highest discharge of bacteria during wet weather conditions:

- Washburn Street
- Guam Road
- Crescent Avenue
- Broadway and Mill Creek

Generally, the following four catchments in the City of Chelsea have the highest discharge of bacteria during dry weather conditions:

- Guam Road
- Webster Avenue & Revere Beach Parkway
- Gillooly Road
- Route 1 Ramp

The dry weather results are overall an order of magnitude less than the wet weather results, though it should be noted that the sampling results are highly variable, outfall specific, and represent only a single point in time. That only one catchment ranks highest in both dry and wet weather is unsurprising; during dry weather, flow from outfalls is assumed to be the result of groundwater infiltration or inflow and illicit connections into the storm drain. Only during wet weather would we expect to see flow related to precipitation and stormwater runoff that enters the storm drain system through catch basins and designated collection infrastructure. Therefore, for this nonpoint source pollution assessment, we have focused on our efforts with the highest pathogen concentrations during wet weather so as to focus on the introduction of pathogens to the stormwater runoff prior to reaching the storm drain. Comparison to the dry weather results highlights the significance of point source pathogen pollution on the Mill Creek watershed but does not influence the selection of non-point source interventions.

Additional details showing relative concentrations of pathogens from the City of Revere and City of Everett interconnections, as well as the ranking process are included in Appendix D. Appendix E includes a table showing the summary of bacteria results by sampled outfall against the catchment metrics presented in Table 2-2.

2.2.2 Estimated Pollutant Loads and Flow

Assessing non-point source pollution can utilize available ground cover information including topography, hydrology, infrastructure, and land use. As part of completing this non-point source pollution assessment, Weston & Sampson evaluated use of the "Simple Method to Calculate Urban

Stormwater Loads" (Schueler, 1987).[17] The Simple Method estimates stormwater runoff pollutant loads for urban areas. The technique requires a modest amount of information, including the sub-watershed drainage area and impervious cover, stormwater runoff pollutant concentrations, and annual precipitation. With the Simple Method, the investigator can either break up land use into specific areas, such as residential, commercial, industrial, and roadway and calculate annual pollutant loads for each type of land, or utilize more generalized pollutant values for urban runoff. It is also important to note that these values may vary depending on other variables such as the age of development. The Simple Method estimates pollutant loads for chemical constituents as a product of annual runoff volume and pollutant concentration. The output of the simple method is an annual pollutant load based on land use type, area of land use, annual runoff, and theoretical pollutant loads from research. Land uses in Chelsea's Mill Creek are relatively consistent – high density residential, commercial, some minor industrial, and small areas of City-owned open space. After using this method and comparing the results to the concentrations measured at the outfalls, combined with consideration that point source pollution continues to be the highest concern for Mill Creek, we determined this method was ineffective at providing information sufficient to make decisions about actual conditions and minorly assisted with catchment prioritization.

2.2.3 Non-Point Hotspots from Field Assessment

Outfall hotspots in the form of Land Use with Higher Potential Pollutant Loading (LUHPPL) were identified. As defined in the *Massachusetts Stormwater Handbook*, land uses such as auto salvage yards, auto fueling facilities, exterior fleet storage yards, vehicle service and equipment cleaning areas, commercial parking lots with high intensity use, road salt storage areas, outdoor storage and loading areas of hazardous substances, confined disposal facilities and disposal sites, marinas, boat yards, or other uses. In Table 2-3 below, each known city-owned outfall is ranked based on their surrounding land use.

Table 2-3: LUHPPL Hot Spots in City of Chelsea Catchments

Outfall	Hotspot Factors	Ranking
Broadway @ Mill Creek	None	Low
Clark Avenue	None	Low
Locke Street 12"	Shopping Center Plaza	High
Locke Street 24"	Shopping Center Plaza	High
Washburn	None	Low
Route 1 Ramp	None	Low
Guam Road	Housing Authority	Medium
Crescent Avenue	Housing Authority	Medium
Fenno & Columbus SW	Auto Service and Gas Station	High
Gillooly Road	Urgent Care Center	Medium
Gillooly Road North	Shopping Center Plaza	High
Webster Ave. & RBP	None	Low
UNK-G	Construction	High

[17] https://scdhec.gov/sites/default/files/media/document/Schueler%20Simple%20Method%20to%20Calculate%20Urban%20Stormwater%20Loads.pdf

3.0 OPPORTUNITIES FOR POLLUTANT REDUCTION

Opportunities for nonpoint source pollution reduction can be divided into two categories: structural and non-structural. The City of Chelsea and City of Revere, through their MS4 General Permit compliance, are already implementing many of these practices including street sweeping, catch basin cleaning, and identifying locations to install stormwater Best Management Practices (BMPs), including green infrastructure.

Many traditional BMPs are likely to fail in portions of this watershed, mainly because of its soil characteristics and topography. BMPs often utilize soil infiltration as a method of pollutant removal, however infiltration through urban fill, which is present throughout the watershed, may add more pollutants than it removes. Additionally, steep slopes and a high water table may limit the volume of runoff that can be captured and the amount of soil absorption possible.

3.1 Structural BMPs

A structural BMP is a stationary and permanent BMP that is designed, constructed, and operated to remove or reduce the presence of pollutants in stormwater on-site before it is discharged to downstream waterbodies. A refined list of effective and feasible BMPs for the City of Chelsea is described below.

3.1.1 Green Stormwater Infrastructure (GSI)

Green infrastructure is designed to capture and infiltrate stormwater where it falls. In 2019, Congress enacted the Water Infrastructure Improvement Act, which defines green infrastructure as "the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters." Green infrastructure relies on soil infiltration and/or nutrient uptake through plant roots to remove pollutants.

Downspout Disconnection

This simple practice reroutes rooftop drainage pipes from either direct connections into the storm sewer or from discharging onto impervious surfaces increasing roadway runoff to draining it into rain barrels, cisterns, or permeable areas. Rain barrels and cisterns can be used to store stormwater for future reuse and discharging onto permeable areas allows stormwater to infiltrate into the soil. Downspout disconnection can be utilized to reduce stormwater runoff at a residential level as well as at a commercial level and could be especially beneficial to cities with combined sewer systems, such as Chelsea. Chelsea started a rain barrel program for residents in 2021 and aggressively pursued downspout disconnection in their recent capital improvements projects in Essex Street (2019) and Broadway (2020, 2021). They disconnected downspouts from combined sewer and routed roof drains to pervious surfaces at grade or to subsurface underdrains infiltration features.

Permeable Pavements

Permeable pavement is ideal for open spaces such as parking lots, plazas, driveways and pathways that contribute a significant amount of runoff to the storm sewer system. Permeable pavement serves to capture and infiltrate stormwater on-site while preserving the original function of the site (i.e., parking, walking paths, bike lanes, etc.). Permeable paving techniques include porous asphalt, pervious concrete, paving stones, and manufactured “grass pavers” often made of concrete or plastic. One of the requirements in Permit Year 4 of the MS4 General Permit is evaluate the feasibility of increasing pervious surfaces throughout the City of Chelsea.

Green Roofs

Green roofs are rooftops covered with growing media and vegetation that enable rainfall infiltration and evapotranspiration of stored water. They are particularly cost-effective in dense urban areas where land values are high and on large industrial or office buildings where stormwater management costs are likely to be high. Green roofs can also help reduce urban heat island. However, promoting green roofs often requires collaboration with and incentives for private developers when targeting buildings that are not publicly owned.

Urban Tree Canopy

Increasing urban tree canopy serves to reduce stormwater runoff through soil infiltration and root uptake. Planting trees also provides myriad co-benefits, such as reducing urban heat island, improving air quality, and increasing property value. Homeowners, businesses, and community groups can participate in planting and maintaining trees throughout the urban environment.

A citywide UHI (Urban Heat Island) analysis was previously conducted for Chelsea using best available science and climate change projections data. Based on UHI modeling and heat index modeling, nine ‘hot spot” areas are identified in the City. The “hot spot” areas were categorized into “existing hot spots” that are known areas of high heat areas in the City and “emerging hot spots” that have the potential to become high heat areas in the near future. Cooling relationships were developed with ambient air temperature and existing land cover (tree canopy cover, and impervious surface areas). An effective cooling of 0.4°F with 10% increase in canopy and 10% decrease in impervious cover was determined applicable to use. While a Citywide increase in tree canopy by 10% can yield overall cooling benefits, the targeted increase of canopy by 30% in areas with less than 15% tree canopy coverage can yield significant cooling benefits in localized hot spots, as shown in the figure below. The City has installed 2,400 trees in the past 5-years, with the support of the DCR, which has had a measurable improvement on quality of urban environment.

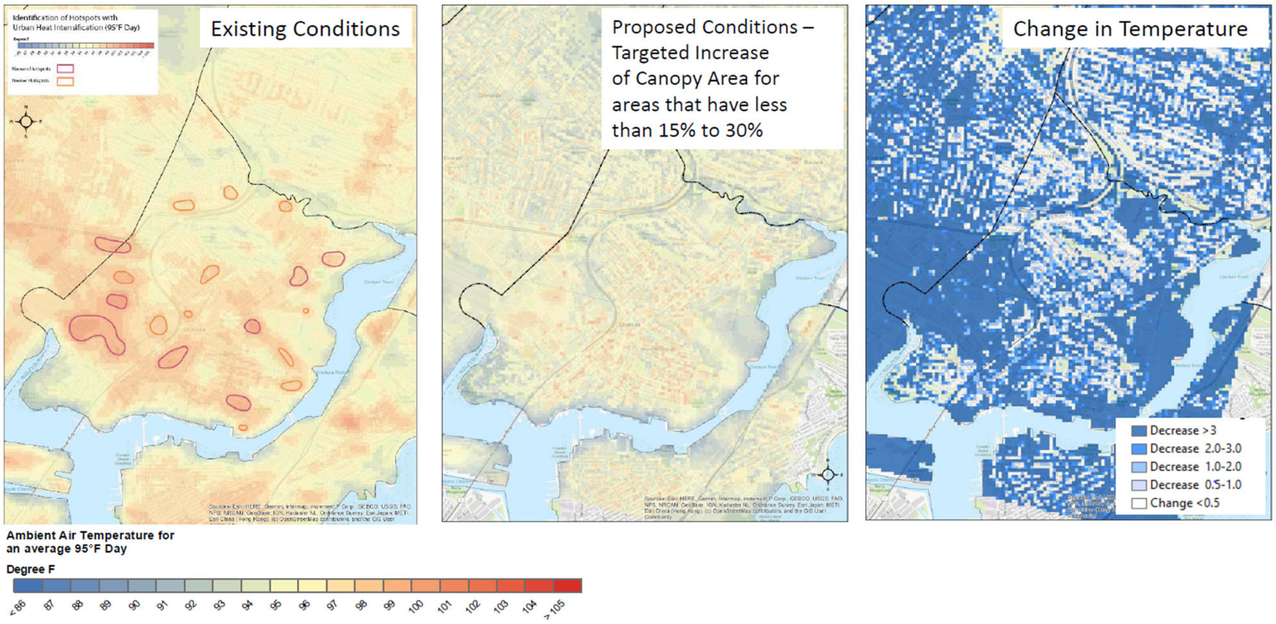


Figure 3-1: Urban Heat Island Effect Over Time - Ambient air temp. on a 95° F day at existing conditions (left), due to increase in tree canopy in targeted areas (center) and change in ambient air temperature due to increase in tree canopy in targeted areas (right)
Source: Weston & Sampson, Urban Heat Island Effect and Heat Mitigation Strategies, ENV 21 MVP 02

Land Conservation

The water quality and flooding impacts of stormwater runoff can be addressed by protecting open spaces and sensitive natural areas within and adjacent to a city. Increased green spaces within the city provides additional co-benefits such as recreation access, improved air quality, and reduced heat island. Natural areas that should be a focus of this effort include riparian areas, wetlands, and steep hillsides. While there are limited undeveloped locations in the City, Chelsea has found opportunities to conserve land such as with 88 Clinton Street, where the parcel has been preserved as a park.

Bioretention Areas / Planters

Bioretention areas are shallow depressions that use engineered soils, native plants, and natural processes to treat stormwater where it falls. Stormwater runoff is directed into the basin via piped or sheet flow. Bioretention basins may have subsurface piped infrastructure that connects to the storm sewer system; some are designed to infiltrate and only discharge to the storm drain system in the event that the system overflows. These systems are designed to reduce runoff volumes, pollutant concentrations, and urban heat island by increasing green space in urban areas.

Planter Boxes and rain gardens are similar to bioretention basins, however they generally do not have piped infrastructure or engineered soils. Stormwater runoff is directed into the basin via or occasionally downspouts or pipes. These BMPs are deal for areas with limited space and can be a useful way to beautify city streets. Chelsea began installing tree planter boxes in 2021.

3.1.2 Sub-surface Infiltration

Sub-surface infiltration techniques involve directing stormwater through piped infrastructure and directly into the ground. They can range from simple infiltration through perforated piping and porous materials to large, engineered systems with concrete structures as support. By allowing for more controlled infiltration into the ground, these systems provide filtration of the stormwater while also allowing for aquifer recharge. Sub-surface systems are particularly attractive in areas in built urban environments, like Chelsea, that have limited ground surface available.

3.1.3 Drainage System Improvements

When stormwater flows over impervious surfaces, it picks up pollutants such as floatable debris, chemicals, oil and grease that can enter the drainage system and negatively impact the treatment process and downstream ecosystems. Another method of removing these pollutants from stormwater is by making modifications to the existing drainage structures. The following systems do not provide peak flow attenuation or groundwater recharge, however they require little additional maintenance beyond existing drainage system best practices.

Catch Basin Hoods

Catch basin hoods are used in sumped catch basins and are designed to retain debris and oils/grease from stormwater within the structure, preventing the pollutants from being transported downstream.

Deep Sump Catch Basin

Deep sump catch basins are underground retention systems designed to remove trash, debris, and coarse sediment from stormwater runoff, and serve as temporary spill containment devices for floatables such as oils and greases. They are often used in tandem with catch basin hoods.

In-line Treatment Units

There any many and diverse treatment units that can be installed in-line with the current municipal drainage system. The units can be added to existing infrastructure, like manholes and catch basins, or can be installed as separate, but attached units. Oil/grit separators are among the best-known solutions; they are underground storage tanks with three chambers that are designed to remove heavy particulates, floating debris, and hydrocarbons from stormwater through a system of chambers. Many other proprietary units are available that can be customized for site constraints, pollutant type, and flow conditions. Some units utilize membrane filtration to remove particulates and particulate-bound pollutants. Since proprietary separators can be placed in almost any location with proper design, they are particularly useful when either site constraints prevent the use of other stormwater techniques or as part of a larger treatment train. The effectiveness of proprietary separators varies greatly by size and design.

3.1.4 Sewer Improvements

Sewage from both combined and separate sewers remains a significant potential source of pollutants in stormwater. Combined sewers, as are present in Chelsea, comingle raw sewage directly with stormwater. In addition, whether combined or separate sewers, damaged pipes in need of rehabilitation or repairs allow the flow of raw sewage from cracks or gaps in sewer pipes through the ground to into proximate drainage pipes before discharge into a receiving water. There are also instances where sewer piping is connected to the drainage system, either from public or private property. Chelsea has ongoing efforts to separate combined sewers and to complete infiltration and inflow assessments and repairs/rehabilitation to address inflow and prevent infiltration which will reduce the potential for sewage to enter Mill Creek. This work is the highest priority to address pollution entering local waterbodies.

3.2 Non-Structural BMPs

Unlike structural BMPS, non-structural BMPs provide source control and pollution prevention through programmatic and policy change to prevent and reduce the among and types of contaminants prior to entering the stormwater system. Non-structural BMPs controls cover a wide range of practices including local stormwater ordinances and regulations, materials management at industrial sites, fertilizer and pest management in residential areas, reduced road salting in winter, erosion and sediment controls at construction sites, and comprehensive snow management. While Chelsea has implemented many of these to some degree, there are several more non-structural BMPs that have been identified as opportunities for increased stormwater pollution mitigation.

3.2.1 Illicit Discharge Detection and Elimination (IDDE)

Chelsea has maintained an IDDE program since the MS4 General Permit was effective in 2003. This program has evolved over the years to address compliance requirements as well as an updated MS4 General Permit in 2016. IDDE efforts start with sampling at the outfall and include investigations in catchments including additional sampling. They may include video inspection, dye testing, smoke testing, and other targeted methods to find and remove illicit connections to the drain.

3.2.2 Sweeping

Street and parking lot sweeping involve the use of mechanical or vacuum roadway cleaning equipment to remove particulates and debris from the roadway before they can be washed into the drainage system or directly to receiving waters by runoff. Sweeping can provide effective source control, particularly of Total Suspended Solids (TSS) with high removal efficiencies when performed frequently. Chelsea currently maintains a street sweeping schedule of twice per month per side of street from March 1st through December 31st.

3.2.3 Catch Basin Cleaning

Catch basins are thought to be able to capture sediments up to approximately 60% of the sump volume. However, when sediment fills greater than 60% of their volume, catch basins reach steady state and storm flows may then bypass treatment as well as re-suspend sediments trapped in the catch basin. Frequent clean-out can retain the volume in the catch basin sump available for treatment of stormwater flows. Typical maintenance of catch basins includes trash removal if a screen or other debris capturing device is used, and removal of sediment using a vactor truck. Some cities have incorporated the use of GIS systems to track sediment collection, and to optimize future catch basin cleaning efforts. Chelsea performs catch basin cleaning according to a schedule set by DPW staff, which targets approximately 1/3 of its catch basins for cleaning annually, which those expected to have high sediment volume cleaned more frequently.

3.2.4 Leaf Litter Pick Up

Organic material, like leaf litter and other yard wastes can release excess nutrients when decaying. Though not a large contributor of pathogens, leaf litter that makes its way into the storm drain system through catch basins can be a significant source of nitrogen and phosphorus into receiving waters. In addition to its robust street sweeping program, the City of Chelsea has a yard waste program that collects yard waste twelve times per year between the months of April and December, with more frequent pickups occurring in the Fall.

