TATA & HOWARD

Phosphorus Source Identification Report
Leicester, Massachusetts

September 2022

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SECTION 1 - BACKGROUND

1.1 General

Tata & Howard, Inc. was retained by the Leicester Highway Department to help fulfill the requirements addressed in the General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts (Permit), made effective by the United States Environmental Protection Agency (EPA) on July 1, 2018 and modified on January 6, 2021. The Town of Leicester, Massachusetts is subject to requirements to address phosphorus in their stormwater discharges because the stormwater is discharged to waterbodies, or their tributaries, that are water quality limited due to high phosphorus loads, as stated in Appendix H, Section II of the Permit. This section requires that the Town of Leicester complete a Phosphorus Source Identification Report that includes the following components:

1. Calculation of total MS4 area draining to the water quality limited receiving water segments or their tributaries, incorporating updated mapping of the MS4 and catchment delineations.
2. Documentation of all dry weather outfall screening and monitoring results, targeting the receiving water segment(s).
3. Calculation of impervious area and Directly Connected Impervious Area (DCIA) for the target catchment.
4. Identification, delineation, and prioritization of potential catchments with high phosphorus loading.
5. Identification of potential retrofit opportunities or opportunities for the installation of structural Best Management Practices (BMPs) during redevelopment, including the removal of impervious area.

The Town must submit the Phosphorus Source Identification Report to the EPA as part of the Year 4 Annual Report by September 28, 2022.

According to the EPA, the Town of Leicester has eleven water segments that are listed in the 2018/2020 Final Massachusetts Integrated List of Waters and receives water from the Town's MS4. Table No. 1-1 below shows the listing of these impaired waters. As shown in the table, Dutton Pond is the only waterbody in Town that is Total Phosphorus impaired. Two outfalls drain directly to Dutton Pond and four outfalls drain to nearby Sargent Pond, which drains to Dutton Pond.

Table No. 1-1
Impaired Receiving Waters – Leicester, Massachusetts

Receiving Water	Segment ID	Number of Outfalls	Phosphorus Impairment?	Other Impairments
Southwick Pond	MA51157	2	No	Aquatic Plants (Macrophytes), Nutrient/Eutrophication Biological Indicators
Waite Pond	MA51170	1	No	Mercury in Fish Tissue
Dutton Pond	MA42015	2	Yes	Nutrient/Eutrophication Biological Indicators
Greenville Pond	MA42023	2	No	Turbidity
Rochdale Pond	MA42048	13	No	Nutrient/Eutrophication Biological Indicators
Cedar Meadow Pond	MA42009	6	No	(Non-Native Aquatic Plants)
Sargent Pond	MA42049	4	No	(Non-Native Aquatic Plants)
Kettle Brook	MA51-01	7	No	(Dewatering), Fanwort, Benthic Macroinvertebrates, Escherichia Coli (E. Coli), Fecal Coliform, Nutrient/Eutrophication Biological Indicators
Burncoat Brook	MA42-07	3	No	Benthic Macroinvertebrates, Escherichia coli (E. Coli)
French River	MA42-03	5	No	Mercury in Fish Tissue
Grindstone Brook	MA42-18	13	No	Escherichia coli (E. Coli)

SECTION 2 – MS4 REGULATED AREA AND CATCHMENTS

2.1 MS4 Regulated Area

The Town of Leicester includes an area of approximately 24.7 square miles, or 15,800 acres. The MS4 regulated area within the town is approximately 8,350 acres. The MS4 regulated area, or urbanized area, is based on the 2000 and 2010 US census data and includes 85 outfall catchment areas. The catchment areas are the areas which drain to each stormwater outfall. The Town of Leicester's Phase 1 MS4 map with catch basins, outfalls, and catchment areas, is included in Appendix A of this report.

2.2 Dry Weather Outfall Screening

During the Year 3 reporting period (July 1, 2020 to June 30, 2021), every outfall in Leicester within the regulated area was inspected during dry weather conditions which is defined as less than 0.1 inches of rainfall occurring within the previous 24-hour period. Characteristics such as pipe material, pipe condition, swale condition, and flow description were recorded. During the inspections, four outfalls were observed to have flow during dry weather conditions. These outfalls were subsequently sampled and tested for the following parameters: E. coli, ammonia as nitrogen, conductivity, Methylene Blue Active Substances as Linear Alkylbenzene Sulphonates (MBAS as LAS), nitrate as nitrogen, nitrite as nitrogen, salinity, total nitrogen, total phosphate as phosphorus, total chlorine, and temperature. Based on the outfall samples, outfalls 74 and 75 were determined to have E. coli levels that exceeded its benchmark field measurement screening value. The outfall sampling results are included in Appendix B of this report.

