

Upton, MA
Nutrient Source Identification Report
MS4 Permit Year 4
June 2022

PHOSPHORUS LOADING



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MS4 Permit Year 4

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Prepared by: BETA GROUP, INC.

Prepared for: Town of Upton

June 2022

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1.0 INTRODUCTION

This report was developed to address phosphorus discharges within the Town of Upton (the Town) to impaired waters. This was done in accordance with the 2016 MS4 General Permit (the Permit), Appendix H Requirements Related to Discharges to Certain Water Quality Limited Waterbodies Section I.1.b.

Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act, Massachusetts Department of Environmental Protection (MassDEP) established water quality standards, and evaluated the conditions of Massachusetts' waters in the Final 2018/2020 Integrated List of Waters (§303(d) list). This list identifies waters that do not meet the water quality standards (referred to as "impaired" or "water quality limited") based on many causes. These causes may include phosphorus, nitrogen, nutrient/eutrophication biological indicators, benthic macroinvertebrates, and more.

Table 1-1Error! Reference source not found. summarizes the status given to the receiving waters in the Town.

Table 1-1: Receiving Waters for Town of Upton

Receiving Water	Number of Outfalls	Impairment for Phosphorus?
West River (MA95-33)	23	Tributary of Blackstone River
West River (MA95-35)	17	Tributary of Blackstone River
Mill River (MA51-35)	1	N
Mill Pond (MA51104)	24	N
North Pond (MA51112)	1	N
Pratt Pond (MA51123)	9	N
Taft Pond (MA51165)	6	N

The West River is tributary to Blackstone River (MA51-05) which is impaired for phosphorus. Due to the stormwater discharges to tributaries of an impaired waterbody, the Town must submit this Nutrient Source Identification Report (NSIR) by the end of Permit Year 4 which includes:

- Calculation of total MS4 area draining to the water quality limited water segments or their tributaries, incorporating updated mapping of the MS4 and catchment delineations produced pursuant to part 2.3.4.6,
- All screening and monitoring results pursuant to part 2.3.4.7.b., targeting the receiving water segment(s)
- Impervious area and DCIA for the target catchment
- Identification, delineation and prioritization of potential catchments with high phosphorus loading

- Identification of potential retrofit opportunities or opportunities for the installation of structural BMPs during redevelopment.

2.0 CALCULATION METHODS

The following are data sources and methods utilized in the analysis of nutrient source loading in Upton.

2.1 DATA SOURCES

Data layers were downloaded and analyzed in the desktop application ArcMap 10.5.

- Base Shapefile
 - 2016 Land Cover / Land Use from MassGIS, Dated May 2019.
Contains information on impervious and pervious land cover by land use type.
 - Natural Resources Conservation Service (NRCS) Soils Database from USDA, Last Modified 07/31/2019.
Contains soil type data throughout Town.
- Outfall Catchment Delineations Shapefile
 - Town Catchment Delineations completed by BETA, Updated Yearly.
Contains catchment areas mapped based on stormwater and topography.

2.2 METHODOLOGY

The methods of data analysis followed the Neponset River Watershed Association's Nutrient Source Identification Report Addendum: Methods, dated June 10, 2021.

2.2.1 BASE SHAPEFILE

Data downloaded from the above data sources for Massachusetts were clipped to the limits of the Town of Upton. A base shapefile was created through the ArcMap "union" operation between the 2016 Land Cover / Land Use layer and the Natural Resources Conservation Service (NRCS) Soils Database, producing a dataset with information on land cover, land use, and soil types.

2.2.2 TOWN CATCHMENT SHAPEFILE

The Town's catchment delineation shapefile was prepared for further analysis by adding and calculating a catchment area field, removing areas that were non-MS4, and removing areas that do not discharge to a phosphorus water quality impaired waterbody.

2.2.3 FINAL TOWN SHAPEFILE

Once the data layers were prepared, the ArcMap "intersect" operation was run between the edited catchment area shapefile and the base shapefile. This produced land use, land cover and soil data within each catchment area.

Operations were then performed on various fields within the new dataset to be able to calculate the following values based on land use within each catchment area:

- Area: The area of a record
- Impervious Area: The area of impervious surfaces occupied by a record
- Impervious Area Percentage: The amount of impervious area in a record as a percentage of the overall catchment area

$$\text{Impervious Area Percentage} = \frac{\text{Impervious Percentage}}{100} * \text{Catchment Area}$$

- DCIA Percentage: An estimate of DCIA represented by a record
$$\text{DCIA Percentage} = \text{Max DCIA M} * (\text{Impervious Area Percentage})^{\text{Max DCIA E}}$$
where Max DCIA M is the multiplier and Max DCIA Exponent is the exponent from the applicable Sutherland equation.

- DCIA Area: An estimate of the amount of DCIA associated with a record

$$\text{DCIA Area} = \frac{\text{DCIA Percentage}}{100} * \text{Catchment Area}$$

- Estimated Phosphorus Load

$$\text{Estimated Phosphorus Load} = \text{Area} * \text{Max PLER}$$

where Max PLER is the phosphorus loading category to which a record was assigned based on Table 1-2 in Attachment 1 of Appendix F of the 2016 Massachusetts Small MS4 General Permit.

The final shapefile was created using the ArcMap “dissolve” operation based on catchment area IDs, which combined the areas, impervious areas, impervious percentages, DCIA areas, DCIA percentages, and estimated phosphorus loadings within each catchment broken down by land use, to produce total values of those features for each catchment area.

3.0 IMPERVIOUS AREA AND DIRECTLY CONNECTED IMPERVIOUS AREA

Impervious area is the land that is paved, covered by buildings, and otherwise developed and unable to absorb water naturally.

