

**Municipality/Organization:** City of Malden  
**EPA NPDES Permit Number:** MA041046  
**MADEP Transmittal Number:** 041088  
**Annual Report Number & Reporting Period:** No. 15: April 1, 2017-March 31, 2018

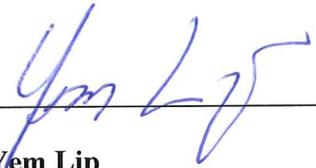
## NPDES PII Small MS4 General Permit Annual Report

### Part I. General Information

**Contact Person:** Yem Lip **Title:** Director of Engineering  
**Telephone #:** 781-397-7040 **Email:** ylip@cityofmalden.org

#### Certification:

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

**Signature:**   
**Printed Name:** Yem Lip  
**Title:** Director of Engineering  
**Date:** 4/27/2018

## Part II. Self-Assessment

The City of Malden has developed and implemented a comprehensive stormwater runoff and illicit discharge program that is designed to address the significant challenges associated with over a century old drainage and sewer infrastructure. The efforts of the City over the past few years has resulted in the removal of millions of gallons of illicit discharge and municipal waterline breaks. In addition, community awareness and participation, particularly through interaction with the Friends of the Malden River, is at its highest level since the inception of the City's Comprehensive program. In this regard, the City of Malden continues to work with regional watershed groups, neighboring communities and athletic organizations, to develop a protocol, or guidance, for recreational uses upon the Malden River, building upon the outfall and surface water sampling programs discussed in this submittal. MyRWA is also in the process of developing a predictive model to further this effort through funding assistance provided by Massachusetts Department of Environmental Protection (MDEP).

The systematic cleaning of catch basins, mapping of infrastructure system components, logging of component attributes, identification of infrastructure needs, and removal of illicit discharges serves to demonstrate the scope and effectiveness of the City's stormwater management program. As indicated previously, the City is actively involved with the stewardship organizations as described above. During this permit year, the following serves to demonstrate the progress that has been made through community outreach, and long term planning efforts;

- Commercial Street Greenways Corridor (Section 1-1) infrastructure evaluation
- Maintenance of trash booms in the (Section 2-2) Malden River by Friends of the Malden River, following the theft of the Cities service boat
- IDDE Plan Implementation
- Malden Conservation Commission efforts to establish a green space buffer with stormwater BMPs along the banks of the Malden River.

After several years of review, the Annual NPDES MS4 Permit has been revised with the provisions of the new permit becoming effective on July 1, 2018. The City of Malden, through its comprehensive stormwater compliance program has already met the majority of the new permit requirements and through the implementation of its comprehensive Illicit Discharge Detection and Elimination (IDDE) program, ongoing drainage system inventory, mapping, and maintenance efforts, together with community outreach, the City has demonstrated its ability to greatly improve the quality of stormwater discharges to tributary surface waters.

The City, through the Mystic Valley Development Commission (MVDC) in cooperation with the U.S. Army Corps of Engineers (ACOE) has entered into the final design and construction specifications stage of the National Ecosystem Restoration (NER) Plan for the Malden River, which is expected to enter the construction phase in the spring of 2019. This comprehensive ecosystem restoration effort includes many significant stormwater quality mitigation measures, including bank restoration, invasive species removal and plantings that will greatly enhance the quality of surface runoff into the River. The City also continues to encourage the implementation of LID design measures in ongoing new development, as well as the incorporation of CIP needs into redevelopment activities.

The Final United States Environmental Protection Agency's (USEPA's) National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) is to become effective on July 1, 2018. To obtain authorization to discharge under this permit, the City of Malden must submit a Notice of Intent (NOI) within 90 days of the effective date of the permit. The City is currently in the process of preparing the NOI. The 2018 MS4 permit will also include new inventory and mapping requirements, beyond the current program.

Specifically, the following tasks are required, which have already been completed by the City;

- Inventory of known Sanitary Sewer Overflows (SSOs) Discharging to the MS4
- MS4 Map
- Inventory of MS4 Outfalls

The City of Malden has maintained a comprehensive IDDE program since 2009, which has resulted in the removal of millions of gallons of illicit discharges as described in Section 3-6. In addition, the identification of numerous municipal water line breaks has resulted in the collection of thousands of gallons of possible water while reducing MWRA user costs to the local community. Specific IDDE Plan elements of the 2018 MS4 Permit include the following;

- Legal Authority
- Protocol & Responsibilities
- Inventory & Mapping Requirements
- Assessment and Priority Ranking of Outfalls
- Dry Weather Outfall Sampling
- Catchment Investigations
- Illicit Discharge Removal
- Indicators of IDDE Program Progress
- Ongoing screening
- Training

The majority of IDDE mapping and written components listed above have been addressed for the City of Malden and a revised IDDE Program plan will be submitted within one (1) year of the effective date of the MS4 permit. In addition, the City is required to develop a program to update the MS4 map to meet the requirements of the new permit.

The USEPA has also provided the following guidance for the first year the 2018 MS4 Permit;

**Catch Basin Cleaning:** Clean catch basins to ensure no catch basin is more than 50% full. Document catch basins inspected and cleaned, including total mass removed and proper disposal.

**Street Sweeping:** Sweep all streets (rural exceptions apply) a minimum of once a year in the spring. Each annual report shall include number of miles cleaned and volume or mass of material removed.

**Develop Infrastructure O&M Procedures:** Winter Road Maintenance: Establish written procedures for winter road maintenance including storage of salt and sand; minimize use of sodium chloride and other salts; ensure snow disposal activities do not result in disposal of snow into surface waters.

**Prepare and Submit Stormwater Management Plan (SWMP):** Develop/update written SWMP.

**Illicit Discharge Detection and Elimination (IDDE):** Complete written IDDE procedures and rank outfalls for IDDE investigation. Document Sanitary Sewer Overflows to the MS4

**Construction Site Runoff Control:** Create written procedure for inspecting construction sites for proper sediment controls

With the exception of the SWMP, each of the above tasks has been completed and/or is being implemented at this time.

Overall, the city of Malden has demonstrated its commitment in meeting the goals of the current MS4 program and is well positioned to address the new requirements that become effective in July of this year.

## **Part III. Summary of Best Management Practices (BMPs) and Compliance Team Goals**

### **1. Public Education, Outreach and Community Involvement**

<b>BMP 1-1 Place Educational Information on City's Web Site and Malden Access Television (MATV). Meetings, presentations, distribution of education materials</b>
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**Responsible Department/Person:**

Engineering Dept, Mayor's Office & MATV

**Measurable Goal(s):**

Continued maintenance of the City informational web site and participation with MATV.

**Progress on Goals- Year 15:**

Community outreach is maintained by the City through the maintenance of an informational website and works with representatives of MATV to update the community on current stormwater management issues. The City has made a clear commitment, through its Mayor and related support staff to promote community awareness and involvement. As discussed in further detail within Section 1-7, the Malden River Greenway project involves the proposed creation of accessible green space along the Malden River. The green space would include new parks, paths and boating amenities. Included within this comprehensive effort are the identification of key drainage and sewer infrastructure needs implementation. During the last permit year, the City has had extensive public participation and regional planning involvement with stewardship. As key projects advance into the design and implementation process, there has been extensive involvement by groups such as the Friends of the Malden River, MyRWA, the Army Corps of Engineers (ACOE), the MVDC and local planning agencies to promote a greater awareness of water quality issues within the Malden River Corridor. The City continues to work with MyWRA to confirm and document the occurrence of model project design to minimize exposure to bacteria/wet weather stormwater loadings on the Malden River. Additional details pertaining to this effort, may be referenced from Section 3.3. It is anticipated that electronic signage and a website will be in-place during the next permit year to identify water quality conditions for recreational users and the general public.

**Goal Status:**

Achieved original goals. Community outreach is an integral part of the City's efforts to mitigate stormwater quality concern.

<b>BMP 1-2      Conduct Recycling Opportunities &amp; Paint Waste Collection Days</b>
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**Responsible Department/Person:**

DPW & Mayor's Office

**Measurable Goal(s):**

Continuation and possible expansion of recycling collection days, and distribution of related educational information.

**Progress on Goals- Year 15**

MDPW sponsors two (2) paint waste collection and recycling days annually. As summarized in Part V, Section 2.5, these collection efforts typically days result in incur disposal costs of approximately \$11,000. The City also continues to maintain its recycling programs at the MDPW yard.

**Goal Status:** Annual Program - Activity Ongoing

<b>BMP 1-3      Enforce Pet Waste Management Programs</b>
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**Responsible Department/Person:**

Animal Control Dept & City Clerk

**Measurable Goal(s):**

Posting of signage, installation of waste collection containers, park maintenance, ordinance enforcement, Community involvement.

**Progress on Goals- Year 15:**

The Board of Health (BOH) actively monitors public recreation areas to discourage the feeding of waterfowl populations that contribute to the degradation of surface water quality. In addition, pet waste, education and control programs (stations) are in-place. The continued replacement of earthen/grassy playing field surfaces with synthetic cover is also a key factor in the reduction of animal waste contributions to stormwater runoff. As discussed in Section 2-1, an approximate 1.5 acre dog park was completed as a capping measure over a portion of areas subjected to landfilling with ash MSW and construction/demolition debris. This project has addressed both stormwater runoff concerns to nearby receiving waters and addresses pest waste management goals.

Fellsmere Pond is a key recreational/surface water body surrounded by protected open space that is monitored by City personnel. A comprehensive restoration of bank bordering walkways and areas of erosion, together with the monitoring and enforcement of the feeding of waterfowl populations has resulted in a clearly identified improvement to surface water quality in the Fellsmere Pond, as well as downstream receiving waters. Public understanding and conformance to the BOH recommendations remains as an area for improvement.

**Goal Status:**

Achieved

<b>BMP 1-4</b>	<b>Establish a partnership with local schools to educate Malden's students about stormwater</b>
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**Responsible Department/Person:**

Stormwater Compliance Team

**Measurable Goal(s):**

Workshops, demonstration projects, student involvement

**Progress on Goals- Year 15:**

During this permit year, the Stormwater Compliance Team spoke to Malden school students on Earth Day about the water cycle and the relationship with the City drainage system. Stormwater management goals and ongoing practices are educational tools that are included in community outreach efforts.

**Goal Status:**

Through the use of website postings and connection to the classroom, the City hopes to continue the advancement of student involvement in meeting this goal.

<b>BMP 1-5</b>	<b>Development of student involvement/internship for High School Seniors and expand Cooperative Education programs for college level interns</b>
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**Responsible Department/Person:**

Engineering Dept & MDPW

**Measurable Goal(s):**

Number of participants

**Progress on Goals- Year 15:**

During this reporting period the City Engineering Department and MDPW did not employ any interns.

**Goal Status:**

The City is currently exploring ways to partner high school and college interns.

<b>BMP 1-7</b>	<b>Host or participate in Stormwater Management brainstorming sessions with citizen advisory groups and Mystic River Watershed representatives (MyRWA)</b>
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**Responsible Department/Person:**

Eng. Dept. & Mayor's Office

**Measurable Goal(s):**

Annual Participation. Dissemination of information to the general public

**Progress on Goals- Year 15:**

The City of Malden continues to work with regional watershed stewardship groups, neighborhood communities and civic organizations to develop protocols, or guidance for recreational uses upon the Malden River, by building upon the results of ongoing outfall and surface water sampling programs. Further, MyRWA is in the process of developing a predictive model for water quality trends through funding assistance provided by MDEP. The City continues to share sampling results with MyRWA and has performed targeted sampling events to investigate discharges to outfalls that have been sampled by MyRWA. The outfall and surface water sampling programs will assist in developing an increased knowledge base to educate and improve community involvement and awareness of the relationship between stormwater discharges and surface water quality.

In addition, the City is working to enhance the quality of the river corridor through the Malden River Greenways, which is a comprehensive planning group comprised of the City of Malden, the Friends of the Malden River, MyRWA, the ACOE, the MVDC and local planning agencies. A Concept Plan of the Greenway may be referenced within Appendix B. Proposed projects include the construction of an emergent wetland, eradication of invasive plants, the creation of open spaces and recreational land uses. Each of these projects will improve stormwater discharges and surface water quality on the Malden River.

Consistent with this goal, protocols and guidance have also been developed for recreational uses on the Malden River, which is subject to both animal and human related bacteria discharges during wet weather conditions. A detailed summary of the protocols in place may be referenced from BMP 3-3. Additional outreach activities for the community included the Mystic River Stormwater Education Collaborative, which Malden joined during this reporting period. This initiative, led by MyRWA, will work to develop a multimedia education program to increase awareness of stormwater pollution for a regional coalition of municipalities.

**Goal Status:**

Ongoing community activity

## 2. Local Planning Processes and Community Involvement

<b>BMP 2-1</b>	<b>Development of incentives for redevelopment initiatives that address existing stormwater management concerns</b>
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**Responsible Department/Person:**

Local Planning Agencies and Compliance Team

**Measurable Goal(s):**

Mitigation of existing stormwater concerns, implementation of Best Management Practices.

**Progress on Goals- Year 15:**

The cities of Malden and Melrose, together with The Pine Banks Park Foundation, Inc., recently completed a comprehensive capping and site closure program to address an area of ashen municipal solid waste (MSW) deposition, as fill, within northerly portions of Pine Banks Park located in Melrose, Massachusetts. Site improvements in this area included a multipurpose synthetic playing area, a Reclaimed Asphalt Pavement (RAP) parking area and a new softball field, which has included significant stormwater quality enhancement measures for the Oak Grove/Malden River watershed. Additional improvements completed at Pine Banks Park during the last permit year includes the construction of an approximate 1.5 acre dog park as a capping measure over a portion of areas subjected to landfilling with ashen MSW and construction/demolition debris. This project has addressed both stormwater runoff concerns to nearby receiving waters and addresses pest waste management goals. Over the past few months, the City, through its Redevelopment Agency (MRA), has been working with the Conservation Commission to create grassy corridor with effective stormwater BMPs along the banks of the Malden River at the DPW (356 Commercial Street). The City through the MRA is also working with the Conservation Commission to advance the goals of the Greenway project.

The South Broadway Park restoration project is another example of stormwater quality enhancements. The greatest opportunities for the advancement of this goal continues to come from the identified infrastructure and watershed needs that are identified through the ongoing CB inventory, mapping inventory program. Through the integration of the stormwater management program into daily work practices by the Malden DPW, infrastructure deficiencies are more quickly identified and placed into the local permitting process.

As awareness and understanding of infrastructure needs has increased through the stormwater compliance program, targeted water quality improvements and repairs have been incorporated into ongoing development practices. This has included the requirement of onsite retention and a comprehensive evaluation of the aged sewer and drainage infrastructure in the downtown area. To this end, the comprehensive Malden Government Center redevelopment project, as well as several ongoing redevelopment activities are being requested/required to identify and/or mitigate infrastructure deficiencies

**Goal Status:**

Through the changes in staffing and engineering support, increased planning and incentives to promote improved stormwater management practices will be a priority during the next permit year.

<b>BMP 2-2      Development of a “Clean Malden” Program</b>
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**Responsible Department/Person:**

Stormwater Compliance Team

**Measurable Goal(s):**

Promote neighborhood stewardship programs designed to remove trash from sensitive watershed areas, catch basin inlets and report conditions of concern.

**Progress on Goals- Year 15:**

The Friends of Malden River is a group of Malden citizens established to promote community awareness and opportunities associated with this resource area. This group meets regularly with MyRWA and has also established lines of communication with the City of Malden, including the Mayor’s office, the Engineering office and the Environmental Justice Coordinator. The Friends of Malden River have worked on funding sources, a Public Improvement Plan (PIP) for 378 Commercial Street and a Malden River festival to support community awareness for the Malden River. In addition to the above, the trash boom located at the head of the Malden River routinely serviced by Malden DPW personnel.

**Goal Status:**

Achieved and ongoing

<b>BMP 2-3      Inter-departmental review and communication to address stormwater quality concerns</b>
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**Responsible Department/Person:**

Local Planning and Inspectional Agencies

**Measurable Goal(s):**

Coordination of Planning and Inspectional services to further identify and address stormwater management issues.

**Progress on Goals- Year 15:**

Through the adoption of a City ordinance pertaining to the stormwater management requirements, the objectives of this BMP have been integrated into the formal Department Head meeting agenda. Representatives of the BOH continue to be instrumental in successful enforcement actions when necessary. This program has led to the isolation and mitigation of illicit flow contributions as well as infrastructure deficiencies to be corrected which are discussed in further detail within the Illicit Discharge Detection and Elimination Program (IDDE) Semi-Annual Status Reports, which have been filed with USEPA and may be referenced from Appendix A. (See also BMP 2-1)

**Goal Status:**

Ongoing

<b>BMP 2-4      Development of an electronic database file management system</b>
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**Responsible Department/Person:**

Engineering Department and Compliance Team

**Measurable Goal(s):**

Compilation of all stormwater infrastructure information, integration of all ongoing inspection, inventory and repair activities.

**Progress on Goals- Year 15:**

The City has completed the conversion of its current mapping system to GIS/electronic format using field GPS receivers. Future goals to advance the operational integration of the electronic file and data management program currently utilized by the City include the use of “tablets” in the field to more readily access information and update existing files. Changes in staffing and more direct daily involvement by engineering personnel will further advance this goal.

**Goal Status:**

Activity Ongoing

<b>BMP 2-5      Development and implementation of local ordinances</b>
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**Responsible Department/Person:**

Local Planning Agencies and Compliance Team

**Measurable Goal(s):**

Adopt and enforce state and federal regulatory guidance. Perform community infrastructure needs analysis and conveyance of information to local permitting processes. Assign BMP guidance and requirements to private land use activities that are connected to the urban stormwater network.

**Progress on Goals- Year 15:**

The City continues to enforce existing stormwater ordinances and is reviewing Green Infrastructure and LID guidance and proposed Permit revisions to provide further enforcement guidance. The Engineering Department and where needed BOH has actively pursued violators of the local ordinances, as they pertain to stormwater quality.

**Goal Status:**

Achieved

<b>BMP 2-6</b> <b>Completion of an infrastructure needs analysis</b>
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**Responsible Department/Person:**

Eng. Department, DPW, Compliance Team

**Measurable Goal(s):**

Development of a long term plan for infrastructure upgrade

**Progress on Goals- Year 15:**

The reorganization of Engineering and MDPW support staff has advanced the focus and prioritization of infrastructure needs, as well as more direct daily involvement by City staff. This evaluation is an ongoing and iterative process that serves not only to enable timely repairs responses but provide a foundation for major capital improvement projects. Through the monitoring of ongoing redevelopment projects by the Engineering Department and inspectional services, and the daily maintenance/repair of the drainage infrastructure by the MDPW and water department, long and short term needs are continually identified. For those minor issues such as broken piping, clogged lines, and or restrictions, these deficiencies are addressed immediately by the MDPW and water department.

**Goal Status:**

Annual Ongoing Activity

### 3. Stormwater Monitoring and Inspection Program

**BMP 3-1 Conduct a minimum of one annual inspection of all known outfalls during dry weather sampling events.**

**Responsible Department/Person:**

Compliance Team

**Measurable Goal(s):**

Documentation of inspection results. Identification of issues of concern and corresponding confirmation resolution/ implementation of mitigation measures.

**Progress on Goals- Year 15:**

During this permit year, several inspections of all known outfalls were performed, however, no dry weather sampling events were conducted by the Stormwater Compliance team. Details pertaining to the inspections and other sampling events may be referenced within BMP 3-3 and Appendix A.

**Goal Status:**

Achieved and Ongoing Activity

**BMP 3-2 Perform targeted sampling and analyses during dry weather and wet weather sampling events to document seasonal and annual trends.**

**Responsible Department/Person:**

Compliance Team

**Measurable Goal(s):**

Collection of water quality data

**Progress on Goals- Year 15:**

A summary table (Table 1.0) with historic dry weather sampling results, together with figures depicting approximate sample locations may be referenced as Appendix B. As discussed further in BMP 3-3, the results of the dry weather sampling program have led to the removal of a significant, long term discharge of raw sewage into the municipal drainage system by representatives of the Gateway Apartments in December of 2016. Dry weather sampling will continue during the next permit year. In addition, several wet weather sampling events were performed during the permit year. Details pertaining to the wet weather sampling event may be referenced within BMP 3-3.

**Goal Status:**

Achieved and Ongoing Activity

<b>BMP 3-3</b>	<b>Perform mass balance modeling within primary watersheds to isolate sub basin bacteria loading sources.</b>
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**Responsible Department/Person:**

Compliance Team

**Measurable Goal(s):**

Identification of source area contributions

**Progress on Goals- Year 15:**

Representatives of NCA and MDPW personnel continue to conduct dry weather inspections of the City's infrastructure and flow isolation studies. This is a systematic program that has resulted in the identification and correction of infrastructure deficiencies, the timely repair of flow conveyance networks and removal of illicit discharges all of which have contributed to improvements in the quality of stormwater discharges. Historically, areas selected for inspection were generally based upon the results of the outfall sampling program and/or the identification of dry weather flows by MDPW staff during their routine maintenance and infrastructure locating program. As this program has continued, a more uniformed and systematic inspection program has been developed.

As referenced in prior reports, in June of 2015, an evaluation of the drainage system in Pleasant/Commercial/Exchange Street portion of the Malden River watershed was conducted in response to the detection of high E. coli levels during a dry weather sampling event in the area between Route 60 and Exchange Street. Subsequent investigations identified indications of sewage discharge during the video inspection of the 8-inch ductile iron pipe that connected to the Gateway at Malden Center Apartments (10 – 20 Summer Street). The City contacted the property owner and they engaged a plumbing contractor to determine the best course of action to resolve the illicit connection. After several camera inspections of the building utility lines, it was determined that a sewer riser was connected to a roof drain, which in turn discharged to the City storm drain system. According to representatives of Gateway Apartments, 11 one (1) bedroom apartments were connected to this roof drain. More specifically, it was determined that sewer connections for each of the "07" apartments (i.e. 107, 207, etc.) for the entire building were connected to a roof drain riser pipe that discharged to the municipal drainage system. The City remained in constant contact with representatives of the Gateway Apartments, who were cooperative and attempted to remove the illicit connection as quickly as possible. However, due to the complexity of the illicit connection and the multiple apartments connected to the roof drain, the work was not completed until 21 December 2016. A subsequent inspection by the City of Malden Plumbing Inspector was conducted and it was confirmed that the sewer riser was disconnected from the City storm drain system. The removal of this illicit connection represents a major reduction in potential surface water discharge and the most significant benefit derived from IDDE Plan implementation to date.

In addition to the above, the most recent dry weather water quality evaluation conducted along the Malden River included the sampling of outfalls on 28 April 2016. During the 28 April sampling event, four (4) outfalls were identified as flowing and were sampled, with the other 22 outfalls either having no flow or were submerged. E. coli levels ranged from 1.0 MPN/100ml (MR-6) to 8.6 MPN/100ml (MR-4). The focus of IDDE response actions recently has also been directed towards the illicit connections identified within the Malden River watershed, as well as the targeted wet weather sampling conducted along the Malden River and the Linden Brook Culvert. As outlined within the City's IDDE Plan, wet weather is defined as an event in which at least 0.25-inches of rain falls within 24 hours prior to the sampling event. A representative rainfall event of 0.42-inches occurred on 29 November 2016 and wet weather sampling was conducted on 30 November 2016.

Six (6) Malden River outfalls were found to be flowing, with high E. coli concentrations encountered at MR-4.1 (870 MPN/100ml) and MR-8 (7,000 MPN/100ml). A comparison of the wet weather concentrations with dry weather levels (Appendix B) at these two locations reveals that no flow has been observed at MR-4.1 during dry weather conditions, while flow was observed at MR-8 during the latest dry weather event, the bacteria level was only 5.2 MPN/100ml. In addition to the outfalls, base flow wet weather samples were collected from Little Creek and the Saugus Branch Culvert headwall. Elevated E. coli levels were detected at all three (3) locations, with the highest concentration (4,900 MPN/100ml) detected at the southern Saugus Branch Culvert headwall (MR-2S). It should be noted that little to no flow was observed at these locations during the sampling event.