3.2.5 Policy Changes

Changes to local policy, including ordinances, regulations, guidance, and design criteria are all ways to improve water quality. Examples of policy changes include:

• Green Streets Policy	Like complete streets policy, guides approach and application.
• Local Tree Ordinance/Bylaw	Regulate public and/or private tree canopy beyond public shade trees.
• Enhanced Stormwater Management	Approach to require appropriate sites to capture and detain, infiltrate, over 1" of stormwater runoff, beyond MA stormwater handbook.
• Stormwater Utility/Enterprise Fund	Sustainable, equitable, manner to provide income for stormwater management, including flood projects. Can create incentives for individual property owners to undertake nature-based solutions on the property level.
• Modify Local Zoning for Climate Resilience	incentive reduction in impervious cover and preservation/reforestation of non-constructed space.
• Adopt a local floodplain more stringent than the FEMA 100- year flood zone	Consider regulating the 500 year flood zone or future predicted flood zone based on modeling.

4.0 RECOMMENDATIONS

The following presents recommendations based on this non-point source pollution assessment for the Mill Creek Watershed.

4.1 Structural BMPs

Opportunity for structural BMPs in Chelsea is particularly limited by size and existing development. Best solutions are those which require a minimal surface area. This means favoring options for in-line treatment and small roadside solutions. Infiltration is sometimes an option but due to extensive sub-surface contamination across the City, locations need to be carefully selected.

Structural BMP solutions should be targeted to the catchments believed to be contributing the highest concentrations of pathogens to Mill Creek. Based on the historical outfall sampling data performed from 2012 to 2021, structural BMPs should be focused on the following four catchments which had the highest ranked pathogen contributions to Mill Creek: Washburn Street, Guam Road, Crescent Avenue, and Broadway and Mill Creek.

Each of these catchments should be investigated for potential BMPs and prioritized for feasibility, effectiveness, and cost. This is completed as part of Volume II of this grant project. The City should continue to invest in opportunities to build and support structural BMPs in Chelsea, including changes to parking and streetscape policy and site design requirements that allow for and promote green infrastructure. Without meaningful policy change, there is little physical room in Chelsea for the structural BMPs that best target pathogen removal and will have the greatest effect on the health of Mill Creek.

4.2 Non-Structural BMPs

Without the limitations of the existing development in Chelsea, non-structural BMPs offer much more room for source control and nonpoint source pollution mitigation, preventing contaminants from ever entering the storm drain.

4.2.1 Good Housekeeping/ Operation & Maintenance

The City currently engages in several non-structural BMPs programs, like street sweeping and catch basin cleaning that should be continued and could be enhanced or expanded. Most notably, a catch basin cleaning program that is optimized to remove debris the catch basins before they are more than 50% full is both good practice for the health of Mill Creek and also required by the City's 2016 MS4 Permit. A pilot program in a targeted area may provide the City with ability to focus cleanings and reduce overall labor and disposal costs. This could be coupled with enhanced asset management procedures, software, and training.

4.2.2 Asset Management

The City currently maintains a database of drainage system infrastructure and mapping through GIS; though the City does now require and keep records of newer infrastructure and update the GIS when inaccuracies are identified, investigations frequently prove that not all infrastructure is mapped and accounted for, as is unsurprising for a system of its age. That said, having an accurate and complete asset inventory and mapping is essential to having a full understanding of connectivity and the ability to analyze flows through the system and into Mill Creek. Without this understanding, projects to improve water quality become more complex and inefficient. Chelsea should consider applying for a State Revolving Fund (SRF) Asset Management Grant to improve its asset inventory, software, and training.

4.2.3 Point Source Identification and IDDE

It is clear from the magnitude of pathogen concentrations consistently monitored at many of the City's outfalls to Mill Creek, a significant amount of pollutants are entering the system from point sources. While nonpoint source pollutant elimination is valuable to the health of the watershed, elimination of nonpoint source pollution alone will not solve Mill Creek's water quality challenges. The City must continue and increase its investment in point source pollution mitigation through sewer separation and IDDE programs. Until point source pollution can be curtailed, non-point source BMPs will represent only a fraction of the improvements needed in the watershed to see significant improvement in the water quality of Mill Creek.

4.2.4 Further Investigation of Sediment Fate and Transport

Another broad issue with Mill Creek outside the scope of this project is understanding of and mitigation of sediment load and transport within the watershed. Little is known about volume, characteristics, and transport. Sediment inputs can impair the ability of the built drainage system to convey stormwater runoff or can impede saltwater flow upstream, thereby encouraging invasives. Sediment also flushes out into the navigational channel of Chelsea Creek where it will eventually require removal by dredge.

APPENDIX A

Outfall Inventory

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
Broadway @ Mill Creek (Horsley Witten ID – 3)	City of Chelsea	Across the street from Holiday Inn Boston Logan Airport - Chelsea, an IHG Hotel; downstream side of bridge in rip-rap	42.403276, -71.018050	Elliptical	RCP	18	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Good	No sedimentation or scour present; outfall surrounded by riprap	 9/8/21
Clark Avenue (Horsley Witten ID – 1)	City of Chelsea	Behind and between Walgreens at #1010 Broadway and Boston Logan Airport – Chelsea, an IHG Hotel	42.403393, -71.019633	Circular	CPE	18	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Good	No sedimentation present, scour present – this outfall is located away from the creek shore and has created a water travel way to the creek	 9/8/21
Locke Street 12" (Horsley Witten ID – 12)	City of Chelsea	Behind Home Depot building on #1100 Revere Beach Parkway	42.405084, -71.025301	Circular	RCP	12	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Good	No sedimentation or scour present; outfall discharges to a concrete channel	 9/8/21

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
Locke Street 24" (Horsley Witten ID – 11)	City of Chelsea	Behind Home Depot building on #1100 Revere Beach Parkway	42.405084, -71.025301	Circular	RCP	24	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Fair	Sedimentation is unknown, scour is not present; outfall discharges to a concrete channel	 9/8/21
Washburn Street (Horsley Witten ID – 4)	City of Chelsea	Behind westerly of #46 Clinton Street	42.402371, -71.017110	Circular	PVC	8	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Good	No sedimentation or scour present	 9/8/21
Broadway @Mill Creek (Downstream) (Horsley Witten ID – 2) (New GIS ID - SWOF3411) (OF-124 Chelsea GIS)	DCR	Tide gate downstream (east) of Broadway/ Rt 107 bridge; mat./dia from plan	42.4036 / -71.0183	UNK	RCP	36	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Good	No sedimentation or scour present	[7] 

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
Revere Beach Parkway/Mill Street (New GIS ID-SWOF4046) (Horsley Witten ID – 8)	DCR	770 MA-16; Spice Mill; outfall downstream (east)	42.4038 / -71.0186	Circular	RCP	10	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Poor – The pipe is broken before the headwall connection. Water does not discharge through headwall outlet	No sedimentation or scour present;	[7] 
Revere Beach Parkway/Wilson (1) (New GIS ID-SWOF4301)	DCR	Unknown	42.4033 / -71.0141	Unknown	Unknown	Unknown	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Unknown	Unknown	[7] 
Revere Beach Parkway/Wilson (2) (New GIS ID-SWOF4061.1/SWOF4061.2) (Horsley Witten ID – 6)	DCR	Unknown	42.4033 / -71.0141	Unknown	Unknown	Unknown	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Unknown	Unknown	[7] 

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
Revere Beach Parkway/Wilson (3) (New GIS ID-SWOF4062)	DCR	Unknown	42.4034 / -71.0139	Unknown	Unknown	Unknown	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Unknown	Unknown	[7] 
Revere Beach Parkway/Wilson (4) (New GIS ID-SWOF4052)	DCR	Unknown	42.4032 / -71.0131	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
Route 1 Ramp	City of Chelsea	Rt. 1S onramp; in phragmites approx. in line with and 100ft beyond light pole.	42.4071 / -71.027	Circular	RCP	18	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Unknown	This location was last sampled from the outfall 9/29/2011; since then the annual a sampling has been performed at an upstream structure	 8/8/07
Guam Rd.	City of Chelsea	Enter from Rt. 1 to Rt. 16E off ramp; walk around creek at south end	42.408 / -71.0271	Circular	RCP	48	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Unknown	This location was last sampled from the outfall 9/29/2011; since then the annual a sampling has been conducted at an upstream structure	 8/3/09

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
Crescent Avenue	City of Chelsea	Easterly of #3 Mill Ct.; behind chain link fence	42.4019 / -71.0123	Circular	RCP	12	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Fair- pipe is 33% submerged	Significant scour is present 5ft deep by 9ft wide. The pipe is 4" covered by sedimentation.	 6/6/22
Fenno & Columbus 8"	City of Chelsea	At corner of Fenno/ Columbus; thru fence gate; south under granite facing outfall	42.4102 / -71.0288	Circular	CMP	8"	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Poor - headwall is in poor condition, pipes are collapsed due to erosion	Sedimentation is unknown; scour is not present	 7/13/21
Fenno/Columbus SW	City of Chelsea	At corner of Fenno/ Columbus; thru fence gate; south under granite facing outfall	42.4102 / -71.0288	Circular	RCP	36	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Poor - headwall is in poor condition, pipes are collapsed due to erosion	Sedimentation is unknown; scour is not present	 7/13/21

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
Gillooly Rd	City of Chelsea	Behind Beth Israel Deaconess Urgent Care at Chelsea at #1000 Broadway	42.4034 / -71.0206	Circular	RCP	24	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Good	No sedimentation or scour present	 9/8/21
Gillooly Rd. North	City of Chelsea	Behind Chili's Bar and Grill at #1040 Revere Beach Parkway; behind 3ft chain link fence	42.4042 / -71.0212	Circular	RCP	10	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Good	No sedimentation: scouring is unknown	 9/8/21
Webster Ave. @ Revere Beach Parkway	City of Chelsea	Northeasterly corner of Webster Avenue and Revere Beach Parkway	42.4046 / -71.0288	Box	RCP	4x5	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Good	Sedimentation is unknown; no scour is present	 9/8/2021

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
Broadway @ Mill Creek (Upstream) (New GIS ID-SWOF5696)	City of Revere	Upstream of Broadway/ Rt. 107 bridge	42.4033 / -71.0178	Circular	RCP	18	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Poor - pipe is broken and water discharges through break in the pipe before the pipe outlet	No sedimentation is present; scour is present	 8/5/21
Fenno St. / Columbus NE (New GIS ID-SWOF4699)	City of Revere	At corner of Fenno/ Columbus; thru fence gate; south under granite facing outfall, right 36" pipe.	42.4102 / -71.0288	Circular	RCP	36	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Poor - Headwall is in poor condition and some pipes are collapsed due to erosion	Sedimentation is unknown; scour is not present	 7/13/21
Fenno St/ Rt. 1 (New GIS ID-SWOF7158)	MassDOT	Exit Rt. 1S to RBP; immediately pull off to left into grassy area on ramp; cross over ramp, down bank; just off NW (right when approaching) end of large wingwall	42.4079 / -71.027	Circular/Flared	RCP	15	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Good	No sedimentation or scour present	 7/11/16

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
Revere Beach Parkway/ Olive St. (3) (New GIS ID-SWOF3019)	(Suspected DCR)	Outfall not City, but last DMH is in RBP, so have to sample that outfall	42.4053 / -71.0206	Circular	RCP	18	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Poor - the outlet of the pipe is buried and covered in phragmites.	Sedimentation is unknown. Scouring is present – location of the outlet is not directly on bank of the creek	 9/27/2017
Revere Beach Parkway/ Olive St. (2) (New GIS ID-SWOF3016)	Unknown	Unknown	42.4052 / -71.0202	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
Spring St. to Mill Creek (New GIS ID-SWOF6176)	City of Revere	Downstream from Fenno/ Columbus intersection; large concrete structure N (left) side of creek.	42.4099 / -71.0283	Unknown	RCP	24	E.Coli, Enterococcus, Ammonia-Nitrogen, Chlorine, Surfactants	Good	Sedimentation is unknown; no scour is present	 6/30/21
Springvale (Interconnection from Everett)	City of Everett	Drain manhole Springvale @ Brook SE Corner	42.410639, -71.034588	Circular	RCP	36	E.Coli, Ammonia-Nitrogen, Chlorine, Surfactants	Good	No sedimentation or scour present	 7/23/2019

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
Union (Interconnection from Everett)	City of Everett	Drain manhole in front of #12 Silver Road, Everette, MA	42.404653, -71.039279	Circular	RCP	36	E.Coli, Ammonia-Nitrogen, Chlorine, Surfactants	Good	No sedimentation or scour present	 7/23/2019
SWOF5619	Unknown	Unknown	42.4101 / -71.0286	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWOF5618	MassDOT	Unknown	42.4095 / -71.0278	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWOF5605	MassDOT	Unknown	42.4089 / -71.0271	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWOF5604	MassDOT	Unknown	42.4085 / -71.0269	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWOF4301 (Horsley Witten ID – 7)	DCR	Unknown	42.4033 / -71.0141	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWOF3031	DCR	Unknown	42.4048 / -71.0197	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWOF5686	DCR	Unknown	42.4055 / -71.0212	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWOF5680	DCR	Unknown	42.406 / -71.0227	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWOF5677	DCR	Unknown	42.406 / -71.0227	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWOF5674	DCR	Unknown	42.4062 / -71.0235	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWOF4052 (Horsley Witten ID – 5)	DCR	Unknown	42.4032 / -71.0131	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWOF4042 (Horsley Witten ID – 9)	DCR	Unknown	42.4025 / -71.0106	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	[7] 
SWOF4050	DCR	Unknown	42.4026 / -71.0107	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea

Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
UNK	Private	Unknown	42.4038 / -71.0211	Circular	RCP	30”	Unknown	Good	No scour or sediment present	 6/6/22
87	Private	Unknown	42.4042 / -71.0213	Circular	VCP	12”	Unknown	Poor – Pipe is present; no sigs of connectivity	No scour or sediment present	 6/6/22
UNK-1	Private	Behind #1040 Revere Beach Parkway, over River Walk pathway chain link fence	42.4053 / -71.0237	Circular/Flare	RCP	40”	Unknown	Good	No scour or sediment visiable	 6/6/22
CHEx10	Private	Unknown	42.4051 / -71.0266	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
119	Private	Unknown	42.405 / -71.0268	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
134	Private	Behind abandon building near Forbes Street	42.4013 / -71.011	Circular	VCP	Unknown	None	Poor – Pipe was collapsed with no flow.	No scour or sedimentation present	 6/06/22
135	Private	Unknown	42.3999 / -71.0113	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
137	Private	Unknown	42.3998 / -71.0117	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
138	Private	Unknown	42.3998 / -71.0117	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
139	Private	Unknown	42.3998 / -71.0118	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
141	Private	Unknown	42.3997 / -71.0123	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
140	Private	Unknown	42.3997 / -71.0124	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
142	Private	Unknown	42.3996 / -71.0126	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWDP-34659	MassDOT	Unknown	42.41054883 / -71.02806579	Headwall	Asphalt Coated Corrugated Metal	36"	Unknown	Unknown	Unknown	No Photo Available
UNK-A	Private (Suspected DOT)	Unknown	42.4056 / -71.0245	Box	RCP	Unknown	Unknown	Unknown	Unknown	 6/6/22
SWDP- 22300	MassDOT	Unknown	42.41000495 / -71.02870148	Pave Waterway	Paved	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWDP-22303	MassDOT	Unknown	42.41047637 / -71.02783113	Headwall	RC	12	Unknown	Unknown	Unknown	No Photo Available

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
88 (Horsley Witten ID – 10)	Private (Suspected DOT)	Parkway Plaza/Mill Creek bridge on southeastern side of wing wall	42.4051 / -71.0215	Circular	RCP	12"	Unknown	Good	No scour or sediment present	 6/6/22
SWDP-22299	MassDOT	Unknown	42.409455981 / -71.02792208	Pave Waterway	Paved	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWDP-22297	MassDOT	Unknown	42.4089378 / -71.02736819	Pave Waterway	Paved	Unknown	Unknown	Unknown	Unknown	Photo not available
UNK-E	Private (Suspected DOT)	In marsh area over housing authority fence; outfall is in line with Clinton Ct.	42.4026/ -71.0135	Unknown	Unknown	Unknown	Unknown	Poor - No pipe visible, flow present	Scour present, 2ft deep by 2ft wide; Sedimentation unknown/	 6/7/22
UNK-TBD	Unknown (Suspected City of Chelsea)	End of Lisa Lane, Behind picket fence	42.402498/ -71.014173	Unknown	Unknown	Unknown	Unknown	Could not located due to illegal dumping of yard waste	None	No photo available
UNK-G	Unknown (Suspected City of Chelsea)	Behind #34 Clinton Street	42.4026/ -71.0176	Unknown	Unknown	Unknown	Unknown	Poor - No pipe visible, trickle flow present	Unknown	 6/6/22

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
SWDP-34658	MassDOT	Unknown	42.40854112 / -71.02690924	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No photo available
UNK-F	Private (Suspected DOT)	In line with MBTA fence on the Mill Ct side	42.4017 / -71.0115	Unknown	Unknown	Unknown	Unknown	Poor - Manhole collapsed, no pipe was located	No flow or scour present	 6/6/22
SWDP-22296	MassDOT	Unknown	42.40808634 / -71.02699374	Headwall	RC	24”	Unknown	Unknown	Unknown	No Photo Available
SWDP-36758	MassDOT	Unknown	42.40768218/ -71.02718037	Headwall	Asphalt Coated Corrugated Metal	12”	Unknown	Unknown	Unknown	No Photo Available
SWDP-28226	MassDOT	Unknown	42.40714646/ -71.02705753	Pipe End	RC	54”	Unknown	Unknown	Unknown	No Photo Available
SWDP-35856	MassDOT	Unknown	42.40722346 / -71.02657273	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWDP-35854	MassDOT	Unknown	42.40691704/ -71.02650557	Headwall	Asphalt Coated Corrugated Metal	12”	Unknown	Unknown	Unknown	No Photo Available
SWDP-28225	MassDOT	Unknown	42.40676206/ -71.02694235	Pipe End	RC	12”	Unknown	Unknown	Unknown	No Photo Available
SWDP-28224	MassDOT	Unknown	42.40664713/ -71.02727932	Headwall	Asphalt Coated Corrugated Metal	12”	Unknown	Unknown	Unknown	No Photo Available