Directly connected impervious area (DCIA) is the amount of impervious area that is directly connected to the storm drain system. Most land in Town was developed before modern requirements of capturing, cleaning, slowing down, and recharging stormwater runoff using best management practices (BMPs). Therefore, some properties may have no BMPs, some have BMPs that meet some modern standards, and others have full compliance with modern standards. Since parcel-specific data of BMPs is not available, the DCIA estimate approximates the average level of BMPs installed throughout Town. DCIA was estimated based on land use categories following EPA guidance.

Table 3-1 summarizes the total impervious area (IA) and estimated DCIA in MS4 regulated areas of Town that are tributary to the Phosphorus impaired waters.

Table 3-1: Impervious Area and DCIA

Impervious Area (Acres)	Estimated DCIA (Acres)	Total (Acres)
34.11	5.37	39.48

Appendix A contains a table of impervious area and DCIA estimates for the Town's MS4 catchment areas. Table 3-2 shows the same information for the ten catchments with the most impervious area in Town. The catchments are labeled by the outfall to which they drain.

Table 3-2: Total Impervious Area and DCIA for 10 Most Impervious Catchments

Catchment Identifier	Impervious Area (Acres)	Percent Impervious	DCIA (Acres)	Percent DCIA
76-1	5.85	16.71%	0.62	1.77%
60-1	3.23	20.97%	0.29	1.89%
67-5	2.76	13.00%	0.26	1.23%
86-2	2.61	28.49%	0.86	9.37%
60-3	2.56	16.05%	0.20	1.23%
86-3	1.87	10.41%	0.29	1.63%
102-2	1.23	14.10%	0.14	1.59%
77-2	1.05	35.07%	0.34	11.48%
76-2	1.04	17.21%	0.18	3.02%
87-6	0.80	43.84%	0.28	15.23%
Top 10 Catchments as a % of Town Total from Table 3-1 (Impervious 34.11 acres; DCIA 5.37 acres)	67.45%		64.53%	

4.0 ESTIMATED NUTRIENT LOADING FROM CATCHMENT AREAS

Following the methods described in Section 2.2 of this report, phosphorus loading potential estimates were calculated for each of the outfall catchments. Appendix B includes the table of phosphorus loading estimates for all MS4 catchments in Town that are tributary to Phosphorus impaired waters. Table 4-1 shows the five catchments with the highest estimated phosphorus loading.

Table 4-1: Estimated Phosphorus Loading for 5 Highest Load Town Catchments

Catchment Identifier	Estimated P Load (Lbs/Yr)
76-1	8.90
60-3	6.47
60-1	5.88
86-2	5.35
86-3	4.55
Top 5 as a % of Total Town Load (65.26 Lbs/Yr)	47.73%

5.0 OUTFALL SCREENING AND SAMPLING RESULTS

The Dry Weather Outfall Screening and Sampling Report dated October 2018 that was reviewed during the writing of this report is included as Appendix C. During the screening and sampling, phosphorus levels were detected at 11 of the outfalls but none exceeded EPA's guidance range of <0.100 mg/L.

6.0 CATCHMENT PRIORITIZATION

Catchments have been prioritized based on phosphorus loading estimates, as shown in the table included in Appendix B. The five catchments with the highest estimated phosphorus loading are shown in a map in Appendix D. It is important to note that since no outfall sampling data showed phosphorus levels of concern, this report was only analyze based on estimated values.

7.0 STORMWATER BEST MANAGEMENT PRACTICES (BMPs)

7.1 EXISTING BMP LOCATIONS

The Town currently has 5 Stormwater Best Management Practices (BMPs) implemented, as shown in the map in Appendix D. These BMPs include:

- Stormwater Basins
- Water Quality Unit

Appendix E includes nutrient removal calculations for the infiltration BMPs in Town.

Although two stormwater basin BMPs are located within two MS4 catchment areas, none of the nutrient removal BMPs are located within the 5 catchment areas with the highest estimated phosphorus loading from Table 4-1.

7.2 POTENTIAL RETROFIT OPPORTUNITIES

Town parcels were examined for the following characteristics important when selecting a location for a BMP retrofit:

- Land Ownership
- Soil Type
- Depth to Water Table
- Proximity to Potential Subsurface Areas of Concern (ie. Contaminated Sites, Zone 2 Watershed Protection Areas)
- Opportunities for Public Use and Education
- Ability for the Town to Access for Maintenance
- Presence of Stormwater Infrastructure Existing in the Area
- Discharges to a Receiving Water (Water Quality Limited, First or Second Order Streams, Public Swimming Beaches, Drinking Water Supply Sources, Shellfish Growing Areas)
- Amount of Impervious Area.

Parcels selected through this process are potential locations suitable for further assessment of BMP and impervious area reduction opportunities. When selecting locations, parcels within each of the 5 high nutrient loading catchments were prioritized. The priority ranking matrix and a map showing the locations are included in Appendix F. Note that all parcels listed are Town-owned, as Town-owned properties often present the fewest barriers to BMP development. These sites should be visited first when performing reconnaissance work to determine the feasibility of constructing a BMP at one or more of these sites to reduce pollutant loading to the Town's MS4. Additionally, it should be noted that rights-of-way were not included in this analysis, but they are often highly desirable sites for BMPs. All rights-of-way, particularly in the high loading catchment areas and where roadway or utility projects are being proposed, should be considered for BMP retrofits in addition to individual parcels.