Targeted wet weather sampling was also conducted along the Linden Brook Culvert on 30 November 2016. The scope of work performed at that time involved the sampling of two (2) manhole structures that discharge to the Linden Brook Culvert, one (1) manhole along the culvert and one (1) outfall/discharge area on the Malden/Revere line (LBR-1). A bacteria sample was collected from an upstream drain manhole on Winship Street and one downstream location on Cherry Street, with elevated E. coli levels detected at both locations (3,500 & 2,400 MPN/100ml, respectively) The stormwater conveyance network in the Winship and Cherry Street area discharges into the Linden Brook Culvert to the east. To assess potential impact to flow within the Linden Brook Culvert, a sample was collected from a downstream location at Home and Mingo Streets (H43-MH1), with a concentration of 260 col/100 ml identified. Although the level encountered is above the action level, it is well below the concentrations detected at Winship and Cherry Streets.

During the 30 November 2016 wet weather sampling event, a water sample was collected from LBR-1. Elevated bacterial levels, (480,000 MPN/100ml) indicative of sewerage infiltration, were encountered. Based upon information obtained from the Malden DPW, since the initial identification of the grease build-up resulting in a sewer line blockage in the area of LBR-1, the City of Malden has performed weekly preventative maintenance, which includes the evaluation of flow within the sewer line and the placement of degreasing chemicals if necessary. These weekly evaluations have indicated that the municipal sewer system in this area has been flowing as expected. Based upon the reported maintenance intervals, it did not appear that a sewer line blockage in the area of LBR-1 was the source of the high E. coli levels. Accordingly, an additional E. coli sample was collected by NCA on 3 January 2017, with a result of 2,000 MPN/100ml detected. Although this level is considered high, the concentration is orders of magnitude lower than the level detected in November of 2016. The City will continue to evaluate this area next reporting period.

As a part of their Massachusetts Environmental Trust funded Mystic Recreation Flagging Project, MyRWA has collected hundreds of samples from six (6) locations, including the Malden River within the Mystic River watershed. The goal of their effort includes the interim development of a “flagging” system in the watershed to alert recreational users to safe or unsafe conditions, which will be followed by the development of “logistic models” that will allow for predictive guidance pertaining to water safety. Based upon the review of historic water quality information compiled by the City and MyRWA, it was postulated that for rainfall events of less than half an inch, a 48 hour period of rebound would allow for the flushing of the River and reduction of bacteria levels to below safe boating standards. To test this hypothesis, sampling events were performed approximately 48 hours following half inch rainfall events at the floating crew dock, located at 356 Commercial Street in Malden.

As a general protocol, it has been recommended that river activities be suspended immediately following significant rainfall events, however the duration of this restriction has lacked sufficient foundation to be adequately determined. Specifically, it is known that there is a period of rebound following wet weather events that directly corresponds to the duration and/or amount of rainfall following which dry weather sampling has revealed consistent bacteria levels below applicable boating (1,260 MPN/100ml) and often swimming (235 MPN/100ml) EPA standards. To further evaluate this rebound condition, the City has worked with representatives of MyRWA to develop a post wet weather protocol for on river activity.

The sampling program was continued during this reporting period to provide further background support for the 48 hour protocol that is enforced by the Malden Athletic Director. Two (2) sampling events were conducted this reporting period and as shown on Table 6.0, bacteria levels of 650 MPN/100ml and 2,400 MPN/100ml were identified on 12 July and 8 September 2017, respectively. The July sampling event is above the USEPA safe swimming standard, but well below the safe boating standard, with the September sample results above both the safe swimming and boating standards. The City will continue this sampling program during the next reporting period and share the data and work with MyRWA to develop a predictive model that will include the use of electronic signboards and development of a public advisory website.

Additional details pertaining to the wet and dry weather inspections performed during this permit year may be referenced from the Illicit Discharge Detection and Elimination Program (IDDE) Semi-Annual Status Reports, which have been filed with USEPA and may be referenced as Appendix A.

**Goal Status:**

Initial city wide objectives for this goal have been met. IDDE program and dry weather flow isolation studies are ongoing.

<b>BMP 3-4</b>	<b>Target the evaluation of stormwater discharges from “green space” parklands, cemeteries and open space to assist in the segregation of human, animal and waterfowl bacteria contributions.</b>
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**Responsible Department/Person:**

Compliance Team

**Measurable Goal(s):**

Separation of non-human bacterial loading and implementation of mitigation measures.

**Progress on Goals- Year 15:**

The City has implemented several measures to reduce discharge of non-human bacterial loading at park lands, cemeteries and open space. These have included the use of dogs, postings to prevent the feeding of waterfowl, pet waste stations and enforcement of posted signage. A comprehensive restoration of bank bordering walkways and areas of erosion, together with the monitoring and enforcement of the feeding of waterfowl populations has resulted in a clearly identified improvement to surface water quality in the Fellsmere Pond, as well as downstream receiving waters. In addition, several recreational facilities such as MacDonald Stadium, Maplewood Park, and portions of the Pine Banks Park have been converted to synthetic playing fields under the direction of City of Malden personnel. In addition, the City converted South Broadway Park from grass playing fields to synthetic surfaces and integrated stormwater BMPs into the design of this large athletic park.

**Goal Status:**

Ongoing Activity

<b>BMP 3-5</b>	<b>Development of mitigation strategy based upon sampling and inspection progress for consideration in annual capital planning.</b>
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**Responsible Department/Person:**

Compliance Team

**Measurable Goal(s):**

Preparation of annual report.

**Progress on Goals- Year 15:**

Dry weather sampling continues to focus upon primary surface water bodies that received base-flow or dry weather contributions from upstream surface waters. The surface water bodies principally include the Malden River, Lower Spot Pond Brook, West End (Edgeworth Brook) Culvert, Little Creek, Linden Brook and the Town Line Brook. As a “flow through” community, significant base flow discharges from the City of Melrose and in particular Ell Pond continue to occur. Beyond the removal of illicit discharges, flow conveyance capacity requirements and necessary infrastructure repairs have been identified. Included amongst long term planning efforts was the completion of a Phase 3 of the comprehensive Infiltration and In-flow (I&I) study for the municipal sewer system that was performed by CDM Smith. This report includes a summary of findings and proposed recommendations to mitigate infiltration and inflow into the City's sewer system and was presented for approval to Massachusetts Water Resources Authority (MWRA) during this permit year. Approval has been received, together with necessary funding.

The City has converted and updated a majority of its current storm drain system mapping to GIS format using field GPS receivers. This includes the scanning of existing record plans as well as the conversion of field data, specifically drainage infrastructure components are located and inventoried as a part of ongoing system wide maintenance, service and inspection program being implemented by the MDPW. This planning tool is essential to the identification of capital planning projects. The results obtained from the outfall sampling program, together with the development of an electronic file management system, continue to assist in the prioritization of infrastructure needs.

**Goal Status:**

Both in-house and contracted services are in place to oversee mitigation maintenance and planning efforts.

<b>BMP 3-6</b>	<b>Development and Implementation of an Illicit Discharge Detection and Elimination (IDDE) Plan</b>
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**Responsible Department/Person:**

Eng Dept & Compliance Team

**Measurable Goal(s):**

Development and implementation of an IDDE Plan.

**Progress on Goals- Year 15:**

The City continues to implement its U.S. Environmental Protection Agency (US EPA) approved IDDE program through its daily CB inspection and maintenance program through the use of a dedicated MDPW Stormwater Team and outside services. The drainage infrastructure is inspected by DPW during catch basin cleaning, and upon the identification of previously unknown dry weather flows, the Engineering Department and NCA are immediately notified by MDPW personnel and targeted mass balance sampling efforts are performed. During dry weather inspections completed under the IDDE program, various dry weather flows have been identified. The Semi-Annual Status Reports pertaining to this effort, which have been filed with USEPA, may be referenced as Appendix A.

**Goal Status:**

Achieved

#### 4. Pre- and Post-Construction Stormwater Runoff Control Measures

<b>BMP 4-1</b>	<b>Development of inspection protocol/checklist local permitting agencies to monitor ongoing construction activities</b>
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**Responsible Department/Person:**  
Compliance Team

**Measurable Goal(s):**  
Development of checklist

**Progress on Goals- Year 15:**

The City's permitting process now incorporates the criteria contained within adopted stormwater ordinances to guide its review process. These ordinances provided the mechanism for enforcement and work is ongoing to integrate the results from daily inspection and monitoring into these processes. (See also BMP 2-1)

**Goal Status:**  
Achieved and Ongoing

<b>BMP 4-2</b>	<b>Integration of Applicant Certification requirement for the monitoring and inspection of development activities into local planning processes.</b>
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**Responsible Department/Person:**  
Compliance Team

**Measurable Goal(s):**  
Applicant Certification and submission of inspection and monitoring reports. (See BMP 4-1)

**Progress on Goals- Year 15:**

No progress has been made to these certification requirements, beyond conditions of approval and City oversight.

**Goal Status:**  
Ongoing

<b>BMP 4-3</b>	<b>Promote the use of new and innovative products/designs in new development initiatives. Condition of approval, monitoring</b>
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**Responsible Department/Person:**

Compliance Team

**Measurable Goal(s):**

Conditions of Approval, monitoring of construction activities.

**Progress on Goals- Year 15:**

Recent municipal projects within the City have included the construction of a new Malden Police Headquarters on Eastern Avenue and improvements completed at Pine Banks Park which includes the construction of an approximate 1.5 acre dog park as a capping measure over a portion of areas subjected to landfilling with ash MSW and construction/demolition debris. This project has addressed both stormwater runoff concerns to nearby receiving waters and addresses pest waste management goals. Previous recreational improvements have also included the conversion of South Broadway Park to synthetic playing field surfaces, along with the completion of surface cover and drainage improvements at Callahan Park. The City continues to enforce the use of low impact stormwater control measures, such as onsite retention and infiltration, as well as the upgrade of its aging infrastructure during ongoing developmental practices in the downtown area. New development projects are being required to undertake detailed investigations of the municipal infrastructure and implementation of BMPs to improve the nature of urban runoff. In addition, to the extent practical, recent redevelopment projects such as Government Center and several large downtown residential developments have been encouraged to utilize LID/green design measures.

**Goal Status:**

Ongoing

<b>BMP 4-4</b>	<b>Enforcement of existing state and federal guidance.</b>
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**Responsible Department/Person:**

Planning Board and Inspectional Services, Eng. Dept.

**Measurable Goal(s):**

Documentation of violations, implementation of corrective actions.

**Progress on Goals- Year 15:**

See BMP 3-6 and 5-8. Following the adoption of local control measures in April 2009, the City has enforced the removal of illicit discharges and required that investigations be undertaken to mitigate improper stormwater discharges. These efforts have led to the repair of sewer laterals within Eldrich Drive in the area of Oak Grove. In addition, the City, through IDDE Plan implementation isolated and identified the responsible party for an illicit connection believed to have conveyed millions of gallons of sewerage to the municipal drainage system prior to its mitigation.

**Goal Status:**

Ongoing

<b>BMP 4-5      Develop partnerships in planning with local Conservation Commission</b>
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**Responsible Department/Person:**

Planning Board and Inspectional Services, Eng. Dept.

**Measurable Goal(s):**

Stormwater quality management practices as conditions of approval.

**Progress on Goals- Year 15:**

The goals of this general permit and the corresponding IDDE program are directly communicated to the local Conservation Commission. In addition, infrastructure needs and deficiencies are communicated to the Commission for review and consideration during the local permitting process. Over the past few months, the City, through its Redevelopment Agency (MRA), has been working with the Malden Conservation Commission to create grassy corridor with effective stormwater BMPs along the banks of the Malden River at the DPW (356 Commercial Street). The City through the MRA is also working with the Conservation Commission to advance the goals of the Greenway project.

**Goal Status:**

Achieved and ongoing

<b>BMP 4-6      Site design measures to improve stormwater quality</b>
--

**Responsible Department/Person:**

Planning Board

**Measurable Goal(s):**

Improved design features for new development.

**Progress on Goals- Year 15:**

The adoption of local ordinances (See BMP 4-3) have provided planning review processes with guidance for appropriate design practices, in addition to BMP 2-5. Further, compliance with stormwater guidance for new development (310 CMR 10.00) is required.

**Goal Status:**

Ongoing

## 5.0 Pollution Prevention and Stormwater Management Strategies.

<b>BMP 5-1      Develop a Formal Training Program for DPW Staff</b>
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**Responsible Department/Person:**

DPW, Human Resources Dept.

**Measurable Goal(s):**

Staff Training

**Progress on Goals- Year 15:**

Day to day responsibilities for implementation of the stormwater compliance program fall under the direction of the Malden Water Department subject to the oversight of the Engineering Department. A trained crew has been assigned to work with NCA and the Malden Engineering Department in meeting the objectives of the IDDE Plan, as well as General Permit Program compliance. This team has been responsible for the identification of numerous water main leaks, resolution of illicit connections and repair of infrastructure components, all of which is directed towards the improvement in the quality of the City's stormwater discharges. Beyond the identification of illicit discharges, the committed focus upon surface water quality and the contributing drainage infrastructure has led to more timely repairs and improved system maintenance.

**Goal Status:**

Achieved and ongoing

<b>BMP 5-2      Maintain Lawn Care Policy</b>
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**Responsible Department/Person:**

DPW, School Dept., Cemetery Dept

**Measurable Goal(s):**

Proper utilization of pesticides, herbicides, fertilizers and appropriate disposal of lawn trimmings, yard waste

**Progress on Goals- Year 15:**

The application of pesticides, herbicides and fertilizers is provided by a licensed outside contractor, supervised by the MDPW. All other lawn care for recreational areas is maintained by the MDPW.

**Goal Status:**

Ongoing activity

<b>BMP 5-3</b>	<b>Development of a maintenance and monitoring plan for open channel component of Town Line Brook</b>
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**Responsible Department/Person:**

Eng. Dept., DCR & Compliance Team

**Measurable Goal(s):**

Removal of excess sediment deposits, restoration of flow capacity, structural repair.

**Progress on Goals- Year 15:**

The City, through its elected and appointed staff has reached out to the DCR for several years concerning the structural and water quality deficiencies associated with Town Line Brook. However, due to funding constraints, there are no plans for future work. The extent of damage to the concrete walls of this trapezoidal channel remains a significant concern, and has been reviewed with representatives of USEPA. Sediment deposition with the channel, together with compromises in its structural integrity represent long term and ongoing sources for degradation of surface water quality.

**Goal Status:**

Ongoing

<b>BMP 5-4</b>	<b>Implementation of recommended maintenance and monitoring plan developed for Spot Pond Brook at Oak Grove.</b>
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**Responsible Department/Person:**

Eng. Dept., DPW & DCR

**Measurable Goal(s):**

Implementation of those recommendations contained within engineering study completed by Meridian Associates, Inc.

**Progress on Goals- Year 15:**

Several meetings and site walks were held with DCR recently concerning Spot Pond Brook. However, due to funding constraints, there are no plans for future work. No planned maintenance activities occurred during this reporting period.

**Goal Status:**

Funding for necessary improvements and attention by DCR remains the goal of this BMP.

**BMP 5-5      Expansion of programs such as the Fellsmere Pond restoration initiative****Responsible Department/Person:**

Mayor's Office, Compliance Team DPW

**Measurable Goal(s):**

Water quality improvement

**Progress on Goals- Year 15:**

The current Administration has made significant commitment to public outreach and community involvement. At the core of this effort is education and input from concerned residents, as well as the business community. With the development of the Friends of the Malden River Organization, a focus of community involvement has been directed to water quality issues associated with the River, which includes litter debris and bank clean up. Potential public opportunities as well as enhancement alternatives for the Malden River Corridor are being actively pursued by local agencies and stewardships groups. In addition to the Malden River, bank stabilization measures and mitigation of significant compromises to the drainage infrastructure that conveys both groundwater outbreak and drainage flow in the area of Fellsmere Pond were identified and addressed. Aeration fountains were recently installed in Fellsmere Pond and a bacteria treatment as completed May of 2017.

**Goal Status:**

Achieved and ongoing

**BMP 5-6      Comprehensive catch basin inspection, inventory, maintenance program****Responsible Department/Person:**

Eng. Dept., DPW & Compliance Team

**Measurable Goal(s):**

Electronic logging of CB locations, documentation of CB construction and functional characteristics, recommendations for improved performance standard compliance at individual locations or tributary segments of the drainage system.

**Progress on Goals- Year 15:**

The ongoing maintenance program includes repairs to catch basins and laterals, which reduces the potential for sediment entrainment and reduces flooding issues. During the 2017-2018 permit year, the Engineering Department and the MDPW utilized the information obtained from the CB inventory and cleaning program to perform the following maintenance activities:

- Replacement/restoration of 8 catch basin structures
- Replacement/restoration of 4 drain manhole structures
- Clearing of 1,500 linear feet of drain laterals
- Cleaning of 125 catch basins
- Cleaning of 72 drain manholes

**Goal Status:**

Achieved and Ongoing

**BMP 5-7 Continue sewer re-lining and connection upgrade program**

**Responsible Department/Person:**

Eng. Dept. & DPW

**Measurable Goal(s):**

Reduction in I/I, identification of potential illicit connections, assist in infrastructure needs analysis

**Progress on Goals- Year 15:**

Recently, a \$3 million dollar contract (2014 S-1) was completed by the City for extensive sewer relining/cleaning services. No sewer re-lining or connection upgrade programs were completed during this permit year.

**Goal Status:**

Ongoing activity

**BMP 5-8 Development and implementation of communication/notification plan for SSOs**

**Responsible Department/Person:**

Eng. Dept. & DPW

**Measurable Goal(s):**

Notification of U.S. EPA and MDEP within 24 hours of event occurrence

**Progress on Goals- Year 15:**

No SSOs were identified during Year 15. Additional details may be referenced from the Illicit Discharge Detection and Elimination Program (IDDE) Semi-Annual Status Reports, which have been filed with USEPA and may be referenced as Appendix A.

**Goal Status:**

Achieved and Ongoing

## 6. Pollution Prevention and Good Housekeeping in Municipal Operations

### **BMP 6-1 Regular meetings of Compliance Team to review plan implementation results**

**Responsible Department/Person:**

Compliance Team

**Measurable Goal(s):**

Data evaluation and review, implementation of corrective actions, and prioritization of mitigation measures.

**Progress on Goals- Year 15:**

Stormwater management requirements, compliance enforcement and ongoing work practices have been integrated into daily work procedures, with an emphasis placed upon improved communication.

**Goal Status:**

Achieved and Ongoing

### **BMP 6-2 Annual Compliance review**

**Responsible Department/Person:**

Compliance Team & Mayor's Office

**Measurable Goal(s):**

Identification of capital plan improvements, modification of plan and objectives, documentation of plan activity for Annual Report.

**Progress on Goals- Year 15:**

This document, together with the development of a working GIS system represents major milestones that serve to demonstrate the extent of efforts that have been undertaken by the City of Malden to achieve the goals and objectives of the MS4 program. Building upon the foundation that has been developed over the past few years, the City is well positioned to meet the goals and requirements of soon to be in-place revisions of the MS4 General Permit, which becomes effective on July 1, 2018. The ongoing IDDE program, including outfall sampling and mass balance isolation studies are key components of ongoing planning efforts designed to prioritize and timely implement necessary infrastructure improvements.

**Goal Status:**

Ongoing

## Part IV. Summary of Information Collected and Analyzed

## Part V. Program Outputs & Accomplishments (Optional)

### 1. Programmatic (See BMPs 1-4 and 5-1)

1.1	Stormwater management position created/staffed	Compliance Team Established
1.2	Annual program budget/expenditures	\$ 620,000 – 720,000

### 2. Education Community Involvement and Training (See BMPs 1-1, 1.2, 1-4, and 1-5)

2.1	Estimated number of residents reached by education program(s)	55%
2.2	Stormwater management committee established	Yes
2.3	Stream teams established or supported	Yes
2.4	Shoreline clean-up participation or quantity of shoreline miles cleaned	0 miles
2.5	Household Paint Waste Collection Days	
	Days sponsored	2 Days
	Community participation	20%
	Material collected	\$11,000
2.6	School curricula implemented	Yes

### 3. Legal/Regulatory (See BMPs 2-5 and 3-6)

3.1	Regulatory Mechanism Status	
	Illicit Discharge Detection & Elimination	Adopted
	Erosion & Sediment Control	Adopted
	Post-Development Stormwater Management	Adopted

### 4. Mapping and Illicit Discharges (See BMPs 2-4)

4.1	Outfall mapping complete	All Known-100%
4.2	Estimated or actual number of outfalls	65
4.3	System-Wide mapping complete	
	Sewer-Paper/Mylar	100%
	Sewer-GIS	100%
	Drain-Paper/Mylar	100%
	Drain-GIS	90%
4.4	Outfalls inspected/screened	100%
4.5	Illicit discharges identified	8
4.6	Illicit connections removed	1,470 GPD (est.)
4.7	% of population on sewer	99.6%
4.8	% of population on septic systems	0.4%

### 5. Construction

5.1	Number of construction starts (>1-acre)	0
5.2	Estimated percentage of construction starts adequately regulated for erosion and sediment control	0
5.3	Site inspections completed	0
5.4	Tickets/Stop work orders issued	None
5.5	Fines collected	None
5.6	Complaints/concerns received from public	None

## 6. Post-Development Stormwater Management

6.1	Estimated percentage of development/redevelopment projects adequately regulated for post-construction stormwater control	100%
6.2	Site inspections completed	0
6.3	Estimated volume of stormwater recharged	None

## 7. Operations and Maintenance – current reporting period (See BMPs 5-1)

7.1	Average frequency of catch basin cleaning (seasonal) (non-commercial/non-arterial streets)	1 day a week
7.2	Average frequency of catch basin cleaning (commercial/arterial or other critical streets)	1 day a week
7.3	Total number of structures cleaned	125
7.4	Storm drain cleaned	1,500 LF
7.5	Qty. of screening/debris removed from storm sewer infrastructure	500 yards
7.6	Disposal or use of debris (landfill, POTW, compost, recycle for sand, beneficial use, etc.)	NA
7.7	Cost of screening disposal	NA
7.8	Average frequency of street sweeping (non-commercial/non-arterial streets)	7 days a week
7.9	Average frequency of street sweeping (commercial/arterial or other critical streets)	7 days a week
7.10	Qty. of sand/debris collected by sweeping	500 tons
7.11	Disposal or use of sweepings (landfill, POTW, compost, recycle for sand, beneficial use, etc.)	354.05 tons
7.12	Cost of sweeping disposal	\$32,398.30
7.13	Street sweepers purchased/leased	0
7.14	Reduction in application on public land of: ("N/A" = never used; "100%" = elimination) Fertilizers (State regulations require applicators (license which City does not currently have) Herbicides Pesticides	100% None None
7.15	Anti/De-Icing precuts and rations 5000 gallon tank	Salt 100% CaCl <sub>2</sub> 100 gals/30 tons CaCl <sub>2</sub> -100%
7.16	Pre-wetting techniques utilized	Yes
7.17	Manual control spreaders used	No
7.18	Automatic or Zero-velocity spreaders used	Yes
7.19	Estimated net reduction in typical year salt application	15%
7.20	Salt pile covered	Yes

# APPENDIX A

Environmental Engineering and Land Use Planning

# **CITY OF MALDEN**

## **Illicit Discharge Detection and Elimination Program Semi-Annual Status Report**

July 1, 2017 – December 31, 2017

Prepared by:

**Nangle Consulting Associates, Inc.**  
45 Dan Road – Suite 115  
Canton, MA 02021

and

**City of Malden Engineering Department**  
17 Pleasant Street  
Malden, Massachusetts

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Table 6.0	Malden River Boat House – E. coli Concentrations

## **ATTACHMENTS**

Attachment A	Laboratory Certificates
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- Figure 1 Watershed Areas
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- Figure 3 Dry Weather Inspection Areas
- Figure 4 Dry Weather Flow Map
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## 1.0 INTRODUCTION

In June of 2009, the City of Malden developed its Illicit Discharge Detection and Elimination (IDDE) program to address issues associated with a municipal drainage and sewage infrastructure whose origin dates back to the mid to late 1800s. Overall the City's IDDE plan was developed to facilitate the implementation of a systematic and iterative procedure for the identification of potential illicit discharges or illicit connections and timely repairs to the storm drainage infrastructure, with the overall goal of improving surface water quality within the City of Malden.

Once relied upon to support the expansion of early American Industry, particularly within the Malden River watershed, this aging infrastructure has been the focus of significant efforts by the City to improve the quality of stormwater flows to tributary receiving waters. Through flow isolation studies, removal of illicit/illegal discharges, lining of major sewage trunk lines and the timely repair of infrastructure deficiencies, the City has significantly advanced the goals and objectives of its IDDE program. This semi-annual status report has been prepared through the cooperative efforts of the City of Malden Engineering Department, the City of Malden Department of Public Works (MDPW) and Nangle Consulting Associates, Inc. (NCA) to summarize those activities that have been undertaken between July 1<sup>st</sup> through December 31 2017, and key tasks proposed for completion during the next reporting period.