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
SWDP-28300	MassDOT	Unknown	42.40699169 / -71.02527234	Headwall	RC	12”	Unknown	Unknown	Unknown	No Photo Available
SWDP-22298	MassDOT	Unknown	42.40682552 / -71.02536091	Pave Waterway	Paved	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWDP-28301	MassDOT	Unknown	42.40650103/ -71.02522666	Headwall	RC	12”	Unknown	Unknown	Unknown	No Photo Available
SWDP-28302	MassDOT	Unknown	42.40635968/ -71.02490552	Headwall	VC	24”	Unknown	Unknown	Unknown	No Photo Available
SWDP-36760	MassDOT	Unknown	42.40563631/ -71.02604908	Headwall	Asphalt Coated Corrugated Metal	12”	Unknown	Unknown	Unknown	No Photo Available
UNK-A	Private (Suspected DOT)	Unknown	42.40568025 / -71.02483308	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWDP-35862	MassDOT	Unknown	42.40584894/ -71.02436639	Headwall	Asphalt Coated Corrugated Metal	12”	Unknown	Unknown	Unknown	No Photo Available
SWDP-28303	MassDOT	Unknown	42.40625392 / -71.02356779	Headwall	VC	8”	Unknown	Unknown	Unknown	No Photo Available
SWDP-31770	MassDOT	Unknown	42.40500093 / -71.0268064	Headwall	Unknown	Unknown	Unknown	Unknown	Unknown	No Photo Available
SWDP-31767	MassDOT	Unknown	42.40485569 / -71.02833051	Headwall	RC	12”	Unknown	Unknown	Unknown	No Photo Available
SWDP-31768	MassDOT	Unknown	42.40459754/ -71.02876143	Pipe End	RC	12”	Unknown	Unknown	Unknown	No Photo Available
SWDP-31769	MassDOT	Unknown	42.4045578 / -71.02897465	Pipe End	VC	54”	Unknown	Unknown	Unknown	No Photo Available
SWDP-22304	MassDOT	Unknown	42.4113338 / -71.02883093	Headwall	Corrugated Metal	48”	Unknown	Unknown	Unknown	No Photo Available

Stormwater Outfalls Discharging to Mill Creek from Revere, Everett, and Chelsea										
Facility ID[1]	Owner	Location Description	Location (Latitude/Longitude)[2]	Pipe Type	Pipe Material	Pipe Diameter (inches)	Description of Sampling[3]	Condition Summary[4]	Observations[5]	Photo (date)[6]
SWDP-31767	MassDOT	Downstream of the northeasterly corner of Webster Avenue and Revere Beach Parkway	42.4047/-71.0286	Circular	RCP	8"	Unknown	Poor – pipe mostly covered	Scouring present, no sediment present	 6/6/22

[1] Facility ID nomenclature is based on the following information:
- Unless otherwise noted below, IDs are taken from the City of Chelsea and City of Revere outfall databases
- "Horsley Witten ID-1" through "Horsley Witten ID-12" are taken from Table 3 of the *2019 Mystic River Restoration Project – Mill Creek Restoration Assessments, FY18 MassBays Healthy Estuaries Grant Program*
- "New GIS IDs" are outfall refences developed by CDM Smith
- "Chelsea GIS ID" is an ID refencing a private outfall on the Revere side of Mill Creek
- "Interconnection from Everett" IDs are intermunicipal connections from the City of Everett to the City of Chelsea. These locations are observed and sampled as part of Chelsea's outfall monitoring performed by Weston & Sampson. These locations were confirmed by the *City of Everett, Stormwater Management Plan (SWMP): Volume 2, Illicit Discharge Detection and Elimination (IDDE) Plan; Appendix C – City of Everette, Outfall Ranking Map. Prepared by the BETA Group, INC.*
- IDs "UNK-A" through "UNK-AF" are taken from Figure 12 of the *2019 Mystic River Restoration Project – Mill Creek Restoration Assessments, FY18 MassBays Healthy Estuaries Grant Program*

[2] Latitude/Longitude coordinates are based on the following information:
- Coordinates with four or eight significant figures in this table were generated from Weston & Sampson ArcGIS mapping
- Coordinates with six significant figures in this table were generated from GoogleMaps as estimated outfall points

[3] Sampling is conducted by Weston & Sampson twice a year for the cities of Revere and Chelsea; the outfalls are tested for each of the parameters listed during one dry-weather event and one wet-weather event each year.
[4] Condition Summary is based off field knowledge from visual observations performed during the sampling conducted by Weston & Sampson
[5] Observations are related to sedimentation and scouring; each observation was determined by field knowledge and visual observations of photos on record from Weston & Sampson
[6] Photos are taken by Weston & Sampson during field observations, included in annual sampling reports for the cities of Chelsea and Revere
[7] Photos from Appendix C of the *2019 Mystic River Restoration Project – Mill Creek Restoration Assessments, FY18 MassBays Healthy Estuaries Grant Program*

APPENDIX B

Overview of Catchments

APPENDIX B

Chelsea, Everett, and Revere, MA
Stormwater Catchments

Mill Creek Water Quality Improvement Project

June 2022 SCALE: NOTED

Weston & Sampson

APPENDIX C

Individual Catchment Maps
(Under Separate Cover)

Appendix D

Summary of Historical Outfall Sampling Data

MEMORANDUM

TO:	Karl Allen Department of Housing and Community Development Chelsea City Hall
FROM:	Gina Cortese, EIT, Weston & Sampson Jennie Moonan, PE, Weston & Sampson
CC:	Tim Corrigan, PE, Weston & Sampson
DATE:	June 28, 2022
SUBJECT:	Coastal Pollutant Remediation (CPR) Grant for Mill Creek Water Quality Improvement Project *Historical Sampling Data and Analysis for Municipal Outfalls Discharging to Mill Creek in Chelsea, MA*

This memorandum has been prepared in support of the Mill Creek Water Quality Improvement Project funded by a Fiscal Year 2022 Coastal Pollutant Remediation Grant Program through the Office of Coastal Zone Management. The information contained in this memorandum supports the non-point source pollution assessment efforts including:

- Review and assessment of historic sampling data and inspection results
- Identification of catchment areas that are contributing a high nonpoint source pollutant load of bacteria and other pollutants common in stormwater runoff to Mill Creek to prioritize areas for conceptual design of structural stormwater Best Management Practices (BMPs)

This information will be incorporated into the existing conditions documentation and support the final report for the Grant Project.

Overview of Sampling Program

Since 2006, the City of Chelsea has completed annual stormwater outfall monitoring and sampling of its known city-owned outfalls in compliance with regulatory requirements. Throughout this time, Weston & Sampson has assisted Chelsea in the program, including documenting observations, collecting samples from flowing outfalls, and aggregating and evaluating the results of laboratory data produced from the sampling. This memorandum describes the stormwater sampling procedures employed and analysis of the City of Chelsea's sampling results from 2012 through 2021 as they pertain to the Mill Creek Water Quality Improvement Project.

Monitoring Procedure

The City of Chelsea performs its sampling according to the requirements of its Administrative Order (AO), Docket No. 09-008 and the National Pollutant Discharge Elimination System (NPDES) General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) in Massachusetts. The AO requires that Chelsea inspects each of its known, city-owned outfalls and inter-municipal connections from Everett twice per year, during the months of June through September. One sampling event must occur during a wet weather period, defined as a minimum of 0.25 inches of rainfall occurring in the 24 hours prior to sampling. One sampling event must occur during a period of dry weather, defined as 48 hours without precipitation greater than 0.1 inches. Though the total number of known, city-owned outfalls has changed since 2006 when the sampling program began, in 2021 there were 24 total outfalls and 5 inter-municipal connections which are inspected biannually.

The City of Revere performs its sampling according to results of the litigation described in the final record *U.S. and Commonwealth of Massachusetts v. City of Revere Civil Action No. 1:10-cv-11460* ("Consent Decree") and associated Illicit Discharge Detection & Elimination (IDDE) Plan, revised June 2019, prepared for compliance with the MS4 General Permit. The Consent Decree requires that Revere monitor 25% of all known, city-owned outfalls each year. One sampling event must occur during a wet weather period, defined as a minimum of 0.25 inches of rainfall occurring in the 12 hours prior to sampling. One sampling event must occur during a period of dry weather, defined as 48 hours without precipitation greater than 0.1 inches. Though the total number of known, city-owned outfalls has changed since 2006 when the sampling program began, in 2021 there were 89 total outfalls.

For each sampling effort, Weston & Sampson staff physically locate and photograph each outfall and document any visual observations. Where flow is discharging during the inspection, staff provide an estimation of the flow volume, document visual characteristics of the flow, and collect flow samples. The requirements for sampling parameters have varied over the duration of the outfall monitoring and sampling program due to evolution from the 2003 MS4 General Permit to the 2016 MS4 General Permit. For outfalls where samples are taken, "benchmark" criteria are used to assess whether a concentration is at or above Federal or State Water Quality Standards and/or is a likely illicit discharge. High concentrations of ammonia are typically found in wastewater. E.coli and enterococcus are indicators of contamination from the excrement of humans, with enterococcus used in cases where salinity is a factor (e.g., saline or brackish waterbodies). Free chlorine concentrations may provide a disinfection effect, which could indicate that higher concentrations of bacteria are entering the stormwater system than are presented in the data. High concentrations of surfactants generally indicate the presence of detergents, such as from laundry or car washing. Based on information supplied by the EPA and Mystic River Watershed Association (MyRWA), benchmark criteria presented in Table 1 below are used to evaluate stormwater outfall sampling. Samples that exceed the benchmark criteria for each parameter are treated as a contributor to the contamination in Mill Creek.

Table 1: Benchmark Criteria for Outfall Sampling Parameters

Parameter	Unit	Benchmark	Note
Ammonia-Nitrogen	mg/L	0.5 mg/L[1]	EPA benchmark related to likely sewage [4]
E. Coli	cfu/100mL	235 cfu/100mL [2]	Benchmark from City of Chelsea ACO Attachment 10 Table 1 benchmark level for indication of wastewater or washwater
Enterococcus	MPN/100mL	104 MPN/100mL [3]	EPA benchmark related to likely sewage [1, 4]
Specific Conductance	µMHOS/CM	Report	EPA required sampling parameter [1]
Surfactants	mg/L	0.25 mg/L [1]	EPA benchmark related to likely sewage [4]
Temperature	°F	Report [1]	EPA required sampling parameter [1]
Total Chlorine	mg/L	Report [1]	EPA Required sampling parameter [1]
Salinty	ppt	0.5 ppt [5]	EPA required sampling parameter [1]

[1] *EPA General Permit for Stormwater Discharges from Small MS4 in Massachusetts*
[2] 314 CMR 4.00: Massachusetts Surface Water Quality Standards, effective December 6, 2013, Class B waterbodies
[3] 314 CMR 4.00: Massachusetts Surface Water Quality Standards, effective December 6, 2013, Class SB waterbodies
[4] *EPA General Permit for Stormwater Discharges from Small MS4 in Massachusetts, see footnote 4 on page 35*
Likely sewer input indicators are any of the following:
- Olfactory or visual evidence of sewage,
- Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria levels greater than the water quality criteria applicable to the receiving water, or
- Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine

[5] *EPA Volunteer Estuary Monitoring: A Methods Manual*

Note that 314 CMR 4.00 was updated in November 2021 and includes revised values for bacteria for Class SB waterbodies.

Results of the outfall monitoring and sampling program are submitted to the EPA annually in a summary report, along with a cursory analysis of historical trends for each outfall. Full results of this sampling program are attached to this memorandum.

Summary of Results

To support the non-point source pollution assessment, Weston & Sampson evaluated laboratory results from samples collected at known, city-owned outfalls discharging to Mill Brook from 2012 through 2021.

Sampling results from wet and dry weather data were reviewed and are included in the attached sampling results raw data.

Generally, the intent of dry weather screening and sampling when flow is present is to identify illicit connections to the drainage system and use these results to facilitate dry weather catchment investigations. These investigations are targeted at finding and removing direct connections to the drainage system that may be from sewer, laundry, etc. In some instances, due to levels of groundwater and deterioration of sewerage pipes, sewage can migrate out of wastewater systems and into drainage systems during periods of dry weather. There can also be direct connections from sewers, public or private, to the drainage system. In addition, illegal dumping into catch basins or other drainage system inputs cannot be ruled out. Dry weather data is generally best used to identify finite, point source pollutants into the drainage system.

Wet weather conditions, however, drive the movement of surface pollutants into a drainage system from across any given catchment area. Wet weather results capture the full picture of surface and sub-surface sources of pollution entering Mill Creek. Therefore, wet weather sampling results are used in our analysis to support catchment prioritization.

According to the Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle, Mill Creek's 0.02 square miles is impaired by fecal coliform bacteria, as well as PCBs in shellfish and additional unknown causes. Because bacteria is the primary pollutant of concern, we utilized the laboratory results for E.coli and Enterococcus for our analysis to understand relative magnitude of pollutant loadings by catchment. It is important to note that results of stormwater grab sampling from stormwater systems capture a moment in time and are not reflective of pollutant loading over a single storm event or an annualized load. Each grab sample may be collected during a storm event with differing intensity or duration, various antecedent conditions, and/or differing groundwater levels, all of which impact results. When data from stormwater grab samples from a single location are available over a period of time, those results can be used to understand relative magnitude compared to benchmarks and to other outfalls.

Chelsea Outfall Results

A summary of the outfall sampling data is presented in Table 2 and Figures 1 and 2.

Table 2: Wet Weather Outfall Sampling Results for Chelsea-Owned Outfalls 2012-2021

Chelsea-Owned Outfall	Bacterial Outfall Sampling Results							
	# Samples[1]		Average[2]		Maximum[2]		Median[2]	
	E. coli	Entero.	E. coli (cfu/100ml)	Entero. (MPN/100ml)	E. coli (cfu/100ml)	Entero. (MPN/100ml)	E. coli (cfu/100ml)	Entero. (MPN/100ml)
Broadway @ Mill Creek	10	9	7,453	10,016	*25,000*	24,196	3,526	8,232
Clark Ave.	8	7	2,649	8,059	8,164	19,863	1,672	7,741
Crescent Ave.	3	3	11,285	9,821	*25,000*	19,863	6,100	13,782
Fenno & Columbus SW	3	3	5,567	6,647	15,531	17,329	590	9,615
Gillooly Rd.	10	9	4,386	5,831	11,199	*25,000*	3,350	3,417
Gillooly Rd. North	10	9	4,270	3,860	*25,000*	*25,000*	2,082	419
Guam Rd.	8	8	13,279	11,277	*25,000*	*25,000*	11,512	7,701
Locke St. 12-inch	9	9	7,678	6,550	*25,000*	*25,000*	591	3,736
Locke St. 24-inch	9	8	7,630	8,618	*25,000*	24,196	*2,500*	5,800
Route 1 Ramp	7	6	9,086	3,416	41,060	8,164	3,448	2,247
Springvale Inter-Municipal Connection[3]	10	1	14,723	*25,000*	*25,000*	*25,000*	16,135	*25,000*
Union Inter-Municipal Connection[3]	6	1	4,390	2,500	9,884	*2,500*	2,900	*2,500*
Washburn St.	10	9	9,156	12,043	19,863	*25,000*	7,834	14,264
Webster Ave. & RBP	9	8	3,419	8,759	7,556	19,863	*2,500*	7,500
Benchmark Criteria							235	104

[1] Samples were not collected at every outfall during each sampling round because in some cases, outfalls had no observed flow. In addition, some outfalls could not be accessed and therefore samples were collected from flow entering manholes or catch basins directly upstream of the outfall; these results are included.

[2] Italicized results indicate that the top limit of the test method was reached (i.e., *25,000* represents a value >25,000). The limit was used for calculation purposes.

[3] Inter-municipal connections originate from Everett and collect stormwater from Everett catchments before connecting into to Chelsea's stormwater system. They are included in Table 2 for comparison to the outfalls, owned by Chelsea, which collect stormwater from Chelsea catchments.