APPENDIX A

- Impervious / DCIA Summary by Catchment

Appendix A: Impervious / DCIA Summary by Catchment

Catchment Identifier	Impervious Area (Acres)	Percent Impervious	DCIA (Acres)	Percent DCIA
76-1	5.85	16.71	0.62	1.77
60-1	3.23	20.97	0.29	1.89
67-5	2.76	13.00	0.26	1.23
86-2	2.61	28.49	0.86	9.37
60-3	2.56	16.05	0.20	1.23
86-3	1.87	10.41	0.29	1.63
102-2	1.23	14.10	0.14	1.59
77-2	1.05	35.07	0.34	11.48
76-2	1.04	17.21	0.18	3.02
87-6	0.80	43.84	0.28	15.23
87-7	0.77	32.21	0.18	7.46
108-6	0.77	16.45	0.11	2.29
68-2	0.72	11.78	0.13	2.19
59-3	0.71	18.17	0.11	2.70
68-1	0.68	22.38	0.08	2.57
78-4	0.62	23.79	0.05	1.99
59-1	0.57	17.12	0.04	1.33
87-4	0.55	22.87	0.10	4.13
87-2	0.54	20.11	0.06	2.18
69-3	0.54	8.87	0.04	0.61
78-3	0.50	38.36	0.15	11.77
87-1	0.48	35.19	0.16	11.48
59-4	0.43	10.77	0.02	0.51
67-4	0.39	46.36	0.26	31.48
78-7	0.37	21.95	0.08	4.67
108-1	0.37	6.80	0.03	0.51
59-2	0.36	17.98	0.06	3.11
108-3	0.34	11.81	0.08	2.67
67-1	0.33	12.67	0.03	1.16
68-4	0.32	18.27	0.02	1.19
77-4	0.24	19.20	0.07	5.77
69-2	0.22	16.03	0.03	1.93
67-6	0.14	6.15	0.0001	0.003
67-2, 67-3	0.14	20.78	0.00001	0.001
86-1	0.03	76.89	0.02	67.43

APPENDIX B

- Estimated Phosphorus Loading Summary by Catchment

Appendix B: Estimated Phosphorus Loading Summary by Catchment

Catchment Identifier	Estimated P Load (Lbs/Yr)
76-1	8.90
60-3	6.47
60-1	5.88
86-2	5.35
86-3	4.55
77-2	3.53
67-5	3.38
69-3	2.31
102-2	2.18
108-6	1.94
87-7	1.94
108-1	1.94
77-4	1.72
68-2	1.28
87-6	1.23
76-2	1.22
59-4	1.10
59-3	1.07
78-7	0.96
59-1	0.94
68-1	0.86
78-3	0.80
87-2	0.76
67-4	0.70
87-1	0.66
87-4	0.64
59-2	0.57
108-3	0.55
67-1	0.54
78-4	0.48
67-6	0.29
68-4	0.24
69-2	0.22
86-1	0.05
67-2, 67-3	0.02

APPENDIX C

- Dry Weather Outfall Screening and Sampling Report, August 2018



October 10, 2018

Dennis Westgate Jr., Director of Public Works
Town of Upton, MA
100 Pleasant Street
Upton, MA 01568

Re: Upton, MA – Dry Weather Outfall Screening and Sampling

Dear Mr. Westgate:

This letter summarizes the Dry Weather Stormwater Outfall Screening and Sampling conducted Tuesday May 2, 2018 and Wednesday May 3, 2018. During the initial town wide outfall screening in 2016, outfalls in the regulated MS4 area with indicators (odor, staining, oil sheen and cloudy flow) found flowing were recommended to be revisited, and sampled for potential illicit connections entering the drainage system. Dry weather field screening and sampling was conducted in accordance with Upton's written IDDE plan and the 2016 MS4 permit requirements at the following outfalls:

- | | | |
|------------|------------|------------|
| a. OF-60-1 | f. OF-77-4 | k. OF-78-6 |
| b. OF-60-2 | g. OF-78-1 | l. OF-70-5 |
| c. OF-60-3 | h. OF-78-2 | m. OF-71-6 |
| d. OF-69-1 | i. OF-78-3 | n. OF-82-2 |
| e. OF-77-2 | j. OF-78-5 | o. OF-53 |

BETA visited these 15 outfalls during dry-weather conditions (<0.01" of precipitation in the previous 24 hours) to visually screen for presence of flow, and indicators of sanitary/septic connection. Outfalls on Merriam Way (60-1, 60-2, 69-1), Jonathan's Way (60-3), Maple Avenue (77-2), Pleasant Street (78-1, 78-2), Mendon Street (78-3), Florence Circle (78-5, 78-6), Hazeltine Street (70-5), Grove Street (71-6), Tyler Road (82-2), and School Street (53-4) were observed to be flowing and were field screened for water quality information. Outfall and drain structures upstream on Depot Street (77-4), were not observed to be flowing at time of inspection. Water quality testing results are summarized in Table 1 (attached) and outfall locations are identified on Figures 1-3.

Field Screening:

BETA performed field screenings for water quality information at all outfall locations (60-1, 60-2, 60-3, 69-1, 77-2, 78-1, 78-2, 78-3, 78-5, 78-6, 70-5, 71-6, 82-2, 53-4) where flow was observed. Samples were analyzed for the following using a field test kit: ammonia, chlorine, specific conductivity, salinity, surfactants, temperature, and pH. Additional pollutants of concern were determined by the assessed receiving water quality, and sent to a lab for testing. See results in Table 1 (attached). Outfall **60-1** had a positive result of **0.30mg/L** for surfactants which is above the threshold indicator of 0.25mg/L. Outfall **78-3** had a positive result of **0.08 mg/L** for Chlorine. All other field test results were below indicator thresholds. See results in Table 1 (attached).

Laboratory Analysis:

E.coli is found at a very high concentration in sewage compared to other flow types and is a good indicator of sewage or seepage discharges. BETA collected samples for E.coli laboratory analysis where flow was found (60-1, 60-2, 60-3, 69-1, 77-2, 78-1, 78-2, 78-3, 78-5, 78-6, 70-5, 71-6, 82-2, 53-4). Samples were sent to Alpha Analytical (M-MA086) located in Medfield, MA. Outfall **78-3** had a positive result of **1800 CFU/100mL** for E.Coli. All other outfalls were below the Massachusetts Department of Public Health swimming standard of 126 CFU/100 mL organisms for outfall. See results in Table 1 (attached).