Since its inception, the City's IDDE program has identified and removed illicit discharges/connections to the municipal drainage system, reduced significant potable water losses due to the detection of leakages, enforced Best Management Practices (BMPs)/stormwater ordinances and completed significant repairs to components of the drainage infrastructure. Support for these activities has been achieved through the development of a City wide GIS Mapping of the municipal drainage and sewage infrastructure; implementation of a comprehensive catch basin cleaning, inventory and repair program; mass balance flow isolation studies; dry and wet weather sampling; dye testing and comprehensive infiltration/inflow studies followed by in-situ lining of major trunk line and camera surveys in identified areas.

There are three (3) primary watersheds that contribute to the conveyance of dry weather and stormwater flows through the City of Malden. These are referred to as the Malden River, Town Line Brook, and Linden Brook watersheds whose approximate configuration maybe referenced from Figure 1. In addition, as a "flow through" community, stormwater and base flow containing bacteria is also conveyed through the City of Malden's drainage infrastructure from upstream neighboring communities.

It is to be noted that the initial drainage infrastructure for the City was installed, by design, to reduce flooding and assist in the conveyance of surface waters through the City to downstream outfalls that discharge coastal waters. Further, the relationship between age of the infrastructure and increased bacterial loadings are particularly evident during wet weather sampling events within older neighborhoods that grew from the extensive industrial operations along the Malden River. To address the constraints associated with this infrastructure, the City Engineering and MDPW, supplemented by outside technical assistance, have developed a program that integrates the implementation of the IDDE Plan into the routine daily work practices. This has led to the identification of infrastructure deficiencies and enabled the timely repair of potential flow and related water quality concerns.

It should be noted that the Final United States Environmental Protection Agency's (USEPA's) National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) is anticipated to become effective on July 1, 2018. To obtain authorization to discharge under this permit, the City of Malden must submit a Notice of Intent (NOI) within 90 days of the effective date of the permit. NCA is currently in the process of preparing the NOI. The 2018 MS4 permit will also include new inventory and mapping requirements, as detailed below;

- Inventory of Known Sanitary Sewer Overflows (SSOs) Discharging to the MS4
- MS4 Map
- Inventory of MS4 Outfalls

In addition, a revised IDDE Program plan is required, which consists of the following major components;

- Legal Authority
- Protocol & Responsibilities
- Inventory & Mapping Requirements
- Assessment and Priority Ranking of Outfalls
- Dry Weather Outfall Sampling
- Catchment Investigations
- Illicit Discharge Removal
- Indicators of IDDE Program Progress
- Ongoing screening
- Training

Although a majority of the IDDE mapping and written components listed above have been addressed for the City of Malden, a revised IDDE Program plan will be submitted within one (1) year of the effective date of the MS4 permit. In addition, the City is required to develop a program to update the MS4 map to meet the requirements of the new permit.

As stated above, this status report has been prepared to document and summarize IDDE activities that have been undertaken by the City during the July 2017 through December 2017 reporting period. Included within this scope of work was the continued sampling of the Malden River after design rainfall events to support the guidance protocols that have been developed for crew rowing activities upon the river. With respect to the above, the City of Malden, through its redevelopment agency (The Malden Redevelopment Authority) has worked closely with representatives of the Athletic Department, the Malden Board of Health and MyRWA to develop protocols for crew activities upon the Malden River following significant wet weather events. Specific details pertaining to this guidance, as well as other activities conducted this reporting period is presented in Section 3.0 of this report.

## **2.0 DOCUMENTED ILLICIT DISCHARGES AND CONNECTIONS**

During this reporting period, no illicit discharges/connections were identified. A summary of the illicit discharges/connections identified to date is presented on Figure 2 and Table 1.0.

## **3.0 OVERVIEW OF IDDE ACTIVITIES (JULY 2017 – DECEMBER 2017)**

In addition to outfall sampling, the City of Malden's IDDE Program incorporates the use of three (3) primary measures to identify and mitigate illicit discharges to its municipal drainage system, which may be described as follows:

- (1) Targeted dry/wet weather inspections and sampling by representatives of the Stormwater Compliance Team.
- (2) Detailed inspection of the municipal infrastructure during the daily implementation of the catch basin clean-out and drainage system mapping program.
- (3) Response to public, private or governmental agencies reports of possible sudden and/or identified discharge to the municipal storm system.

To provide a basis for the iterative inspection program and the observations recorded during this reporting period, the following excerpt from the City's IDDE work plan describes the methods and prioritization procedure maintained for this ongoing mitigation measure;

- Based upon the initial outfall monitoring data obtained, the City is currently implementing a Rapid-Assessment Prioritization approach through the targeted assessment of dry-weather flows in several areas within the City. Specifically the major tributaries to the most significant volume dry weather discharges to the Town Line Brook and the Malden River have been identified and sampled at key junction locations to initially determine the dry weather contributions from adjacent communities through major flood control infrastructure that is routed through the City of Malden.

Although no dry weather sampling was conducted during this reporting period, a comprehensive dry weather sampling event was conducted on all accessible Malden River outfalls in April of 2016. Results of this comp stamping program obtained by the City, together with surface water quality data obtained by others, continues to be shared between the City, public and private educational officials, the local community and Mystic River Watershed Association (MyRWA), to develop safety/guidance protocols for recreational uses on the Malden River.

By design, observations recorded during the system inspections, together with the results of infrastructure sampling, serve as the basis for ongoing work plan tasks and updates to the original IDDE plan. Accordingly, the IDDE program maintained by the City is regarded as an ongoing and iterative effort that has successfully demonstrated the capability to quickly respond to water quality issues as needs and concerns are identified. Since the initial implementation of the IDDE Plan, public outreach, postings of signage, daily work practices, interdepartmental meetings and local permitting processes have served to promote and understand the need for appropriate responses to illicit discharges. Contact information is readily available through a variety of media, including mailings and web site postings to ensure implementation of appropriate response measures by members of the Stormwater Compliance Team. The current municipal leadership has made a significant effort to increase public awareness and participation through increased integration of digital and electronic media into daily practices. Public outreach has also

included active participation by the Compliance Team through community workshops, educational presentations and regional watershed meetings.

### **3.1 Targeted Dry Weather Inspection/Sampling Program (NCA)**

Historically, areas selected for inspection were generally based upon the results of the outfall sampling program and/or the identification of dry weather flows by MDPW staff during their routine maintenance and infrastructure locating program. As described in further detail in Section 3.1.1, the City continues to share sampling results with MyRWA and has performed targeted sampling events to investigate discharges to outfalls that have been sampled by MyRWA. A map depicting the approximate locations where targeted dry weather inspections have been conducted by NCA to date is presented as Figure 3. In addition, the drainage infrastructure is also inspected by the MDPW during the catch basin cleaning program. Upon the identification of previously unknown dry weather flows, the Engineering Department and NCA are immediately notified by MDPW personnel and targeted mass balance sampling efforts are performed. During dry weather inspections completed under the IDDE program, various dry weather flows have been identified. A summary of these flows within the municipal system that have been identified to date are shown on Table 2.0 and Figure 4. In addition to illicit discharges and connections (Table 1.0), waterline breaks have also been identified and addressed.

#### *3.1.1 Malden River Watershed*

As described in earlier submittals, the City of Malden's stormwater compliance team initially targeted potential illicit discharges to the Malden River as its highest priority. Utilizing the outfall monitoring data and information obtained during dry weather sampling events, the City has identified significant base flow as surface waters, to the Malden River. Consistent with the original design of the MDC/DCR conveyance network; this occurs primarily thorough culverted channels/brooks located in northwestern portions of the City. This flow includes contributions that originate from the Fells Reservation and Lower Spot Pond Brook. A total of 26 outfalls to the Malden River have been identified as depicted on Figure 5. Periodic dry weather sampling has been performed by NCA, MyRWA and the USEPA. The most recent dry weather water quality evaluation conducted along the Malden River included the sampling of outfalls on 28 April 2016. During the 28 April sampling event, four (4) outfalls were identified as flowing and were sampled, with the other 22 outfalls either having no flow or were submerged. Reference to Table 3.0, shows that E. coli levels ranged from 1.0 MPN/100ml (MR-6) to 8.6 MPN/100ml (MR-4).

In June of 2015, an evaluation of the drainage system in Pleasant/Commercial/Exchange Street portion of the Malden River watershed was conducted in response to the detection of high E. coli levels during a dry weather sampling event in the area between Route 60 and Exchange Street. Subsequent investigations identified indications of sewage discharge during the video inspection of the 8-inch ductile iron pipe that connected to the Gateway at Malden Center Apartments (10 – 20 Summer Street). The City contacted the property owner and they engaged a plumbing contractor to determine the best course of action to resolve the illicit connection. After several camera inspections of the building utility lines, it was determined that a sewer riser was connected

to a roof drain, which in turn discharged to the City storm drain system. According to representatives of Gateway Apartments, 11 one (1) bedroom apartments were connected to this roof drain. More specifically, it was determined that sewer connections for each of the “07” apartments (i.e. 107, 207, etc.) for the entire building were connected to a roof drain riser pipe that discharged to the municipal drainage system. The City remained in constant contact with representatives of the Gateway Apartments, who were cooperative and attempted to remove the illicit connection as quickly as possible. However, due to the complexity of the illicit connection and the multiple apartments connected to the roof drain, the work was not completed until 21 December 2016. A subsequent inspection by the City of Malden Plumbing Inspector was conducted and it was confirmed that the sewer riser was disconnected from the City storm drain system. The removal of this illicit connection represents a major reduction in potential surface water discharge and the most significant benefit derived from IDDE Plan implementation to date.

One illicit discharge that has been the focus of numerous dry and wet weather sampling events due to elevated E. coli levels is LSP-4. LSP-4 is an outfall that discharges into the Lower Spot Pond Brook culvert from the drainage system located within Eldrich Drive (Figure 6). Base flow, as groundwater, is consistently observed within this drainage network and to isolate potential sewage contributions to this base flow, a comprehensive evaluation of the flow conveyance network associated with LSP-4 was completed in February 2012. Following dye testing by the Compliance Team, camera surveys performed by representatives of the property owner confirmed that compromises to the laterals servicing two (2) residential building had occurred. Working with representatives of the Malden Engineering Department, repairs to the sewer laterals in the area of Building 1054 and 1056 were completed by the property owner in March 2012. Since that time, and as summarized on Table 3.0, dry weather flow sampling at LSP-4 has revealed a significant decrease in bacteria levels relative to concentrations detected in 2012. While the repairs to the sewer laterals demonstrated a clearly defined improvement in dry weather base flow to LSP-4, E. coli concentrations of 110,000 and 3,200 MPN/100 ml were detected at LSP-4 in July and November of 2014, respectively. As described previously, the drainage system in Eldrich Drive receives base flow, as groundwater infiltration and it is likely that the levels of groundwater relative to the exfiltration zone for the former broken laterals is a contributing factor. To correct this condition, the owner of the residential development has been notified that relining and restoring the structural integrity of the main drainage line and manholes should be performed. Dry weather conditions at LSP-4 will continue to be monitored next reporting period.

As referenced in Section 1.0, Malden is a flow through community that receives surface water flows from neighboring communities, which have been found to contain elevated levels of bacteria entering into the City’s drainage system. One example of this is depicted on Figure 7, which demonstrates the elevated levels of E. coli emanating from Ell Pond in Melrose. As shown, E coli levels of 86,640 MPN/100ml were detected at Ell Pond, which exhibited a consistent decline throughout downstream sampling locations in Malden, followed by a large increase at Route 16 in Everett (81,640 MPN/100ml). It is to be noted that elevated bacteria levels have been recorded at the Malden/Melrose town line through the period of IDDE plan implementation.

### 3.1.2 Town Line Brook Watershed

Town Line Brook in Malden begins at the Malden and Everett boundary and is culverted until it daylights into an open concrete lined trapezoidal channel at Broadway. Significant tidal influences exist in the form of an approximate 2-3 foot change in surface water elevation between Broadway and the remaining length of the culvert to the Revere City line. As shown on Figure 8, a total of 29 outfalls to Town Line Brook in Malden have been identified. The historic monitoring data of Town Line Brook has revealed relatively uniform bacteria levels during dry weather sampling events. Several outfall locations have consistently exhibited bacteria loadings during dry weather sampling events, including S3-MH12, TL-0, TL-9 and Trifone Brook (TL-24). Manhole sample point S3-MH12 is the upstream sampling point for this section of the Brook as it enters the Malden system from Everett, while TL-0 is located at Broadway, where Town Line Brook daylights. TL-9 is located proximate to the terminus of Hadley Street in Malden and receives dry weather flows from the City of Everett, with Trifone Brook (TL-24), also flowing from Everett prior to discharging into Town Line Brook. Based upon the historic monitoring of these outfalls, it is apparent that contributions continue to enter the Malden system from upstream areas.

### 3.1.3 Linden Brook Watershed

Linden Brook Culvert is the major stormwater conveyance network located in northeasterly portions of the City. Dry weather inspections have revealed base flow throughout the culvert at all times, with E. coli levels detected historically within the mid-portion of the culvert, at manhole H43-MH1, located on Home Street (Figure 9). Flow isolation studies performed to date within this portion of the City had not revealed any specific source conditions for the results of prior sampling. In an effort to identify source conditions, flow isolation studies have been conducted on upstream drainage connections to the Linden Brook Culvert. A dry weather flow (Flow # 18), was identified in the areas of Cherry and Gilbert Streets, which contributes flows from the northern and central portions of Malden to the Linden Brook Culvert (Figure 9).

An initial dry weather flow sample collected from drainage manhole (C18-MH5) located on Cherry Street contained elevated E. coli levels and to further assess this condition, dry weather flows were sampled several times from this drainage manhole. In addition, several upstream dry weather flow samples were also collected from a manhole located on Winship Street (W47-MH1). Reference to Table 3.0 and Figure 9, indicates that the E. coli levels encountered at both drainage manholes contained high bacterial levels during each of the sampling events. Although it does not appear that the bacteria levels encountered at Cherry and Winship Streets are source conditions that impact flows within central portions of the Linden Brook Culvert at Home Street, additional characterization of the Cherry/Winship Street flow and Linden Brook Culvert base flow will be continued next reporting period.

During a September 2012 sampling event, conducted with representatives of the USEPA, a water sample was collected from outfall LBR-1 (Figure 9), located in Revere, at which time distinct indications of sewage odors were noted. Consistent with the identification of strong sewage odors, significantly elevated levels of E. coli (>241,920 MPN/100 ml) were detected in sample LBR-1. To assess this condition and as described in prior status reports, the City of Malden contracted with National Water Main Cleaning Company, under the supervision of CDM Smith. As summarized previously, CDM Smith, believed that the line blockage was due to grease build up and may have been a crucial factor for the conditions identified at LBR-1, in addition to a “minor” defect in the form of a leaky joint.

Following the above described maintenance and mitigation measures, multiple dry weather sampling events were conducted at LBR-1. As shown on Table 3.0, E. coli concentrations from the two (2) most recent sampling events in July and November of 2014 were 520 MPN/100 ml and 88 MPN/100 ml, respectively, well below the levels encountered prior to the cleaning of the syphon. As discussed in further detail within Section 3.2.2 below, elevated E. coli levels were again encountered within LBR-1 during a recent wet weather sampling event.

### **3.2 Targeted Wet Weather Inspection/Sampling Program (NCA)**

The focus of recent IDDE response actions has been directed towards the illicit connections identified within the Malden River watershed, as well as the targeted wet weather sampling conducted along the Malden River and the Linden Brook Culvert in November of 2016. As outlined within the City’s IDDE Plan, wet weather is defined as an event in which at least 0.25-inches of rain falls within 24 hours prior to the sampling event. A representative rainfall event of 0.42-inches occurred on 29 November 2016 and wet weather sampling was conducted on 30 November 2016. A summary of the results obtained from Malden River and Linden Brook Culvert sample locations may be referenced from the following sections.

#### ***3.2.1 Malden River***

As shown on Table 4.0, six (6) Malden River outfalls were found to be flowing on 30 November 2016, with high E. coli concentrations encountered at MR-4.1 (870 MPN/100ml) and MR-8 (7,000 MPN/100ml). A comparison of the wet weather concentrations with dry weather levels (Table 3.0) at these two locations reveals that no flow has been observed at MR-4.1 during dry weather conditions, while flow was observed at MR-8 during the latest dry weather event, the bacteria level was only 5.2 MPN/100ml. In addition to the outfalls, base flow wet weather samples were collected from Little Creek and the Saugus Branch Culvert headwall. Elevated bacteria levels were detected at all three (3) locations, with the highest concentration (4,900 MPN/100ml) detected at the southern Saugus Branch Culvert headwall (MR-2S). It should be noted that little to no flow was observed at these locations during the sampling event.

In addition to the above referenced outfalls, a wet weather sample was collected from Lower Spot Pond Brook outfall, LSP-4. As shown on Table 4.0, although elevated *E. coli* concentrations were encountered (15,000 MPN/100ml), the levels were substantially lower than those detected previously. To supplement the results obtained from the laboratory analysis of *E. coli*, a colorimetric field test for ammonia utilizing Hach Ammonia (Nitrogen) Test Strips was performed at selected wet weather Malden River sample locations. As shown on Table 5.0, in general, the field test results were consistent with the laboratory results obtained. The City will continue to utilize the field ammonia test to supplement the ongoing laboratory analysis program.

### 3.2.2 Linden Brook Culvert

Targeted wet weather sampling was also conducted along the Linden Brook Culvert on 29 November 2016. The scope of work performed at that time involved the sampling of two (2) manhole structures that discharge to the Linden Brook Culvert, one (1) manhole along the culvert and one (1) outfall/discharge area on the Malden/Revere line (LBR-1). As shown on Table 4.0 and Figure 9, a bacteria sample was collected from an upstream drain manhole on Winship Street and one downstream location on Cherry Street, with elevated *E. coli* levels detected at both locations (3,500 & 2,400 MPN/100ml, respectively). The stormwater conveyance network in the Winship and Cherry Street area discharges into the Linden Brook Culvert to the east (Figure 9). To assess potential impact to flow within the Linden Brook Culvert, a sample was collected from a downstream location at Home and Mingo Streets (H43-MH1), with a concentration of 260 col/100 ml identified. Although the level encountered is above the action level, it is well below the concentrations detected at Winship and Cherry Streets.

As referenced within Section 3.1.3, during the 30 November 2016 wet weather sampling event, a water sample was collected from LBR-1. As shown on Table 4.0, elevated bacterial levels, (480,000 MPN/100ml) indicative of sewerage infiltration, were encountered. Based upon information obtained from the Malden DPW, since the initial identification of the grease build-up in 2012 resulting in a sewer line blockage in the area of LBR-1, the City of Malden has performed weekly preventative maintenance, which includes the evaluation of flow within the sewer line and the placement of degreasing chemicals if necessary. These weekly evaluations have indicated that the municipal sewer system in this area has been flowing as expected. Based upon the reported maintenance intervals, it did not appear that a sewer line blockage in the area of LBR-1 was the source of the high *E. coli* levels. Accordingly, an additional *E. coli* sample was collected by NCA on 3 January 2017, with a result of 2,000 MPN/100ml detected. Although this level is considered high, the concentration is orders of magnitude lower than the level detected in November of 2016. The City will continue to evaluate this area during the next six month period. Similar to the Malden River wet weather samples, to supplement the results obtained from the laboratory analysis of *E. coli*, ammonia field tests were performed at selected wet weather Linden Brook Culvert sample locations. As shown on Table 5.0, in general, the field test results were consistent with the laboratory results obtained. The City will continue to utilize the field ammonia test to supplement the ongoing laboratory analysis program.

### 3.2.3 Malden River Floating Dock

As a part of their Massachusetts Environmental Trust funded Mystic Recreation Flagging Project, MyRWA has collected hundreds of samples from six (6) locations, including the Malden River within the Mystic River watershed. The goal of their effort includes the interim development of a “flagging” system in the watershed to alert recreational users to safe or unsafe conditions, which will be followed by the development of “logistic models” that will allow for predictive guidance pertaining to water safety. Based upon the review of historic water quality information compiled by the City and MyRWA, it was postulated that for rainfall events of less than half an inch, a 48 hour period of rebound would allow for the flushing of the River and reduction of bacteria levels to below safe boating standards. To test this hypothesis, sampling events were performed approximately 48 hours following half inch rainfall events at the floating crew dock, located at 356 Commercial Street in Malden.

Users of the floating dock have included primarily private clubs who were subject to special conditions and agreements pertaining to the use of the property. Recently, this recreational activity has fallen under the jurisdiction of the Malden Athletic Department who has been working with representatives of the MRA, the City and outside technical assistance to develop safety protocols for both student requirements and issues associated with the water quality of the Malden River. With respect to the latter, dry and wet weather sampling performed by the City has clearly demonstrated that elevated bacteria levels occur within the river during and immediately after significant rainfall events due to the urban nature of the tributary watersheds within the cities of Malden, Medford, Melrose and Everett.

As a general protocol, it has been recommended that crew activities be suspended immediately following significant rainfall events, however the duration of this restriction has lacked sufficient foundation to be adequately determined. Specifically, it is known that there is a period of rebound following wet weather events that directly corresponds to the duration and/or amount of rainfall following which dry weather sampling has revealed consistent bacteria levels below applicable boating (1,260 MPN/100ml) and often swimming (235 MPN/100ml) standards. To further evaluate this rebound condition, the City has worked with representatives of MyRWA to develop a post wet weather protocol for on river activity.

As summarized on Table 6.0, the 48 hour rebounding protocol has led to the documentation of bacteria levels below the USEPA safe boating standard for most of the applicable rainfall events. In addition, the corresponding safe swimming standard was met on 19 April, 7 July and 4 October 2016, with only a slight exceedences observed on 28 April 2016. In contrast, an E. coli concentration of 2,900 MPN/100ml was detected during the sampling event performed in November of 2016. Reference to Table 6.0, shows that the 4 October sample was collected 53 hours from the last rainfall, while the November sample, which contained elevated E. coli levels, was collected only 10.8 hours from the last rainfall. This pattern is consistent with rebound condition described above.

The sampling program was continued during this reporting period to provide further background support for the 48 hour protocol that is enforced by the Malden Athletic Director. Two (2) sampling events were conducted this reporting period and as shown on Table 6.0, bacteria levels of 650 MPN/100ml and 2,400 MPN/100ml were identified on 12 July and 8 September 2017, respectively. The July sampling event is above the USEPA safe swimming standard, but well below the safe boating standard, with the September sample results above both the safe swimming and boating standards. The City will continue this sampling program during the next reporting period and share the data and work with MyRWA to develop a predictive model that will include the use of electronic signboards and development of a public advisory website.

### **3.3 Inflow Infiltration Sewer System Evaluation & Capacity Analysis**

The City of Malden has also completed a comprehensive Infiltration and Inflow (I&I) study for its municipal sewer system. CDM Smith, on behalf of the City, has prepared a Phase 3 Sanitary Sewer Evaluation Survey (SSES) report that includes a summary of findings and proposed recommendations to mitigate excessive infiltration and inflow into the City's sewer system. This report was approved by MWRA last year. As described in Section 3.1.1, the City also has a contract in place for emergency repairs to the sewage infrastructure. This contract allowed for the video camera surveys performed in the Pleasant and Exchange Street area and the I&I investigations performed by CDM Smith.

### **4.0 SANITARY SEWER OVERFLOWS (SSO'S)**

No SSOs were identified during this reporting period.

### **5.0 EVALUATION OF IDDE PROGRAM GOALS AND OBJECTIVES**

The City of Malden has implemented a comprehensive illicit discharge elimination program that has resulted in the isolation and mitigation of numerous illicit discharges/connections and reduced significant potable water losses due to the detection of water line breaks. During the last reporting period, the removal of a significant, long term discharge of raw sewage into the municipal drainage system was finalized, which demonstrated both the effectiveness and importance of the IDDE program. In anticipation of the formal promulgation of the long discussed revisions of the regulatory requirements of the MS4 program, the City is currently preparing the required NOI to accommodate these revisions. Consistent with the seasonal focus of the IDDE Plan, targeted dry and wet weather sampling will be performed during the spring/summer period.