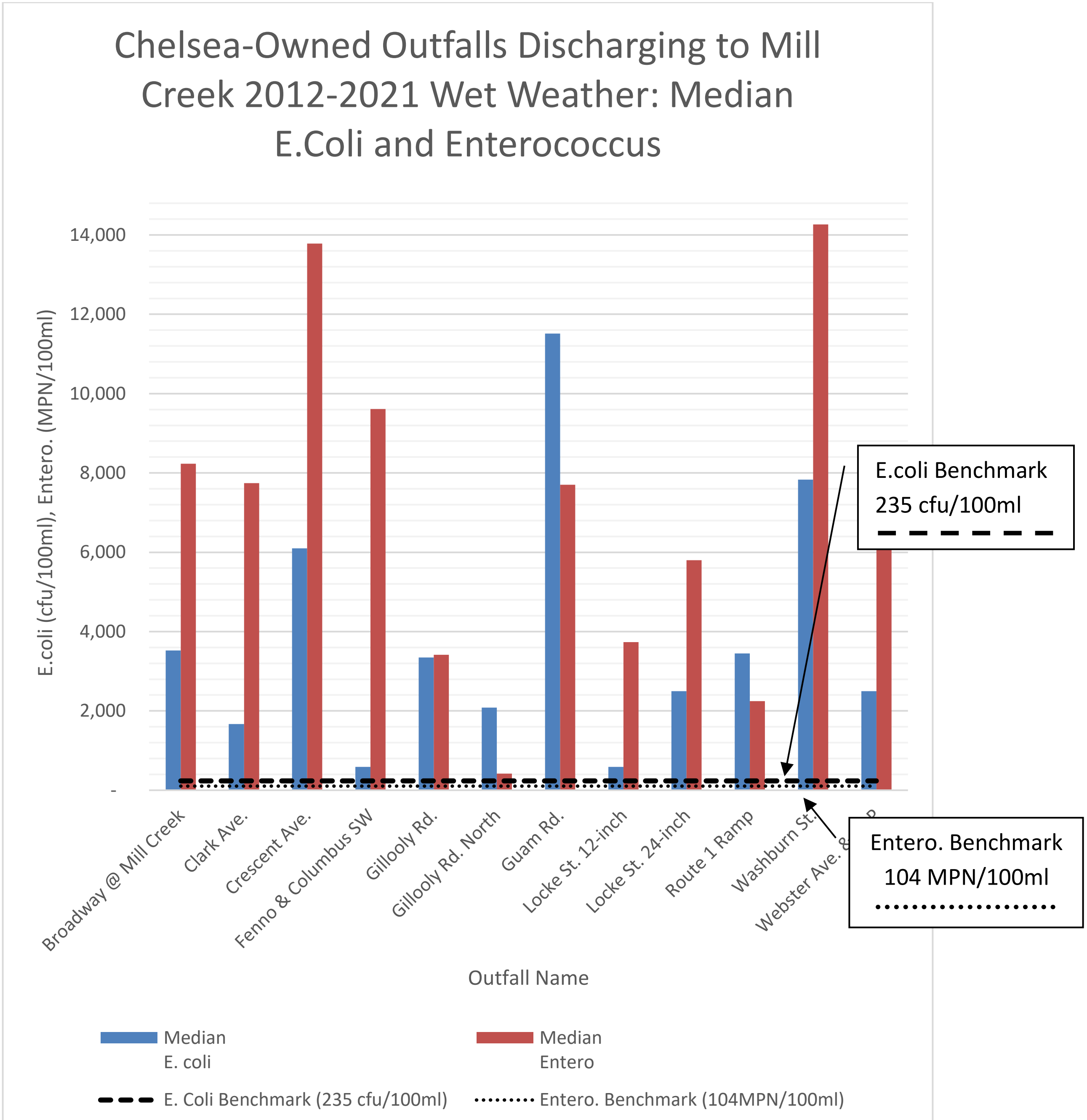
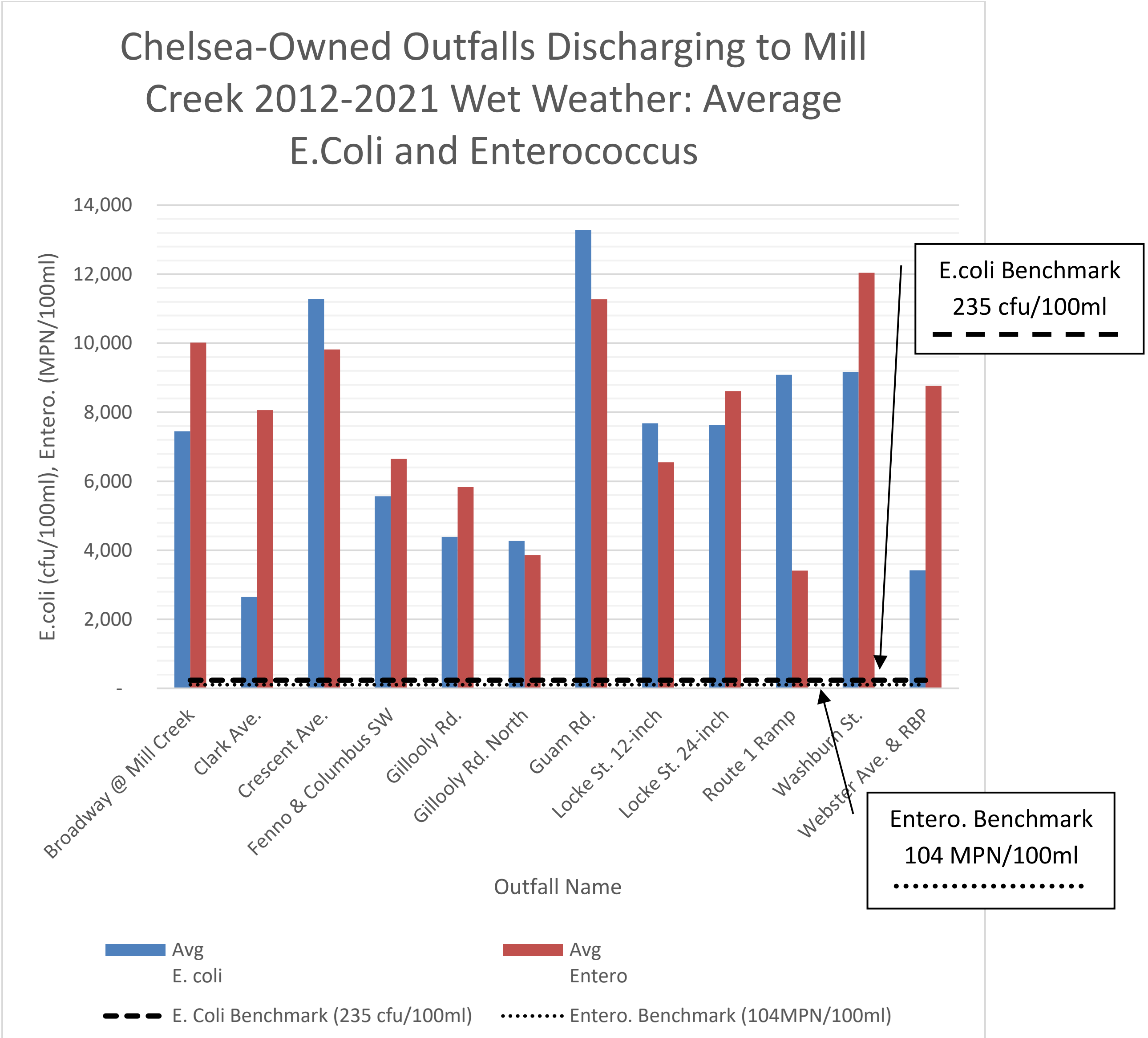


Figure 1: Bacteria Concentrations at Each Chelsea-Owned Outfall 2012-2021 Wet Weather



When these results are sorted by average or median E. coli or Enterococcus, as shown in Table 3, the same outfalls rise to the top:

- Washburn St.
- Guam Rd.
- Crescent Ave.
- Broadway @ Mill Creek

However, these results are not yet normalized by catchment land area, land uses, etc. as Chelsea catchment delineation is still in progress. Also, note that we excluded maximum values due to limitations imposed by detection limits associated with the laboratory methods.

Table 3: Ranking of Wet Weather Chelsea-Owned Outfall Sampling Results 2012-2021

Chelsea-Owned Outfall	Average[1]		Median[1]		Ranking				
	E. coli (cfu/100mL)	Entero (MPN/100mL)	E. coli (cfu/100mL)	Entero (MPN/100mL)	By Average E.Coli	By Average Entero	By Median E.coli	By Median Entero	Total Score (Sum)
Washburn St.	9,156	12,043	7,834	14,264	3	1	2	1	7
Guam Rd.	13,279	11,277	11,512	7,701	1	2	1	6	10
Crescent Ave.	11,285	9,821	6,100	13,782	2	4	3	2	11
Broadway @ Mill Creek	7,453	10,016	3,526	8,232	7	3	4	4	18
Locke St. 24-inch	7,630	8,618	*2,500*	5,800	6	6	8	8	28
Webster Ave. & RBP	3,419	8,759	*2,500*	7,500	11	5	7	7	30
Fenno & Columbus SW	5,567	6,647	590	9,615	8	8	12	3	31
Route 1 Ramp	9,086	3,416	3,448	2,247	4	12	5	11	32
Clark Ave.	2,649	8,059	1,672	7,741	12	7	10	5	34
Locke St. 12-inch	7,678	6,550	591	3,736	5	9	11	9	34
Gillooly Rd.	4,386	5,831	3,350	3,417	9	10	6	10	35
Gillooly Rd. North	4,270	3,860	2,082	419	10	11	9	12	42

[1] Italicized results indicate that the top limit of the test method was reached (i.e., *25,000* represents a value >25,000). The limit was used for calculation purposes.

Results of All Known Municipal Outfalls Tributary to Mill Creek

In addition to the 12 known, Chelsea-owned outfalls that discharge into Mill Creek, there are 8 additional known outfalls owned by or located in the City of Revere that discharge into Mill Creek. Revere, with assistance from Weston & Sampson, runs an outfall monitoring and sampling program similar to Chelsea's. Revere monitors at least 25% of its total outfalls annually such that each outfall is monitored at least once every four years. Like Chelsea, Revere performs its monitoring and sampling during one wet and one dry weather event each year. Revere utilizes the same benchmark criteria as shown in Table 1.

As discussed briefly above, there are also two inter-municipal connections which collect stormwater from catchments in Everett before connecting into Chelsea's stormwater system. The Springvale and Union intermunicipal connections connect upstream of the Guam Rd. and Webster Ave & RBP outfalls, respectively. While it is important to note the possible influence these inter-municipal connections may have on the sampling results of their downstream outfalls, the outfall sampling results cannot solely be attributed to the inter-municipal connections. Therefore, we continue to present the results of both these outfalls and inter-municipal connections separately.

While we compare the results from these Chelsea, Revere, and Everett contributions to Mill Creek, it is important to remember that this information is being used, at present, to inform a decision about where to best locate stormwater BMPs within the City of Chelsea. Therefore, though it is helpful to view the health of the watershed wholistically and as a system that extends beyond the Chelsea city bounds, the information presented in Tables 4 and 5, is used here to provide perspective on the influence of Chelsea's stormwater discharges to Mill Creek.

Table 4: Wet-Weather Outfall Sampling Results from City-Owned Outfalls in Chelsea and Revere to Mill Creek

WET WEATHER 2012-2021												
		# Samples[1]		Average[2]		Median[2]		Ranking				
								By Average		By Median		Sum
Outfall	Owner	E. coli	Entero	E. coli (cfu/100mL)	Entero (MPN/100mL)	E. coli (cfu/100mL)	Entero (MPN/100mL)	E.Coli	Entero	E.Coli	Entero	Total
Springvale Inter-Municipal Connection	Everett	10	1	14,723	*25,000*	16,135	*25,000*	2	1	2	1	6
Washburn St.	Chelsea	10	9	9,156	12,043	7,834	14,264	5	3	4	2	14
Revere Beach Parkway/ Olive St. (3)	(Suspected DCR)	4	3	29,501	11,301	25,312	7,701	1	4	1	10	16
Crescent Ave.	Chelsea	3	3	11,285	9,821	6,100	13,782	4	8	5	3	20
Guam Rd.	Chelsea	8	8	13,279	11,277	11,512	7,701	3	5	3	10	21
Broadway @ Mill Creek	Chelsea	10	9	7,453	10,016	3,526	8,232	10	7	6	8	31
Revere Beach Parkway/ Wilson St. (2)	(Suspected DCR)	6	5	5,764	10,922	3,426	8,700	12	6	8	6	32
Revere Beach Parkway/ Mill St.	(Suspected DCR)	5	4	9,067	12,904	235	13,060	7	2	21	4	34
Locke St. 24-inch	Chelsea	9	8	7,630	8,618	2,500	5,800	9	11	11	13	44
Fenno & Columbus SW	Chelsea	3	3	5,567	6,647	590	9,615	13	13	19	5	50
Route 1 Ramp	Chelsea	7	6	9,086	3,416	3,448	2,247	6	20	7	17	50
Webster Ave. & RBP	Chelsea	9	8	3,419	8,759	2,500	7,500	19	9	11	12	51
Locke St. 12-inch	Chelsea	9	9	7,678	6,550	591	3,736	8	14	18	14	54
Clark Ave.	Chelsea	8	7	2,649	8,059	1,672	7,741	20	12	14	9	55
Gillooly Rd.	Chelsea	10	9	4,386	5,831	3,350	3,417	15	17	9	15	56
Union Inter-Municipal Connection	Everett	6	1	4,390	*2,500*	2,900	*2,500*	14	21	10	16	61
Broadway @ Mill Creek (upstream)	Revere	6	5	3,486	6,104	755	1,100	17	15	17	19	68
Gillooly Rd. North	Chelsea	10	9	4,270	3,860	2,082	419	16	19	13	21	69
Fenno St. / Columbus NE	Revere	6	5	3,484	5,907	1,081	602	18	16	16	20	70
Spring St. to Mill Creek	Revere	4	4	1,586	2,015	1,495	2,000	21	22	15	18	76
Broadway @ Mill Creek (Downstream)	(Suspected DCR)	6	5	1,288	5,502	123	20	22	18	22	23	85
Fenno St/ Rt. 1	MassDOT	6	4	926	180	386	73	23	23	20	22	88

[1] Samples were not collected at every outfall during each sampling round because in some cases, outfalls had no observed flow. In addition, some outfalls could not be accessed and therefore samples were collected from flow entering manholes or catch basins directly upstream of the outfall; these results are included.

[2] Italicized results indicate that the top limit of the test method was reached (i.e., *25,000* represents a value >25,000). The limit was used for calculation purposes.

[3]Inter-municipal connections originate from Everett and collect stormwater from Everett catchments before connecting into to Chelsea's stormwater system.

Table 5: Dry-Weather Outfall Sampling Results from City-Owned Outfalls in Chelsea and Revere to Mill Creek

DRY WEATHER 2012-2021														
		# Samples[1]		Average[2]		Median[2]		Ranking						
								By Average		By Median		Sum		
Outfall	Owner	E. coli	Entero	E. coli (cfu/100mL)	Entero (MPN/100mL)	E. coli (cfu/100mL)	Entero (MPN/100mL)	E.Coli	Entero	E.Coli	Entero	(Dry) Total	Wet Weather Rank
Revere Beach Pkwy./Olive St. (3)	(Suspected DCR)	5	5	17,599	10,151	17,329	714	1	1	1	3	**6** ↑	16
Guam Rd.	Chelsea	8	7	9,010	2,471	2,788	1,616	2	3	3	1	**9** ↑	21
Webster Ave. & RBP	Chelsea	5	4	3,236	658	2,500	684	9	8	4	4	**25** ↑	51
Gillooly Rd.	Chelsea	10	9	3,343	3,208	582	580	8	2	12	5	**27** ↑	56
Revere Beach Pkwy/Wilson St. (2)	(Suspected DCR)	5	4	4,178	878	2,500	207	6	7	4	10	**27** ↑	32
Spring St. to Mill Creek	Revere	2	2	1,299	1,006	1,299	1,006	13	5	9	2	**29** ↑	76
Route 1 Ramp	Chelsea	5	4	7,853	1,891	185	146	3	4	15	12	**34** ↑	50
Locke St. 12-inch	Chelsea	4	3	7,305	154	2,100	185	5	14	7	11	**37** ↑	54
Washburn St.	Chelsea	5	4	1,699	347	1,900	253	10	10	8	9	**37** ↓	14
Locke St. 24-inch	Chelsea	5	4	1,288	879	771	440	14	6	11	7	**38** ↑	44
Broadway @ Mill Creek	Chelsea	6	5	937	439	529	520	16	9	13	6	**44** ↓	31
Clark Ave.	Chelsea	2	1	521	331	521	331	19	11	14	8	**52** ↑	55
Broadway @ Mill Creek (upstream)	Revere	6	6	1,500	72	184	21	12	15	17	16	**60** ↑	68
Gillooly Rd. North	Chelsea	8	7	593	165	185	20	18	12	15	17	**62** ↑	69
Broadway @ Mill Creek (Downstream)	(Suspected DCR)	6	6	4,168	35	0	0	7	18	21	18	**64** ↑	85
Fenno/Columbus NE	Revere	4	3	627	39	53	43	17	17	19	15	**68** ↑	70
Crescent Ave.	Chelsea	1	1	66	56	66	56	21	16	18	14	**69** ↓	20
Fenno St/ Rt. 1	MassDOT	4	3	223	2	11	0	20	19	20	18	**77** ↑	88
Springvale Inter-Municipal Connection[3]	Everett	10	0	7,751	-	3,556	-	4	-	2	-	-	-
Union Inter-Municipal Connection[3]	Everett	3	0	1,633	-	2,400	-	11	-	6	-	-	-

[1] Samples were not collected at every outfall during each sampling round because in some cases, outfalls had no observed flow. In addition, some outfalls could not be accessed and therefore samples were collected from flow entering manholes or catch basins directly upstream of the outfall; these results are included.
[2] Italicized results indicate that the top limit of the test method was reached (i.e., *25,000* represents a value >25,000). The limit was used for calculation purposes.
[3] Inter-municipal connections originate from Everett and collect stormwater from Everett catchments before connecting into to Chelsea's stormwater system.

Though there are several influences outside of Chelsea that are large contributors, you can see that again, for wet weather sampling, the same four outfalls in Chelsea are top contributors:

- Washburn St.
- Guam Rd.
- Crescent Ave.
- Broadway @ Mill Creek

Note that, again, these results are not normalized by catchment land area, land uses, etc. Note also that sampling in Revere and Chelsea outfalls occurred on different days following different antecedent weather conditions; the results presented in Table 4 are to be used for general comparison of magnitude purposes but cannot and should not be used to identify definitive, cumulative levels of contamination originating from each outfall.

Tables 6 and 7 show that several outfalls not owned by the City of Chelsea rank highly: Revere Beach Parkway/ Olive (3), Revere Beach Parkway/ Wilson (2), and Revere Beach Parkway/ Mill Street. Table 6 below identifies the three highest ranking of these during wet weather sampling and shows how the outfall sampling data has changed since 2012 for both wet and dry sampling events.