Catchment Investigation:

BETA conducted catchment investigations for Merriam Way and Nathaniel Way (OF-60-1) and Mendon Street (OF-78-3) in accordance with the 2016 MS4 permit requirements and under the written IDDE plan. This included identification of the drainage delineation, and inspection of key junction structures to determine potential contaminate sources. Illicit connections are determined as any discharge to a drainage system that is not composed entirely of storm water with the exception of discharges pursuant to a NPDES permit or firefighting activities. The following are the results of the catchment investigation for each outfall:

Merriam Way and Nathaniel Way

Outfall 60-1 –BETA visually inspected and tested key junction MH 60-4 on July 24, 2018. Pipes entering MH 60-4 from Merriam Way and Nathaniel Way both tested positive for surfactants and chlorine. Field tests were conducted July 30, 2018 on all flowing manholes upstream of MH 60-4. Manhole 60-5 was the only flowing MH and tested positive for Chlorine (**0.62 mg/L**) and Surfactants (**0.25 mg/L**). All other drainage structures upstream of MH 60-4 on Merriam Way and Nathaniel Way were visually inspected for other pipe connections. Multiple plastic pipes were found discharging into catch basins. See Figure 2 for identified Catch Basin connections. Testing results for OF-60-1 can be found in Table 1 (attached).

Mendon Street

Outfall 78-3 –BETA visually inspected the catchment area of OF 78-3 on July 24, 2018 to determine possible reasons for a positive E.Coli result. During the inspection, a large pile of grass clippings were found at 48 Pleasant Street across from the outfall, and a pool was located at 39 Pleasant Street. Information acquired offsite from the Upton Assessor's office indicate this area is made up of early 20th century, single family homes. Pleasant Street has sewer which crosses Mendon Street. BETA visually inspected the drainage structures on August 10, 2018, and did not find any illicit connections. See Figure 3 for the locations of observations recorded July 24, 2018.

Conclusion:

Dry-weather screening and sampling found evidence of contamination at two of the fifteen outfalls. Outfall **60-1** was found to have **0.30mg/L** of surfactants, and the key junction MH 60-4 was found to have contamination from both chlorine and surfactants. A catchment investigation indicated pipes entering catch basins on Merriam Way and Nathaniel Way. A direct connection to a catch basin is not always illicit, these pipes could be from a sump pump, floor drain, or discharging wash water. Outfall **78-3** was found to have **0.08 mg/L** for Chlorine and **1800 CFU/100mL** for E.Coli. There are no records of sewer on Mendon Street and most of the homes were built in the early 20th century, which indicates most homes are on septic. There are records of sewer on Pleasant street, with a main crossing the drainage pipe.

Surfactants are an indicator of oils, detergents and shampoos, and could be the result of car washing, leaks from vehicles, spills or illegal connections. Chlorine is found in potable water which on its own could indicate a leaking water main or service. E.Coli can be transferred from any warm blooded animal waste that ended up in the drain, including birds and dogs. A leaking septic is an indirect connection, where discharged untreated sewage leaks from the septic into a drainage line in the MS4 area. Likely sewer indicators of ammonia, surfactants, and olfactory or visual evidence were not found.

Recommendations:


These sampling results should be included in the IDDE program assessment ranking and reporting.

Based on the results and analysis of the IDDE investigation, BETA recommends the following:

- Educating and outreach to homes in the OF-78-3 catchment area to encourage good storm water practices, and to notify BOH for potential septic failure/issues.
- Conduct a sewer main inspection at the intersection of Pleasant Street and Mendon Street to locate potential exfiltration.
- Contacting homes in the OF-60-1 catchment area with catch basin connections (sump pumps, floor drains wash water), to determine the discharge source.

If we can be of any further assistance regarding this matter, please contact us at our office.

Very truly yours,
BETA Group, Inc.



Michael Hornig, PE
Associate

Attachments:

Table 1: Town of Upton IDDE Investigation Summary Table

Figure 1: Sample Locations

Figure 2-3: Priority Outfalls

Table 1 - IDDE - Investigation Summary Table

Samples taken May 2, 2018 and May 3, 2018

Town of Upton Dry Weather Sampling Outfalls			Appendix G Pollutants of Concern																
Street Name	Outfall ID	Type of Indicat or	Discharge to Waterbody or Tributary	Final (Impaired) Receiving Water	Notes	Ammonia (mg/L)	Free (residual) Chlorine (mg/L)	Conductivity (µS/cm)	Salinity	pH	Surfactant (mg/L)	Temperature (°C)	E. Coli (CFU/100ml)	Total Phosphorus (mg/l)	Chloride (mg/l)	Total Cadmium (mg/l)	Total Mercury (mg/l)	Total Copper (mg/l)	Total Lead (mg/l)
Threshold Indicators						>0.5	Any detectable levels			<6.5, >8.3	>0.25		>126						
Test Type						field test	field test	field instrument	field instrument	field instrument	field test	field instrument	Lab			lab	lab	lab	lab
Equipment/glassware						Hach NI-SA	Hach CN-80	YSI556	YSI556	YSI556	Chemetrics K-9400	YSI556	6 hrs						
Holding time (if lab)						--	--	--	--	--	--	--							
Merriam Way	60-1	flow	Warren Brook	West River		0.0	0.0	402	Under scale	7.0	0.30	10.90	ND	ND	154.0	NT	NT	NT	NT
Merriam Way	60-2	flow	Warren Brook	West River		0.0	0.0	298	Under scale	6.9	<0.25	10.05	ND	0.015	114.0	NT	NT	NT	NT
Jonathan's Way	60-3	flow	Warren Brook	West River		0.0	0.0	555	Under scale	7.1	<0.25	11.52	2.0	0.015	212.0	NT	NT	NT	NT
Merriam Way	69-1	flow	Warren Brook	West River		0.0	0.0	68	Under scale	7.4	<0.25	10.95	11.0	0.023	16.7	NT	NT	NT	NT
Maple Avenue	77-2	flow	Unnamed Stream	West River		<0.5	0.0	321	Under scale	7.1	<0.25	18.15	38.0	0.012	107.0	ND	ND	ND	ND
Depot Street	77-4	flow	Unnamed Stream	West River	NO FLOW	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pleasant Street	78-1	flow	Center Brook		Sampled from MH 78-28	0.0	0.0	811	Under scale	6.6	<0.25	16.62	11.0	0.021	304.0	NT	NT	NT	NT
Pleasant Street	78-2	flow	Center Brook			0.0	0.0	486	Under scale	7.0	<0.25	15.68	21.0	0.052	171.0	NT	NT	NT	NT
Mendon Street	78-3	flow	Center Brook			0.0	0.08	969	Under scale	6.9	<0.25	19.83	1800	0.041	345	NT	NT	NT	NT
Florence Circle	78-5	flow	Center Brook		NO FLOW	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Florence Circle	78-6	flow	Center Brook	West River		0.0	0.0	390	Under scale	6.9	<0.25	12.47	10.0	0.054	146.0	NT	NT	NT	NT
Hazeltine Street	70-5	flow	Center Brook			0.0	0.0	463	Under scale	7.9	<0.25	11.20	3.0	0.023	174.0	NT	NT	NT	NT
Grove Street	71-6	flow	Center Brook			0.0	0.0	333	Under scale	7.1	<0.25	13.71	44.0	0.016	125.0	NT	NT	NT	NT
Tyler Road	82-2	flow	Unnamed Stream	Mill River		0.0	0.0	460	Under scale	7.2	<0.25	11.88	ND	0.012	163.0	NT	NT	NT	NT
School Street	53-4	flow	Pratt Pond		Sampled from MH 53.3	0.0	0.0	28	Under scale	7.1	<0.25	15.19	10.0	-	-	NT	NT	NT	NT

Notes:

OF: Outfall

CB: Catch Basin

DMH: Drain Manhole

Yellow highlight: 2018 sample exceeds contaminant criteria

NT: Not Tested

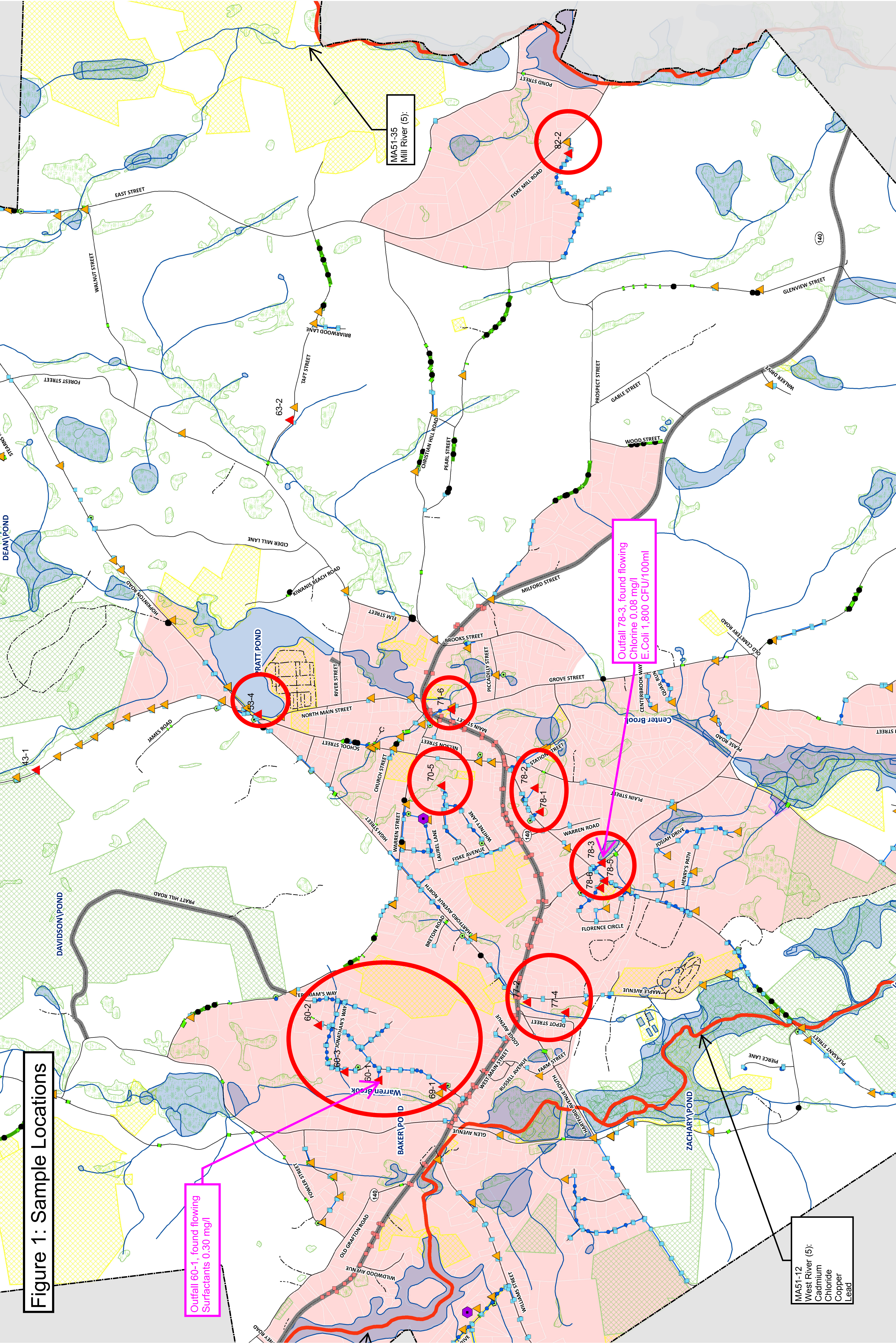
NP: Not Present

ND: Not Detected at the reporting limit for the sample

A YSI Professional multiparameter meter, Hach Pocket Colorimeter CN-80 test kit, Hach Colorimeter