Through the assistance of the USEPA, through their prior multiple lines of evidence testing program, a greater understanding of the distinction between human and animal bacteria loadings has been further defined. The Compliance Team is continuing to investigate the feasibility of identifying cost efficient sampling parameters, such as caffeine analysis and hopes to work with USEPA in implementing multiple lines of evidence testing within the Malden River Watershed during the next reporting period. At the recommendation of USEPA, the use of ammonia test strips was incorporated into flow isolation and mass balance evaluations of dry and wet weather conditions.

Further understanding of surface water quality characteristics and bacteria loadings has been obtained through the development of formal and documented crew safety protocols, particularly as it pertains to wet weather rebound within the River. This sampling effort will be continued during the upcoming school year and corresponding reporting period and it is planned to integrate an electronic notification capability through the Cities' partnership with representatives of MyRWA. Dry weather inspections during the ongoing catch basin cleaning inventory program together with targeted wet weather sampling within the Malden River Corridor also remain as priorities to assist in the planning of Capital and Infrastructure needs.

# TABLES

**Environmental Engineering and Land Use Planning**

**Table 1.0 Summary of Illicit Connections/Discharges identified as of 12/31/2017**

**Illicit Connections**

<b>Illicit Connection Identification</b>	<b>Date Identified</b>	<b>Discharge Type</b>	<b>Estimated Volume</b>	<b>Date Removed</b>	<b>Location</b>
ID-1	1/15/2009	Sewage	40 gpd	2/16/2009	33 Lodgen Ct., Unit 1F
ID-2	1/15/2009	Grey Water	100 gpd	3/2/2009	34 Hanover Street
ID-4	8/28/2009	Sewage	60 gpd	9/4/2009	2-4 Hancock Street
ID-9	5/18/2010	Sewage	60 gpd	5/19/2010	36 Charles Street
ID-12	Apr-12	Confirmed Roof Drain	NA	NA	100-110 Pleasant Street
ID-13	Sep-12	Sewage	Unknown	January-13	Exchange Street
ID-15	Oct-13	Process Water	Unknown	N/A	Sharon Street
ID-16	6/2/2016	Sewage	1,210 gpd	12/21/2016	Summer Street (11 units)

**Total Illicit Flow Removed to Date:**

**1,470 gallons/day**

**536,550 gallons/year**

**Illicit Discharges**

<b>Illicit Discharge Identification</b>	<b>Date Identified</b>	<b>Discharge Type</b>	<b>Estimated Volume</b>	<b>Date Removed</b>	<b>Location</b>
ID-3	8/11/2009	Oil Sheen	Unknown	n/a	Near 1081 Fellsway
ID-5	9/10/2009	#2 oil spill	<5 gallons	9/10/2009	269 Pearl Street
ID-6	9/21/2009	Poss. Washwater	Unknown	9/21/2009	120 Main Street
ID-7	12/9/2009	Trans. Dielectric fluid	<27 Gallons	12/10/2009	Near 6 Grove Street
ID-8	4/29/2010	Hydraulic Fluid	<10 Gallons	4/29/2010	496 Main Street
ID-10	2/10/2012	Sewage	Note 1	Pending	1056 Erlich Drive
ID-11*	9/11/2012	Sewage	Unknown	11/6/2012	Linden Brook @ Lynn St.
ID-14	8/15/2013	Grey Water	Unknown	13-Dec	Forestdale School

1 - approximately 1 gallon per minute observed discharging at LSP-4 during dry weather

\* Possible discharge due to grease blockage-Syphon still under investigation

**Table 2.0 Summary of Dry Weather Flows Identified as of 12/31/2017**

<b>Flow Identification</b>	<b>Location</b>	<b>Flow Type</b>	<b>Status</b>
Flow 1	Medford City Line	Water Line Leak	Removed
Flow 2	Saint Mary's Street	Groundwater	No Further Action
Flow 3	Fellsmere Reservation	Groundwater	No Further Action
Flow 4	Malden River	Surcharge-Submerged Invert	Evaluation Ongoing
Flow 5	DCR Spot Pond Brook	Base Flow	Evaluation Ongoing
Flow 6	Forestdale-Pine Banks Park	Base Flow	No Further Action
Flow 7	Wigglesworth Street	Groundwater-Illicit Discharge	Removed
Flow 8	Main Street	Water Line Leak	Removed
Flow 9	Pierce Street	Groundwater Breakout	No Further Action
Flow 10	Linden Brook	Base Flow	Evaluation Ongoing
Flow 11	LSP-4	Dry Weather Flow	Evaluation Ongoing
Flow 12	Kennedy Dr-Granada Highlands Apts.	Base Flow	No Further Action
Flow 13	Orchard Street	Dry Weather Flow	Evaluation Ongoing
Flow 14	Exchange Street	Intermittent Dry Weather Flow	Evaluation Ongoing
Flow 15	Lower Commercial Street	Dry Weather Flow	Evaluation Ongoing
Flow 16	Huntley Street	Dry Weather Flow	No Further Action
Flow 17	Goldcliff Road	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 18	Cherry & Gilbert Streets	Dry Weather Flow	Evaluation Ongoing
Flow 19	Sylvan Street	Dry Weather Flow	Evaluation Ongoing
Flow 20	First Street & Elwell Ave	Base Flow	No Further Action
Flow 21	Bowman Street	Base Flow	No Further Action
Flow 22	Springdale Street	Dry Weather Flow	No Further Action
Flow 23	Grant Street	Dry Weather Flow	Evaluation Ongoing
Flow 24	Wheeler Street	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 25	Revere Street	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 26	Kennedy Dr & Fairfield Avenue	Base Flow	No Further Action
Flow 27	Sharon Street	Process Water	No Further Action
Flow 28	Pleasant/Commercial/Exchange Sts.	Dry Weather Flow - Sewage	Removed
Flow 29	Summer Street	Base Flow	No Further Action

**Table 3.0 Dry Weather Conditions - E. coli Concentrations**

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Designation	E. coli (MPN/100ml) 30, 9223B ACTION LEVEL- 235 MPN/100ml								
	9/12/2013	9/24/2013	7/2/2014	11/5/2014	6/25/2015	7/14/2015	8/25/2015	9/29/2015	4/28/2016
	<b>Malden River</b>								
MR-0	980	-	-	-	-	-	-	-	NS-stagnent
MR-1	-	-	-	-	-	-	-	-	NS-stagnent
MR-3	-	-	-	-	-	-	-	-	NF
MR-4	-	-	-	-	-	-	-	-	8.6
MR-4.1	-	-	-	-	-	-	-	-	NF
MR-5	-	-	-	-	-	-	-	-	NF
MR-6	-	-	-	-	-	-	-	580	1.0
MR-6.1	-	-	-	-	-	-	-	-	NF
MR-7	-	-	-	-	-	-	-	-	NF
MR-8	292	-	-	-	-	-	-	-	5.2
MR-8.1	-	-	-	-	-	-	-	-	NF
MR-9	-	-	-	-	-	-	-	-	NF
MR-10	-	-	-	-	-	-	-	-	NF
MR-11	-	-	-	-	-	-	-	-	ND (2.0)
MR-11.1	-	-	-	-	-	-	-	-	NF
MR-12	-	-	-	-	-	-	-	-	-
MR-12.1	-	-	-	-	-	-	-	-	NF
MR-12.2	-	-	-	-	-	-	-	-	-
MR-13	-	-	-	-	-	-	-	-	-
LSP-0-Channel <sup>2</sup>	-	-	-	-	-	-	-	-	-
LSP-3	-	-	-	-	-	-	-	-	-
LSP-4	-	2,000	110,000	3,200	-	-	-	-	-
LSP-9	-	-	-	-	-	-	-	-	-
LSP-10-Channel <sup>2</sup>	-	-	-	-	-	-	-	-	-
CH-1	-	-	-	-	-	<1	-	-	-
C15-MH8.1	-	-	-	-	-	-	-	1,200	-
C46-MH19	-	-	-	-	500	-	-	-	-
E13-MH4 (Elrich)	-	2,000	-	-	-	-	-	-	-
E28-MH8	-	-	-	-	-	-	-	-	-
E28-SP1	-	-	-	-	-	-	-	-	-
E28-SP2	-	-	-	-	-	-	-	-	-
E28-MH1	-	-	-	-	-	19,000	140,000	>483,920	-
E28-MH2W	-	-	-	-	-	9,000	-	-	-
E28-MH2N	-	-	-	-	-	3.1	-	-	-
E28-MH4	-	-	-	-	-	4,500	-	-	-
E28-MH4A	-	-	-	-	-	-	-	-	-
E28BY-MH1	-	-	-	-	82,000	9,800	10,000	5,800	-
F26-MH3	-	-	-	-	-	6,700	>483,920	>483,920	-
NG-C1	-	-	-	-	-	-	-	-	-
P27-MH10	-	-	-	-	-	39	-	-	-
P27-MH12	-	-	-	-	-	-	27	-	-
S29-MH1	-	-	-	-	-	-	-	-	-
S29-MH3	-	-	-	-	-	-	-	-	-
S39-MH1	-	-	-	-	-	34	30	-	-
<b>Little Creek</b>									
LC-0	-	-	-	-	3,700	460	-	-	NS-stagnent
LC-N	-	-	-	-	2,400	-	-	-	NS-submerged
LC-S	-	-	-	-	-	-	-	-	NS-submerged
<b>Saugus Branch</b>									
MR-2	550	-	-	-	-	-	-	-	NS-stagnent
MR-2N	-	-	150	490	390	35	310	3,100	NS-stagnent
MR-2S	-	-	130	440	440	75	290	440	NS-stagnent
<b>Town Line Brook</b>									
TL-0 <sup>3</sup>	-	-	-	-	-	-	-	-	-
TL-3	-	-	-	-	-	-	-	-	-
TL-9	-	-	-	-	-	-	-	-	-
TL-13	-	-	-	-	-	-	-	-	-
B53-MH7	-	-	-	-	-	-	-	-	-
BP-MH3	-	-	-	-	-	-	-	-	-
S3-MH12 <sup>3</sup>	-	-	-	-	-	-	-	-	-
S14-MH4	-	-	ND (1.0)	4.1	-	-	-	-	-
<b>Linden Brook</b>									
B46-MH2	-	<1	-	-	-	-	-	-	-
C18-MH5	-	23,000	11,000	1,300	-	-	-	-	-
C36-MH1	-	-	-	-	-	-	-	-	-
D17-MH1	-	-	-	-	-	-	-	-	-
F1-MH4	-	-	-	-	-	-	-	-	-
F23-MH2	-	13	-	-	-	-	-	-	-
G36-MH2	-	-	1,700	290	-	-	-	-	-
H43-MH1	-	12	-	1,000	-	-	-	-	-
K6-MH1	-	-	-	-	-	-	-	-	-
L5-MH1	-	-	-	-	-	-	-	-	-
LBR-1	-	-	520	88	-	-	-	-	-
M31-MH1	-	12	-	-	-	-	-	-	-
O10-MH1	-	-	-	-	-	-	-	-	-
P24-MH1	-	-	-	-	-	-	-	-	-
S27-MH2	-	-	-	17	-	-	-	-	-
S45-MH4	-	-	-	8.5	-	-	-	-	-
V1-MH1	-	-	-	-	-	-	-	-	-
W26-MH1	-	-	-	-	-	-	-	-	-
W47-MH1	-	-	3,500	1,700	-	-	-	-	-

NS-not sampled

NF-no flow

- not evaluated

ND - None Detected above Reported Detection Limit  
(results in parentheses represent the detection limit)

Laboratory certificates contained within attachments

**Table 4.0 Wet Weather Conditions - E. coli Concentrations**

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Identification	E. coli (MPN/100ml)	
	30, 9223B	
	ACTION LEVEL- 235 MPN/100ml	
	11/30/2016	1/3/2017
<b>Malden River</b>		
BH-1	2,900	-
MR-0	NS-stagnent	-
MR-1	NS-stagnent	-
MR-3	NF	-
MR-4	180	-
MR-4.1	870	-
MR-5	190	-
MR-6	43	-
MR-6.1	NF	-
MR-7	NF	-
MR-8	7,000	-
MR-8.1	NF	-
MR-9	NF	-
MR-10	NF	-
MR-11	3.1	-
MR-11.1	NF	-
MR-12	-	-
MR-12.1	NF	-
MR-12.2	-	-
MR-13	-	-
Saint Mary St.	-	-
Fellsmere Pond	-	-
LSP-4	15,000	-
LSP-5.1-Channel	-	-
LSP-9	-	-
LSP-10-Channel	-	-
<b>Little Creek</b>		
LC-0	3,200	-
LC-N	NS-submerged	-
LC-S	NS-submerged	-
P12-MH10	-	-
<b>Saugus Branch</b>		
MR-2	-	-
MR-2N	4,600	-
MR-2S	4,900	-
Broadway/Eastern	-	-
<b>Town Line Brook</b>		
TL-0	-	-
TL-9	-	-
TL-13	-	-
TL-16	-	-
TL-24	-	-
TL-BL-EV	-	-
S3-MH12	-	-
<b>Linden Brook</b>		
C18-MH5	2,400	-
H43-MH1	260	-
LBR-1	480,000	2,000
W47-MH1	3,500	-

NS-not sampled

NF-no flow

- not evaluated

ND - None Detected above Reported Detection Limit  
(results in parentheses represent the detection limit)

Laboratory certificates contained within attachments.

**Table 5.0 Wet Weather Conditions - Ammonia Concentrations**

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Identification	Ammonia (ppm)
	11/30/2016
<b>Malden River</b>	
BH-1	-
MR-0	NS-stagnent
MR-1	NS-stagnent
MR-3	NF
MR-4	2
MR-4.1	0
MR-5	0
MR-6	4
MR-6.1	NF
MR-7	NF
MR-8	0
MR-8.1	NF
MR-9	NF
MR-10	NF
MR-11	6
MR-11.1	NF
MR-12	-
MR-12.1	NF
MR-12.2	-
MR-13	-
LSP-4	-
LSP-9	-
<b>Little Creek</b>	
LC-0	0
LC-N	NS-submerged
LC-S	NS-submerged
P12-MH10	-
<b>Saugus Branch</b>	
MR-2	-
MR-2N	0.5
MR-2S	0.5
<b>Linden Brook</b>	
C18-MH5	1
H43-MH1	0
LBR-1	6
W47-MH1	1

Samples field analyzed using  
Hach Ammonia (Nitrogen) Test Strips (0-6.0 ppm).  
NS-not sampled  
NF-no flow  
- not evaluated

**Table 6.0 Malden River Boat House - E. Coli Concentrations**

Site Location, Malden River - Malden, MA

Sample Description: Water

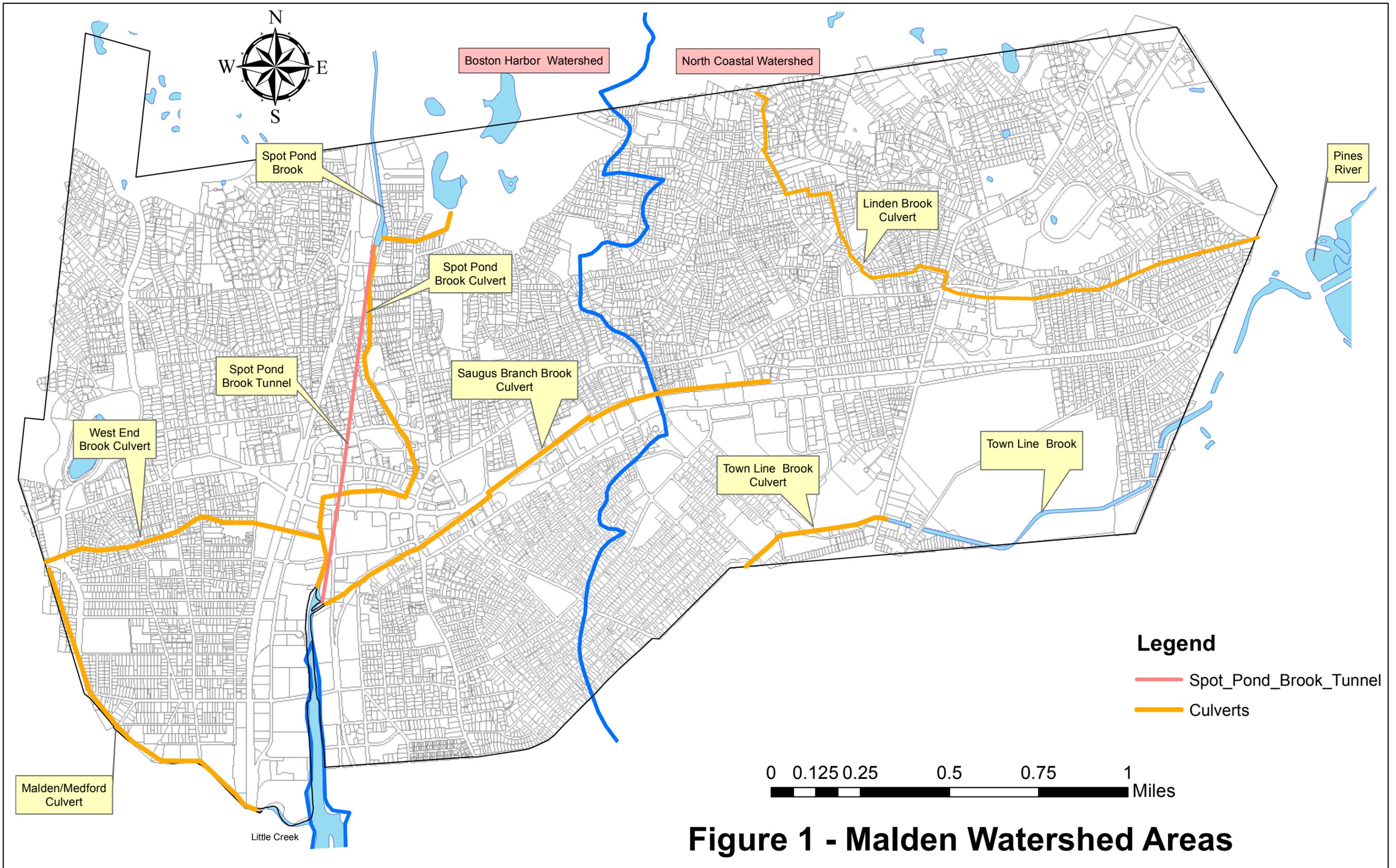
Sample Designation	E. coli (MPN/100ml) 9223B ACTION LEVEL- 235 MPN/100ml						
	4/19/2016	4/28/2016	7/7/2016	10/4/2016	11/30/2016	7/12/2017	9/8/2017
	<b>Sample Collection Time</b>	12:45	11:45	13:00	13:15	7:25	12:00
<b>Time Elapsed from Rain Event</b>	6.45 hrs	46.5 hrs	51.5 hrs	53 hrs	10.8 hrs	26 hrs	33 hrs
<b>Rainfall Amount</b>	0.02"	0.27"	0.34"	0.03"	0.42"	0.40"	0.46"
BH-1	210	290	47	140	2,900	650	2,400

File No. 465.09

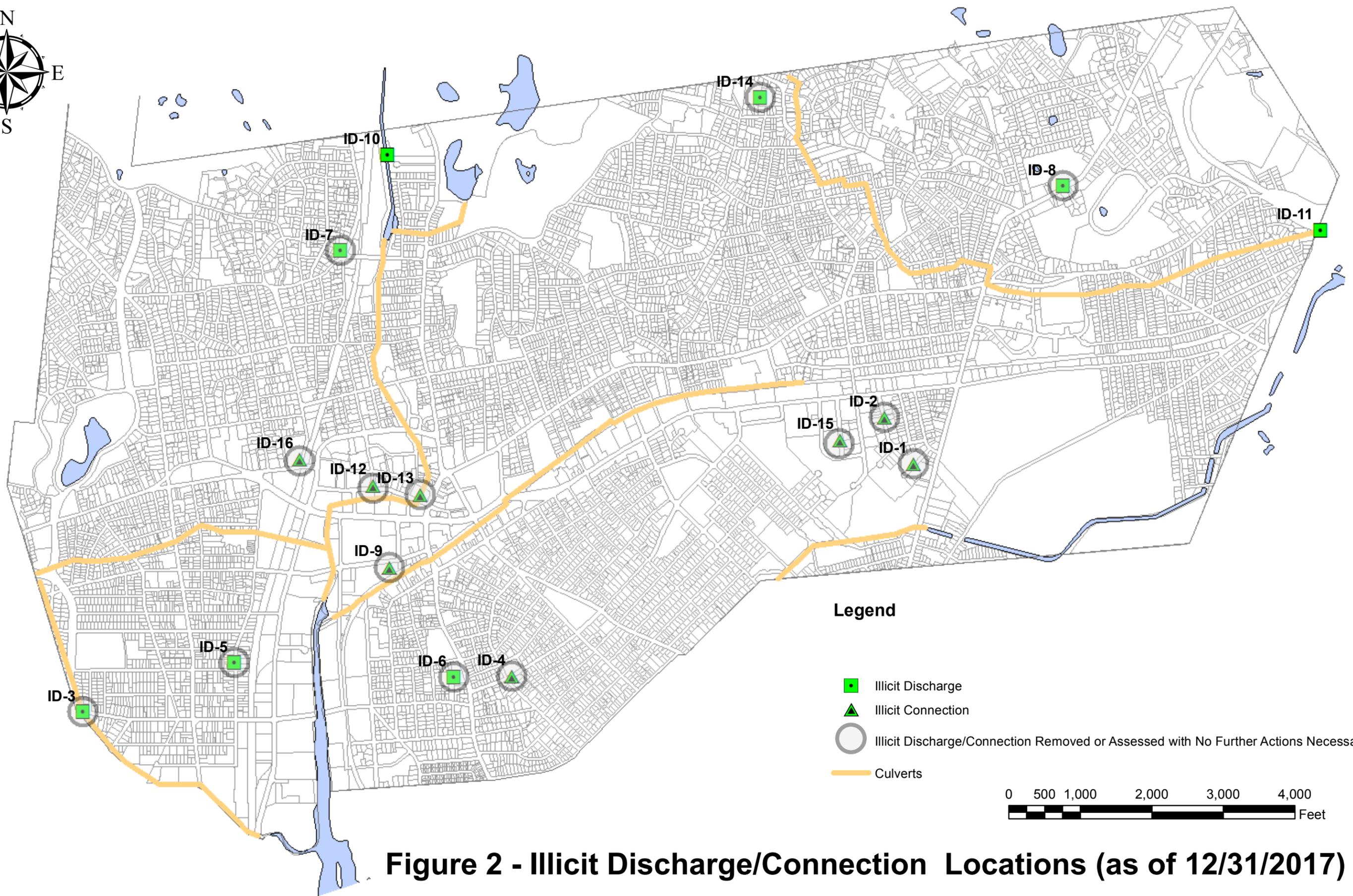
Laboratory certificates contained within attachments.