Table 6: Timeseries of Wet Weather Outfall Data Sampling for Selected Outfalls in Revere

Sample Year (WET)	Revere Beach Parkway/ Olive (3)		Revere Beach Parkway/ Wilson (2)		Revere Beach Parkway/ Mill St.	
	E.coli (cfu/100mL)	Enterococcus (MPN/100mL)	E.coli (cfu/100mL)	Enterococcus (MPN/100mL)	E.coli (cfu/100mL)	Enterococcus (MPN/100mL)
2012	Not monitored in 2012					
2013	Could Not Locate		8,200	8,700	No Flow	
2014	Not monitored in 2014					
2015	No Flow		933	1,046	>24,200	>24,200
2016	64,880	7,701	0	0	211	496
2017	19,863	>24,200	18,600	>24,200	19,863	>24,200
2018	30,760	1,201	4,352	19,863	235	1,119
2019	>2,420	Present	>2,420	Present	26	Present
2020	Not monitored in 2020					
2021	Not monitored in 2021					

Table 7: Timeseries of Dry Weather Outfall Data Sampling for Selected Outfalls in Revere

Sample Year (DRY)	Revere Beach Parkway/ Olive (3)		Revere Beach Parkway/ Wilson (2)		Revere Beach Parkway/ Mill St.	
	E.coli (cfu/100mL)	Enterococcus (MPN/100mL)	E.coli (cfu/100mL)	Enterococcus (MPN/100mL)	E.coli (cfu/100mL)	Enterococcus (MPN/100mL)
2012	Not monitored in 2012					
2013	Could Not Locate		4,000	3,000	No Flow	
2014	Not monitored in 2014					
2015	>24,200	>24,200	Could Not Sample		No Flow	
2016	2105	>24,200	12,033	228	No Flow	

Sample Year (DRY)	Revere Beach Parkway/ Olive (3)		Revere Beach Parkway/ Wilson (2)		Revere Beach Parkway/ Mill St.	
	E.coli (cfu/100mL)	Enterococcus (MPN/100mL)	E.coli (cfu/100mL)	Enterococcus (MPN/100mL)	E.coli (cfu/100mL)	Enterococcus (MPN/100mL)
2017	17,329	714	934	98	No Flow	
2018	41,060	41	1,421	187	No Flow	
2019	>2,420	Absent	>2,4200	Present	No Flow	
2020	Not monitored in 2020					
2021	Not monitored in 2021					

ATTACHMENTS:

Chelsea Raw Outfall Sampling Data 2006 – 2021

Revere Raw Outfall Sampling Data 2006 – 2021

Chelsea, MA
Outfall Sampling Data 2006 - 2021

Location	2006 Dry				2006 Wet			
	Fecal (cfu/100ml)	E-coli (cfu/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Fecal (cfu/100ml)	E-coli (cfu/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)
Broadway @ Mill Creek	8	4	**0.9**	0.8	**800**	**600**	**0.3**	0.4
Clark Ave.	No flow				No flow			
Crescent Ave.	2	1	**0.6**	0.8	No flow			
Fenno & Columbus SW	Outfall not yet identified				Outfall not yet identified			
Gillooly Rd.	**240**	28	**0.5**	**2.7**	170	170	**0.3**	**1.3**
Gillooly Rd. North	Outfall not yet identified				Outfall not yet identified			
Guam Road	Outfall not yet identified				Outfall not yet identified			
Locke St. (24")	80	15	0.3	0.2	No flow			
Locke St. (12")	No flow				No flow			
Route 1 ramp	No flow				No flow			
Washburn St.	**2200**	<1	0.2	0.6	**450**	180	0.2	0.8
Webster Ave. & RBP	Believed stagnant				Believed stagnant			

Location	2007 Dry					2007 Wet				
	Fecal (cfu/100ml)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Fecal (cfu/100ml)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)
Broadway @ Mill Creek	110	80	**260**	**0.4**	<0.10	**88000**	**28000**	**>24000**	**3.7**	0.7
Clark Ave.	No flow					No flow				
Crescent Ave.	20	<10	24	0.2	0.2	No flow				
Fenno & Columbus SW	No flow					**29000**	**1200**	**3100**	0.2	0.5
Gillooly Rd.	200	110	**460**	**0.3**	**3.4**	**550**	**490**	**190**	0.2	**3.6**
Gillooly Rd. North	Outfall not yet identified					Outfall not yet identified				
Guam Road	No flow					No flow				
Locke St. (24")	No flow					No flow				
Locke St. (12")	No flow					No flow				
Route 1 ramp	100	60	**320**	0.2	0.4	**4700**	**440**	**1000**	**0.5**	0.5
Washburn St.	**21000**	**16000**	**580**	0.1	0.3	**8200**	**6700**	**350**	**0.4**	0.7
Webster Ave. & RBP	No sample possible from DMH					**53000**	**4200**	**720**	**0.4**	0.9

Location	2008 Dry					2008 Wet				
	Fecal (cfu/100ml)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Fecal (cfu/100ml)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)
Broadway @ Mill Creek	130	**130**	10	**0.6**	0.7	NA	<10	**9200**	0.2	0.3
Clark Ave.	Not inspected					Not inspected				
Crescent Ave.	No flow					NA	<10	**10000**	0.1	0.2
Fenno & Columbus SW	No flow					No flow				
Gillooly Rd.	**300**	100	<10	**0.4**	**4.6**	NA	<10	**11000**	0.2	0.6
Gillooly Rd. North	Outfall not yet identified					Outfall not yet identified				
Guam Road	No Flow					NA	<10	**610**	0.2	0.3
Locke St. (24")	No Flow					NA	<10	**>24000**	0.1	0.1
Locke St. (12")	No Flow					NA	20	**4900**	0.1	0.2
Route 1 ramp	No Flow					No flow				
Washburn St.	**5500**	**5400**	<10	0.2	<0.10	NA	<10	**1900**	0.1	0.3
Webster Ave. & RBP	**14000**	**900**	10	0.2	0.5	NA	<10	**4900**	0.1	0.2

Location	2009 Dry				2009 Wet			
	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)
Broadway @ Mill Creek	160	75	**0.5**	0.8	210	**160**	**0.9**	0.7
Clark Ave.	No flow				No flow			
Crescent Ave.	No flow				No flow			
Fenno & Columbus SW	No flow				No flow			
Gillooly Rd.	20	10	**0.4**	**3.4**	**1500**	10	**0.7**	**3.6**
Gillooly Rd. North	20	31	**0.5**	**7.6**	50	50	**0.8**	**4.7**
Guam Road	No flow				50	10	**0.3**	0.2
Locke St. (24")	10	10	<0.1	0.2	No flow			
Locke St. (12")	No flow				30	100	**0.5**	**1.1**
Route 1 ramp	150	**120**	**0.5**	0.6	No flow			
Washburn St.	**1800**	**140**	**0.3**	0.6	**380**	40	**0.4**	<0.10
Webster Ave. & RBP	**350**	**200**	**0.7**	0.2	**680**	**350**	0.2	<0.10

* **Bold** indicates a value that exceeds EPA benchmarks: Fecal coliform (through 2008) >200 cfu/100mL; E-coli >235 cfu/100mL; Enterococcus >104 cfu/100 mL; surfactants >0.25 mg/l; ammonia-N >0.5 mg/l (previously 1.0mg/l); chlorine >0.01mg/l.
(1) Ecoli and/or Enterococci - Samples analyzed outside of 8-hour holding time due to laboratory oversight
** Thermometer broke; no data.
OR = over range of multi meter

Chelsea, MA
Outfall Sampling Data 2006 - 2021

Location	2010								2011								2012											
	Dry				Wet				Dry				Wet				Dry						Wet					
	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)
Broadway @ Mill Creek	**400**	30	**0.3**	**1.2**	**11000**	**7300**	<0.1	0.22	**1300**	**120**	**0.49**	**0.50**	**12000**	**5800**	0.2	0.16	ND	ND	**0.65**	**0.9**	76	0.00	**900**	**7800**	0.20	<0.10	70	**0.03**
Clark Ave.	No flow				No flow				No flow				No flow				No Flow						**1200**	**3100**	0.19	0.3	68	0.00
Crescent Ave.	No flow				**3300**	**6500**	0.2	0.16	No flow				**4100**	**2600**	0.2	0.22	No Flow						No Flow					
Fenno & Columbus SW	No flow				No flow				No flow				No flow				No Flow						No Flow					
Gillooly Rd.	**280**	**150**	**0.4**	**1.4**	**1400**	**1700**	**0.3**	<0.10	130	**110**	**3.8**	**0.30**	**1300**	**1900**	0.2	0.68	**400**	**800**	**0.49**	**3.3**	66	**0.03**	**4200**	**5900**	0.16	**0.6**	65	**0.02**
Gillooly Rd. North	No flow				**900**	**8700**	<0.1	0.64	No flow				**250**	**1100**	0.2	**2.50**	No Flow						**300**	**6100**	0.24	**3.5**	65	0.00
Guam Road	**420**	**120**	<0.1	0.3	Unable to Access				Outfall not accessible				**3300**	**870**	0.2	0.21	**1000**	**400**	<0.10	0.2	73	0.01	**1000**	**3800**	0.17	0.3	67	**0.08**
Locke St. (24")	No flow				No Flow				No flow				No flow				No Flow						No Flow					
Locke St. (12")	No flow				**500**	**2600**	<0.1	0.21	No flow				**1700**	**1500**	0.1	0.22	No Flow						200	**2300**	<0.10	0.4	74	0.00
Route 1 ramp	<10	<10	**0.3**	0.4	Pipe Submerged				**9300**	**780**	0.9	**0.70**	**9200**	<10	**0.3**	0.62	No Flow						No Flow					
Washburn St.	<10	<10	0.2	0.2	**1000**	**13000**	<0.1	0.24	**7700**	**1500**	0.1	**0.30**	**11000**	**5300**	0.1	0.22	**1900**	100	<0.10	<0.10	68	0.00	**8800**	**8900**	<0.10	0.4	68	**0.04**
Webster Ave. & RBP	**300**	**170**	<0.1	<0.10	**3800**	**7700**	0.2	0.20	**760**	**280**	<0.10	0.20	**12000**	**7000**	0.2	0.13	**400**	**500**	<0.10	<0.10	72	**0.04**	**2100**	**7500**	<0.10	<0.10	72	**0.09**

* **Bold** indicates a value that exceeds EPA benchmarks: Fecal coliform (through 2008) >200 cfu/100mL; E-coli >235 cfu/100mL; Enterococcus >104 cfu/100 mL; surfactants >0.25 mg/l; ammonia-N >0.5 mg/l (previously 1.0mg/l); chlorine >0.01mg/l.
(1) Ecoli and/or Enterococci - Samples analyzed outside of 8-hour holding time due to laboratory oversight
** Thermometer broke; no data.

Chelsea, MA
Outfall Sampling Data 2006 - 2021

2013

Location	Dry E-coli (cfu/100ml)	Dry Enterococcus (MPN/100ml)	Dry Surfactants (mg/l)	Dry Ammonia-Nit. (mg/l)	Dry Temperature (°F)	Dry Chlorine (mg/L)	Wet E-coli (cfu/100ml)	Wet Enterococcus (MPN/100ml)	Wet Surfactants (mg/l)	Wet Ammonia-Nit. (mg/l)	Wet Temperature (°F)	Wet Chlorine (mg/L)
Broadway @ Mill Creek	**782**	**850**	**0.76**	0.4	82	**1.10**	**2700**	**6100**	0.10	0.3	**	**0.40**
Clark Ave.	No Flow						**380**	**3300**	0.10	0.1	60	0.00
Crescent Ave.	66	56	<0.1	0.2	80	**0.70**	**6100**	**1900**	0.13	0.1	**	**1.10**
Fenno & Columbus SW	No Flow						**590**	**1900**	1.00	0.13	**	**0.20**
Gillooly Rd.	**544**	**580**	**0.35**	**2.7**	70	0.00	**1100**	**2000**	0.10	0.1	60	0.00
Gillooly Rd. North	26	62	**0.75**	**7.8**	70	**1.10**	60	**320**	0.10	0.1	**	0.00
Guam Road	No Flow						**2600**	**4900**	0.10	0.1	59	0.00
Locke St. (24")	No Flow						**1400**	**5800**	0.10	0.1	**	**0.60**
Locke St. (12")	No Flow						200	**250**	0.10	0.1	**	0.00
Route 1 ramp	ND	ND	<0.1	**0.6**	60	**0.90**	No Flow					
Washburn St.	**2820**	**782**	0.21	**0.6**	68	0.00	**1100**	**10000**	0.10	0.1	**	**1.10**
Webster Ave. & RBP	**3140**	**986**	**0.54**	0.4	78	**0.70**	**3900**	**7700**	1.00	0.2	**	**0.10**

2014

Location	Dry E-coli (cfu/100ml)	Dry Enterococcus (MPN/100ml)	Dry Surfactants (mg/l)	Dry Ammonia-Nit. (mg/l)	Dry Temperature (°F)	Dry Chlorine (mg/L)	Wet E-coli (cfu/100ml)	Wet Enterococcus (MPN/100ml)	Wet Surfactants (mg/l)	Wet Ammonia-Nit. (mg/l)	Wet Temperature (°F)	Wet Chlorine (mg/L)
Broadway @ Mill Creek	No Flow						**11199**	**24196**	**0.59**	0.2	51	**0.06**
Clark Ave.	No Flow						**341**	**1674**	0.24	0.2	50	**0.10**
Crescent Ave.	No Flow						**2755**	**7701**	**0.50**	0.2	51	**0.06**
Fenno & Columbus SW	No Flow						**15531**	**17329**	**0.43**	0.1	52	0.01
Gillooly Rd.	**2420**	**1120**	**0.86**	**2.6**	47	**0.03**	**7270**	**4352**	**0.41**	0.3	52	0.00
Gillooly Rd. North	**921**	1	**0.69**	**6.5**	48	0.00	**3076**	**2613**	0.22	0.4	51	**0.03**
Guam Road	**1553**	**1046**	**0.26**	0.2	65	0.00	**4611**	**6867**	**0.42**	0.1	65	**0.08**
Locke St. (24")	**2420**	**2420**	**0.82**	0.4	50	0.00	**12033**	**11199**	**0.39**	0.2	51	**0.17**
Locke St. (12")	No Flow						**332**	**556**	0.22	0.2	52	0.01
Route 1 ramp	No Flow						No Flow					
Washburn St.	No Flow						**11199**	**17329**	**0.34**	0.3	52	**0.15**
Webster Ave. & RBP	No Flow						**3441**	**4352**	**0.35**	0.2	51	**0.14**

2015

Location	Dry E-coli (cfu/100ml)	Dry Enterococcus (MPN/100ml)	Dry Surfactants (mg/l)	Dry Ammonia-Nit. (mg/l)	Dry Temperature (°F)	Dry Chlorine (mg/L)	Wet E-coli (cfu/100ml)	Wet Enterococcus (MPN/100ml)	Wet Surfactants (mg/l)	Wet Ammonia-Nit. (mg/l)	Wet Temperature (°F)	Wet Chlorine (mg/L)
Broadway @ Mill Creek	No Flow						**19863**	**24196**	0.17	0.1	68	**0.03**
Clark Ave.	No Flow						**8164**	**12997**	0.10	**0.7**	68	**0.03**
Crescent Ave.	No Flow						**>24196**	**19863**	**0.52**	0.2	69	**0.05**
Fenno & Columbus SW	No Flow						No Flow					
Gillooly Rd.	**1483**	**644**	**0.38**	**2.6**	68	0.00	**8164**	**9804**	0.24	0.2	68	**0.03**
Gillooly Rd. North	**852**	10	**0.54**	**7.5**	72	0.00	**>24196**	**>24196**	0.10	0.4	65	**0.09**
Guam Road	**9804**	**2481**	0.11	0.2	68	**0.02**	**>24196**	**19863**	0.18	0.2	64	0.00
Locke St. (24")	**422**	**218**	**0.26**	0.5	74	**0.20**	**>24196**	**19863**	0.14	0.2	66	**0.19**
Locke St. (12")	No Flow						**15531**	**5172**	0.10	0.2	66	**0.02**
Route 1 ramp	No Flow						**7701**	**8164**	0.21	0.2	64	0.00
Washburn St.	No Flow						**19863**	**19863**	0.12	0.2	64	**0.03**
Webster Ave. & RBP	No Flow						**7556**	**12033**	0.16	0.1	67	**0.06**

* **Bold** indicates a value that exceeds EPA benchmarks: Fecal coliform (through 2008) >200 cfu/100mL; E-coli >235 cfu/100mL; Enterococcus >104 cfu/100 mL; surfactants >0.25 mg/l; ammonia-N >0.5 mg/l (previously 1.0mg/l); chlorine >0.01mg/l.
(1) Ecoli and/or Enterococci - Samples analyzed outside of 8-hour holding time due to laboratory oversight
** Thermometer broke; no data.

Chelsea, MA
Outfall Sampling Data 2006 - 2021

Location	2016												2017											
	Dry						Wet						Dry						Wet					
	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)
Broadway @ Mill Creek	No Flow						**364**	**414**	**0.47**	<0.40	54	0.00	**1986**	**727**	**0.88**	**1.10**	71	**0.36**	**2419**	**8664**	**0.32**	<0.2	66	0.00
Clark Ave.	No Flow						No Flow						No Flow						**5475**	**19863**	**0.32**	0.4	66	**0.08**
Crescent Ave.	No Flow						Could not Sample						No Flow						No Flow					
Fenno & Columbus SW	No Flow						No Flow						No Flow						No Flow					
Gillooly Rd.	**332**	**145**	**0.56**	**2.3**	47	0.00	**934**	**332**	**0.28**	**1.4**	57	**0.20**	**>24196**	**>24196**	**2.50**	**13.0**	70	0.00	**11199**	**>24196**	0.19	0.4	67	**0.29**
Gillooly Rd. North	52	20	**0.72**	**8.5**	48	0.00	**243**	<10	**0.63**	**5.0**	55	0.00	No Sample						**4884**	**517**	**0.36**	**3.8**	62	0.00
Guam Road	**3076**	**836**	0.14	0.4	42	**0.04**	**>24196**	**19863**	0.22	0.5	58	**--**	**2420**	**8,164**	0.18	<0.2	68	**0.02**	**>24196**	**>24196**	**0.50**	**2.2**	69	0.00
Locke St. (24")	No Flow						**2282**	**404**	0.21	0.4	52	0.00	No Flow						**14136**	**24196**	0.21	<0.2	64	**0.21**
Locke St. (12")	**>241960**	**32230**	**4.80**	**37.0**	54	0.00	**>24196**	**17329**	**1.60**	**15.0**	58	0.00	No Flow						**>24196**	**>24196**	0.10	0.2	64	0.01
Route 1 ramp	**36540**	**7270**	**0.52**	**2.1**	44	0.00	**262**	**206**	0.24	0.3	54	0.00	No Flow						**3448**	**8164**	0.14	<0.2	68	**0.05**
Washburn St.	No Flow						**1539**	**428**	0.15	**0.7**	56	0.00	No Flow						**17329**	**>24196**	**0.43**	0.3	64	**0.03**
Webster Ave. & RBP	No Flow						No Flow						**9208**	**867**	0.22	0.39	69	**0.03**	**1119**	**15531**	0.10	<0.2	66	0.00

* **Bold** indicates a value that exceeds EPA benchmarks: Fecal coliform (through 2008) >200 cfu/100mL; E-coli >235 cfu/100mL; Enterococcus >104 cfu/100 mL; surfactants >0.25 mg/l; ammonia-N >0.5 mg/l (previously 1.0mg/l); chlorine >0.01mg/l.
(1) Ecoli and/or Enterococci - Samples analyzed outside of 8-hour holding time due to laboratory oversight
** Thermometer broke; no data.