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
Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine
source MA MS4 General Permit 2018

Figure 1: Sample Locations



MA51-12
West River (5):
Cadmium
Chloride
Copper
Lead

Outfall 78-3, found flowing
Chlorine 0.08 mg/l
E. Coli 1,800 CFU/100ml

Outfall 60-1, found flowing
Surfactants 0.30 mg/l

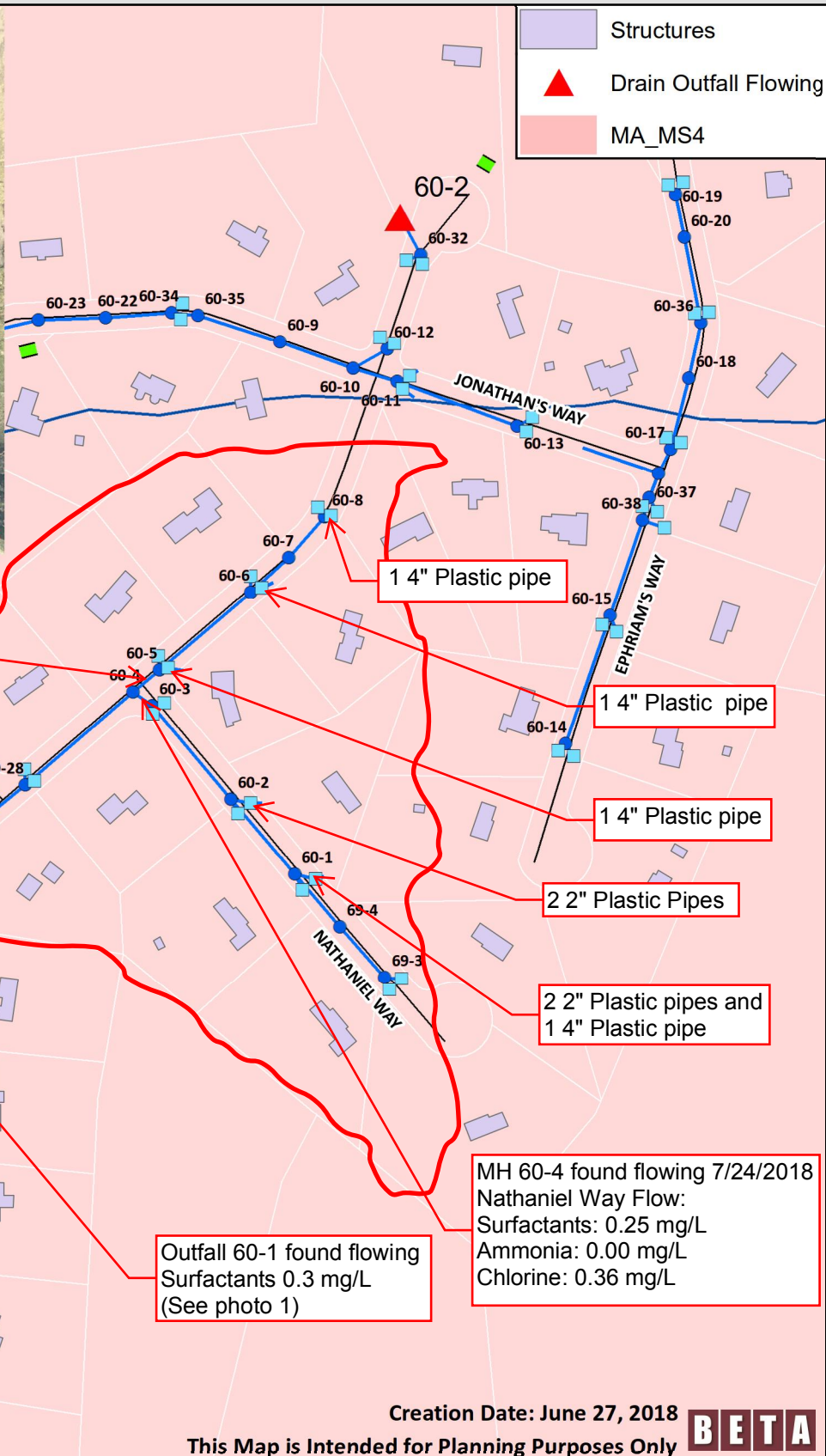
MA51-35
Mill River (5):

60-1
05/02/18

Photo 1

Photo 1

MH 60-4 found flowing 7/24/2018
Merriam Way Flow:
Surfactants: 0.25 mg/L
Ammonia: 0.00-0.25 mg/L
Chlorine: 0.16 mg/L