# FIGURES

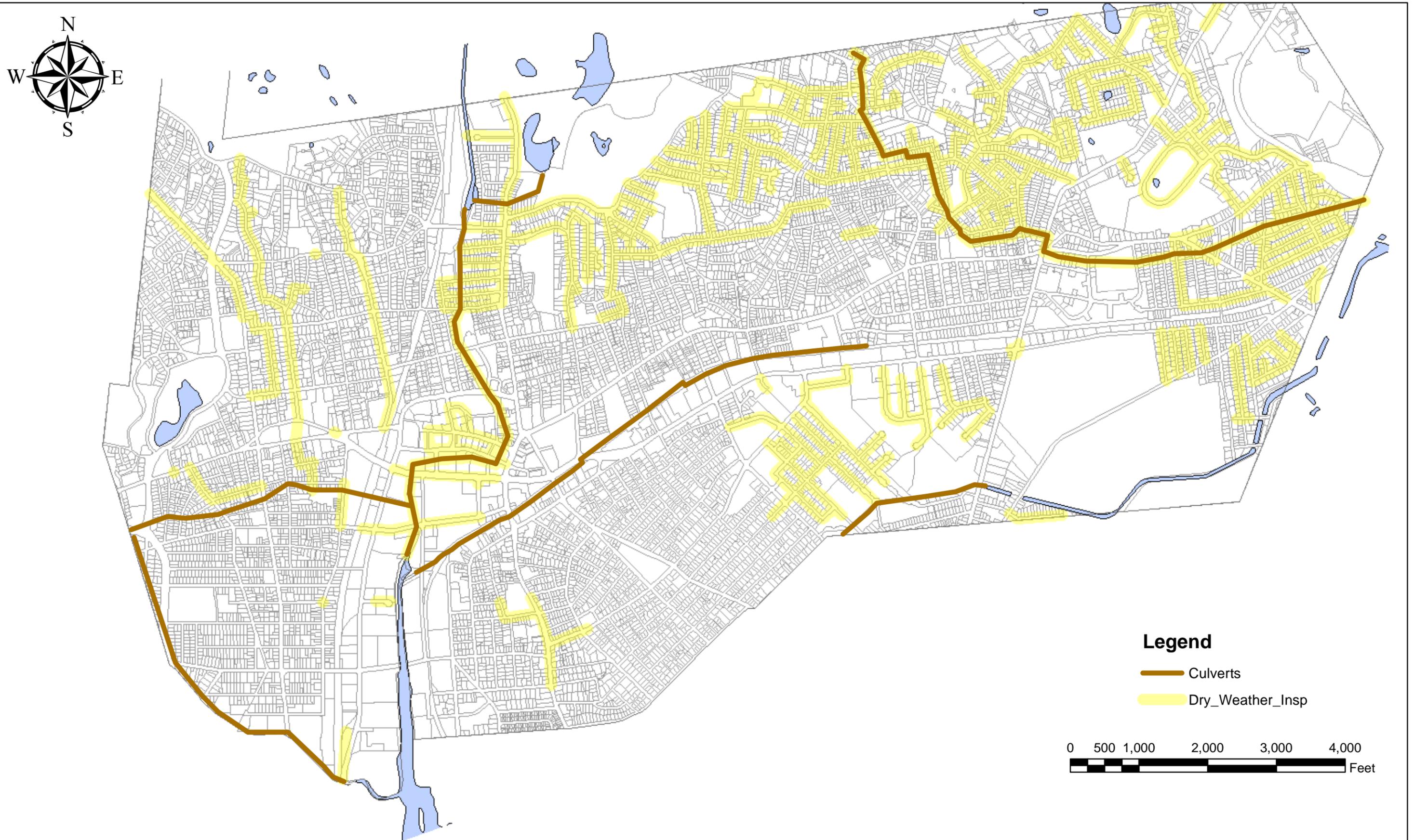
Environmental Engineering and Land Use Planning



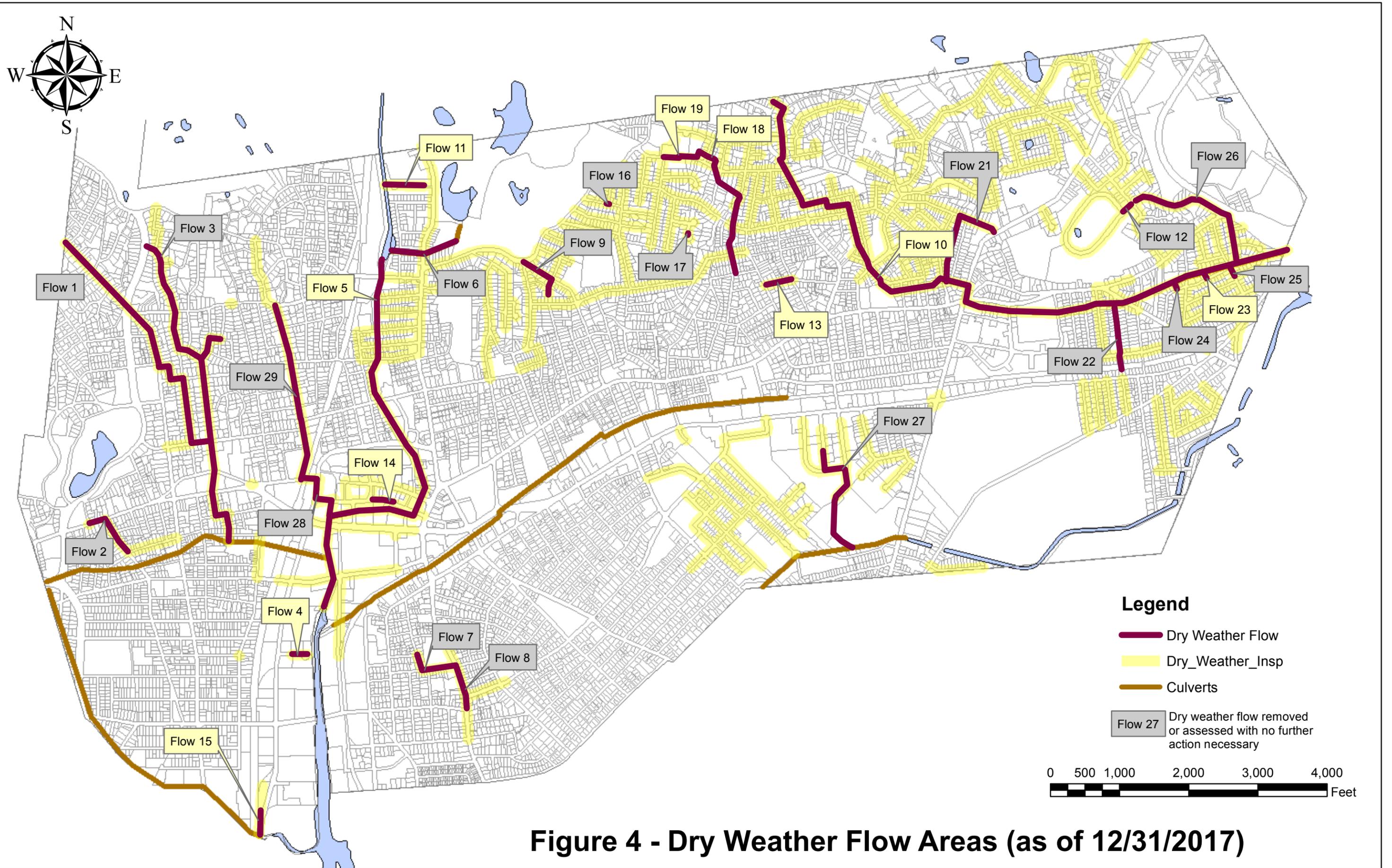
**Figure 1 - Malden Watershed Areas**



**Figure 2 - Illicit Discharge/Connection Locations (as of 12/31/2017)**



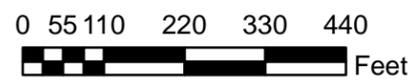
**Figure 3 - Dry Weather Inspection Areas (as of 12/31/2017)**



**Figure 4 - Dry Weather Flow Areas (as of 12/31/2017)**

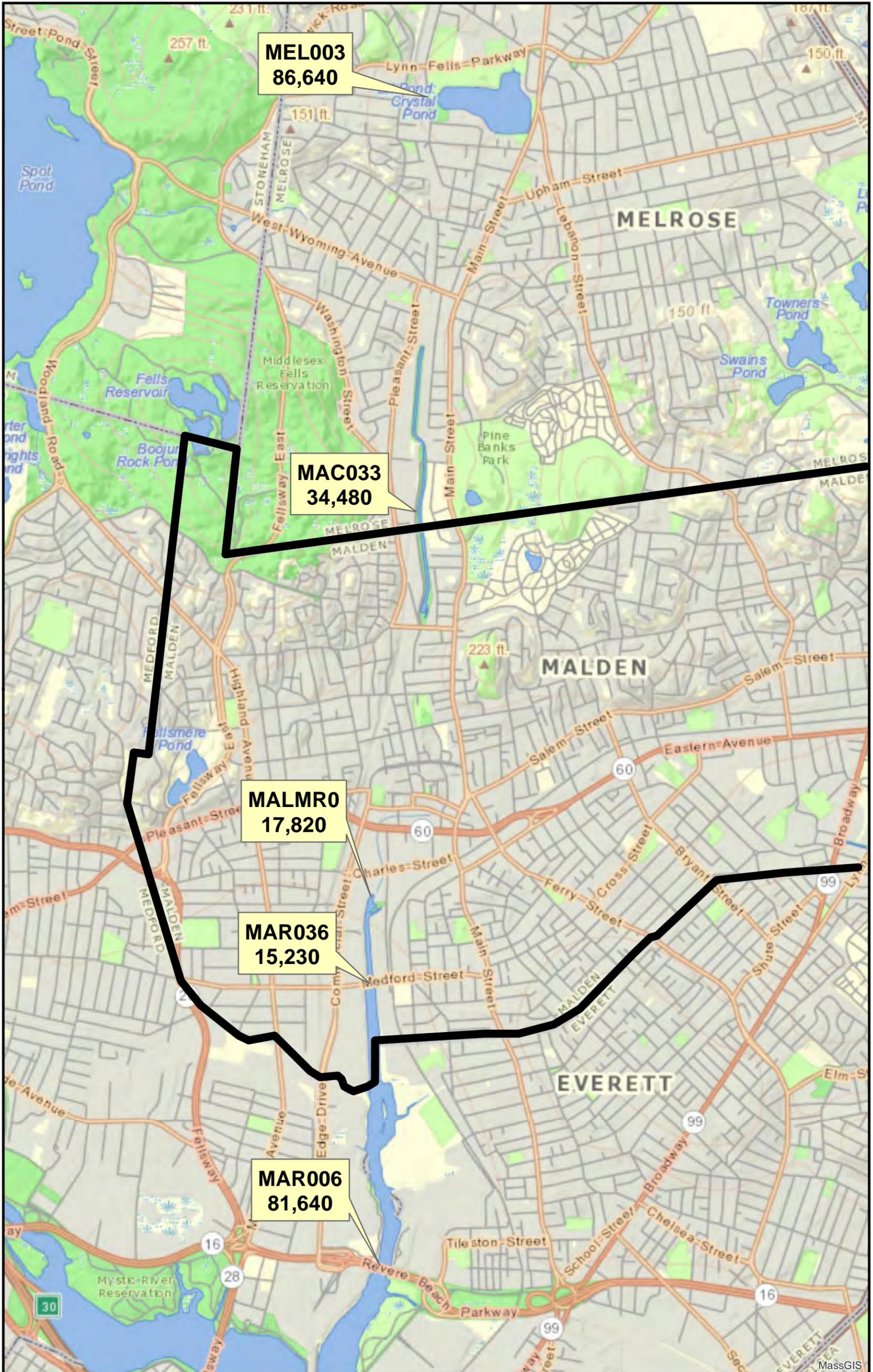


**Figure 5 - Malden River Outfalls**





**Figure 6 - Lower Spot Pond Brook Outfalls**



**June 1, 2015 Wet Weather Sampling E. Coli Results (MPN/100 ML)**

Data collected by MyRWA and presented in July 10, 2015 Bacterial Assessment Report



Figure 7



**Figure 8 - Town Line Brook Outfalls**



**NANGLE CONSULTING ASSOCIATES, INC.**  
 Environmental Engineering and Land Use Planning  
 45 Dan Road • Suite 115 • Canton • Massachusetts 02021

**Figure 9 - Dry and Wet Weather Sampling Program-Linden Brook**  
 MALDEN, MASSACHUSETTS



# ATTACHMENT A

Environmental Engineering and Land Use Planning



## ANALYTICAL REPORT

Lab Number:	L1723704
Client:	Nangle Consulting Associates 45 Dan Road Suite 115 Canton, MA 02021
ATTN:	Chuck Altobello
Phone:	(781) 821-0521
Project Name:	CITY OF MALDEN
Project Number:	465.09
Report Date:	07/18/17

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

---

Eight Walkup Drive, Westborough, MA 01581-1019  
508-898-9220 (Fax) 508-898-9193 800-624-9220 - [www.alphalab.com](http://www.alphalab.com)



**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

<b>Alpha Sample ID</b>	<b>Client ID</b>	<b>Matrix</b>	<b>Sample Location</b>	<b>Collection Date/Time</b>	<b>Receive Date</b>
L1723704-01	BH-1	WATER	MALDEN, MA	07/12/17 12:00	07/12/17

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

### Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

#### HOLD POLICY

For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

### Case Narrative (continued)

#### Sample Receipt

The samples were received at the laboratory above the required temperature range. The samples were transported to the laboratory in a cooler with ice and delivered directly from the sampling site.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:

 Amita Naik

Title: Technical Director/Representative

Date: 07/18/17

# **INORGANICS & MISCELLANEOUS**

Project Name: CITY OF MALDEN

Project Number: 465.09

Lab Number: L1723704

Report Date: 07/18/17

**SAMPLE RESULTS**

Lab ID: L1723704-01

Client ID: BH-1

Sample Location: MALDEN, MA

Matrix: Water

Date Collected: 07/12/17 12:00

Date Received: 07/12/17

Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	650		MPN/100ml	1.0	NA	1	-	07/12/17 15:45	121,9223B	AJ



**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

**Method Blank Analysis**  
**Batch Quality Control**

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab for sample(s): 01 Batch: WG1021896-1										
E. Coli (MPN)	<1		MPN/100ml	1	NA	1	-	07/12/17 15:45	121,9223B	AJ

**Project Name:** CITY OF MALDEN

**Project Number:** 465.09

Serial\_No:07181720:40

**Lab Number:** L1723704

**Report Date:** 07/18/17

**Sample Receipt and Container Information**

Were project specific reporting limits specified?

YES

**Cooler Information**

**Cooler**                      **Custody Seal**

A                                      Absent

**Container Information**

<b>Container ID</b>	<b>Container Type</b>	<b>Cooler</b>	<b>Initial pH</b>	<b>Final pH</b>	<b>Temp deg C</b>	<b>Pres</b>	<b>Seal</b>	<b>Frozen Date/Time</b>	<b>Analysis(*)</b>
L1723704-01A	Bacteria Cup Na2S2O3 preserved	A	NA		17.6	Y	Absent		E-COLI-QT(.33)
L1723704-01B	Bacteria Cup Na2S2O3 preserved	A	NA		17.6	Y	Absent		E-COLI-QT(.33)

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

## GLOSSARY

### Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

### Footnotes

- 1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

### Terms

**Analytical Method:** Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

**Final pH:** As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

**Frozen Date/Time:** With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

**Initial pH:** As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

**Total:** With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

### Data Qualifiers

- A** - Spectra identified as "Aldol Condensation Product".
- B** - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related

Report Format: Data Usability Report



**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

#### Data Qualifiers

projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

- C** - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.
- D** - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
- E** - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
- G** - The concentration may be biased high due to matrix interferences (i.e. co-elution) with non-target compound(s). The result should be considered estimated.
- H** - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.
- I** - The lower value for the two columns has been reported due to obvious interference.
- M** - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.
- NJ** - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.
- P** - The RPD between the results for the two columns exceeds the method-specified criteria.
- Q** - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)
- R** - Analytical results are from sample re-analysis.
- RE** - Analytical results are from sample re-extraction.
- S** - Analytical results are from modified screening analysis.
- J** - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).
- ND** - Not detected at the reporting limit (RL) for the sample.

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

## REFERENCES

- 121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

## LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.



## Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

### Westborough Facility

**EPA 624:** m/p-xylene, o-xylene

**EPA 8260C:** NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.

**EPA 8270D:** NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.

**EPA 300:** DW: Bromide

**EPA 6860:** NPW and SCM: Perchlorate

**EPA 9010:** NPW and SCM: Amenable Cyanide Distillation

**EPA 9012B:** NPW: Total Cyanide

**EPA 9050A:** NPW: Specific Conductance

**SM3500:** NPW: Ferrous Iron

**SM4500:** NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO<sub>2</sub>, NO<sub>3</sub>.

**SM5310C:** DW: Dissolved Organic Carbon

### Mansfield Facility

**SM 2540D:** TSS

**EPA 3005A** NPW

**EPA 8082A:** NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.

**EPA TO-15:** Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene,

3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.

**Biological Tissue Matrix:** EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

### Westborough Facility:

#### Drinking Water

**EPA 300.0:** Nitrate-N, Fluoride, Sulfate; **EPA 353.2:** Nitrate-N, Nitrite-N; **SM4500NO3-F:** Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500CI-D, SM2320B, SM2540C, SM4500H-B**

**EPA 332:** Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.

**Microbiology:** **SM9215B; SM9223-P/A, SM9223B-Colilert-QT, SM9222D.**

#### Non-Potable Water

**SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH, EPA 350.1:** Ammonia-N, **LACHAT 10-107-06-1-B:** Ammonia-N, **SM4500NO3-F, EPA 353.2:** Nitrate-N, **EPA 351.1, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D.**

**EPA 624:** Volatile Halocarbons & Aromatics,

**EPA 608:** Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs

**EPA 625:** SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045:** PCB-Oil.

**Microbiology:** **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

### Mansfield Facility:

#### Drinking Water

**EPA 200.7:** Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1 Hg.**

#### Non-Potable Water

**EPA 200.7:** Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.

**EPA 200.8:** Al, Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn.

**EPA 245.1 Hg.**

**SM2340B**

For a complete listing of analytes and methods, please contact your Alpha Project Manager.





## ANALYTICAL REPORT

Lab Number:	L1731750
Client:	Nangle Consulting Associates 45 Dan Road Suite 115 Canton, MA 02021
ATTN:	Chuck Altobello
Phone:	(781) 821-0521
Project Name:	CITY OF MALDEN
Project Number:	465.09
Report Date:	09/14/17

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Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

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508-898-9220 (Fax) 508-898-9193 800-624-9220 - [www.alphalab.com](http://www.alphalab.com)



**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1731750  
**Report Date:** 09/14/17

<b>Alpha Sample ID</b>	<b>Client ID</b>	<b>Matrix</b>	<b>Sample Location</b>	<b>Collection Date/Time</b>	<b>Receive Date</b>
L1731750-01	BH-1	WATER	MALDEN, MA	09/08/17 13:30	09/08/17

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1731750  
**Report Date:** 09/14/17

### Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

#### HOLD POLICY

For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1731750  
**Report Date:** 09/14/17

### Case Narrative (continued)

#### Sample Receipt

The sample was received at the laboratory above the required temperature range. The sample was transported to the laboratory in a cooler with ice and delivered directly from the sampling site.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:

 Cristin Walker

Title: Technical Director/Representative

Date: 09/14/17

# **INORGANICS & MISCELLANEOUS**

Project Name: CITY OF MALDEN

Project Number: 465.09

Lab Number: L1731750

Report Date: 09/14/17

## SAMPLE RESULTS

Lab ID: L1731750-01

Client ID: BH-1

Sample Location: MALDEN, MA

Matrix: Water

Date Collected: 09/08/17 13:30

Date Received: 09/08/17

Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	2400		MPN/100ml	1.0	NA	1	-	09/08/17 18:15	121,9223B	CW



**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1731750  
**Report Date:** 09/14/17

**Method Blank Analysis**  
**Batch Quality Control**

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab for sample(s): 01 Batch: WG1039893-1										
E. Coli (MPN)	<1		MPN/100ml	1	NA	1	-	09/08/17 18:15	121,9223B	CW

**Project Name:** CITY OF MALDEN

**Project Number:** 465.09

Serial\_No:09141721:34

**Lab Number:** L1731750

**Report Date:** 09/14/17

**Sample Receipt and Container Information**

Were project specific reporting limits specified?

YES

**Cooler Information**

**Cooler**                      **Custody Seal**

A                                      Absent

**Container Information**

<b>Container ID</b>	<b>Container Type</b>	<b>Cooler</b>	<b>Initial pH</b>	<b>Final pH</b>	<b>Temp deg C</b>	<b>Pres</b>	<b>Seal</b>	<b>Frozen Date/Time</b>	<b>Analysis(*)</b>
L1731750-01A	Bacteria Cup Na2S2O3 preserved	A	NA		18.2	Y	Absent		E-COLI-QT(.33)
L1731750-01B	Bacteria Cup Na2S2O3 preserved	A	NA		18.2	Y	Absent		E-COLI-QT(.33)

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1731750  
**Report Date:** 09/14/17

## GLOSSARY

### Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

### Footnotes

- 1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

### Terms

**Analytical Method:** Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

**Final pH:** As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

**Frozen Date/Time:** With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

**Initial pH:** As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

**Total:** With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

### Data Qualifiers

- A** - Spectra identified as "Aldol Condensation Product".
- B** - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related

**Report Format:** Data Usability Report



**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1731750  
**Report Date:** 09/14/17

#### Data Qualifiers

projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

- C** - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.
- D** - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
- E** - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
- G** - The concentration may be biased high due to matrix interferences (i.e. co-elution) with non-target compound(s). The result should be considered estimated.
- H** - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.
- I** - The lower value for the two columns has been reported due to obvious interference.
- M** - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.
- NJ** - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.
- P** - The RPD between the results for the two columns exceeds the method-specified criteria.
- Q** - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)
- R** - Analytical results are from sample re-analysis.
- RE** - Analytical results are from sample re-extraction.
- S** - Analytical results are from modified screening analysis.
- J** - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).
- ND** - Not detected at the reporting limit (RL) for the sample.

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1731750  
**Report Date:** 09/14/17

## REFERENCES

- 121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

## LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.



## Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

### Westborough Facility

**EPA 624:** m/p-xylene, o-xylene

**EPA 8260C:** NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.

**EPA 8270D:** NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.

**EPA 300:** DW: Bromide

**EPA 6860:** NPW and SCM: Perchlorate

**EPA 9010:** NPW and SCM: Amenable Cyanide Distillation

**EPA 9012B:** NPW: Total Cyanide

**EPA 9050A:** NPW: Specific Conductance

**SM3500:** NPW: Ferrous Iron

**SM4500:** NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO<sub>2</sub>, NO<sub>3</sub>.

**SM5310C:** DW: Dissolved Organic Carbon

### Mansfield Facility

**SM 2540D:** TSS

**EPA 3005A** NPW

**EPA 8082A:** NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.

**EPA TO-15:** Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene,

3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.

**Biological Tissue Matrix:** EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

### Westborough Facility:

#### Drinking Water

**EPA 300.0:** Nitrate-N, Fluoride, Sulfate; **EPA 353.2:** Nitrate-N, Nitrite-N; **SM4500NO3-F:** Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500CI-D, SM2320B, SM2540C, SM4500H-B**

**EPA 332:** Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.

**Microbiology:** **SM9215B; SM9223-P/A, SM9223B-Colilert-QT, SM9222D.**

#### Non-Potable Water

**SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH, EPA 350.1:** Ammonia-N, **LACHAT 10-107-06-1-B:** Ammonia-N, **SM4500NO3-F, EPA 353.2:** Nitrate-N, **EPA 351.1, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D.**

**EPA 624:** Volatile Halocarbons & Aromatics,

**EPA 608:** Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs

**EPA 625:** SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045:** PCB-Oil.

**Microbiology:** **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

### Mansfield Facility:

#### Drinking Water

**EPA 200.7:** Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1 Hg.**

#### Non-Potable Water

**EPA 200.7:** Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.

**EPA 200.8:** Al, Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn.

**EPA 245.1 Hg.**

**SM2340B**

For a complete listing of analytes and methods, please contact your Alpha Project Manager.