The results of the dry weather outfall screening were used to update an initial outfall inventory and priority ranking matrix. The priority ranking matrix considers factors such as potential discharge to areas of concern to public health, receiving water quality, and age of infrastructure. The outfalls were ultimately separated into high and low priority, where high priority outfalls are those that discharge to impaired waterbodies and/or discharge to an area of concern to public health. Due to the outfall sampling results, outfalls 74 and 75 were rated as problem outfalls. The outfall inventory and priority ranking matrix is included in Appendix B of this report.

SECTION 3 – IMPERVIOUS AREA AND DIRECTLY CONNECTED IMPERVIOUS AREA

3.1 Impervious Area

Impervious area (IA) is area with surfaces that are unable to allow the natural infiltration of stormwater into the ground. Common impervious areas include paved roadways and parking lots, buildings or other structures, and bituminous or concrete sidewalks. Impervious area for the Town of Leicester was calculated using the Massachusetts Geographic Information System (MassGIS) 2016 Land Cover/Land Use data layer. This data layer contains a combination of land cover mapping from 2016 aerial imagery and land use derived from standardized assessor parcel information and includes an impervious land cover category. The Land Cover/Land Use data layer was overlaid in GIS with the Town's data layer for outfall catchment areas to estimate total areas, impervious areas, and percent impervious area for each outfall catchment area. The total area of all outfall catchment areas is approximately 790 acres with a total impervious area of approximately 140 acres, or 18% impervious area. Outfalls that drain to Dutton Pond, which is phosphorus impaired, were also calculated. The total catchment area for the six outfalls that drain to Dutton Pond is approximately 60 acres with a total impervious area of approximately 23.5 acres, or 39% impervious area. Table No. 3-1 below shows the estimated impervious areas and corresponding percent impervious areas for outfall catchment areas that drain to Dutton Pond. The outfalls are listed in order by the amount of impervious area.

Table No. 3-1
Impervious Area for Dutton Pond Catchments

Outfall ID	Catchment Area (Acres)	Impervious Area (Acres)	Percent Impervious Area (%)
74	28.1	11.8	42.0
76	5.9	3.0	50.8
79	9.4	2.8	29.8
77	5.7	2.6	45.6
78	7.0	1.8	25.7
75	3.5	1.5	42.9

3.2 Directly Connected Impervious Area

Directly connected impervious area (DCIA), also referred to as "effective impervious cover", is the amount of impervious area that drains directly to the storm sewer system without first flowing across permeable land area or a BMP. Site-specific information about the existence of certain BMPs is not available at the parcel level. As a result, an estimate of DCIA is used to approximate the average level of stormwater control measures installed across a watershed. DCIA was estimated using the MassGIS 2016 Land Cover/Land Use

data layer and Sutherland equations. The Sutherland equations calculate percent DCIA for each land use type using the percent impervious area of that land use type. Table No. 3-2 below shows the Sutherland equations.

Table No. 3-2
Sutherland Equations

Land Use Type – GIS Layer	"Connectedness" Category	Sutherland Equation (Percent DCIA and IA)
Agriculture	Mostly Disconnected	$DCIA=0.01(IA)^2$
Commercial	Average	$DCIA=0.1(IA)^{1.5}$
Forest	Mostly Disconnected	$DCIA=0.01(IA)^2$
Industrial	Average	$DCIA=0.1(IA)^{1.5}$
Mixed use, other	Average	$DCIA=0.1(IA)^{1.5}$
Mixed use, primarily commercial	Average	$DCIA=0.1(IA)^{1.5}$
Mixed use, primarily residential	Average	$DCIA=0.1(IA)^{1.5}$
Open land	Average	$DCIA=0.1(IA)^{1.5}$
Recreation	Average	$DCIA=0.1(IA)^{1.5}$
Residential - multi-family	Highly Connected	$DCIA=0.4(IA)^{1.2}$
Residential - other	Average	$DCIA=0.1(IA)^{1.5}$
Residential - single family	Average	$DCIA=0.1(IA)^{1.5}$
Right-of-way	Average	$DCIA=0.1(IA)^{1.5}$
Tax exempt	Average	$DCIA=0.1(IA)^{1.5}$
Unknown	Average	$DCIA=0.1(IA)^{1.5}$
Water	Average	$DCIA=0.1(IA)^{1.5}$

Percent DCIA for an outfall catchment area was calculated by summing the percent DCIA of all land use types with an impervious land use cover in the catchment area. Percent DCIA and DCIA area were calculated for all outfalls that drain to Dutton Pond. Table No. 3-3 below shows the estimated DCIA areas and corresponding percent DCIAs for outfall catchment areas that drain to Dutton Pond.