Location	2018											
	Dry						Wet					
	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)
Broadway @ Mill Creek	No Flow						**4352**	**1396**	<0.10	<0.20	44	0.00
Clark Ave.	No Flow						**990**	**12033**	<0.10	<0.20	43	0.00
Crescent Ave.	Could Not Sample						Could Not Sample					
Fenno & Columbus SW	Could Not Sample						Could Not Sample					
Gillooly Rd.	**620**	**228**	**0.46**	**0.8**	64	**0.06**	**1081**	**2481**	<0.10	0.27	64	**0.06**
Gillooly Rd. North	183	<10	**0.57**	**9.40**	67	0	**4106**	**109**	0.11	**0.80**	46	0.00
Guam Road	**12997**	**1,616**	0.12	<0.2	78	**0.15**	**17230**	**7701**	0.11	<0.20	52	**0.11**
Locke St. (24")	No Flow						**1169**	**1250**	<0.10	<0.20	54	0.00
Locke St. (12")	No Flow						**591**	**591**	<0.10	<0.20	52	0.00
Route 1 ramp	41	20	<0.1	<0.20	78	**1.39**	**6131**	**2247**	<0.10	<0.20	51	0.00
Washburn St.	Too Little to Sample						**6867**	**11199**	0.11	<0.20	44	0.00
Webster Ave. & RBP	**932**	**279**	0.20	<0.20	**68**	**0.03**	**2481**	**4884**	<0.10	<0.20	52	**0.08**

Location	2019											
	Dry						Wet					
	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)
Broadway @ Mill Creek	75	98	**0.71**	**0.51**	77	**0.23**	**7270**	**15531**	0.11	<0.20	70	**0.12**
Clark Ave.	41	**331**	**0.50**	<0.20	74	**0.10**	**2143**	**3448**	<0.10	<0.20	68	0.00
Crescent Ave.	Could Not Sample						Could Not Sample					
Fenno & Columbus SW	Could Not Sample						Could Not Sample					
Gillooly Rd.	74	**345**	**0.40**	**2.7**	68	**0.05**	**6488**	**2143**	<0.10	<0.20	68	**0.04**
Gillooly Rd. North	122	86	**0.58**	**8.50**	70	0	**1664**	63	0.11	**1.10**	67	0.00
Guam Road	**38730**	**2755**	0.14	**0.7**	72	**0.04**	**5794**	**2224**	<0.10	0.38	68	0.00
Locke St. (24")	**771**	**512**	0.18	0.33	75	**0.02**	**8164**	**5794**	<0.10	0.40	70	**0.28**
Locke St. (12")	20	**185**	**0.40**	**5.20**	74	0.00	**1956**	**7270**	<0.10	0.39	67	**0.12**
Route 1 ramp	185	**272**	0.22	**0.80**	61	0.00	**41060**	52	<0.10	0.40	68	**0.25**
Washburn St.	**663**	**201**	0.15	<0.20	69	**0.10**	**19863**	**24196**	<0.10	**0.55**	68	0.00
Webster Ave. & RBP	N/A	N/A	N/A	N/A	N/A	N/A	**5172**	**19863**	<0.10	**0.73**	68	**0.05**

* **Bold** indicates a value that exceeds EPA benchmarks: Fecal coliform (through 2008) >200 cfu/100mL; E-coli >235 cfu/100mL; Enterococcus >104 cfu/100 mL; surfactants >0.25 mg/l; ammonia-N >0.5 mg/l (previously 1.0mg/l); chlorine >0.01mg/l.
(1) Ecoli and/or Enterococci - Samples analyzed outside of 8-hour holding time due to laboratory oversight
** Thermometer broke; no data.

Chelsea, MA
Outfall Sampling Data 2006 - 2021

Location	2020											
	Dry						Wet					
	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)
Broadway @ Mill Creek	**>2419.6**	**Present**	**2.27**	**1.10**	66	**0.22**	**>2419.6**	**Present**	0.19	**0.80**	74	0.00
Clark Ave.	**1000**	**Present**	0.07	0	72	0.00	**>2419.6**	**Present**	0.14	0.0	74	**0.07**
Crescent Ave.	Could Not Sample						Could Not Sample					
Fenno & Columbus SW	Could Not Sample						Could Not Sample					
Gillooly Rd.	**>2419.6**	**Present**	**0.28**	**7.2**	68	**0.06**	**>2419.6**	**Present**	0.11	**0.80**	70	**0.05**
Gillooly Rd. North	**2400**	**Present**	**0.29**	**5.00**	66	0	**>2419.6**	**Present**	**0.33**	**4.00**	68	0.00
Guam Road	No Flow						No Flow					
Locke St. (24")	**>2419.6**	**Present**	**0.30**	0.00	72	**0.07**	**>2419.6**	**Present**	0.10	0.00	76	0.00
Locke St. (12")	**1700**	Absent	0.09	**0.53**	72	0.00	No Flow					
Route 1 ramp	No Flow						**>2419.6**	**Present**	0.15	**0.53**	78	**0.09**
Washburn St.	**>2419.6**	**Present**	**1.57**	**4.5**	72	0.00	**>2419.6**	**Present**	0.12	0.00	71	**0.03**
Webster Ave. & RBP	**>2419.6**	**Present**	**0.96**	**1.1**	68	0.00	**>2419.6**	**Present**	0.19	0.00	74	0.00

Location	2021															
	Dry								Wet							
	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)	Salinity (ppt)	Conductance (ms/cm)	E-coli (cfu/100ml)	Enterococcus (MPN/100ml)	Surfactants (mg/l)	Ammonia-Nit. (mg/l)	Temperature (°F)	Chlorine (mg/L)	Salinity (ppt)	Conductance (ms/cm)
Broadway @ Mill Creek	**276**	**520**	0.08	<0.5	73.0	**0.07**	**OR**	**OR**	**461**	**1850**	0.08	<0.5	68.8	0.00	1.60	3.12
Clark Ave.	No Flow								No Flow							
Crescent Ave.	Could Not Sample								No Flow							
Fenno & Columbus SW	No Flow								**579**	**712**	<0.05	<0.5	68.5	0.04	1.00	2.00
Gillooly Rd.	57	10	0.24	**8.21**	67.7	0.01	3.30	5.43	**921**	**464**	<0.10	**2.9**	66.5	0.00	1.5	2.88
Gillooly Rd. North	187	**978**	0.15	<0.5	66.9	0.00	3.10	5.21	**866**	10	**0.32**	**5.1**	65.6	0.00	2.8	5.2
Guam Road	**>2420**	**959**	<0.05	<0.5	70.0	0.00	0.80	1672 µS/cm	No Flow							
Locke St. (24")	**326**	**368**	<0.05	<0.5	67.9	**0.06**	2.00	3.50	**1986**	**439**	<0.05	<0.5	67.6	0.00	0.50	1.15
Locke St. (12")	**>2420**	278	0.08	<0.5	68.1	**0.07**	1.50	2.61	**291**	**480**	0.10	**6.20**	66.9	0.00	0.80	1.55
Route 1 ramp	**>2420**	**8660**	<0.05	**0.57**	72.9	0.00	3.10	5.63	**>2420**	**1660**	<0.10	<0.5	69.5	0.02	0.70	1.27
Washburn St.	**613**	**305**	<0.05	<0.5	67.4	0.00	0.80	1602 µS/cm	**>2420**	**368**	<0.05	<0.5	65.5	0.00	0.70	1.53
Webster Ave. & RBP	No Flow								**>2420**	**2010**	<0.05	<0.5	68.2	0.00	0.60	1.20

* **Bold** indicates a value that exceeds EPA benchmarks: Fecal coliform (through 2008) >200 cfu/100mL; E-coli >235 cfu/100mL; Enterococcus >104 cfu/100 mL; surfactants >0.25 mg/l; ammonia-N >0.5 mg/l (previously 1.0mg/l); chlorine >0.01mg/l.
(1) Ecoli and/or Enterococci - Samples analyzed outside of 8-hour holding time due to laboratory oversight
** Thermometer broke; no data.

Table 3
City of Revere, Massachusetts
Illicit Discharge Detection & Elimination Program
Comparison of 2006 - 2021 Stormwater Sampling

2006

Location	Dry				Wet			
	Fecal (cfu/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Fecal (cfu/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)
Amelia Pl. (2)	No Flow				No Flow			
Archer St.	Outfall not yet identified				Outfall not yet identified			
Atwood St. (no access to outfall - DMH)	No Flow				**650**	140	**0.5**	0.50
Blanchard St.	No Flow				No Flow			
Bosson St.	Outfall not yet identified				Outfall not yet identified			
Dix St.	Outfall not yet identified				Outfall not yet identified			
Dunn St. PS	Outfall not yet identified				Outfall not yet identified			
Elmwood St.	Could Not Locate				Could Not Locate			
Fairfield St.	Outfall not yet identified				Outfall not yet identified			
Garfield Ave. (1)(Upstream)	Outfall not yet identified				Outfall not yet identified			
Garfield Ave. (2)(Downstream)	Outfall not yet identified				Outfall not yet identified			
Gibson Field	No Flow				No Flow			
Gilbert Ave.	No Flow				Trace			
Intervale St.	Outfall not yet identified				Outfall not yet identified			
Lawson Ave. (1)	No Flow				No Flow			
Lawson Ave. (2)	Outfall not yet identified				Outfall not yet identified			
Lechmere St.	40	10	**6.10**	0.60	**6,500**	**440**	**0.3**	1.00
Liberty Avenue	Outfall not yet identified				Outfall not yet identified			
Marshview Terrace	CNL Outfall - Pond Outlet - No Flow				CNL Outfall - Pond Outlet - No Flow			
McCoba St.	No Flow				7,400	80	0.2	2.70
Oak Island Rd. (CNL outfall - CB)	No Flow				No Flow			
Rice Ave. (Outfall submerged - DMH)	No Flow				No Flow			
River Ave.	No Flow				No Flow			
Sachem St.	Could Not Locate				Could Not Locate			
Spring St. to Mill Creek	Outfall not yet identified				Outfall not yet identified			

2007

Location	Dry				Wet			
	Fecal (cfu/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Entero (MPN/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)
Amelia Pl. (2)	No Flow				No Flow			
Archer St.	Outfall not yet identified				Outfall not yet identified			
Atwood St. (no access to outfall - DMH)	No Flow				96	24	**0.4**	0.86
Blanchard St.	No Flow				No Flow			
Bosson St.	Outfall not yet identified				Outfall not yet identified			
Dix St.	Outfall not yet identified				Outfall not yet identified			
Dunn St. PS	Outfall not yet identified				Outfall not yet identified			
Elmwood St.	Could Not Locate				Could Not Locate			
Fairfield St.	Outfall not yet identified				Outfall not yet identified			
Garfield Ave. (1)(Upstream)	Outfall not yet identified				Outfall not yet identified			
Garfield Ave. (2)(Downstream)	Outfall not yet identified				Outfall not yet identified			
Gibson Field	No flow				**280**	100	**0.8**	0.53
Gilbert Ave.	No Flow				No Flow			
Intervale St.	Outfall not yet identified				Outfall not yet identified			
Lawson Ave. (1)	No Flow				No Flow			
Lawson Ave. (2)	Outfall not yet identified				Outfall not yet identified			
Lechmere St.	<10	<10	**0.4**	**3.70**	**34,000**	**3,100**	**0.4**	0.86
Liberty Avenue	Outfall not yet identified				Outfall not yet identified			
Marshview Terrace	No Flow				No Flow			
McCoba St.	No Flow				No Flow			
Oak Island Rd. (CNL outfall - CB)	No Flow				No Flow			
Rice Ave. (Outfall submerged - DMH)	<10	<10	**0.5**	**3.40**	**>30,000**	**>30,000**	**4.9**	**10.00**
River Ave.	No Flow				No Flow			
Sachem St.	Could Not Locate				Could Not Locate			
Spring St. to Mill Creek	Outfall not yet identified				Outfall not yet identified			

2008

Location	Dry				Wet			
	Entero (MPN/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Entero (MPN/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)
Amelia Pl. (2)	No Flow				No Flow			
Archer St.	Outfall not yet identified				Outfall not yet identified			
Atwood St. (no access to outfall - DMH)	No Flow				No Flow			
Blanchard St.	No Flow				No Flow			
Bosson St.	Outfall not yet identified				Outfall not yet identified			
Dix St.	Outfall not yet identified				Outfall not yet identified			
Dunn St. PS	Outfall not yet identified				Outfall not yet identified			
Elmwood St.	Could Not Locate				Could Not Locate			
Fairfield St.	Outfall not yet identified				Outfall not yet identified			
Garfield Ave. (1)(Upstream)	No Access				No Access			
Garfield Ave. (2)(Downstream)	Outfall not yet identified				Outfall not yet identified			
Gibson Field	No Flow				No Flow			
Gilbert Ave.	No Flow				No Flow			
Intervale St.	Outfall not yet identified				Outfall not yet identified			
Lawson Ave. (1)	No Flow				No Flow			
Lawson Ave. (2)	Outfall not yet identified				Outfall not yet identified			
Lechmere St.	**520**	30	**0.4**	**4.90**	**250**	180	0.2	0.83
Liberty Avenue	Outfall not yet identified				Outfall not yet identified			
Marshview Terrace	No Flow				No Flow			
McCoba St.	No Flow				<10	30	<0.1	0.58
Oak Island Rd. (CNL outfall - CB)	No Flow				No Flow			
Rice Ave. (Outfall submerged - DMH)	**25,000**	**17,000**	**0.4**	**2.00**	**1,100**	10	**0.7**	**3.10**
River Ave.	No Flow				No Flow			
Sachem St.	Could Not Locate				Could Not Locate			
Spring St. to Mill Creek	Outfall not yet identified				Outfall not yet identified			

2009

Location	Dry				Wet			
	Entero (MPN/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Entero (MPN/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)
Amelia Pl. (2)	No Flow				**>24,000**	**34,000**	0.2	<0.10
Archer St.	No Flow				No Flow			
Atwood St. (no access to outfall - DMH)	No Flow				**1,400**	**700**	<0.1	<0.10
Blanchard St.	No Flow				**2,000**	**5,500**	<0.1	<0.10
Bosson St.	Could Not Locate				Could Not Locate			
Dix St.	No Flow				No Access			
Dunn St. PS	No Flow				Submerged			
Elmwood St.	Could Not Locate				Could Not Locate			
Fairfield St.	Could Not Locate				Could Not Locate			
Garfield Ave. (1)(Upstream)	No Flow				No Access			
Garfield Ave. (2)(Downstream)	**530**	**510**	0.1	0.17	No Access			
Gibson Field	No Flow				**930**	**1,400**	<0.1	0.39
Gilbert Ave.	No Flow				**2,800**	**1,300**	0.1	0.11
Intervale St.	Outfall not yet identified				Outfall not yet identified			
Lawson Ave. (1)	No Flow				No Flow			
Lawson Ave. (2)	Could Not Locate				Could Not Locate			
Lechmere St.	**1,200**	**2,700**	**0.9**	**2.30**	**4,400**	**2,100**	<0.1	<0.10
Liberty Avenue	Outfall not yet identified				Outfall not yet identified			
Marshview Terrace	No Flow				No Flow			
McCoba St.	No Flow				2,400	7,400	<0.1	<0.10
Oak Island Rd. (CNL outfall - CB)	No Flow				No Flow			
Rice Ave. (Outfall submerged - DMH)	**>2,400**	**900**	**0.7**	**7.00**	No Access			
River Ave.	No Flow				**3,700**	**1,800**	0.1	<0.10
Sachem St.	Could Not Locate				**ld Not Locate**			
Spring St. to Mill Creek	Outfall not yet identified				Outfall not yet identified			

2010

Location	Dry				Wet			
	Entero (MPN/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Entero (MPN/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)
Amelia Pl. (2)	No Flow				No Flow			
Archer St.	No Flow				No Flow			
Atwood St. (no access to outfall - DMH)	No Flow				No Flow			
Blanchard St.	No Flow				No Flow			
Bosson St.	Buried; Not Monitoring				Buried; Not Monitoring			
Dix St.	No Flow				No Flow			
Dunn St. PS	Could Not Locate				Could Not Locate			
Elmwood St.	Buried; Not Monitoring				Buried; Not Monitoring			
Fairfield St.	Buried; Not Monitoring				Buried; Not Monitoring			
Garfield Ave. (1)(Upstream)	No Access				No Access, but could see flow			
Garfield Ave. (2)(Downstream)	No Access				No Access			
Gibson Field	No Flow				No Flow			
Gilbert Ave.	No Flow				No Flow			
Intervale St.	Outfall not yet identified				Outfall not yet identified			
Lawson Ave. (1)	No Flow				No Flow			
Lawson Ave. (2)	Could Not Locate				Could Not Locate			
Lechmere St.	**1,300**	80	**0.4**	**4.50**	**5,200**	**5,500**	**0.3**	**1.10**
Liberty Avenue	Outfall not yet identified				Outfall not yet identified			
Marshview Terrace	No Flow				No Flow			
McCoba St.	No Flow				No Flow			
Oak Island Rd. (CNL outfall - CB)	No Flow				No Flow			
Rice Ave. (Outfall submerged - DMH)	**2,600**	**7,300**	0.3	**1.70**	**5,200**	**1,100**	0.2	**2.00**
River Ave.	No Flow				**5,800**	<10	**0.6**	0.10
Sachem St.	Could Not Locate				**ld Not Locate**			
Spring St. to Mill Creek	Outfall not yet identified				Outfall not yet identified			