# **CITY OF MALDEN**

## **Illicit Discharge Detection and Elimination Program Semi-Annual Status Report**

January 1, 2017 – June 30, 2017

Prepared by:

**Nangle Consulting Associates, Inc.**  
45 Dan Road – Suite 115  
Canton, MA 02021

and

**City of Malden Engineering Department**  
200 Pleasant Street  
Malden, Massachusetts

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Table 2.0	Summary of Dry Weather Flows Identified as of 6/30/2017
Table 3.0	Summary of Dry Weather Conditions – E. coli Concentrations
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Table 5.0	Summary of Wet Weather Conditions – Ammonia Concentrations
Table 6.0	Malden River Boat House – E. coli Concentrations

## **ATTACHMENTS**

Attachment A	Laboratory Certificates
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## **FIGURES**

- Figure 1 Watershed Areas
- Figure 2 Illicit Discharge/Connection Locations
- Figure 3 Dry Weather Inspection Areas
- Figure 4 Dry Weather Flow Map
- Figure 5 Malden River Outfalls
- Figure 6 Lower Spot Pond Brook Outfalls
- Figure 7 MyRWA Wet Weather Sampling Results
- Figure 8 Town Line Brook Outfalls
- Figure 9 Dry & Wet Weather Sampling Program  
Linden Brook Culvert

## 1.0 INTRODUCTION

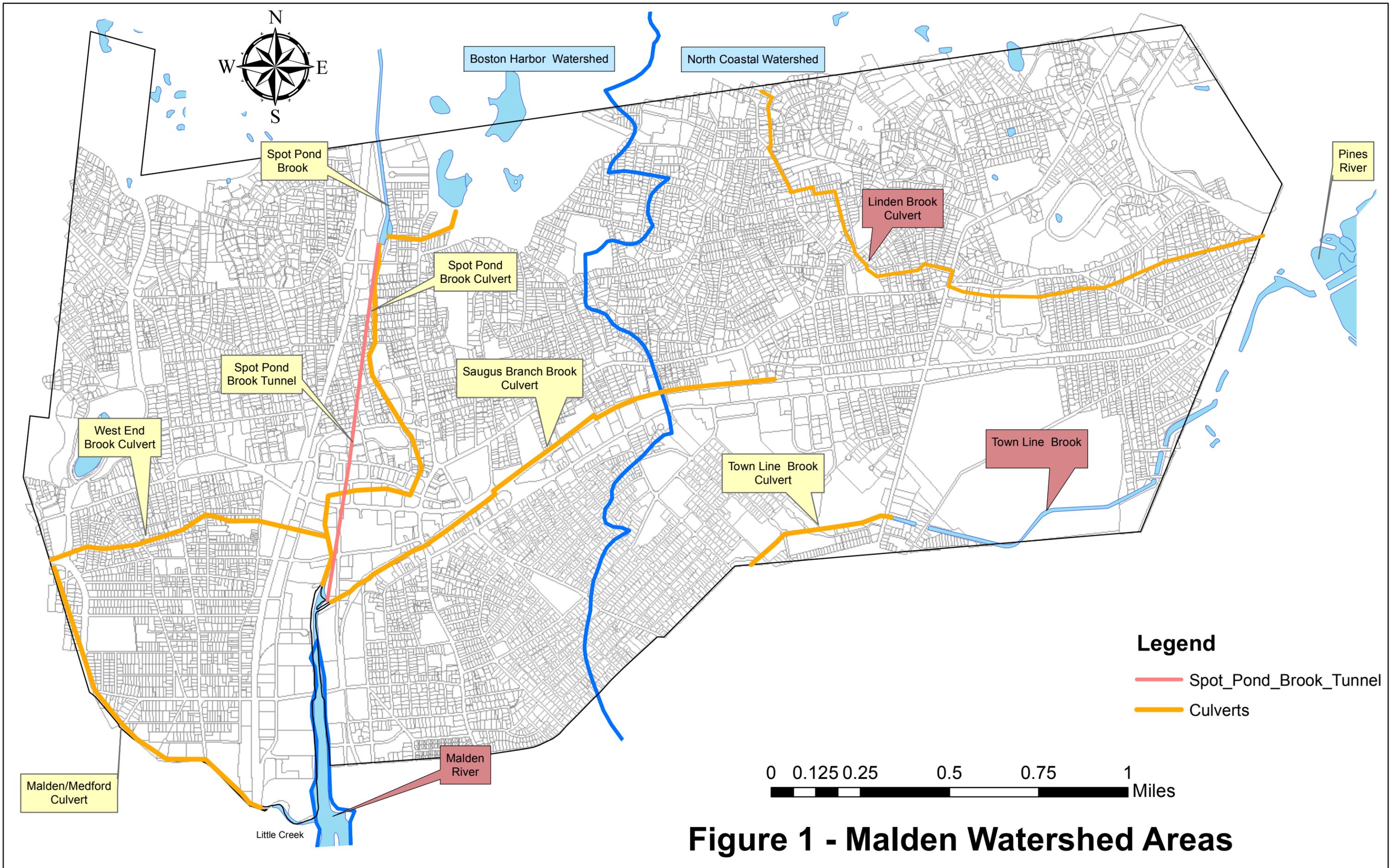
In June of 2009, the City of Malden developed its Illicit Discharge Detection and Elimination (IDDE) program to address issues associated with a municipal drainage and sewage infrastructure whose origin dates back to the mid to late 1800s. Once replied upon to support the expansion of early American Industry, particularly within the Malden River watershed, this aging infrastructure has been the focus of significant efforts by the City to improve the quality of stormwater flows to tributary receiving waters. Through flow isolation studies, removal of illicit/illegal discharges, lining of major sewage trunk lines and the timely repair of infrastructure deficiencies, the City has significantly advanced the goals and objectives of its IDDE program. This submittal has been prepared to summarize those activities that have been undertaken between January 1<sup>st</sup> through June 30 2017, and key tasks proposed for completion during the next reporting period.

The City of Malden's IDDE plan was developed to facilitate the implementation of a systematic and iterative procedure for the identification of potential illicit discharges or illicit connections and timely repairs to the storm drainage infrastructure, with the overall goal of improving surface water quality within the City of Malden. This semi-annual status report has been prepared through the cooperative efforts of the City of Malden Engineering Department, the City of Malden Department of Public Works (MDPW) and Nangle Consulting Associates, Inc. (NCA) to document key program tasks completed during this reporting period.

There are three (3) primary watersheds that contribute to the conveyance of dry weather and stormwater flows through the City of Malden. These are referred to as the Malden River, Town Line Brook, and Linden Brook watersheds whose approximate configuration maybe referenced from Figure 1. In addition, as a "flow through" community, stormwater and base flow containing bacteria is also conveyed through the City of Malden's drainage infrastructure from upstream neighboring communities.

The foundation for successful IDDE plan implementation has been developed through comprehensive Community Outreach, and efforts by the Stormwater Compliance Team (SCT) and local enforcement measures. Since its inception, the City's IDDE program has identified and removed illicit discharges/connections to the municipal drainage system, reduced significant potable water losses due to the detection of leakages, enforced Best Management Practices (BMPs)/stormwater ordinances and completed significant repairs to components of the drainage infrastructure. Support for these activities has been achieved through the development of a City wide GIS Mapping of the municipal drainage and sewage infrastructure; implementation of a comprehensive catch basin cleaning, inventory and repair program; mass balance flow isolation studies; dry and wet weather sampling; dye testing and comprehensive infiltration/inflow studies followed by in-situ lining of major trunk line and camera surveys in identified areas.

It is to be noted that the initial drainage infrastructure for the City was installed, by design, to reduce flooding and assist in the conveyance of surface waters through the City to downstream outfalls that discharge coastal waters. Further, the relationship between age of the infrastructure and increased bacterial loadings are particularly evident during wet weather sampling events within older neighborhoods that grew from the extensive industrial operations along the Malden River. To address the constraints associated with this infrastructure, the City Engineering and



**Figure 1 - Malden Watershed Areas**

MDPW, supplemented by outside technical assistance, have developed a program that integrates the implementation of the IDDE Plan into the routine daily work practices. This has led to the identification of infrastructure deficiencies and enabled the timely repair of potential flow and related water quality concerns.

A major example of successful IDDE Plan implementation was the identification of a significant illicit discharge connection in June of 2016, within the area of Pleasant and Exchange Streets, in response to the results of dry weather sampling and mass balance flow isolation studies. As discussed in the last IDDE Status Report, the illicit connection of eleven (11) residential apartments to a roof drain riser that discharged to the municipal drainage system has been removed. This connection was made at the time of original building construction and its identification and removal speaks to the importance and effectiveness of the City of Malden IDDE program.

As stated above, this report has been prepared to document and summarize IDDE activities that have been undertaken by the City during the January 2017 through June 2017 reporting period. Included within this scope of work was the performance of a wet weather sampling event at the outfall at Linden Brook, referred to as LBR-1, located in the City of Revere in January of 2017. While dry weather sampling efforts were planned during this past reporting period, precipitation events prior to targeted sampling events prevented implementation. In addition, continued sampling of the Malden River after design rainfall events has been performed to support the guidance protocols that have been developed for crew rowing activities upon the river.

With respect to the above, the City of Malden, through its redevelopment agency (The Malden Redevelopment Authority) has worked closely with representatives of the Athletic Department, the Malden Board of Health and MyRWA to develop protocols for crew activities upon the Malden River following significant wet weather events. Specific details pertaining to this guidance, as well as other activities conducted this reporting period is presented in Section 3.0 of this report. The data and information obtained during this reporting period also serves as the basis for tasks to be completed during the next 6 month period.

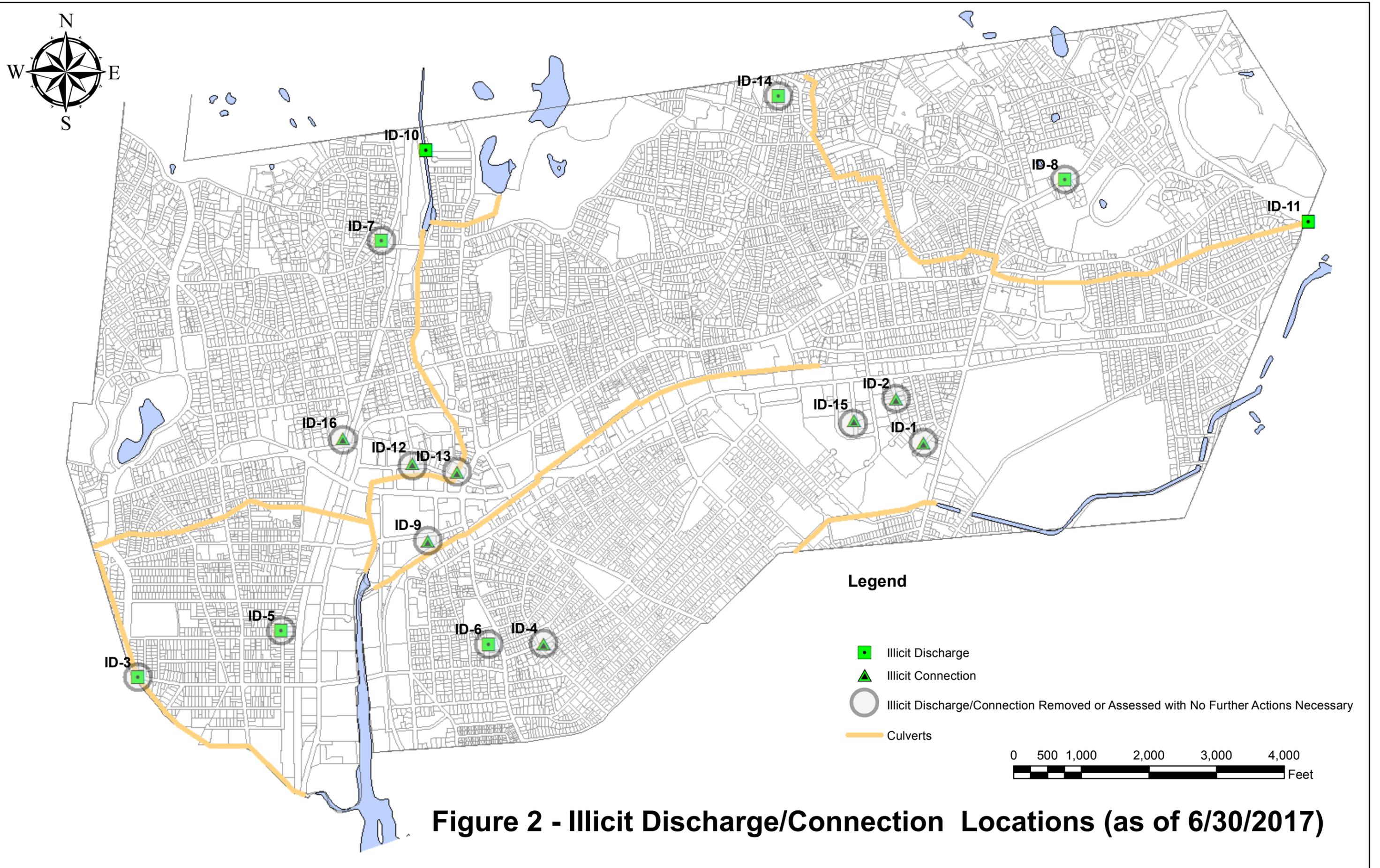
## **2.0 DOCUMENTED ILLICIT DISCHARGES AND CONNECTIONS**

During this reporting period, no illicit discharges/connections were identified. A summary of the illicit discharges/connections identified to date is presented on Figure 2 and Table 1.0.

## **3.0 OVERVIEW OF IDDE ACTIVITIES (JANUARY 2017 – JUNE 2017)**

In addition to outfall sampling, the City of Malden's IDDE Program incorporates the use of three (3) primary measures to identify and mitigate illicit discharges to its municipal drainage system, which may be described as follows:

- (1) Targeted dry/wet weather inspections and sampling by representatives of the Stormwater Compliance Team.



**Figure 2 - Illicit Discharge/Connection Locations (as of 6/30/2017)**

- (2) Detailed inspection of the municipal infrastructure during the daily implementation of the catch basin clean-out and drainage system mapping program.
- (3) Response to public, private or governmental agencies reports of possible sudden and/or identified discharge to the municipal storm system.

To provide a basis for the iterative inspection program and the observations recorded during this reporting period, the following excerpt from the City's IDDE work plan describes the methods and prioritization procedure maintained for this ongoing mitigation measure;

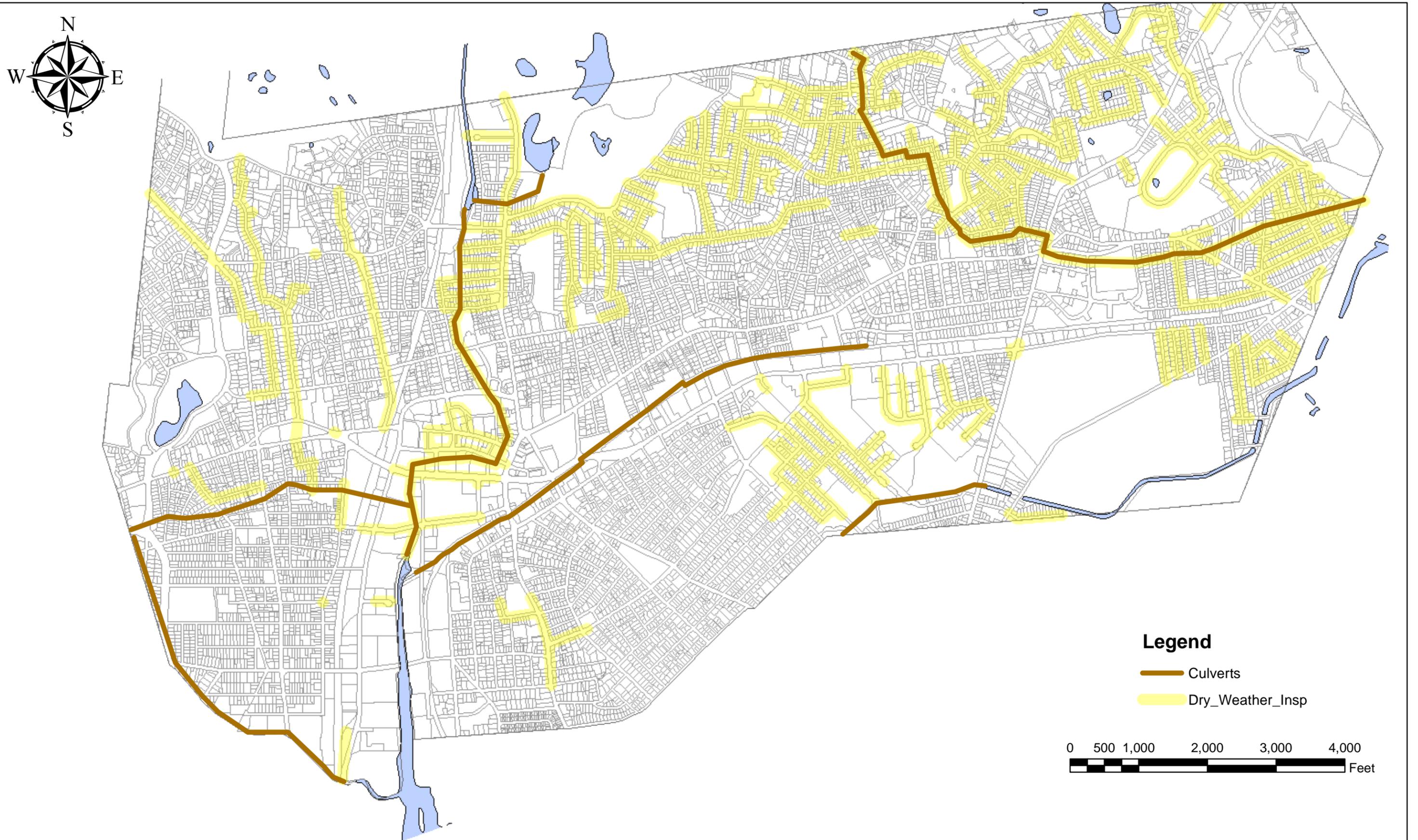
- Based upon the initial outfall monitoring data obtained, the City is currently implementing a Rapid-Assessment Prioritization approach through the targeted assessment of dry-weather flows in several areas within the City. Specifically the major tributaries to the most significant volume dry weather discharges to the Town Line Brook and the Malden River have been identified and sampled at key junction locations to initially determine the dry weather contributions from adjacent communities through major flood control infrastructure that is routed through the City of Malden.

Although no dry weather sampling was conducted during this reporting period, a comprehensive dry weather sampling event was conducted on all accessible Malden River outfalls in April of 2016. As stated above, the information obtained through the City's outfall sampling program, together with surface water quality data obtained by others, continues to be shared between the City, public and private educational officials, the local community and Mystic River Watershed Association (MyRWA) to develop safety/guidance protocols for recreational uses on the Malden River.

By design, observations recorded during the system inspections, together with the results of infrastructure sampling, serve as the basis for ongoing work plan tasks and updates to the original IDDE plan. Accordingly, the IDDE program maintained by the City is regarded as an ongoing and iterative effort that has successfully demonstrated the capability to quickly respond to water quality issues as needs and concerns are identified. Since the initial implementation of the IDDE Plan, public outreach, postings of signage, daily work practices, interdepartmental meetings and local permitting processes have served to promote and understand the need for appropriate responses to illicit discharges. Contact information is readily available through a variety of media, including mailings and web site postings to ensure implementation of appropriate response measures by members of the Stormwater Compliance Team. The current municipal leadership has made a significant effort to increase public awareness and participation through increased integration of digital and electronic media into daily practices. Public outreach has also included active participation by the Compliance Team through community workshops, educational presentations and regional watershed meetings.

### **3.1 Targeted Dry Weather Inspection/Sampling Program (NCA)**

Historically, areas selected for inspection were generally based upon the results of the outfall sampling program and/or the identification of dry weather flows by MDPW staff during their routine maintenance and infrastructure locating program. As described in further detail in Section 3.1.1, the City continues to share sampling results with MyRWA and has performed targeted sampling events to investigate discharges to outfalls that have been sampled by MyRWA. A map depicting the approximate locations where targeted dry weather inspections have been conducted by NCA to date is presented as Figure 3. In addition, the drainage infrastructure is also



**Figure 3 - Dry Weather Inspection Areas (as of 6/30/2017)**

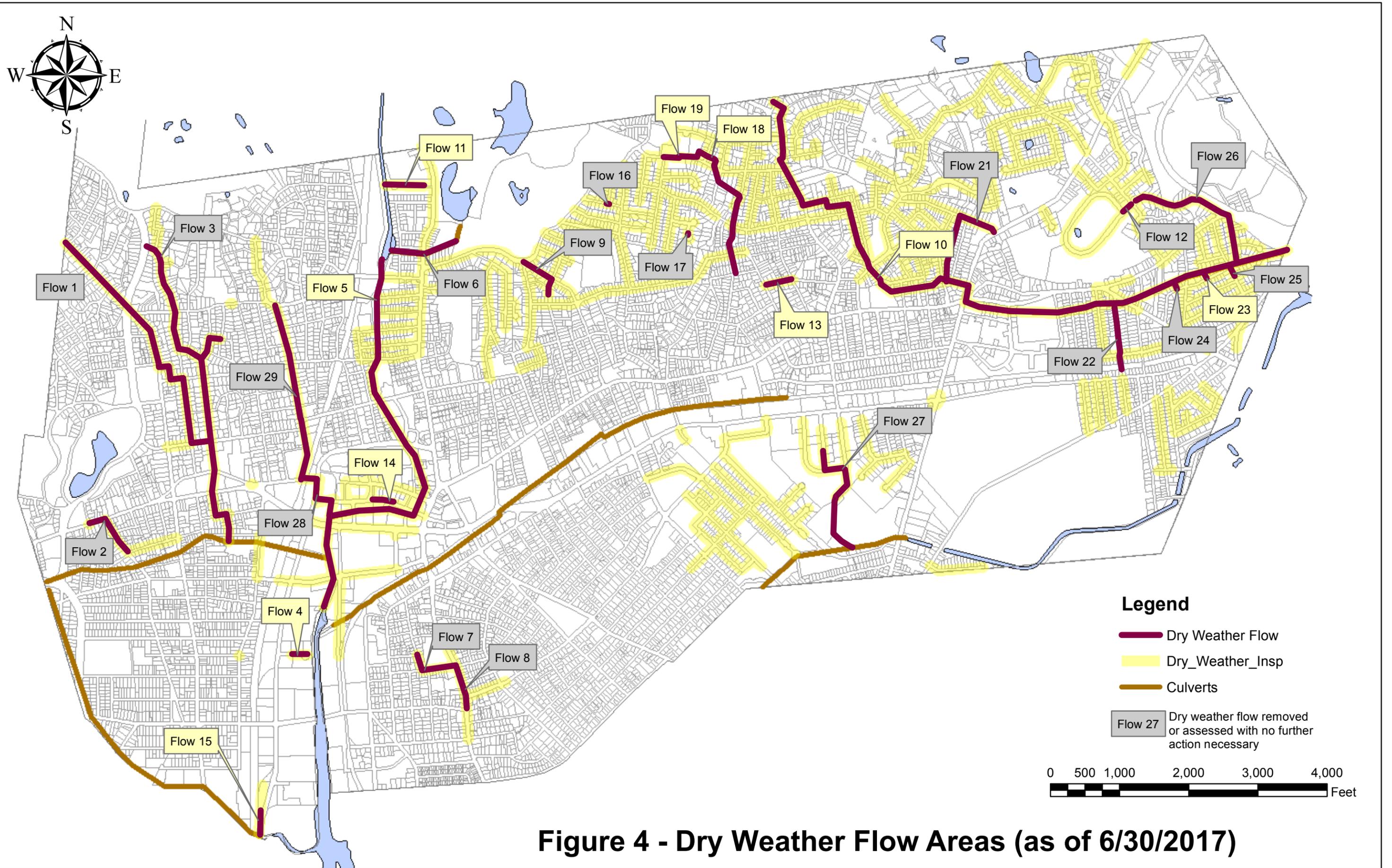
inspected by the MDPW during the catch basin cleaning program. Upon the identification of previously unknown dry weather flows, the Engineering Department and NCA are immediately notified by MDPW personnel and targeted mass balance sampling efforts are performed. During dry weather inspections completed under the IDDE program, various dry weather flows have been identified. A summary of these flows within the municipal system that have been identified to date are shown on Table 2.0 and Figure 4. In addition to illicit discharges and connections (Table 1.0), waterline breaks have also been identified and addressed.

### *3.1.1 Malden River Watershed*

As described in earlier submittals, the City of Malden's stormwater compliance team initially targeted potential illicit discharges to the Malden River as its highest priority. Utilizing the outfall monitoring data and information obtained during dry weather sampling events, the City has identified significant base flow as surface waters, to the Malden River. Consistent with the original design of the MDC/DCR conveyance network; this occurs primarily thorough culverted channels/brooks located in northwestern portions of the City. This flow includes contributions that originate from the Fells Reservation and Lower Spot Pond Brook. A total of 26 outfalls to the Malden River have been identified as depicted on Figure 5. Periodic dry weather sampling has been performed by NCA, MyRWA and the USEPA. The most recent dry weather water quality evaluation conducted along the Malden River included the sampling of outfalls on 28 April 2016. During the 28 April sampling event, four (4) outfalls were identified as flowing and were sampled, with the other 22 outfalls either having no flow or were submerged. Reference to Table 3.0, shows that E. coli levels ranged from 1.0 MPN/100ml (MR-6) to 8.6 MPN/100ml (MR-4).

As outlined within previous status reports, in June of 2015, an evaluation of the drainage system in Pleasant/Commercial/Exchange Street portion of the Malden River watershed was conducted in response to the detection of high E. coli levels during a dry weather sampling event in the area between Route 60 and Exchange Street. Supplemental dry weather sampling by the Stormwater Compliance Team at several drain manholes located on Exchange Street, Commercial Street and Pleasant Street revealed additional high levels of E. coli.