Table No. 3-3
DCIA for Dutton Pond Catchments

Outfall ID	Catchment Area (Acres)	DCIA (Acres)	Percent DCIA (%)
74	28.1	3.9	13.9
79	9.4	1.0	10.6
76	5.9	1.0	16.9
77	5.7	0.8	14.0
78	7.0	0.6	8.6
75	3.5	0.6	17.1

SECTION 4 – PHOSPHORUS LOADING

4.1 General

The Town was listed in the Massachusetts MS4 General Permit as a municipality that discharges to a waterbody that is impaired due to phosphorus. While phosphorus is a nutrient for plant growth, excess phosphorus can speed up the aging process of waterbodies by over stimulating algae growth. Algae blooms create high biochemical oxygen demand (BOD) as the algae decomposes and uses up available oxygen supplies, thus threatening the survival of fish and other aquatic organisms.

The EPA states that Dutton Pond has high phosphorus loading. The Town has six outfalls that discharge into Dutton Pond. The phosphorus load of each outfall was estimated using the baseline phosphorus load equation from Attachment 1 to Appendix F of the MS4 General Permit, which accounts for each land use within a catchment area. The baseline phosphorus load equation is as follows:

Baseline P Load = $(Area_1 \times PLER_1) + (Area_2 \times PLER_2) + (Area_3 \times PLER_3) \ldots$

Annual composite phosphorus load export rates (PLERs) were provided in Attachment 1 to Appendix F of the MS4 General Permit and are provided below in Table No. 4-1.

Table No. 4-1
Annual Composite Phosphorus Load Export Rates (PLERs)

Land Cover	Composite PLERs (lb./ac/yr.)
Commercial	1.13
Industrial	1.27
High Density Residential	1.04
Medium Density Residential	0.49
Low Density Residential	0.30
Freeway	0.73
Open Space	0.26
Agriculture	0.45
Forest	0.12

Annual phosphorus loads were calculated for all outfalls that drain to Dutton Pond. All outfalls discharging to Dutton Pond have a combined estimated phosphorus load of approximately 25.9 lb./yr. Table No. 4-2 below shows the phosphorus loads for the outfall catchment areas associated with Dutton Pond.

Table No. 4-2
Estimated Phosphorus Loading for Dutton Pond Catchments

Outfall ID	Estimated Phosphorus Load (lb./yr.)
74	12.0
79	3.7
76	3.1
77	2.9
78	2.7
75	1.5

Problem outfall number 74 has the highest phosphorus load within its catchment area at 12.0 lb./yr.

Based on impervious area, DCIA, and phosphorus load calculations, Outfall 74 is the highest priority for interventions to begin reducing phosphorus loading of the six outfalls in the Dutton Pond catchment area.

SECTION 5 – POTENTIAL RETROFIT OPPORTUNITIES

5.1 General

All six outfall catchment areas that drain to Dutton Pond were examined to determine the presence of Town-owned parcels for potential BMP retrofit opportunities. After examination, it was determined that only Outfall 77 had a catchment area that overlapped with a Town-owned parcel.

This parcel is the Leicester Library, located at 1136 Main Street. This property has approximately 21,300 square feet of impervious area. The site was updated in 2019 with a newly paved and expanded parking lot. A retention area was also added behind the parking lot to mitigate stormwater runoff.

Due to the minimal number of Town-owned properties within the target catchment areas, the Town should focus on non-structural controls such as enhanced street sweeping and increased catch basin cleaning frequency to decrease phosphorus loads in these catchment areas. During redevelopment in these catchment areas, the Town should work with developers to decrease the amount of impervious area where possible. If new developments are proposed within these catchment areas, the Town should work to limit the amount of impervious area by minimizing the proposed street width to the extent possible, and requiring that new developments include BMPs such as rain gardens and bioswales.

Appendix A

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PAXTON

HOLDEN

WORCESTER

LEICESTER

SPENCER

CHARLTON

OXFORD

AUBURN

N

Kettle Brook Reservoir

Cook Pond

Southwick Pond

Sugden Reservoir

Whittemore Street Pond

Shaw Pond

Lynde Brook Reservoir

Waite Pond

Burncoat Pond

Dutton Pond

Cedar Meadow Pond

Watson Millpond

Stiles Reservoir

Greenville Pond West

Greenville Pond

Rochdale Pond

Henshaw Pond

Texas Pond

Stoneville Reservoir

Dark Brook Reservoir [U.B.]