2011

Location	Dry							Wet						
	Entero (MPN/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Spec. Cond. (uMHOS/ CM	Temp. (deg. F)	Total Cl_2 (mg/l)	Entero (MPN/ 100ml)	E-coli (cfu/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Spec. Cond. (uMHOS/ CM	Temp. (deg. F)	Total Cl_2 (mg/l)
Amelia Pl. (2)	Not monitored in 2011							Not monitored in 2011						
Archer St.	No Flow							**680**	210	**0.30**	0.4	740	60	**0.40**
Atwood St. (no access to outfall - DMH)	Not monitored in 2011							Not monitored in 2011						
Blanchard St.	No Flow							**5800**	**1400**	**0.50**	0.3	56	60	**0.30**
Bosson St.	Not monitored in 2011							Not monitored in 2011						
Dix St.	No Flow							No Flow						
Dunn St. PS	No Flow							No Flow						
Elmwood St.	Not monitored in 2011							Not monitored in 2011						
Fairfield St.	Not monitored in 2011							Not monitored in 2011						
Garfield Ave. (1)(Upstream)	Flowing, But No Access to Sample							Flowing, But No Access to Sample						
Garfield Ave. (2)(Downstream)	Flowing, But No Access to Sample							Flowing, But No Access to Sample						
Gibson Field	No Flow							**200**	**370**	0.20	0.3	2000	60	0.20
Gilbert Ave.	No Flow							**960**	**430**	**0.25**	0.3	140	60	0.20
Intervale St.	No Flow							No Flow						
Lawson Ave. (1)	No Flow							No Flow						
Lawson Ave. (2)	No Flow							**>24000**	**15000**	**0.30**	0.3	810	60	0.00
Lechmere St.	Not monitored in 2011							Not monitored in 2011						
Liberty Avenue	Outfall not yet identified							Outfall not yet identified						
Marshview Terrace	Not monitored in 2011							Not monitored in 2011						
McCoba St.	Not monitored in 2011							Not monitored in 2011						
Oak Island Rd. (CNL outfall - CB)	No Flow							No Flow						
Rice Ave. (Outfall submerged - DMH)	**5500**	**7200**	0.20	**0.5**	5200	**	**0.70**	**1300**	**10000**	0.20	**1.2**	3100	60	**0.70**
River Ave.	No Flow							**2100**	**290**	0.20	0.3	610	60	0.00
Sachem St.	CNL Outfall - DMH Stagnant - No Flow							**all - Can't Open DMH**						
Spring St. to Mill Creek	Outfall not yet identified							Outfall not yet identified						

Bold indicates a value that exceeds the following MADEP surface water quality standards or EPA illicit discharge detection benchmarks:

Bacteria:

Class SA - Shellfish(SF) - Outstanding Resource Water (ORW): Fecal >28 MPN/100mL

Class SA, SB, & SB-Combined Sewer Overflow(CSO): Enterococcus >104 cfu/100mL (non-saline equivalent = E-coli >235 cfu/100mL)

All Classes: chlorine, specific conductance, and temperature are "report"; however, abnormally high results are noted in **bold**. Review of these results in combination with other parameters is provided in later tables and report text.

All Classes: Surfactants >0.25 mg/l.

All Classes: Ammonia-Nitrogen >0.5 mg/l (prior to 2011; >1.0mg/l)

Exceedances all or almost all sampling rounds.
Exceedances in multiple sampling rounds.
Exceedances only during wet-weather rounds.
None or only 1 exceedance.
Determined to be not City-owned.

Table 3
City of Revere, Massachusetts
Illicit Discharge Detection & Elimination Program
Comparison of 2006 - 2021 Stormwater Sampling

2012

Location	Dry: Entero (MPN/ 100ml)	Dry: E-coli (cfu/ 100ml)	Dry: Surf. (mg/l)	Dry: NH_4 (mg/l)	Dry: Spec. Cond. (uMHOS/ CM	Dry: Temp. (deg. F)	Dry: Total Cl_2 (mg/l)	Wet: Entero (MPN/ 100ml)	Wet: E-coli (cfu/ 100ml)	Wet: Surf. (mg/l)	Wet: NH_4 (mg/l)	Wet: Spec. Cond. (uMHOS/ CM	Wet: Temp. (deg. F)	Wet: Total Cl_2 (mg/l)
Amelia Pl. (2)	No Flow							**7800**	ND	0.10	0.2	31	40	0.00
Archer St.	Not monitored in 2012							Not monitored in 2012						
Atwood St. (no access to outfall - DMH)	From IDDE; no outfall this location							From IDDE; no outfall this location						
Blanchard St.	Not monitored in 2012							Not monitored in 2012						
Bosson St.	Not monitored in 2012							Not monitored in 2012						
Dix St.	Not monitored in 2012							Not monitored in 2012						
Dunn St. PS	Not monitored in 2012							Not monitored in 2012						
Elmwood St.	Not monitored in 2012							Not monitored in 2012						
Fairfield St.	Not monitored in 2012							Not monitored in 2012						
Garfield Ave. (1)(Upstream)	Not monitored in 2012							Not monitored in 2012						
Garfield Ave. (2)(Downstream)	Not monitored in 2012							Not monitored in 2012						
Gibson Field	Not monitored in 2012							Not monitored in 2012						
Gilbert Ave.	Not monitored in 2012							Not monitored in 2012						
Intervale St.	Not monitored in 2012							Not monitored in 2012						
Lawson Ave. (1)	Not monitored in 2012							Not monitored in 2012						
Lawson Ave. (2)	Not monitored in 2012							Not monitored in 2012						
Lechmere St.	Not monitored in 2012							Not monitored in 2012						
Liberty Avenue	Outfall not yet identified							Outfall not yet identified						
Marshview Terrace	Not monitored in 2012							Not monitored in 2012						
McCoba St.	Not monitored in 2012							Not monitored in 2012						
Oak Island Rd. (CNL outfall - CB)	Not monitored in 2012							Not monitored in 2012						
Rice Ave. (Outfall submerged - DMH)	Not monitored in 2012							Not monitored in 2012						
River Ave.	Not monitored in 2012							Not monitored in 2012						
Sachem St.	Not monitored in 2012							Not monitored in 2012						
Spring St. to Mill Creek	Outfall not yet identified							Outfall not yet identified						

2013

Location	Dry: Entero (MPN/ 100ml)	Dry: E-coli (cfu/ 100ml)	Dry: Surf. (mg/l)	Dry: NH_4 (mg/l)	Dry: Spec. Cond. (uMHOS/ CM)	Dry: Temp. (deg. F)	Dry: Total Cl_2 (mg/l)	Wet: Entero (MPN/ 100ml)	Wet: E-coli (cfu/ 100ml)	Wet: Surf. (mg/l)	Wet: NH_4 (mg/l)	Wet: Spec. Cond. (uMHOS/ CM)	Wet: Temp. (deg. F)	Wet: Total Cl_2 (mg/l)
Amelia Pl. (2)	Not monitored in 2013							Not monitored in 2013						
Archer St.	Not monitored in 2013							Not monitored in 2013						
Atwood St. (no access to outfall - DMH)	From IDDE; no outfall this location							From IDDE; no outfall this location						
Blanchard St.	Not monitored in 2013							Not monitored in 2013						
Bosson St.	Not monitored in 2013							Not monitored in 2013						
Dix St.	Not monitored in 2013							Not monitored in 2013						
Dunn St. PS	Not monitored in 2013							Not monitored in 2013						
Elmwood St.	Not monitored in 2013							Not monitored in 2013						
Fairfield St.	Not monitored in 2013							Not monitored in 2013						
Garfield Ave. (1)(Upstream)	Not monitored in 2013							Not monitored in 2013						
Garfield Ave. (2)(Downstream)	Not monitored in 2013							Not monitored in 2013						
Gibson Field	Not monitored in 2013							Not monitored in 2013						
Gilbert Ave.	Not monitored in 2013							Not monitored in 2013						
Intervale St.	Not monitored in 2013							Not monitored in 2013						
Lawson Ave. (1)	Not monitored in 2013							Not monitored in 2013						
Lawson Ave. (2)	Not monitored in 2013							Not monitored in 2013						
Lechmere St.	Not monitored in 2013							Not monitored in 2013						
Liberty Avenue	Not monitored in 2013							Not monitored in 2013						
Marshview Terrace	Not monitored in 2013							Not monitored in 2013						
McCoba St.	Not monitored in 2013							Not monitored in 2013						
Oak Island Rd. (CNL outfall - CB)	Not monitored in 2013							Not monitored in 2013						
Rice Ave. (Outfall submerged - DMH)	Not monitored in 2013							Not monitored in 2013						
River Ave.	Not monitored in 2013							Not monitored in 2013						
Sachem St.	Not monitored in 2013							Not monitored in 2013						
Spring St. to Mill Creek	No Flow							**1500**	**490**	0.14	0.3	1600	43	0.0

2014

Location	Dry: Entero (MPN/ 100ml)	Dry: E-coli (cfu/ 100ml)	Dry: Surf. (mg/l)	Dry: NH_4 (mg/l)	Dry: Spec. Cond. (uMHOS/ CM)	Dry: Temp. (deg. F)	Dry: Total Cl_2 (mg/l)	Wet: Entero (MPN/ 100ml)	Wet: E-coli (cfu/ 100ml)	Wet: Surf. (mg/l)	Wet: NH_4 (mg/l)	Wet: Spec. Cond. (uMHOS/ CM)	Wet: Temp. (deg. F)	Wet: Total Cl_2 (mg/l)
Amelia Pl. (2)	Not monitored in 2014							Not monitored in 2014						
Archer St.	Not monitored in 2014							Not monitored in 2014						
Atwood St. (no access to outfall - DMH)	Not monitored in 2014							From IDDE; no outfall at this location						
Blanchard St.	Not monitored in 2014							Not monitored in 2014						
Bosson St.	Not monitored in 2014							Not monitored in 2014						
Dix St.	Not monitored in 2014							Not monitored in 2014						
Dunn St. PS	Not monitored in 2014							Not monitored in 2014						
Elmwood St.	Not monitored in 2014							Not monitored in 2014						
Fairfield St.	Not monitored in 2014							Not monitored in 2014						
Garfield Ave. (1)(Upstream)	Not monitored in 2014							Not monitored in 2014						
Garfield Ave. (2)(Downstream)	Not monitored in 2014							Not monitored in 2014						
Gibson Field	Not monitored in 2014							Not monitored in 2014						
Gilbert Ave.	Not monitored in 2014							Not monitored in 2014						
Intervale St.	Not monitored in 2014							Not monitored in 2014						
Lawson Ave. (1)	Not monitored in 2014							Not monitored in 2014						
Lawson Ave. (2)	Not monitored in 2014							Not monitored in 2014						
Lechmere St.	17	17	0.18	**2.5**	5600	50	0.00	**1785**	**2143**	0.10	0.1	360	41	0.00
Liberty Avenue	No flow							No flow						
Marshview Terrace	No flow							No flow						
McCoba St.	No flow							1860	4352	0.13	0.2	220	44	0.00
Oak Island Rd. (CNL outfall - CB)	Not monitored in 2014							Not monitored in 2014						
Rice Ave. (Outfall submerged - DMH)	Not monitored in 2014							Not monitored in 2014						
River Ave.	Not monitored in 2014							Not monitored in 2014						
Sachem St.	Not monitored in 2014							Not monitored in 2014						
Spring St. to Mill Creek	Not monitored in 2014							Not monitored in 2014						

2015

Location	Dry: Entero (MPN/ 100ml)	Dry: E-coli (cfu/ 100ml)	Dry: Surf. (mg/l)	Dry: NH_4 (mg/l)	Dry: Spec. Cond. (uMHOS/ CM)	Dry: Temp. (deg. F)	Dry: Total Cl_2 (mg/l)	Wet: Entero (MPN/ 100ml)	Wet: E-coli (cfu/ 100ml)	Wet: Surf. (mg/l)	Wet: NH_4 (mg/l)	Wet: Spec. Cond. (uMHOS/ CM)	Wet: Temp. (deg. F)	Wet: Total Cl_2 (mg/l)
Amelia Pl. (2)	No Flow							<10	<10	<0.10	0.1	8.6	20	**0.14**
Archer St.	No Flow							**1725**	**1112**	**0.63**	<0.1	12000	64	0.00
Atwood St. (no access to outfall - DMH)	No Flow							**545**	**545**	**0.55**	<0.1	16000	61	**0.20**
Blanchard St.	No Flow							**7270**	**1046**	0.18	<0.1	280	62	0.00
Bosson St.	Does not Exist							Does not Exist						
Dix St.	No Flow							No Flow						
Dunn St. PS	No Flow							No Flow						
Elmwood St.	Does not Exist							Does not Exist						
Fairfield St.	Does not Exist							Does not Exist						
Garfield Ave. (1)(Upstream)	No Flow							No Flow						
Garfield Ave. (2)(Downstream)	No Flow							No Flow						
Gibson Field	**290**	13	**1.20**	0.1	36000	50	**0.02**	**228**	121	<0.10	<0.1	250	64	0.00
Gilbert Ave.	84	20	**1.30**	<0.1	45000	48	**0.03**	No Flow						
Intervale St.	No Flow							**12033**	**1187**	<0.10	<0.1	95	64	0.00
Lawson Ave. (1)	No Flow							**4611**	**11199**	0.12	0.1	250	64	0.00
Lawson Ave. (2)	CNL							CNL						
Lechmere St.	41	83	**0.39**	**3.2**	4500	44	**0.08**	**3654**	**3873**	<0.10	<0.1	400	64	**0.02**
Liberty Avenue	No Flow							5247	4884	0.12	<0.1	470	65	No data
Marshview Terrace	No Flow							No Flow						
McCoba St.	No Flow							1850	1014	<0.10	<0.1	74	66	0.00
Oak Island Rd. (CNL outfall - CB)	No Flow							24196	6294	0.11	<0.1	32	66	0.00
Rice Ave. (Outfall submerged - DMH)	**290**	**>24196**	**0.28**	**0.9**	3600	56	0.01	**3654**	**1989**	<0.10	<0.1	110	72	**0.10**
River Ave.	No Flow							**12033**	**496**	0.19	<0.1	3700	62	0.00
Sachem St.	No Flow							**No Flow**						
Spring St. to Mill Creek	25	98	0.13	<0.1	1400	48	**0.03**	**3873**	**3255**	0.16	<0.1	160	63	0.00

Bold indicates a value that exceeds the following MADEP surface water quality standards or EPA illicit discharge detection benchmarks:
Bacteria:
Class SA - Shellfish(SF) - Outstanding Resource Water (ORW): Fecal >28 MPN/100mL
Class SA, SB, & SB-Combined Sewer Overflow(CSO): Enterococcus >104 cfu/100mL (non-saline equivalent = E-coli >235 cfu/100mL)
All Classes: chlorine, specific conductance, and temperature are "report"; however, abnormally high results are noted in **bold**. Review of these results in combination with other parameters is provided in later tables and report text.
All Classes: Surfactants >0.25 mg/l.
All Classes: Ammonia-Nitrogen >0.5 mg/l (prior to 2011; >1.0mg/l)

Exceedances all or almost all sampling rounds.	Exceedances only during wet-weather rounds.
Exceedances in multiple sampling rounds.	None or only 1 exceedance.
Determined to be not City-owned.	