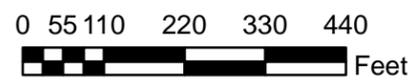
During the inspection of Exchange Street drainage manhole E28BY-MH1, a strong sewage odor was identified and the evaluation of both the sewage and drainage infrastructure indicated that the invert elevations for the piping systems were very close, suggesting that possible exfiltration from the municipal sewage system was impacting the nearby drainage network. In response to the observations recorded within the Exchange Street area, representatives of CDM Smith Inc. (CDM) were requested to review the results of their inflow/ infiltration investigation in the area and according to CDM, no significant or obvious signs of infiltration or exfiltration were noted. To further investigate the drainage system in the area, the City contracted National Water Main Cleaning Company (National) to camera the area of concern. On 2 June 2016, National, under the direction of the City, CDM and NCA initiated the CCTV inspection.



**Figure 4 - Dry Weather Flow Areas (as of 6/30/2017)**



**Figure 5 - Malden River Outfalls**



A visual inspection of manhole P27-MH11 in Pleasant Street revealed that in addition to the 36-inch RCP line that flows from P27-MH10 there was a second 36-inch RCP line that was not identified on plans reviewed during this study. Field observations noted at manhole P27-MH11 included a strong sewage odor and visual indications of sewage contributions from the second 36-inch RCP line. A video inspection of this line revealed that it ran west along the center of Pleasant Street and then turned north to Summer Street, to manhole S39-MH3. It is to be noted that indications of sewage were observed along the entire length of pipe at the time of inspection. The video inspection equipment was then moved to manhole S39-MH3 and visual observations of the manhole showed water entering the structure from a 12-inch RCP located on the western side of the manhole. Of particular importance to this mass balance flow isolation program was the absence of flow within the pipe from Summer Street (north). Video inspection of the 12-inch RCP revealed additional indications of sewage discharge and that the drainage line connected to manhole S39-MH3.1, approximately 50 feet to the west.

A visual inspection of manhole S39-MH3.1 revealed two (2) 8-inch ductile iron pipe inverts within the structure. The video inspection of the ductile iron pipe that connects to manhole S39-MH3.2, located approximately 100 feet south-southwest of manhole S39-MH3.1, revealed no illicit connections or indications of compromise. However, indications of sewage discharge were identified during the video inspection of the 8-inch ductile iron pipe that connected to the Gateway at Malden Center Apartments (10 – 20 Summer Street), approximately 35 feet to the northwest of manhole S39-MH3.1. Video observations noted included the presence of a stub and two (2) 8-inch ductile iron pipes which connected to 10 – 20 Summer Street building. Indications of sewage were noted within each of the pipes and flow from building was emanating from the northern pipe, which appears to run parallel with Summer Street.

Representatives of the City, CDM and NCA spoke with the facility manager for the building and were allowed access to several common area bathrooms and locker rooms, as well as the building basement. A visual inspection of the sewerage and drain lines within the basement and several dye tests were performed to determine the origin of the sewage from within the building, however they were inconclusive. The City contacted the property owner and they engaged a plumbing contractor to determine the best course of action to resolve the illicit connection. After several camera inspections of the building utility lines, it was determined that a sewer riser was connected to a roof drain, which in turn discharged to the City storm drain system.

According to representatives of Gateway Apartments, 11 one (1) bedroom apartments were connected to this roof drain. More specifically, it was determined that sewer connections for each of the “07” apartments (i.e. 107, 207, etc.) for the entire building were connected to a roof drain riser pipe that discharged to the municipal drainage system. The City remained in constant contact with representatives of the Gateway Apartments, who were cooperative and attempted to remove the illicit connection as quickly as possible. However, due to the complexity of the illicit connection and the multiple apartments connected to the roof drain, the work was not completed until 21 December 2016. A subsequent inspection by the City of Malden Plumbing Inspector was

conducted and it was confirmed that the sewer riser was disconnected from the City storm drain system. During the next reporting period, a dry weather sampling event will be conducted in the area to characterize E. coli concentrations post illicit connection removal. The removal of this illicit connection represents a major reduction in potential surface water discharge and the most significant benefit derived from IDDE Plan implementation to date.

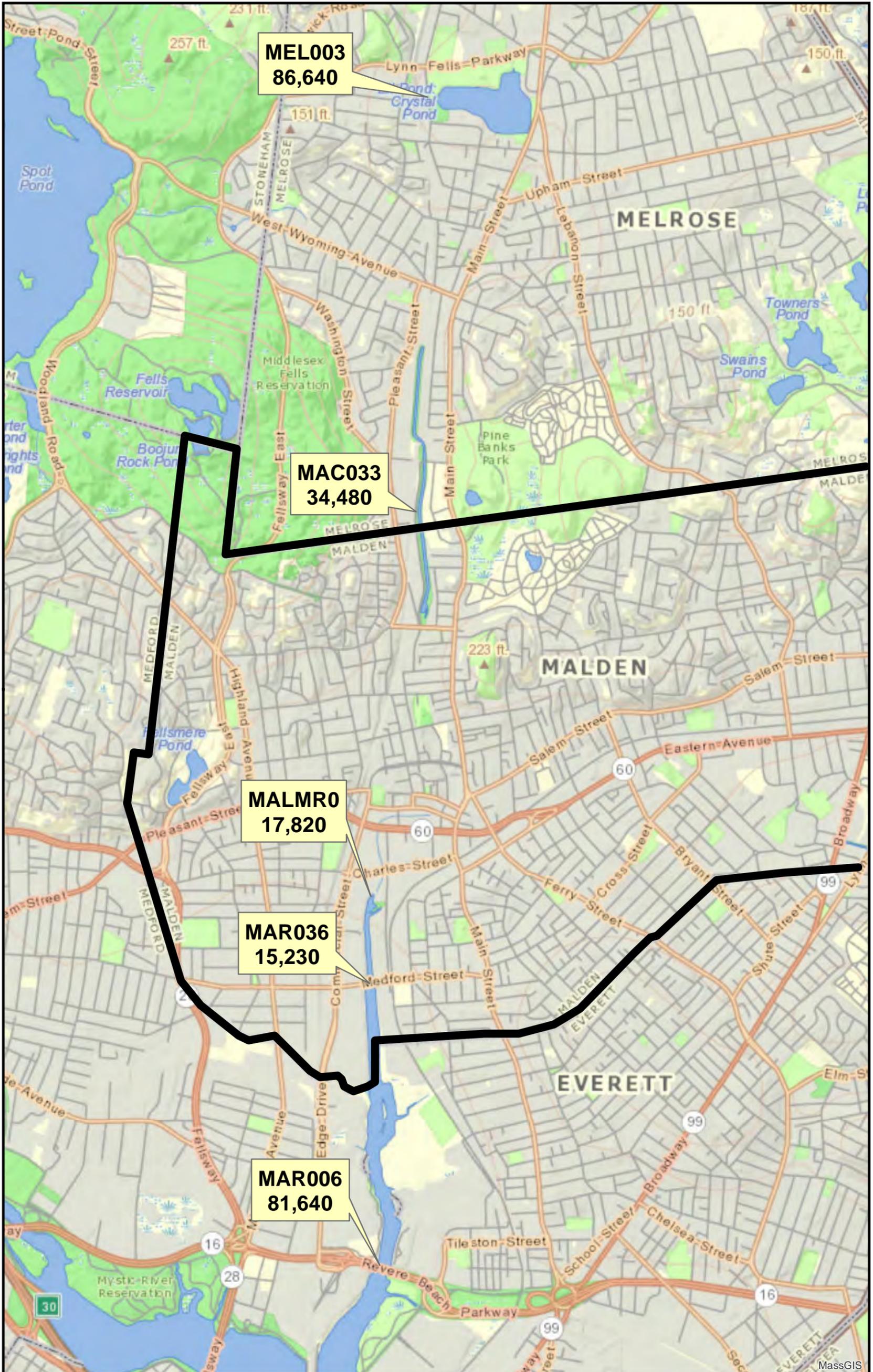
One illicit discharge that has been the focus of numerous dry and wet weather sampling events due to elevated E. coli levels is LSP-4. LSP-4 is an outfall that discharges into the Lower Spot Pond Brook culvert from the drainage system located within Eldrich Drive (Figure 6). Base flow, as groundwater, is consistently observed within this drainage network and to isolate potential sewage contributions to this base flow, a comprehensive evaluation of the flow conveyance network associated with LSP-4 was completed in February 2012. Given the proximity of the sewer and drain lines to LSP-4, as well as the settlement of the drain line in the area of Buildings 1054 and 1056 Elrich Drive, attention was directed towards the sewer laterals and nearby drainage line servicing the two apartment buildings. Following dye testing by the Compliance Team, camera surveys performed by representatives of the property owner confirmed that compromises to the laterals servicing two (2) residential building had occurred.

Working with representatives of the Malden Engineering Department, repairs to the sewer laterals in the area of Building 1054 and 1056 were completed by the property owner in March 2012. Since that time, and as summarized on Table 3.0, dry weather flow sampling at LSP-4 has revealed a significant decrease in bacteria levels relative to concentrations detected in 2012. However, E. coli concentrations of 110,000 and 3,200 MPN/100 ml were detected at LSP-4 in July and November of 2014, respectively. The drainage system in Eldrich Drive receives base flow, as groundwater infiltration and it is likely that the levels of groundwater relative to the exfiltration zone for the former broken laterals is a contributing factor. Specifically, while the sewer laterals were replaced/repared, long impacted contact soils and underlying groundwater likely contain bacteria residuals that enter the drainage system during periods of high groundwater. To correct this condition, the owner of the residential development has been notified that relining and restoring the structural integrity of the main drainage line and manholes should be performed.

As referenced in Section 1.0, Malden is a flow through community that receives surface water flows from neighboring communities, which have been found to contain elevated levels of bacteria entering into the City's drainage system. One example of this is depicted on Figure 7, which demonstrates the elevated levels of E. coli emanating from Ell Pond in Melrose. As shown, E coli levels of 86,640 MPN/100ml were detected at Ell Pond, which exhibited a consistent decline throughout downstream sampling locations in Malden, followed by a large increase at Route 16 in Everett (81,640 MPN/100ml). It is to be noted that elevated bacteria levels have been recorded at the Malden/Melrose town line through the period of IDDE plan implementation.



**Figure 6 - Lower Spot Pond Brook Outfalls**



**June 1, 2015 Wet Weather Sampling E. Coli Results (MPN/100 ML)**

Data collected by MyRWA and presented in July 10, 2015 Bacterial Assessment Report



Figure 7

### *3.1.2 Town Line Brook Watershed*

Town Line Brook in Malden begins at the Malden and Everett boundary and is culverted until it daylights into an open concrete lined trapezoidal channel at Broadway. Significant tidal influences exist in the form of an approximate 2-3 foot change in surface water elevation between Broadway and the remaining length of the culvert to the Revere City line. As shown on Figure 8, a total of 29 outfalls to Town Line Brook in Malden have been identified. The historic monitoring data of Town Line Brook has revealed relatively uniform bacteria levels during dry weather sampling events. Several outfall locations have consistently exhibited bacteria loadings during dry weather sampling events, including S3-MH12, TL-0, TL-9 and Trifone Brook (TL-24). Manhole sample point S3-MH12 is the upstream sampling point for this section of the Brook as it enters the Malden system from Everett, while TL-0 is located at Broadway, where Town Line Brook daylights. TL-9 is located proximate to the terminus of Hadley Street in Malden and receives dry weather flows from the City of Everett, with Trifone Brook (TL-24), also flowing from Everett prior to discharging into Town Line Brook. Based upon the historic monitoring of these outfalls, it is apparent that contributions continue to enter the Malden system from upstream areas. Targeted sampling within the Town Line Brook Watershed will be performed during the next reporting period.

### *3.1.3 Linden Brook Watershed*

Linden Brook Culvert is the major stormwater conveyance network located in northeasterly portions of the City. Dry weather inspections have revealed base flow throughout the culvert at all times, with E. coli levels detected historically within the mid-portion of the culvert, at manhole H43-MH1, located on Home Street (Figure 9). Flow isolation studies performed to date within this portion of the City had not revealed any specific source conditions for the results of prior sampling. In an effort to identify source conditions, flow isolation studies have been conducted on upstream drainage connections to the Linden Brook Culvert. A dry weather flow (Flow # 18), was identified in the areas of Cherry and Gilbert Streets, which contributes flows from the northern and central portions of Malden to the Linden Brook Culvert (Figure 9).

An initial dry weather flow sample collected from drainage manhole (C18-MH5) located on Cherry Street contained elevated E. coli levels and to further assess this condition, dry weather flows were sampled several times from this drainage manhole. In addition, several upstream dry weather flow samples were also collected from a manhole located on Winship Street (W47-MH1). Reference to Table 3.0 and Figure 9, indicates that the E. coli levels encountered at both drainage manholes contained high bacterial levels during each of the sampling events. Although it does not appear that the bacteria levels encountered at Cherry and Winship Streets are source conditions that impact flows within central portions of the Linden Brook Culvert at Home Street, additional characterization of the Cherry/Winship Street flow and Linden Brook Culvert base flow will be continued next reporting period.



**Figure 8 - Town Line Brook Outfalls**



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 Environmental Engineering and Land Use Planning  
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**Figure 9 - Dry and Wet Weather Sampling Program-Linden Brook**  
 MALDEN, MASSACHUSETTS



During a September 2012 sampling event, conducted with representatives of the USEPA, a water sample was collected from outfall LBR-1 (Figure 9), located in Revere, at which time distinct indications of sewage odors were noted. Consistent with identification of strong sewage odors and immediately apparent from a review of Table 3.0 is the significantly elevated level of E. coli (>241,920 MPN/100 ml) detected in sample LBR-1. To assess this condition and as described in prior status reports, the City of Malden contracted with National Water Main Cleaning Company, under the supervision of CDM Smith. As summarized in the following excerpt from an email to the City of Malden from CDM Smith, it is believed that line blockage due to grease build up may have been a crucial factor for the conditions identified at LBR-1, in addition to a “minor” defect in the form of a leaky joint.

As you know, National Water Main Cleaning Company along with CDM Smith staff were out on site on Tuesday November 6, 2012 to investigate the potential illicit connection into the Linden Brook Culvert at Salem Street near the Route 1 underpass. The following is a summary of the day’s events. The following figure graphically represents the results of the work.

National Water Main was onsite to clean and CCTV the siphon under the Old Linden Brook culvert. Upon arrival the condition of the sewers had not changed from the previous visit held 2 weeks prior: The downstream manhole (MH 3 in the attached figure) and a manhole upstream of the siphon (MH 1 in the figure) were completely plugged with heavy grease. A limited amount of liquid was passing through MH 3. Heavy cleaning of MH 3 and the sewer under the culvert took longer than expected. From MH 3 upstream to MH 1 an enormous amount of grease and sediment was removed. The pipe was 100% clogged with slugs of grease in several spots.

The sewer between MH 1 and MH 2 was successfully CCTV’d with the aid of the jetter (upstream of the siphon). This pipe was found to be in good condition. The most notable defect was a leaking joint (runner) at 9pm 54-ft from MH 1 (while traveling downstream). This was a rather minor defect. Active I/I was observed, however, it is possible that when the siphon builds some head, a small amount of sewage could exfiltrate from this same joint.

We discovered what appears to be an external drop connection just downstream of MH 2. This prevented us from CCTV’ing any further as the camera could not pass the vertical 90 degree bend. CCTV from the upstream direction would require two jettors or bypass pumping, (one to keep MH 3 drained and one to intercept flow from upstream in MH 2). This vertical drop was heavily blocked with grease. Approximately 80% of the grease in this pipe was removed with a root cutter and the pipe is in much better condition.

Last we lowered the camera into the 12-in connection to the culvert that once housed a gate valve (in MH 3). It no longer houses any gate, instead there is a masonry plug that seems to be in good condition. As the intent of finding the definitive source of sewage into the culvert was inconclusive, we recommend that we resample the outfall and test for parameters consistent with sewage. If the results are consistent with the previous results we should develop a new approach to finding the source.

As shown on Table 3.0, following the above described maintenance work, four (4) dry weather sampling events were conducted at LBR-1, with E. coli concentrations ranging from 1 MPN/100 ml to 520 MPN/100 ml, well below the levels encountered prior to the cleaning of the syphon. As discussed in further detail within Section 3.2.2 below, elevated E. coli levels were again encountered within LBR-1 during a recent wet weather sampling event.

## 3.2 Targeted Wet Weather Inspection/Sampling Program (NCA)

The focus of recent IDDE response actions has been directed towards the illicit connections identified within the Malden River watershed, as well as the targeted wet weather sampling conducted along the Malden River and the Linden Brook Culvert in November of 2016. As outlined within the City's IDDE Plan, wet weather is defined as an event in which at least 0.25-inches of rain falls within 24 hours prior to the sampling event. A representative rainfall event of 0.42-inches occurred on 29 November 2016 and wet weather sampling was conducted on 30 November 2016. A summary of the results obtained from Malden River and Linden Brook Culvert sample locations may be referenced from the following sections.

### 3.2.1 Malden River

As shown on Table 4.0, six (6) Malden River outfalls were found to be flowing on 30 November 2016, with high E. coli concentrations encountered at MR-4.1 (870 MPN/100ml) and MR-8 (7,000 MPN/100ml). A comparison of the wet weather concentrations with dry weather levels (Table 3.0) at these two locations reveals that no flow has been observed at MR-4.1 during dry weather conditions, while flow was observed at MR-8 during the latest dry weather event, the bacteria level was only 5.2 MPN/100ml. In addition to the outfalls, base flow wet weather samples were collected from Little Creek and the Saugus Branch Culvert headwall. Elevated bacteria levels were detected at all three (3) locations, with the highest concentration (4,900 MPN/100ml) detected at the southern Saugus Branch Culvert headwall (MR-2S). It should be noted that little to no flow was observed at these locations during the sampling event. To supplement the results obtained from the laboratory analysis of E. coli, a colorimetric field test for ammonia utilizing Hach Ammonia (Nitrogen) Test Strips was performed at selected wet weather Malden River sample locations. As shown on Table 5.0, in general, the field test results were consistent with the laboratory results obtained. The City will continue to utilize the field ammonia test to supplement the ongoing laboratory analysis program.

### 3.2.2 Linden Brook Culvert

Targeted wet weather sampling was also conducted along the Linden Brook Culvert on 29 November 2016. The scope of work performed at that time involved the sampling of two (2) manhole structures that discharge to the Linden Brook Culvert, one (1) manhole along the culvert and one (1) outfall/discharge area on the Malden/Revere line (LBR-1). As shown on Table 4.0 and Figure 9, a bacteria sample was collected from an upstream drain manhole on Winship Street and one downstream location on Cherry Street, with elevated E. coli levels detected at both locations (3,500 & 2,400 MPN/100ml, respectively). The stormwater conveyance network in the Winship and Cherry Street area discharges into the Linden Brook Culvert to the east (Figure 9). To assess potential impact to flow within the Linden Brook Culvert, a sample was collected from a downstream location at Home and Mingo Streets (H43-MH1), with a concentration of 260 col/100 ml identified. Although the level encountered is above the action level, it is well below the concentrations detected at Winship and Cherry Streets.

As referenced within Section 3.1.3, during the 30 November 2016 wet weather sampling event, a water sample was collected from LBR-1. As shown on Table 4.0, elevated bacterial levels, (480,000 MPN/100ml) indicative of sewerage infiltration, were encountered. Based upon information obtained from the Malden DPW, since the initial identification of the grease build-up in 2012 resulting in a sewer line blockage in the area of LBR-1, the City of Malden has performed weekly preventative maintenance, which includes the evaluation of flow within the sewer line and the placement of degreasing chemicals if necessary. These weekly evaluations have indicated that the municipal sewer system in this area has been flowing as expected. Based upon the reported maintenance intervals, it did not appear that a sewer line blockage in the area of LBR-1 was the source of the high E. coli levels. Accordingly, an additional E. coli sample was collected by NCA on 3 January 2017, with a result of 2,000 MPN/100ml detected. Although this level is considered high, the concentration is orders of magnitude lower than the level detected in November of 2016. The City will continue to evaluate this area during the next six month period.

Similar to the Malden River wet weather samples, to supplement the results obtained from the laboratory analysis of E. coli, ammonia field tests were performed at selected wet weather Linden Brook Culvert sample locations. As shown on Table 5.0, in general, the field test results were consistent with the laboratory results obtained. The City will continue to utilize the field ammonia test to supplement the ongoing laboratory analysis program.

### *3.2.3 Malden River Floating Dock*

As a part of their Massachusetts Environmental Trust funded Mystic Recreation Flagging Project, MyRWA has collected hundreds of samples from six (6) locations, including the Malden River within the Mystic River watershed. The goal of their effort includes the interim development of a “flagging” system in the watershed to alert recreational users to safe or unsafe conditions, which will be followed by the development of “logistic models” that will allow for predictive guidance pertaining to water safety. Based upon the review of historic water quality information compiled by the City and MyRWA, it was postulated that for rainfall events of less than half an inch, a 48 hour period of rebound would allow for the flushing of the River and reduction of bacteria levels to below safe boating standards. To test this hypothesis, sampling events were performed approximately 48 hours following half inch rainfall events at the floating crew dock, located at 356 Commercial Street in Malden.

Users of the floating dock have included primarily private clubs who were subject to special conditions and agreements pertaining to the use of the property. Recently, this recreational activity has fallen under the jurisdiction of the Malden Athletic Department who has been working with representatives of the MRA, the City and outside technical assistance to develop safety protocols for both student requirements and issues associated with the water quality of the Malden River. With respect to the latter, dry and wet weather sampling performed by the City has clearly demonstrated that elevated bacteria levels occur within the river during and immediately after significant rainfall events due to the

urban nature of the tributary watersheds within the cities of Malden, Medford, Melrose and Everett.

As a general protocol, it has been recommended that crew activities be suspended immediately following significant rainfall events, however the duration of this restriction has lacked sufficient foundation to be adequately determined. Specifically, it is known that there is a period of rebound following wet weather events that directly corresponds to the duration and/or amount of rainfall following which dry weather sampling has revealed consistent bacteria levels below applicable boating (1,260 MPN/100ml) and often swimming (235 MPN/100ml) standards. To further evaluate this rebound condition, the City has worked with representatives of MyRWA to develop a post wet weather protocol for on river activity.

As summarized on Table 6.0, the 48 hour rebounding protocol has led to the documentation of bacteria levels below the USEPA safe boating standard for most of the applicable rainfall events. In addition, the corresponding safe swimming standard was met on 19 April, 7 July and 4 October 2016, with only a slight exceedences observed on 28 April 2016. In contrast, an E. coli concentration of 2,900 MPN/100ml was detected during the sampling event performed in November of 2016. Reference to Table 6.0, shows that the 4 October sample was collected 53 hours from the last rainfall, while the November sample, which contained elevated E. coli levels, was collected only 10.8 hours from the last rainfall. This pattern is consistent with rebound condition described above.

The sampling program was continued during this reporting period to provide further background support for the 48 hour protocol that is enforced by the Malden Athletic Director. One (1) sampling event was conducted this reporting period (12 July 2017). As shown on Table 6.0, a bacteria level of 650 MPN/100ml was identified during the July sampling event which is above the USEPA safe swimming standard, but well below the safe boating standard. As noted on Table 6.0, the July sample was collected 26 hours from the last rainfall. The City will continue this sampling program during the next reporting period and share the data and work with MyRWA to develop a predictive model that will include the use of electronic signboards and development of a public advisory website.

### **3.3 Inflow Infiltration Sewer System Evaluation & Capacity Analysis**

The City of Malden has also completed a comprehensive Infiltration and Inflow (I&I) study for its municipal sewer system. CDM Smith, on behalf of the City, has prepared a Phase 3 Sanitary Sewer Evaluation Survey (SSES) report that includes a summary of findings and proposed recommendations to mitigate excessive infiltration and inflow into the City's sewer system. This report was approved by MWRA last year. As described in Section 3.1.1, the City also has a contract in place for emergency repairs to the sewage infrastructure. This contract allowed for the video camera surveys performed in the Pleasant and Exchange Street area and the I&I investigations performed by CDM Smith.

#### **4.0 SANITARY SEWER OVERFLOWS (SSO'S)**

No SSOs were identified during this reporting period.