Smiths Pond

City Pond

Sargent Pond

Town Meadow Brook

Burncoat Brook

Grindstone Brook

French River

Keith Brook

Collier Brook

Southwick Pond
Aquatic Plants (Macrophytes), Nutrient/Eutrophication Biological Indicators

Leicester Recycling Center

Kettle Brook
E. coli, Dewatering, Fanwort, Benthic Macroinvertebrates, Fecal Coliform, Nutrient/ Eutrophication Biological Indicators

Leicester Senior Center

Sargent Pond
Non-Native Aquatic Plants

Leicester High School and Elementary School

Leicester Middle School

Leicester Town Hall

Leicester Fire and EMS

Leicester Library

Waite Pond
Mercury in Fish Tissue

Leicester Police Department

Dutton Pond
Total Phosphorus, Nutrient/ Eutrophication Biological Indicators

Cedar Meadow Pond
Non-Native Aquatic Plants

Grindstone Brook
E. coli

Leicester Highway Department

Burncoat Brook
E. coli, Benthic Macroinvertebrates

Greenville Pond
Turbidity

Rochdale Pond
Nutrient/Eutrophication Biological Indicators

French River
Mercury in Fish Tissue

MOOSE HILL ROAD
PRYOR ROAD
WHITTEMORE STREET
HEMLOCK STREET
MARSHALL STREET
WHITE BIRCH STREET
LAFLASH LANE
SANFORD ROAD
ELM STREET
CRYSTAL STREET
LYNDEBROOK DRIVE
ELLIOT STREET
PAYTON STREET
MULBERRY STREET
EARLE STREET
BOND STREET
SCONSET AVENUE
SANDY CIRCLE
MAIGHANS WAY
TRACY LANE
BILLYS WAY
WASHBURN STREET
MANNVILLE STREET
SYLVESTER STREET
WILLIAM CIRCLE
HYLAND AVENUE
ANNA CIRCLE
CAREY HILL CIRCLE
PATRICKS DRIVE
WINSLOW AVENUE
HOMESTEAD LANE
DEER POND DRIVE
WARREN AVENUE
GLEASON WAY
LAKE AVENUE
LAKE SARGENT DRIVE
CHAPEL STREET
WOODLAND ROAD
PINE AVENUE
WAITE STREET
SECOND STREET
WEST STREET
SOUTH STREET
BOTTOMLEY AVENUE
BROWN STREET
RESERVOIR STREET
REDFIELD ROAD
SARGENT STREET
LOCUST STREET
SOUTH MAIN STREET
MAPLE STREET
PINE STREET
MEADOWLANE STREET
GROVE STREET
HIGH STREET
PLEASANT STREET
WESLEY DRIVE
BREEZY GREEN ROAD
COLONIAL DRIVE
MONTEREY DRIVE
HARDING STREET
WILLOW HILL ROAD
COLLIER AVENUE
OLNEY STREET
MOYD STREET
TOWTAID STREET
LOGAN STREET
POND COURT
TOBIN ROAD
BROOK STREET
CHESNAR DRIVE
MCCLINTOCK AVENUE
HILLSIDE ROAD
MERRICK STREET
FOLSOM STREET
INGRAM ROAD
ATWOOD ROAD
CEMETERY ROAD
GERTRUDE AVENUE
SHELTER RIDGE ROAD
AUTUMN LANE
DONAHUE STREET
BOUTILIER ROAD
LEXINGTON AVENUE
PETER SALEM ROAD
MEMORIAL DRIVE
LAUREL WOOD AVENUE
TANGLEWOOD ROAD
CRESTWOOD ROAD
CRICKLEWOOD DRIVE
BIRCHWOOD DRIVE
MAYFLOWER CIRCLE
TOWN BEACH ROAD
MOUNT PLEASANT AVENUE
BLUEBERRY LANE
BURNCOAT STREET
PINE RIDGE DRIVE
BURNCOAT LANE
LAKE DRIVE
RAWSON STREET
WATSON STREET
LAKEVIEW DRIVE
CHARLES STREET
FAIRVIEW DRIVE
FERNCROFT ROAD
ANGELL TERRACE
MARLBORO DRIVE
CHRIS CIRCLE
FLAGG DRIVE
GREEN STREET
GREENVILLE CIRCLE
SALMINEN AVENUE
SALMINEN DRIVE
BALDWIN STREET
SCOTT LANE
PARKER STREET
HAMMOND STREET
SABINA CIRCLE
WENDY PLACE
LEELA LANE
RIVER STREET
CHARLTON STREET
ACKLEY DRIVE
ACKLEY STREET
PARK LANE
FOREST STREET
BROOKSIDE DRIVE
BRICKYARD ROAD
KING STREET
EDWARD STREET
VASILLA DRIVE
CLARK STREET
HUNTINGTON MEMORIAL HIGHWAY
HENSHAW STREET
VIRGINIA DRIVE
CARLETON ROAD
CRAIG STREET
SIANI ROAD
DALE STREET
WATCH STREET
MILL STREET
AUBURN STREET
KINNEAR DRIVE
STAFFORD STREET
OLD STAFFORD TURNPIKE
VICTORIA DRIVE