Table 3
City of Revere, Massachusetts
Illicit Discharge Detection & Elimination Program
Comparison of 2006 - 2021 Stormwater Sampling

2016

Location	Dry							Wet						
	Entero (MPN/ 100ml)	E-coli (MPN/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Spec. Cond. (uMHOS/CM)	Temp. (deg. F)	Total Cl_2 (mg/l)	Entero (MPN/ 100ml)	E-coli (MPN/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Spec. Cond. (uMHOS/CM)	Temp. (deg. F)	Total Cl_2 (mg/l)
Amelia Pl. (2)	No Flow							20	<10	<0.10	<0.2	30	38	0.00
Archer St.	No Flow							No Flow						
Atwood St. (no access to outfall - DMH)	No Flow							Could Not Access						
Blanchard St.	No Flow							No Flow						
Bosson St.	Does not Exist							Does not Exist						
Dix St.	No Flow							No Flow						
Dunn St. PS	No Flow							No Flow						
Elmwood St.	Does not Exist							Does not Exist						
Fairfield St.	Does not Exist							Does not Exist						
Garfield Ave. (1)(Upstream)	No Flow							No Flow						
Garfield Ave. (2)(Downstream)	No Flow							No Flow						
Gibson Field	N/A	**1785**	**1.20**	<0.2	4700	62	**0.03**	<10	<10	<0.10	<0.2	1700	36	0.00
Gilbert Ave.	**120**	**3076**	**1.20**	<0.2	48000	60	**0.03**	51	10	**0.93**	<0.2	40000	36	0.00
Intervale St.	No Flow							No Flow						
Lawson Ave. (1)	No Flow							No Flow						
Lawson Ave. (2)	CNL							CNL						
Lechmere St.	**613**	**496**	**0.40**	**1.8**	7600	66	0.01	**1989**	**697**	0.13	<0.2	1600	39	**0.14**
Liberty Avenue	No Flow							<10	<10	<0.10	<0.2	580	40	0.02
Marshview Terrace	No Flow							No Flow						
McCoba St.	No Flow							109	504	<0.10	<0.2	490	38	0.00
Oak Island Rd. (CNL outfall - CB)	No Flow							No Flow						
Rice Ave. (Outfall submerged - DMH)	CNL							No Flow						
River Ave.	No Flow							52	41	0.22	<0.2	4800	34	**0.17**
Sachem St.	No Flow							No Flow						
Spring St. to Mill Creek	No Flow							**187**	97	<0.10	<0.2	2000	43	No reading

2017

Location	Dry							Wet						
	Entero (MPN/ 100ml)	E-coli (MPN/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Spec. Cond. (uMHOS/CM)	Temp. (deg. F)	Total Cl_2 (mg/l)	Entero (MPN/ 100ml)	E-coli (MPN/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Spec. Cond. (uMHOS/CM)	Temp. (deg. F)	Total Cl_2 (mg/l)
Amelia Pl. (2)	No Flow							**6131**	**880**	0.25	<0.20	18	69	0.00
Archer St.	No Flow							No Flow						
Atwood St. (no access to outfall - DMH)	No Flow							Bolted MH Cover						
Blanchard St.	No Flow							**24196**	**888**	0.12	<0.20	160	62	**0.08**
Bosson St.	Does not Exist							Does not Exist						
Dix St.	No Flow							No Flow						
Dunn St. PS	Could not Locate							Could not Locate						
Elmwood St.	Does not Exist							Does not Exist						
Fairfield St.	Does not Exist							Does not Exist						
Garfield Ave. (1)(Upstream)	No Flow							Cannot Access						
Garfield Ave. (2)(Downstream)	No Flow							Cannot Access						
Gibson Field	No Flow							**8664**	**>24196**	<0.10	<0.20	61	62	0.00
Gilbert Ave.	31	109	**0.65**	0.4	48000	60	0.00	Pipe Submerged						
Intervale St.	No Flow							No Flow						
Lawson Ave. (1)	No Flow							No Flow						
Lawson Ave. (2)	Could not Locate							Could not Locate						
Lechmere St.	**7270**	**3873**	**0.35**	**2.2**	6500	62	**0.07**	**>24196**	**17329**	0.15	0.20	290	54	0.00
Liberty Avenue	No Flow							No Flow						
Marshview Terrace	No Flow							No Flow						
McCoba St.	No Flow							Water Level too High						
Oak Island Rd. (CNL outfall - CB)	No Flow							No Flow						
Rice Ave. (Outfall submerged - DMH)	No Flow							Submerged						
River Ave.	No Flow							**3076**	**441**	0.15	<0.20	130	62	**0.05**
Sachem St.	No Flow							**No Flow**						
Spring St. to Mill Creek	Could not Locate							Could not Locate						

2018

Location	Dry							Wet						
	Entero (MPN/ 100ml)	E-coli (MPN/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Spec. Cond. (uMHOS/CM)	Temp. (deg. F)	Total Cl_2 (mg/l)	Entero (MPN/ 100ml)	E-coli (MPN/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Spec. Cond. (uMHOS/CM)	Temp. (deg. F)	Total Cl_2 (mg/l)
Amelia Pl. (2)	No Flow							41	195	<0.10	0.31	66	52	**0.03**
Archer St.	Not monitored in 2018							Not monitored in 2019						
Atwood St. (no access to outfall - DMH)	Not monitored in 2018							Not monitored in 2018						
Blanchard St.	Not monitored in 2018							Not monitored in 2018						
Bosson St.	Does not Exist							Does not Exist						
Dix St.	Not monitored in 2018							Not monitored in 2018						
Dunn St. PS	Not monitored in 2018							Not monitored in 2018						
Elmwood St.	Not monitored in 2018							Not monitored in 2018						
Fairfield St.	Not monitored in 2018							Not monitored in 2018						
Garfield Ave. (1)(Upstream)	Not monitored in 2018							Not monitored in 2018						
Garfield Ave. (2)(Downstream)	Not monitored in 2018							Not monitored in 2018						
Gibson Field	Too Little to Sample							**1918**	132	0.16	0.25	2800	-	0.00
Gilbert Ave.	Cannot Locate Pipe							Cannot Locate Pipe						
Intervale St.	Not monitored in 2018							Not monitored in 2018						
Lawson Ave. (1)	Not monitored in 2018							Not monitored in 2018						
Lawson Ave. (2)	Could not Locate							Could not Locate						
Lechmere St.	Not monitored in 2018							Not monitored in 2018						
Liberty Avenue	Not monitored in 2018							Not monitored in 2018						
Marshview Terrace	Not monitored in 2018							Not monitored in 2018						
McCoba St.	Not monitored in 2018							Not monitored in 2018						
Oak Island Rd. (CNL outfall - CB)	Not monitored in 2018							Not monitored in 2018						
Rice Ave. (Outfall submerged - DMH)	Not monitored in 2018							Not monitored in 2018						
River Ave.	No Flow							**1376**	132	0.15	0.26	2600	55	0.00
Sachem St.	Not monitored in 2018													
Spring St. to Mill Creek	Not monitored in 2018							Not monitored in 2018						

Bold indicates a value that exceeds the following MADEP surface water quality standards or EPA illicit discharge detection benchmarks:
Bacteria:
Class SA - Shellfish(SF) - Outstanding Resource Water (ORW): Fecal >28 MPN/100mL
Class SA, SB, & SB-Combined Sewer Overflow(CSO): Enterococcus >104 cfu/100mL (non-saline equivalent = E-coli >235 cfu/100mL)
All Classes: chlorine, specific conductance, and temperature are "report"; however, abnormally high results are noted in **bold**. Review of these results in combination with other parameters is provided in later tables and report text.
All Classes: Surfactants >0.25 mg/l.
All Classes: Ammonia-Nitrogen >0.5 mg/l (prior to 2011; >1.0mg/l)
*Note: in 2019, Enterococcus was only analyzed as present/absent and was therefore not used to quantify exceedance of EPA benchmarks

Exceedances all or almost all sampling rounds.
Exceedances in multiple sampling rounds.
Exceedances only during wet-weather rounds.
None or only 1 exceedance.
Determined to be not City-owned.

Table 3
City of Revere, Massachusetts
Illicit Discharge Detection & Elimination Program
Comparison of 2006 - 2021 Stormwater Sampling

Location	2019 Dry: Entero (MPN/ 100ml)	E-coli (MPN/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Spec. Cond. (uMHOS/CM)	Temp. (deg. F)	Total Cl_2 (mg/l)	2019 Wet: Entero (MPN/ 100ml)	E-coli (MPN/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Spec. Cond. (uMHOS/CM)	Temp. (deg. F)	Total Cl_2 (mg/l)
Amelia Pl. (2)	No Flow							41	195	<0.10	0.31	66	52	**0.03**
Archer St.	Not monitored in 2019							Not monitored in 2019						
Atwood St. (no access to outfall - DMH)	Not monitored in 2019							Not monitored in 2019						
Blanchard St.	Not monitored in 2019							Not monitored in 2019						
Bosson St.	Does not Exist							Does not Exist						
Dix St.	Not monitored in 2019							Not monitored in 2019						
Dunn St. PS	Not monitored in 2019							Not monitored in 2019						
Elmwood St.	Not monitored in 2019							Not monitored in 2019						
Fairfield St.	Not monitored in 2019							Not monitored in 2019						
Garfield Ave. (1)(Upstream)	Not monitored in 2019							Not monitored in 2019						
Garfield Ave. (2)(Downstream)	Not monitored in 2019							Not monitored in 2019						
Gibson Field	Not monitored in 2019							Not monitored in 2019						
Gilbert Ave.	Cannot Locate Pipe							Cannot Locate Pipe						
Intervale St.	Not monitored in 2019							Not monitored in 2019						
Lawson Ave. (1)	Not monitored in 2019							Not monitored in 2019						
Lawson Ave. (2)	Could not Locate							Could not Locate						
Lechmere St.	Not monitored in 2019							Not monitored in 2019						
Liberty Avenue	Not monitored in 2019							Not monitored in 2019						
Marshview Terrace	Not monitored in 2019							Not monitored in 2019						
McCoba St.	Not monitored in 2019							Not monitored in 2019						
Oak Island Rd. (CNL outfall - CB)	Not monitored in 2019							Not monitored in 2019						
Rice Ave. (Outfall submerged - DMH)	Not monitored in 2019							Not monitored in 2019						
River Ave.	Not monitored in 2019							Not monitored in 2019						
Sachem St.	Not monitored in 2019							Not monitored in 2019						
Spring St. to Mill Creek	Not monitored in 2019							Not monitored in 2019						

Location	2020 Dry: Entero (MPN/ 100ml)	E-coli (MPN/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Spec. Cond. (C ms/CM)	Temp. (deg. F)	Total Cl_2 (mg/l)
Amelia Pl. (2)	Not monitored in 2020						
Archer St.	Not monitored in 2020						
Atwood St. (no access to outfall - DMH)	Could not access						
Blanchard St.	Not monitored in 2020						
Bosson St.	Does not Exist						
Dix St.	Not monitored in 2020						
Dunn St. PS	Could not access						
Elmwood St.	Not monitored in 2020						
Fairfield St.	Not monitored in 2020						
Garfield Ave. (1)(Upstream)	Not monitored in 2020						
Garfield Ave. (2)(Downstream)	Not monitored in 2020						
Gibson Field	Not monitored in 2020						
Gilbert Ave.	Cannot Locate Pipe						
Intervale St.	Not monitored in 2020						
Lawson Ave. (1)	Not monitored in 2020						
Lawson Ave. (2)	Could not Locate						
Lechmere St.	Not monitored in 2020						
Liberty Avenue	Could not access						
Marshview Terrace	No Flow						
McCoba St.	Not monitored in 2020						
Oak Island Rd. (CNL outfall - CB)	No Flow						
Rice Ave. (Outfall submerged - DMH)	Not monitored in 2020						
River Ave.	Not monitored in 2020						
Sachem St.	No Flow						
Spring St. to Mill Creek	Not monitored in 2020						

Location	2021 Dry: Entero (MPN/ 100ml)	E-coli (MPN/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Oil & Grease (mg/L)	Spec. Cond. (ms/CM)	Salinity (ppt)	Temp. (deg. F)	Total Cl_2 (mg/l)	2021 Wet: Entero (MPN/ 100ml)	E-coli (MPN/ 100ml)	Surf. (mg/l)	NH_4 (mg/l)	Oil & Grease (mg/L)	Spec. Cond. (ms/CM)	Salinity (ppt)	Temp. (deg. F)	Total Cl_2 (mg/l)
Amelia Pl. (2)	No flow									10500	**>2420**	<0.05	<0.5	-	0.01	0.00	68	**0.23**
Archer St.	No flow									**5170**	**>2420**	<0.05	<0.5	-	0.03	0.00	67	**0.37**
Atwood St. (no access to outfall - DMH)	Pipe 50% submerged; No visible flow									Pipe Submerged; unable to sample								
Blanchard St.	No flow									**24200**	**>2420**	<0.05	<0.5	-	0.04	0.00	68	**0.04**
Bosson St.	CNL - No flow in upstream catch basin									CNL - Upstream catch basin submerged; no sample taken								
Dix St.	Catch basin submerged; no sample taken									Catch basin submerged; no sample taken								
Dunn St. PS	54	**117**	**0.32**	<1.0	-	1.02	0.50	75	**0.10**	Manhole submerged; no sample taken								
Elmwood St.	Upstream catch basins no flow									Upstream catch basins submerged; no samples taken								
Fairfield St.	Upstream catch basins submerged; no samples taken									Upstream catch basins submerged; no samples taken								
Garfield Ave. (1)(Upstream)	No samples taken at upstream manhole									**>24000**	**>2420**	<0.05	<0.5	-	0.05	0.00	69	**0.09**
Garfield Ave. (2)(Downstream)	No samples taken at upstream manhole									**>24000**	**>2420**	<0.05	<0.5	-	0.09	0.00	68	0.00
Gibson Field	Outfall submerged; no flow at upstream manhole									**17300**	**>2420**	<0.05	<0.5	-	0.09	0.00	66	0.00
Gilbert Ave.	CNL - No flow at upstream catch basin									**	**	**	**	-	0.05	0.00	67	**0.08**
Intervale St.	No flow; partially submerged									**14100**	**>2420**	<0.05	<0.5	-	0.10	0.00	67	**0.16**
Lawson Ave. (1)	No flow									**8160**	**>2420**	<0.05	<0.5	-	0.05	0.00	67	**0.09**
Lawson Ave. (2)	Upstream catch basin not visible; no flow									Catch Basin Submerged; CNL outfall								
Lechmere St.	**1124**	**1455**	0.17	**2.7**	-	5.99	3.10	82	**0.07**	**17300**	**>2420**	<0.05	<0.5	-	0.19	0.10	67	**0.21**
Liberty Avenue	No flow									**>24000**	**>2420**	<0.05	<0.5	-	0.28	0.10	66	**0.05**
Marshview Terrace	Now flow									No Flow								
McCoba St.	Upstream catch basin no flow									Outfall Submerged; CNO upstream manhole								
Oak Island Rd. (CNL outfall - CB)	Upstream catch basin no flow									Outfall Submerged								
Rice Ave. (Outfall submerged - DMH)	**166**	**38**	<0.05	**0.94**	<1.6	3.94	2.10	71	0.00	**13000**	**>2420**	<0.05	<0.5	<1.4	0.04	0.00	66	0.00
River Ave.	No flow									**17300**	**>2420**	<0.05	<0.5	-	0.14	0.00	67	**0.11**
Sachem St.	CNL - No flow in upstream manhole									**4350**	**>2420**	<0.05	<0.5	-	0.99	0.00	67	**0.14**
Spring St. to Mill Creek	**1986**	**>2420**	<0.05	<1.0	-	0.14	0.70	76	0.00	**>24000**	**>2420**	<0.05	<0.5	-	0.33	0.10	67	**0.08**

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Class SA, SB, & SB-Combined Sewer Overflow(CSO): Enterococcus >104 cfu/100mL (non-saline equivalent = E-coli >235 cfu/100mL)
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All Classes: Ammonia-Nitrogen >0.5 mg/l (prior to 2011; >1.0mg/l)
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Exceedances only during wet-weather rounds.
None or only 1 exceedance.
Determined to be not City-owned.

Appendix E

Analysis of Outfall Sampling Data By Catchment

Weston & Sampson

55 Walkers Brook Drive, Suite 100, Reading, MA 01867
Tel: 978.532.1900

				Wet Weather						Dry Weather					
Outfall	SWOF ID	City	Catchment Area (SF)	# Samples E. coli	# Samples Entero	Median E. coli (cfu/100ml)	Median Entero (MPN/100ml)	Median E.Coli Concentration per Catchment Area (cfu/100ml/ SF)	Median Entero Concentration per Catchement Area (MPN/ 100ml/ SF)	# Samples E. coli	# Samples Entero	Median E. coli (cfu/100ml)	Median Entero (MPN/100ml)	Median E.Coli Concentration per Catchment Area (cfu/100ml/ SF)	Median Entero Concentration per Catchement Area (MPN/ 100ml/ SF)
Broadway @ Mill Creek		Chelsea	261,100	10	9	3,526	8,232	0.014	0.032	6	5	529	520	0.002	0.002
Clark Ave.		Chelsea	481,800	8	7	1,672	7,741	0.003	0.016	2	1	521	331	0.001	0.001
Crescent Ave.		Chelsea	217,400	3	3	6,100	13,782	0.028	0.063	1	1	66	56	0.000	0.000
Fenno & Columbus SW		Chelsea	853,200	3	3	590	9,615	0.001	0.011	0	0	--	--	--	--
Gillooly Rd.		Chelsea	700,800	10	9	3,350	3,417	0.005	0.005	10	9	582	580	0.001	0.001
Gillooly Rd. North		Chelsea	-	10	9	2,082	419	--	--	8	7	185	20	--	--
Guam Rd.		Chelsea	2,247,100	8	8	11,512	7,701	0.005	0.003	8	7	2,788	1,616	0.001	0.001
Locke St. 12-inch		Chelsea	1,383,000	9	9	591	3,736	0.000	0.003	4	3	2,100	185	0.002	0.000
Locke St. 24-inch		Chelsea	-	9	8	2,500	5,800	--	--	5	4	771	440	--	--
Route 1 Ramp		Chelsea	245,100	7	6	3,448	2,247	0.014	0.009	5	4	185	146	0.001	0.001
Washburn St.		Chelsea	241,700	10	9	7,834	14,264	0.032	0.059	5	4	1,900	253	0.008	0.001
Webster Ave. & RBP		Chelsea	5,172,900	9	8	2,500	7,500	0.000	0.001	5	4	2,500	684	0.000	0.000
Springvale Inter-Municipal Connection		Everett	13,822,800	10	1	16,135	25,000	0.001	0.002	10	0	3,556	--	0.000	--
Union Inter-Municipal Connection		Everett	3,430,000	6	1	2,900	2,500	0.001	0.001	3	0	2,400	--	0.001	--
Broadway @ Mill Creek (Downstream)	SWOF3411	(Suspected DCR)	2,176,100	6	5	123	20	0.000	0.000	6	6	0	0	0.000	0.000
Revere Beach Parkway/ Mill St.	SWOF4046	(Suspected DCR)	348,200	5	4	235	13,060	0.001	0.038	0	0	--	--	--	--
Revere Beach Parkway/ Olive St. (003)	SWOF3019	(Suspected DCR)	311,700	4	3	25,312	7,701	0.081	0.025	5	5	17,329	714	0.056	0.002
Revere Beach Parkway/ Wilson St. (002)	SWOF4061.1 /SWOF4061.2	(Suspected DCR)	1,583,700	6	5	3,426	8,700	0.002	0.005	5	4	2,500	207	0.002	0.000
Fenno St/ Rt. 1	SWOF7158	MassDOT	974,100	6	4	386	73	0.000	0.000	4	3	11	-	0.000	0.000
Broadway @ Mill Creek (upstream)	SWOF5696	Revere	74,600	6	5	755	1,100	0.010	0.015	6	6	184	21	0.002	0.000
Fenno St. / Columbus NE	SWOF4699	Revere	4,931,700	6	5	1,081	602	0.000	0.000	4	3	53	43	0.000	0.000
Spring St. to Mill Creek	SWOF6176	Revere	116,800	4	4	1,495	2,000	0.013	0.017	2	2	1,299	1,006	0.011	0.009