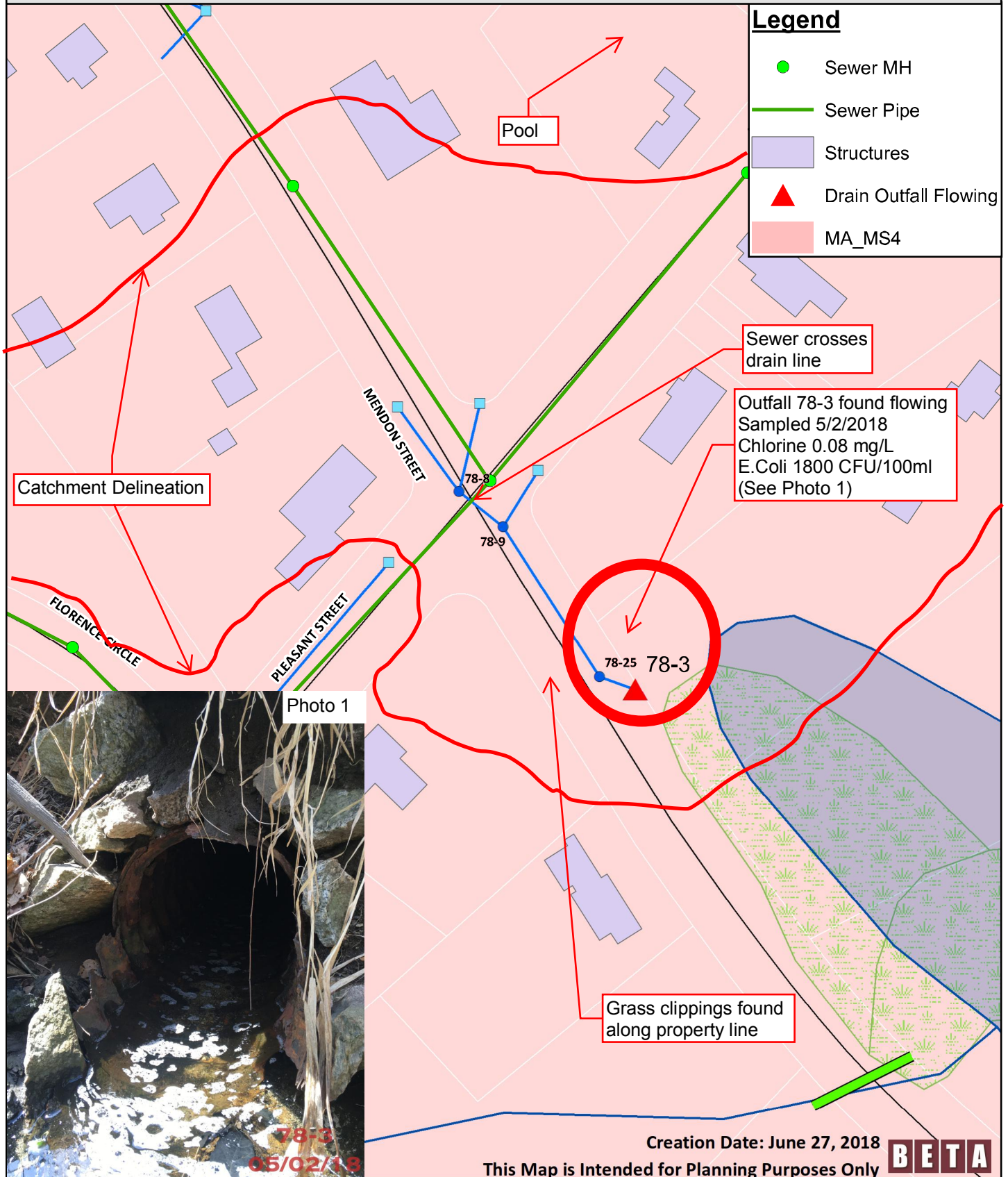
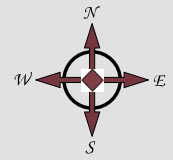
Creation Date: June 27, 2018