Legend

- Building
- Oil/Water Separator
- Open Swale
- Outfall
- Catch Basin
- Open Water
- Stream

Note: Stormwater catchment areas (not shown in Legend) are shown in various colors.

Phase I System Map
Leicester, Massachusetts

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Approximate Scale: 1" = 1,250'
June 2022

Appendix B

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Outfall Inventory and Priority Ranking Matrix
Leicester, Massachusetts
Revision Date: June 30, 2022

Outfall ID	Receiving Water	Previous Screening Results Indicate Likely Sewer Input? [1]	Discharging to Area of Concern to Public Health? [2]	Frequency of Past Discharge Complaints	Receiving Water Quality [3]	Density of Generating Sites [4]	Age of Development/ Infrastructure [5]	Historic Combined Sewers or Septic? [6]	Aging Septic? [7]	Culverted Streams? [8]	Additional Characteristics	Score	Priority Ranking
Information Source		Outfall inspections and sample results	GIS Maps	Town Staff	Impaired Waters List	Land Use/GIS Maps, Aerial Photography	Land Use Information, Visual Observation	Town Staff, GIS Maps	Land Use, Town Staff	GIS and Storm System Maps	Other		
Scoring Criteria		Yes = 3 (Problem Outfall) No = 0	Yes = 3 No = 0	Frequent = 3 Occasional = 2 None = 0	Poor = 3 Fair = 2 Good = 0	High = 3 Medium = 2 Low = 1	High = 3 Medium = 2 Low = 1	Yes = 3 No = 0	Yes = 3 No = 0	Yes = 3 No = 0	TBD		
74	Sargent Pond	3	0	0	0	1	3	0	0	0	Sampling Indicates Illicit Sewer Discharge	7	Problem
75	Sargent Pond	3	0	0	0	1	3	0	0	0	Sampling Indicates Illicit Sewer Discharge	7	Problem
1	Burncoat Brook	0	0	0	2	1	3	0	0	0	Excessive Vegetation Around Outfall	6	High Priority
2	Burncoat Brook	0	0	0	2	1	3	0	0	0	Ditch Work Required, Branches and Leaves	6	High Priority
3	Burncoat Brook	0	0	0	2	1	1	0	0	0	None	4	High Priority
4	Cedar Meadow Pond	0	3	0	3	1	3	0	0	0	None	10	High Priority
5	Cedar Meadow Pond	0	3	0	3	1	1	0	0	0	Excessive Sediment	8	High Priority
7	Henshaw Pond	0	0	0	0	1	1	0	0	0	None	2	High Priority
8	Henshaw Pond	0	0	0	0	1	1	0	0	0	None	2	High Priority
9	Henshaw Pond	0	0	0	0	1	1	0	0	0	None	2	High Priority
10	Henshaw Pond	0	0	0	0	1	3	0	0	0	Crumbling Outfall, Ditch Work Required, Pipe Buried in Leaves	4	High Priority
11	Henshaw Pond	0	0	0	0	1	3	0	0	0	Ditch Work Required, Rocks, Sediment, and Leaves causing standing water	4	High Priority
12	Grindstone Brook	0	0	0	2	1	3	0	0	0	None	6	High Priority
14	Grindstone Brook	0	0	0	2	2	3	0	0	0	Ditch Work Required, Sediment Blocking Pipe	7	High Priority
15	Grindstone Brook	0	0	0	2	2	3	0	0	0	Ditch Work Required, Sediment and Leaves Blocking Pipe	7	High Priority
16	Grindstone Brook	0	0	0	2	2	3	0	0	0	None	7	High Priority
17	Grindstone Brook	0	0	0	2	2	3	0	0	0	None	7	High Priority
18	Grindstone Brook	0	0	0	2	2	3	0	0	0	None	7	High Priority
19	Grindstone Brook	0	0	0	2	2	1	0	0	0	None	5	High Priority
20	Grindstone Brook	0	0	0	2	2	1	0	0	0	Ditch Work Required, Sediment and Trees Blocking Pipe	5	High Priority
21	Grindstone Brook	0	0	0	2	1	3	0	0	0	None	6	High Priority

Outfall Inventory and Priority Ranking Matrix
Leicester, Massachusetts
Revision Date: June 30, 2022

Outfall ID	Receiving Water	Previous Screening Results Indicate Likely Sewer Input? [1]	Discharging to Area of Concern to Public Health? [2]	Frequency of Past Discharge Complaints	Receiving Water Quality [3]	Density of Generating Sites [4]	Age of Development/ Infrastructure [5]	Historic Combined Sewers or Septic? [6]	Aging Septic? [7]	Culverted Streams? [8]	Additional Characteristics	Score	Priority Ranking
Information Source		Outfall inspections and sample results	GIS Maps	Town Staff	Impaired Waters List	Land Use/GIS Maps, Aerial Photography	Land Use Information, Visual Observation	Town Staff, GIS Maps	Land Use, Town Staff	GIS and Storm System Maps	Other		
Scoring Criteria		Yes = 3 (Problem Outfall) No = 0	Yes = 3 No = 0	Frequent = 3 Occasional = 2 None = 0	Poor = 3 Fair = 2 Good = 0	High = 3 Medium = 2 Low = 1	High = 3 Medium = 2 Low = 1	Yes = 3 No = 0	Yes = 3 No = 0	Yes = 3 No = 0	TBD		
22	Grindstone Brook	0	0	0	2	1	3	0	0	0	Ditch Work Required, Rocks, Sediment blocking pipe	6	High Priority
23	Grindstone Brook	0	0	0	2	1	1	0	0	0	None	4	High Priority
24	Grindstone Brook	0	0	0	2	1	1	0	0	0	None	4	High Priority
25	Grindstone Brook	0	0	0	2	1	3	0	0	0	None	6	High Priority
26	Greenville Pond	0	0	0	3	1	1	0	0	0	None	5	High Priority
27	French River	0	0	0	2	1	1	0	0	0	Crumbling Headwall Fell and Broke Pipe	4	High Priority
28	French River	0	0	0	2	1	3	0	0	0	None	6	High Priority
29	Unnamed	0	0	0	0	1	3	0	0	0	Pipe in Poor Condition	4	High Priority
30	Rochdale Pond	0	0	0	3	1	3	0	0	0	None	7	High Priority
31	Rochdale Pond	0	0	0	3	1	3	0	0	0	None	7	High Priority
32	Rochdale Pond	0	0	0	3	1	3	0	0	0	None	7	High Priority
33	Rochdale Pond	0	3	0	3	1	3	0	0	0	Ditch Work Required, Excessive Sediment	10	High Priority
34	Rochdale Pond	0	3	0	3	1	3	0	0	0	None	10	High Priority
35	Rochdale Pond	0	3	0	3	1	3	0	0	0	None	10	High Priority
36	Rochdale Pond	0	3	0	3	1	1	0	0	0	None	8	High Priority
37	Rochdale Pond	0	3	0	3	1	1	0	0	0	None	8	High Priority
38	Rochdale Pond	0	3	0	3	1	3	0	0	0	Ditch Work Required, Excessive Sediment	10	High Priority
39	French River	0	0	0	2	1	3	0	0	0	None	6	High Priority
40	Rochdale Pond	0	0	0	3	1	3	0	0	0	None	7	High Priority
41	Rochdale Pond	0	3	0	3	3	3	0	0	0	None	12	High Priority
42	French River	0	0	0	2	3	3	0	0	0	Ditch Work Required, Excessive Sediment	8	High Priority
43	Rochdale Pond	0	3	0	3	3	3	0	0	0	None	12	High Priority
44	French River	0	0	0	2	3	3	0	0	0	Ditch Work Required, Leaves Blocking Swale	8	High Priority
45	Rochdale Pond	0	3	0	3	3	3	0	0	0	Crumbling Pipe	12	High Priority
49	Waite Pond	0	0	0	3	1	3	0	0	0	None	7	High Priority
56	Cedar Meadow Pond	0	3	0	3	1	3	0	0	0	Ditch Work Required, Leaves and Branches around Opening	10	High Priority
57	Cedar Meadow Pond	0	3	0	3	1	1	0	0	0	None	8	High Priority

Outfall Inventory and Priority Ranking Matrix
Leicester, Massachusetts
Revision Date: June 30, 2022