This Map is Intended for Planning Purposes Only

BETA

Town of Upton, Massachusetts

Figure 3: Outfall 78-3

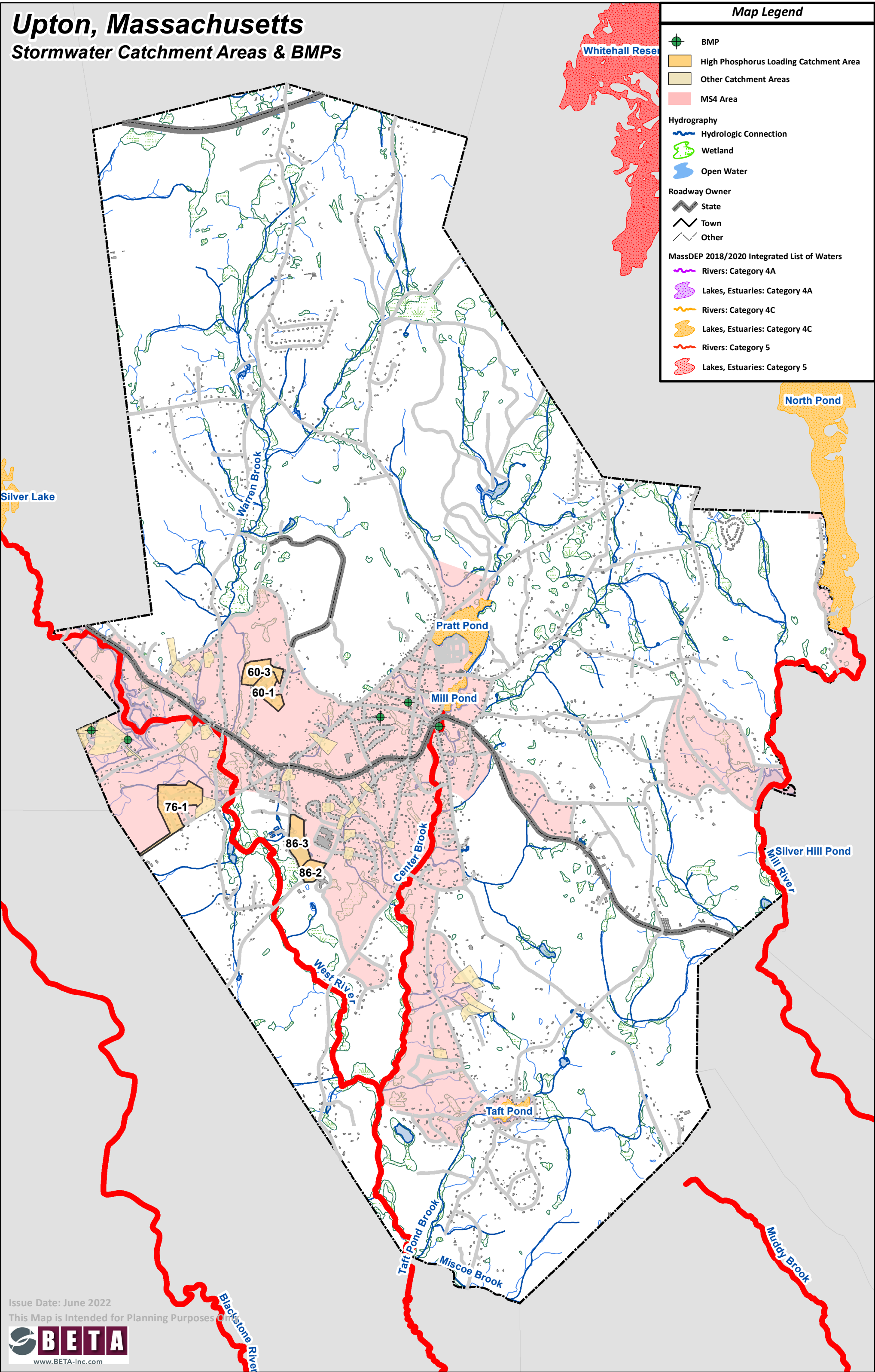


APPENDIX D

- Map of Five Catchments with the Highest Estimated Nutrient Loadings

Upton, Massachusetts

Stormwater Catchment Areas & BMPs



APPENDIX E

- Existing BMP Nutrient Removal Calculations

Appendix E: Existing BMP Nutrient Removal Calculations

BMP ID	Address	BMP Type	Phosphorus Removal (lb/yr)	Nitrogen Removal (lb/yr)	TSS Removal (lb/yr)
BMP-1	9 Dairy Drive	Stormwater Basin	2.58	38.62	2682.45
BMP-2	17 Laurel Lane	Stormwater Basin	0.34	3.66	368.98
BMP-4	2 Grove Street	Stormwater Basin	0.17	1.56	40.13
BMP-5	21 Dairy Drive	Stormwater Basin	0.44	6.71	448.53

APPENDIX F

- Potential BMP Retrofit Sites

Appendix F: Permittee-Owned BMP Retrofit Locations

Nutrient Removal	Address	Ownership		Soil Type ¹		Depth to Water Table ¹		Within a Potential Subsurface Area of Concern ²		Opportunity for Public Use and Education		Access for Maintenance		Current Stormwater Infrastructure in Area		Receiving Water ³		Priority Score	Comment
		Owner	Score 0 - 1	Type	Score ⁴ 0 - 3	Depth (ft) ⁵	Score ⁶ 0 - 3	Yes/No	Score 0 - 1	Yes/No	Score 0 - 1	Yes/No	Score 0 - 1	Yes/No	Score 0 - 1	Yes/No	Score 0 - 1	High Score, High Priority	
Nitrogen	Maple Avenue Parcel: M_190136_879135 Maplewood Cemetary	Town	1	A	3	> 6	3	No	0	Yes	1	Yes	1	Yes	1	No	0	10	Land at the cemetery could be examined for future BMPs.
Nitrogen	42 West Main Street Parcel: M_188843_880546 DPW Fueling Station	Town	1	B	2	> 6	3	No	0	Yes	1	Yes	1	Yes	1	No	0	9	Large impervious parking lot could be retrofitted with future BMPs.
Nitrogen	15 Milford Street Parcel: M_191580_880339 VFW Post, Parking Lot	Town	1	B	2	> 6	3	No	0	No	0	Yes	1	No	0	No	0	7	Large impervious parking lot could be retrofitted with future BMPs.
Nitrogen	71 North Main Street Parcel: M_191665_881072 Lakeview Cemetery, Open Land	Town	1	B	2	< 2	0	No	0	Yes	1	Yes	1	No	0	Yes	1	6	Land at the cemetery could be examined for future BMPs.
Nitrogen	69 Main Street Parcel: M_190600_880025 Memorial School	Town	1	C	1	2.5	1	No	0	Yes	1	Yes	1	No	0	No	0	5	Land at the elementary school could be examined for future BMPs.

NOTES

1. Data source: USDA Nautral Resources Conservation Service, Web Soil Survey

2. Examples: Contaminated Sites, Zone 2 Watershed Protection Areas. Data source: MassGIS, MassDEP Tier Classified Oil and/or Hazardous Material Sites

3. Control of Discharges to Water Quality Limited Waters, First or Second Order Streams, Public Swimming Beaches, Drinking Water Supply Sources, Shellfish Growing Areas

4. Score breakdown: Hydrologic Soil Group A =3, B = 2, C = 1, D = 0.

5. Depth to water table data unknown, value estimated using MassDEP Energy & Environmental Affairs Data Portal for Well Drillings and best engineering judgement.

6. Score breakdown: Depths of 0 to less than 2 ft = 0, 2 to less than 4 ft = 1, 4 to less than 6 ft = 2, at least 6 ft = 3.

Assabet River Reservoir

Town of Upton, Massachusetts

BMP Retrofit Locations