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58	Cedar Meadow Pond	0	3	0	3	1	3	0	0	0	Ditch Work Required, Leaves, Rocks, Sediment, and Branches around Opening	10	High Priority
59	Cedar Meadow Pond	0	3	0	3	1	3	0	0	0	Excessive Sediment	10	High Priority
60	Southwick Pond	0	3	0	3	1	3	0	0	0	Ditch Work Required, Excessive Sediment, Blocked Pipe	10	High Priority
61	Southwick Pond	0	3	0	3	1	3	0	0	0	None	10	High Priority
65	Smiths Pond	0	3	0	0	1	3	0	0	0	Section of Pipe Disconnected	7	High Priority
66	Smiths Pond	0	3	0	0	1	3	0	0	0	None	7	High Priority
76	Sargent Pond	0	0	0	0	1	3	0	0	0	None	4	High Priority
77	Sargent Pond	0	0	0	0	1	3	0	0	0	Covered with Debris	4	High Priority
78	Dutton Pond	0	0	0	3	2	3	0	0	0	Ditch Work Required, Excessive Sediment, Blocked Pipe	8	High Priority
79	Dutton Pond	0	0	0	3	2	3	0	0	0	Covered with Debris	8	High Priority
80	Henshaw Pond	0	3	0	0	2	3	0	0	0	Grass Clippings, Leaves, Sediment, Debris	8	High Priority
81	Henshaw Pond	0	3	0	0	2	2	0	0	0	Some Sediment	7	High Priority
83	Lynde Brook Reservoir	0	3	0	0	1	3	0	0	0	None	7	High Priority
84	Lynde Brook Reservoir	0	3	0	0	1	3	0	0	0	Remove Propane Tank in Swale	7	High Priority
85	Town Meadow Brook	0	0	0	0	1	3	0	0	0	None	4	High Priority
86	Town Meadow Brook	0	0	0	0	1	3	0	0	0	None	4	High Priority
87	Town Meadow Brook	0	0	0	0	1	3	0	0	0	None	4	High Priority
88	Town Meadow Brook	0	0	0	0	1	3	0	0	0	None	4	High Priority
89	Town Meadow Brook	0	0	0	0	1	3	0	0	0	Ditch Work Required, Sediment and Leaves Mostly Covering Opening	4	High Priority
46	Kettle Brook	0	0	0	2	1	1	0	0	0	None	4	Low Priority
47	Kettle Brook	0	0	0	2	1	1	0	0	0	Leaves at Opening	4	Low Priority

Outfall Inventory and Priority Ranking Matrix
Leicester, Massachusetts
Revision Date: June 30, 2022

Outfall ID	Receiving Water	Previous Screening Results Indicate Likely Sewer Input? [1]	Discharging to Area of Concern to Public Health? [2]	Frequency of Past Discharge Complaints	Receiving Water Quality [3]	Density of Generating Sites [4]	Age of Development/ Infrastructure [5]	Historic Combined Sewers or Septic? [6]	Aging Septic? [7]	Culverted Streams? [8]	Additional Characteristics	Score	Priority Ranking
Information Source		Outfall inspections and sample results	GIS Maps	Town Staff	Impaired Waters List	Land Use/GIS Maps, Aerial Photography	Land Use Information, Visual Observation	Town Staff, GIS Maps	Land Use, Town Staff	GIS and Storm System Maps	Other		
Scoring Criteria		Yes = 3 (Problem Outfall) No = 0	Yes = 3 No = 0	Frequent = 3 Occasional = 2 None = 0	Poor = 3 Fair = 2 Good = 0	High = 3 Medium = 2 Low = 1	High = 3 Medium = 2 Low = 1	Yes = 3 No = 0	Yes = 3 No = 0	Yes = 3 No = 0	TBD		
48	Kettle Brook	0	0	0	2	1	2	0	0	0	Ditch Work Required, Rip Rap and Leaves Blocking Pipe	5	Low Priority
50	Kettle Brook	0	0	0	2	1	3	0	0	0	Ditch Work Required, Sediment and Leaves Covering Pipe	6	Low Priority
51	Kettle Brook	0	0	0	2	1	3	0	0	0	Ditch Work Required, Vegetation and Leaves Covering Pipe	6	Low Priority
52	City Pond	0	0	0	0	1	1	0	0	0	None	2	Low Priority
53	City Pond	0	0	0	0	1	1	0	0	0	None	2	Low Priority
54	Kettle Brook	0	0	0	2	1	3	0	0	0	Ditch Work Required, Sediment and Leaves at Opening	6	Low Priority
55	Kettle Brook	0	0	0	2	1	3	0	0	0	Ditch Work Required, Sediment and Leaves at Opening	6	Low Priority
64	Smiths Pond	0	0	0	0	1	1	0	0	0	None	2	Low Priority
67	Smiths Pond	0	0	0	0	1	3	0	0	0	Ditch Work Required, Sediment and Rocks Blocking Pipe	4	Low Priority
68	Smiths Pond	0	0	0	0	1	1	0	0	0	None	2	Low Priority
69	Smiths Pond	0	0	0	0	1	3	0	0	0	Excessive Vegetation Around Outfall	4	Low Priority
70	Smiths Pond	0	0	0	0	1	3	0	0	0	Ditch Work Required, Downed Trees and Branches Covering Pipe	4	Low Priority
71	Lynde Brook	0	0	0	0	1	3	0	0	0	None	4	Low Priority
72	Lynde Brook	0	0	0	0	1	3	0	0	0	None	4	Low Priority
73	Lynde Brook	0	0	0	0	1	3	0	0	0	None	4	Low Priority
82	Unnamed	0	0	0	0	1	3	0	0	0	None	4	Low Priority

Scoring Criteria:

[1] Previous screening results indicate likely sewer input if any of the following are true:

- 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

[2] Outfalls/interconnections that discharge to or near any of the following areas: public beaches, recreational areas, drinking water supplies, or shellfish beds

[3] Receiving water quality based on latest version of MassDEP Integrated List of Waters.

- Poor = Waters with approved TMDLs (Category 4a Waters) where illicit discharges have the potential to contain the pollutant identified as the cause of the impairment
- Fair = Water quality limited waterbodies that receive a discharge from the MS4 (Category 5 Waters)
- Good = No water quality impairments

[4] Generating sites are institutional, municipal, commercial, or industrial sites with a potential to contribute to illicit discharges (e.g., car dealers, car washes, gas stations, garden centers, industrial manufacturing, etc.)

[5] Age of development and infrastructure:

- High = Industrial areas greater than 40 years old and areas where the sanitary sewer system is more than 40 years old
- Medium = Developments 20-40 years old
- Low = Developments less than 20 years old

[6] Areas once served by combined sewers and but have been separated, or areas once served by septic systems but have been converted to sanitary sewers.

[7] Aging septic systems are septic systems 30 years or older in residential areas.

[8] Any river or stream that is culverted for distance greater than a simple roadway crossing.

Summary of Outfall Analytical Results
Leicester, Massachusetts

Sample Location Identifier	Outfall 17	Outfall 74		Outfall 75	Outfall 89	Benchmark Field Measurement Screening Values
Sample Date	5/25/2021	5/25/2021	6/10/2021	5/25/2021	5/25/2021	
Sample Location	Peter Salem Road	Grove Street	Grove Street	Grove Street	Birchwood Road	
Weather Conditions	Sunny, 60's	Sunny, 60's	Sunny, 70's	Sunny, 60's	Sunny, 60's	
Precipitation Previous 48 Hours	0.04"	0.04"	0.05"	0.04"	0.04"	
PARAMETER - Method (units)						
Microbiology						
E. Coli - EPA 1603 (cfu/100 mL)	<10.0	3,650	202	24,200	<10.0	235
Classic Chemistry			NT			
Ammonia as N - EPA 350.1 (mg/L)	<0.10	0.14		4.16	0.22	0.5
Conductivity - EPA 2510B (umhos/cm)	239	863		1,370	813	2,000
MBAS as LAS - EPA 5540C (mg/L)	<0.1	<0.1		<0.1	<0.1	0.25
Nitrate as N - EPA 353.2 (mg/L)	1.04	0.248		0.329	0.616	
Nitrite as N - EPA 353.2 (mg/L)	<0.010	<0.010		0.175	<0.010	
Salinity - EPA 2520B (ppt)	0.1	0.4		0.7	0.4	
Total Nitrogen - EPA 4500N (mg/L)	1.37	0.595		17.9	1.04	
Total Phosphate as P - EPA 365.1 (mg/L)	0.16	0.13		1.73	0.11	
Total Chlorine (mg/L)	<0.02	<0.02		0.04	0.03	0.02
Temperature (°F)	54	58.6		56.3	55.5	

Notes:

1. ppt = parts per thousand; mg/L = Milligrams per liter; cfu = colony forming units; umhos/cm = umhos per centimeter; °F = Fahrenheit
2. Values preceded by "<" indicate that the result is non detect and the method reporting limit is shown
3. NT = Not Tested.
4. Temperature was measured in the field using a pH/Temperature probe
5. Total Chlorine was measured in the field using a Hach Chlorine Analyzer