#### **5.0 EVALUATION OF IDDE PROGRAM GOALS AND OBJECTIVES**

The City of Malden has implemented a comprehensive illicit discharge elimination program that has resulted in the isolation and mitigation of numerous illicit discharges/connections and reduced significant potable water losses due to the detection of water line breaks. During this reporting period, the removal of a significant, long term discharge of raw sewage into the municipal drainage system that was finalized, which demonstrated both the effectiveness and importance of the IDDE program. The City continues to advance its commitment to the objectives of the IDDE Program through the hiring of additional staff, purchase of equipment, and the recent designation of a Compliance Team leader within its water department, who is responsible for the daily administration of this program. At the recommendation of USEPA, the use of ammonia test strips was incorporated into flow isolation and mass balance evaluations of dry and wet weather conditions.

Through the assistance of the USEPA, through their prior multiple lines of evidence testing program, a greater understanding of the distinction between human and animal bacteria loadings has been further defined. The Compliance Team is continuing to investigate the feasibility of identifying cost efficient sampling parameters, such as caffeine analysis and hopes to work with USEPA in implementing multiple lines of evidence testing within the Malden River Watershed during the next reporting period. Further understanding of surface water quality characteristics and bacteria loadings has been obtained through the development of crew safety protocols, particularly as it pertains to wet weather rebound within the River. This sampling effort will be continued during the upcoming school year and corresponding reporting period. Dry weather inspections during the ongoing catch basin cleaning inventory program together with targeted wet weather sampling within the Malden River Corridor also remain as priorities to assist in the planning of Capital and Infrastructure needs. Lastly, while proposed revisions to the MS4 General Permit have been delayed, the City will continue to meet the goals of this new guidance.

# TABLES

**Environmental Engineering and Land Use Planning**

**Table 1.0 Summary of Illicit Connections/Discharges identified as of 6/30/2017**

**Illicit Connections**

<b>Illicit Connection Identification</b>	<b>Date Identified</b>	<b>Discharge Type</b>	<b>Estimated Volume</b>	<b>Date Removed</b>	<b>Location</b>
ID-1	1/15/2009	Sewage	40 gpd	2/16/2009	33 Lodgen Ct., Unit 1F
ID-2	1/15/2009	Grey Water	100 gpd	3/2/2009	34 Hanover Street
ID-4	8/28/2009	Sewage	60 gpd	9/4/2009	2-4 Hancock Street
ID-9	5/18/2010	Sewage	60 gpd	5/19/2010	36 Charles Street
ID-12	Apr-12	Confirmed Roof Drain	NA	NA	100-110 Pleasant Street
ID-13	Sep-12	Sewage	Unknown	January-13	Exchange Street
ID-15	Oct-13	Process Water	Unknown	N/A	Sharon Street
ID-16	6/2/2016	Sewage	1,210 gpd	12/21/2016	Summer Street (11 units)

**Total Illicit Flow Removed to Date:**

**1,470 gallons/day**

**536,550 gallons/year**

**Illicit Discharges**

<b>Illicit Discharge Identification</b>	<b>Date Identified</b>	<b>Discharge Type</b>	<b>Estimated Volume</b>	<b>Date Removed</b>	<b>Location</b>
ID-3	8/11/2009	Oil Sheen	Unknown	n/a	Near 1081 Fellsway
ID-5	9/10/2009	#2 oil spill	<5 gallons	9/10/2009	269 Pearl Street
ID-6	9/21/2009	Poss. Washwater	Unknown	9/21/2009	120 Main Street
ID-7	12/9/2009	Trans. Dielectric fluid	<27 Gallons	12/10/2009	Near 6 Grove Street
ID-8	4/29/2010	Hydraulic Fluid	<10 Gallons	4/29/2010	496 Main Street
ID-10	2/10/2012	Sewage	Note 1	Pending	1056 Erlich Drive
ID-11*	9/11/2012	Sewage	Unknown	11/6/2012	Linden Brook @ Lynn St.
ID-14	8/15/2013	Grey Water	Unknown	13-Dec	Forestdale School

1 - approximately 1 gallon per minute observed discharging at LSP-4 during dry weather

\* Possible discharge due to grease blockage-Syphon still under investigation

**Table 2.0 Summary of Dry Weather Flows Identified as of 6/30/2017**

<b>Flow Identification</b>	<b>Location</b>	<b>Flow Type</b>	<b>Status</b>
Flow 1	Medford City Line	Water Line Leak	Removed
Flow 2	Saint Mary's Street	Groundwater	No Further Action
Flow 3	Fellsmere Reservation	Groundwater	No Further Action
Flow 4	Malden River	Surcharge-Submerged Invert	Evaluation Ongoing
Flow 5	DCR Spot Pond Brook	Base Flow	Evaluation Ongoing
Flow 6	Forestdale-Pine Banks Park	Base Flow	No Further Action
Flow 7	Wigglesworth Street	Groundwater-Illicit Discharge	Removed
Flow 8	Main Street	Water Line Leak	Removed
Flow 9	Pierce Street	Groundwater Breakout	No Further Action
Flow 10	Linden Brook	Base Flow	Evaluation Ongoing
Flow 11	LSP-4	Dry Weather Flow	Evaluation Ongoing
Flow 12	Kennedy Dr-Granada Highlands Apts.	Base Flow	No Further Action
Flow 13	Orchard Street	Dry Weather Flow	Evaluation Ongoing
Flow 14	Exchange Street	Intermittent Dry Weather Flow	Evaluation Ongoing
Flow 15	Lower Commercial Street	Dry Weather Flow	Evaluation Ongoing
Flow 16	Huntley Street	Dry Weather Flow	No Further Action
Flow 17	Goldcliff Road	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 18	Cherry & Gilbert Streets	Dry Weather Flow	Evaluation Ongoing
Flow 19	Sylvan Street	Dry Weather Flow	Evaluation Ongoing
Flow 20	First Street & Elwell Ave	Base Flow	No Further Action
Flow 21	Bowman Street	Base Flow	No Further Action
Flow 22	Springdale Street	Dry Weather Flow	No Further Action
Flow 23	Grant Street	Dry Weather Flow	Evaluation Ongoing
Flow 24	Wheeler Street	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 25	Revere Street	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 26	Kennedy Dr & Fairfield Avenue	Base Flow	No Further Action
Flow 27	Sharon Street	Process Water	No Further Action
Flow 28	Pleasant/Commercial/Exchange Sts.	Dry Weather Flow - Sewage	Removed
Flow 29	Summer Street	Base Flow	No Further Action

**Table 3.0 Dry Weather Conditions - E. coli Concentrations**

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Designation	E. coli (MPN/100ml) 30, 9223B ACTION LEVEL- 235 MPN/100ml									
	9/12/2013	9/24/2013	7/2/2014	11/5/2014	6/25/2015	7/14/2015	8/25/2015	9/29/2015	4/28/2016	
	Malden River									
MR-0	980	-	-	-	-	-	-	-	-	NS-stagnent
MR-1	-	-	-	-	-	-	-	-	-	NS-stagnent
MR-3	-	-	-	-	-	-	-	-	-	NF
MR-4	-	-	-	-	-	-	-	-	-	8.6
MR-4.1	-	-	-	-	-	-	-	-	-	NF
MR-5	-	-	-	-	-	-	-	-	-	NF
MR-6	-	-	-	-	-	-	-	580	-	1.0
MR-6.1	-	-	-	-	-	-	-	-	-	NF
MR-7	-	-	-	-	-	-	-	-	-	NF
MR-8	292	-	-	-	-	-	-	-	-	5.2
MR-8.1	-	-	-	-	-	-	-	-	-	NF
MR-9	-	-	-	-	-	-	-	-	-	NF
MR-10	-	-	-	-	-	-	-	-	-	NF
MR-11	-	-	-	-	-	-	-	-	-	ND (2.0)
MR-11.1	-	-	-	-	-	-	-	-	-	NF
MR-12	-	-	-	-	-	-	-	-	-	-
MR-12.1	-	-	-	-	-	-	-	-	-	NF
MR-12.2	-	-	-	-	-	-	-	-	-	-
MR-13	-	-	-	-	-	-	-	-	-	-
LSP-0-Channel <sup>2</sup>	-	-	-	-	-	-	-	-	-	-
LSP-3	-	-	-	-	-	-	-	-	-	-
LSP-4	-	2,000	110,000	3,200	-	-	-	-	-	-
LSP-9	-	-	-	-	-	-	-	-	-	-
LSP-10-Channel <sup>2</sup>	-	-	-	-	-	-	-	-	-	-
CH-1	-	-	-	-	-	<1	-	-	-	-
C15-MH8.1	-	-	-	-	-	-	-	1,200	-	-
C46-MH19	-	-	-	-	500	-	-	-	-	-
E13-MH4 (Elrich)	-	2,000	-	-	-	-	-	-	-	-
E28-MH8	-	-	-	-	-	-	-	-	-	-
E28-SP1	-	-	-	-	-	-	-	-	-	-
E28-SP2	-	-	-	-	-	-	-	-	-	-
E28-MH1	-	-	-	-	-	19,000	140,000	>483,920	-	-
E28-MH2W	-	-	-	-	-	9,000	-	-	-	-
E28-MH2N	-	-	-	-	-	3.1	-	-	-	-
E28-MH4	-	-	-	-	-	4,500	-	-	-	-
E28-MH4A	-	-	-	-	-	-	-	-	-	-
E28BY-MH1	-	-	-	-	82,000	9,800	10,000	5,800	-	-
F26-MH3	-	-	-	-	-	6,700	>483,920	>483,920	-	-
NG-C1	-	-	-	-	-	-	-	-	-	-
P27-MH10	-	-	-	-	-	39	-	-	-	-
P27-MH12	-	-	-	-	-	-	27	-	-	-
S29-MH1	-	-	-	-	-	-	-	-	-	-
S29-MH3	-	-	-	-	-	-	-	-	-	-
S39-MH1	-	-	-	-	-	34	30	-	-	-
Little Creek										
LC-0	-	-	-	-	3,700	460	-	-	-	NS-stagnent
LC-N	-	-	-	-	2,400	-	-	-	-	NS-submerged
LC-S	-	-	-	-	-	-	-	-	-	NS-submerged
Saugus Branch										
MR-2	550	-	-	-	-	-	-	-	-	NS-stagnent
MR-2N	-	-	150	490	390	35	310	3,100	-	NS-stagnent
MR-2S	-	-	130	440	440	75	290	440	-	NS-stagnent
Town Line Brook										
TL-0 <sup>3</sup>	-	-	-	-	-	-	-	-	-	-
TL-3	-	-	-	-	-	-	-	-	-	-
TL-9	-	-	-	-	-	-	-	-	-	-
TL-13	-	-	-	-	-	-	-	-	-	-
B53-MH7	-	-	-	-	-	-	-	-	-	-
BP-MH3	-	-	-	-	-	-	-	-	-	-
S3-MH12 <sup>3</sup>	-	-	-	-	-	-	-	-	-	-
S14-MH4	-	-	ND (1.0)	4.1	-	-	-	-	-	-
Linden Brook										
B46-MH2	-	<1	-	-	-	-	-	-	-	-
C18-MH5	-	23,000	11,000	1,300	-	-	-	-	-	-
C36-MH1	-	-	-	-	-	-	-	-	-	-
D17-MH1	-	-	-	-	-	-	-	-	-	-
F1-MH4	-	-	-	-	-	-	-	-	-	-
F23-MH2	-	13	-	-	-	-	-	-	-	-
G36-MH2	-	-	1,700	290	-	-	-	-	-	-
H43-MH1	-	12	-	1,000	-	-	-	-	-	-
K6-MH1	-	-	-	-	-	-	-	-	-	-
L5-MH1	-	-	-	-	-	-	-	-	-	-
LBR-1	-	-	520	88	-	-	-	-	-	-
M31-MH1	-	12	-	-	-	-	-	-	-	-
O10-MH1	-	-	-	-	-	-	-	-	-	-
P24-MH1	-	-	-	-	-	-	-	-	-	-
S27-MH2	-	-	-	17	-	-	-	-	-	-
S45-MH4	-	-	-	8.5	-	-	-	-	-	-
V1-MH1	-	-	-	-	-	-	-	-	-	-
W26-MH1	-	-	-	-	-	-	-	-	-	-
W47-MH1	-	-	3,500	1,700	-	-	-	-	-	-

NS-not sampled

NF-no flow

- not evaluated

ND - None Detected above Reported Detection Limit  
(results in parentheses represent the detection limit)

Laboratory certificates contained within attachments

**Table 4.0 Wet Weather Conditions - E. coli Concentrations**

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Identification	E. coli (MPN/100ml)	
	30, 9223B	
	ACTION LEVEL- 235 MPN/100ml	
	11/30/2016	1/3/2017
<b>Malden River</b>		
BH-1	2,900	-
MR-0	NS-stagnent	-
MR-1	NS-stagnent	-
MR-3	NF	-
MR-4	180	-
MR-4.1	870	-
MR-5	190	-
MR-6	43	-
MR-6.1	NF	-
MR-7	NF	-
MR-8	7,000	-
MR-8.1	NF	-
MR-9	NF	-
MR-10	NF	-
MR-11	3.1	-
MR-11.1	NF	-
MR-12	-	-
MR-12.1	NF	-
MR-12.2	-	-
MR-13	-	-
Saint Mary St.	-	-
Fellsmere Pond	-	-
LSP-4	15,000	-
LSP-5.1-Channel	-	-
LSP-9	-	-
LSP-10-Channel	-	-
<b>Little Creek</b>		
LC-0	3,200	-
LC-N	NS-submerged	-
LC-S	NS-submerged	-
P12-MH10	-	-
<b>Saugus Branch</b>		
MR-2	-	-
MR-2N	4,600	-
MR-2S	4,900	-
Broadway/Eastern	-	-
<b>Town Line Brook</b>		
TL-0	-	-
TL-9	-	-
TL-13	-	-
TL-16	-	-
TL-24	-	-
TL-BL-EV	-	-
S3-MH12	-	-
<b>Linden Brook</b>		
C18-MH5	2,400	-
H43-MH1	260	-
LBR-1	480,000	2,000
W47-MH1	3,500	-

NS-not sampled

NF-no flow

- not evaluated

ND - None Detected above Reported Detection Limit  
(results in parentheses represent the detection limit)

Laboratory certificates contained within attachments.

**Table 5.0 Wet Weather Conditions - Ammonia Concentrations**

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Identification	Ammonia (ppm)
	11/30/2016
<b>Malden River</b>	
BH-1	-
MR-0	NS-stagnent
MR-1	NS-stagnent
MR-3	NF
MR-4	2
MR-4.1	0
MR-5	0
MR-6	4
MR-6.1	NF
MR-7	NF
MR-8	0
MR-8.1	NF
MR-9	NF
MR-10	NF
MR-11	6
MR-11.1	NF
MR-12	-
MR-12.1	NF
MR-12.2	-
MR-13	-
LSP-4	-
LSP-9	-
<b>Little Creek</b>	
LC-0	0
LC-N	NS-submerged
LC-S	NS-submerged
P12-MH10	-
<b>Saugus Branch</b>	
MR-2	-
MR-2N	0.5
MR-2S	0.5
<b>Linden Brook</b>	
C18-MH5	1
H43-MH1	0
LBR-1	6
W47-MH1	1

Samples field analyzed using  
Hach Ammonia (Nitrogen) Test Strips (0-6.0 ppm).  
NS-not sampled  
NF-no flow  
- not evaluated

## Table 6.0 Malden River Boat House - E. Coli Concentrations

Site Location, Malden River - Malden, MA

Sample Description: Water

Sample Designation	E. coli (MPN/100ml) 9223B ACTION LEVEL- 235 MPN/100ml					
	4/19/2016	4/28/2016	7/7/2016	10/4/2016	11/30/2016	7/12/2017
	<b>Sample Collection Time</b>	12:45	11:45	13:00	13:15	7:25
<b>Time Elapsed from Rain Event</b>	6.45 hrs	46.5 hrs	51.5 hrs	53 hrs	10.8 hrs	26 hrs
<b>Rainfall Amount</b>	0.02"	0.27"	0.34"	0.03"	0.42"	0.40"
BH-1	210	290	47	140	2,900	650

File No. 465.09

Laboratory certificates contained within attachments.

# ATTACHMENT A

Environmental Engineering and Land Use Planning



## ANALYTICAL REPORT

Lab Number:	L1723704
Client:	Nangle Consulting Associates 45 Dan Road Suite 115 Canton, MA 02021
ATTN:	Chuck Altobello
Phone:	(781) 821-0521
Project Name:	CITY OF MALDEN
Project Number:	465.09
Report Date:	07/18/17

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), NJ NELAP (MA935), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-14-00197).

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Eight Walkup Drive, Westborough, MA 01581-1019  
508-898-9220 (Fax) 508-898-9193 800-624-9220 - [www.alphalab.com](http://www.alphalab.com)



**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

<b>Alpha Sample ID</b>	<b>Client ID</b>	<b>Matrix</b>	<b>Sample Location</b>	<b>Collection Date/Time</b>	<b>Receive Date</b>
L1723704-01	BH-1	WATER	MALDEN, MA	07/12/17 12:00	07/12/17

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

### Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

#### HOLD POLICY

For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

### Case Narrative (continued)

#### Sample Receipt

The samples were received at the laboratory above the required temperature range. The samples were transported to the laboratory in a cooler with ice and delivered directly from the sampling site.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:

 Amita Naik

Title: Technical Director/Representative

Date: 07/18/17

# **INORGANICS & MISCELLANEOUS**

Project Name: CITY OF MALDEN

Project Number: 465.09

Lab Number: L1723704

Report Date: 07/18/17

**SAMPLE RESULTS**

Lab ID: L1723704-01

Client ID: BH-1

Sample Location: MALDEN, MA

Matrix: Water

Date Collected: 07/12/17 12:00

Date Received: 07/12/17

Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	650		MPN/100ml	1.0	NA	1	-	07/12/17 15:45	121,9223B	AJ



**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

**Method Blank Analysis**  
**Batch Quality Control**

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab for sample(s): 01 Batch: WG1021896-1										
E. Coli (MPN)	<1		MPN/100ml	1	NA	1	-	07/12/17 15:45	121,9223B	AJ

**Project Name:** CITY OF MALDEN

**Project Number:** 465.09

Serial\_No:07181720:40

**Lab Number:** L1723704

**Report Date:** 07/18/17

**Sample Receipt and Container Information**

Were project specific reporting limits specified?

YES

**Cooler Information**

**Cooler**                      **Custody Seal**

A                                      Absent

**Container Information**

**Container ID**    **Container Type**

<b>Cooler</b>	<b>Initial pH</b>	<b>Final pH</b>	<b>Temp deg C</b>	<b>Pres</b>	<b>Seal</b>	<b>Frozen Date/Time</b>	<b>Analysis(*)</b>
A	NA		17.6	Y	Absent		E-COLI-QT(.33)
A	NA		17.6	Y	Absent		E-COLI-QT(.33)

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

## GLOSSARY

### Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

### Footnotes

- 1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

### Terms

**Analytical Method:** Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

**Final pH:** As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

**Frozen Date/Time:** With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

**Initial pH:** As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

**Total:** With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

### Data Qualifiers

- A** - Spectra identified as "Aldol Condensation Product".
- B** - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related

Report Format: Data Usability Report



**Project Name:** CITY OF MALDEN  
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#### Data Qualifiers

projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

- C** - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.
- D** - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
- E** - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
- G** - The concentration may be biased high due to matrix interferences (i.e. co-elution) with non-target compound(s). The result should be considered estimated.
- H** - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.
- I** - The lower value for the two columns has been reported due to obvious interference.
- M** - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.
- NJ** - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.
- P** - The RPD between the results for the two columns exceeds the method-specified criteria.
- Q** - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)
- R** - Analytical results are from sample re-analysis.
- RE** - Analytical results are from sample re-extraction.
- S** - Analytical results are from modified screening analysis.
- J** - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).
- ND** - Not detected at the reporting limit (RL) for the sample.

**Project Name:** CITY OF MALDEN  
**Project Number:** 465.09

**Lab Number:** L1723704  
**Report Date:** 07/18/17

## REFERENCES

- 121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

## LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.



## Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

### Westborough Facility

**EPA 624:** m/p-xylene, o-xylene

**EPA 8260C:** NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.

**EPA 8270D:** NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.

**EPA 300:** DW: Bromide

**EPA 6860:** NPW and SCM: Perchlorate

**EPA 9010:** NPW and SCM: Amenable Cyanide Distillation

**EPA 9012B:** NPW: Total Cyanide

**EPA 9050A:** NPW: Specific Conductance

**SM3500:** NPW: Ferrous Iron

**SM4500:** NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO<sub>2</sub>, NO<sub>3</sub>.

**SM5310C:** DW: Dissolved Organic Carbon

### Mansfield Facility

**SM 2540D:** TSS

**EPA 3005A** NPW

**EPA 8082A:** NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.

**EPA TO-15:** Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene,

3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.

**Biological Tissue Matrix:** EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

### Westborough Facility:

#### Drinking Water

**EPA 300.0:** Nitrate-N, Fluoride, Sulfate; **EPA 353.2:** Nitrate-N, Nitrite-N; **SM4500NO3-F:** Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500CI-D, SM2320B, SM2540C, SM4500H-B**

**EPA 332:** Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.

**Microbiology:** **SM9215B; SM9223-P/A, SM9223B-Colilert-QT, SM9222D.**

#### Non-Potable Water

**SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH, EPA 350.1:** Ammonia-N, **LACHAT 10-107-06-1-B:** Ammonia-N, **SM4500NO3-F, EPA 353.2:** Nitrate-N, **EPA 351.1, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D.**

**EPA 624:** Volatile Halocarbons & Aromatics,

**EPA 608:** Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs

**EPA 625:** SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045:** PCB-Oil.

**Microbiology:** **SM9223B-Colilert-QT; Enterolert-QT, SM9221E.**

### Mansfield Facility:

#### Drinking Water

**EPA 200.7:** Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1 Hg.**

#### Non-Potable Water

**EPA 200.7:** Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.

**EPA 200.8:** Al, Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn.

**EPA 245.1 Hg.**

**SM2340B**

For a complete listing of analytes and methods, please contact your Alpha Project Manager.



# APPENDIX B

Environmental Engineering and Land Use Planning

# MALDEN RIVER GREENWAY

For generations the Malden River was an industrial waterway walled-off to public use. **The Malden River Greenway Plan** lays out a vision that will transform the river, creating a world-class park system running through the cities of Everett, Malden, and Medford.

The Malden River Greenway intends to provide safe, connected and accessible paths for local residents and visitors along the Malden River.

It will establish an urban greenscape with thriving biodiversity and promote a healthy lifestyle through active design and open space programming.

The development of the Malden River Greenway will become integral to an open space network that provides a key link in the larger regional greenway system.

MALDEN CENTER T  
 Extended path provides a safe and direct connection to Malden Center.

On-street bike lanes connect to the expanded riverfront trail system

Pedestrian crossing from the Northern Strand trail to the riverfront.

An extended and enhanced trail network connects the head of the river to Medford Street.

The Wellington Connector provides an off-street path to the river from Malden and Medford.

A riverfront trail runs through the National Grid site to create a naturalized path and open space.

Iconic pedestrian bridges connect key open spaces on both sides of the river to create a loop system.

The proposed parkway creates a park promenade with direct access to the Malden River.

New roadway provides a direct connection to Village Landing Park.

Paths connect under Woods Memorial Bridge on both side of the river.

An extended path system leads through the wetlands to Gateway Park.

Potential Transit Oriented Development at Wellington Station includes a park connected to the greenway.

Northern Strand Trail and Malden River Greenway will connect to the casino and bridge across the river.

- Greenway network
- Naturalized wetland
- ↔ Links to proposed bike network
- Existing buildings to be redeveloped
- ▲ Existing water activity
- ▲ Proposed water activity
- ↔ Proposed pedestrian bridges

**Malden River Greenway Plan, 2017**  
 Planning and Design: Utile, Bishop Land Design  
 Funded by: The Solomon Foundation, City of Everett, Bike to the Sea, Wynn Boston Harbor, Proetie, Lane & Associates Ltd.  
 Managed by: Mystic River Watershed Association



**Table 1.0 Dry Weather Conditions - E. coli Concentrations**

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Designation	E. coli (MPN/100ml) 30, 9223B ACTION LEVEL- 235 MPN/100ml									
	9/12/2013	9/24/2013	7/2/2014	11/5/2014	6/25/2015	7/14/2015	8/25/2015	9/29/2015	4/28/2016	
	Malden River									
MR-0	980	-	-	-	-	-	-	-	-	NS-stagnent
MR-1	-	-	-	-	-	-	-	-	-	NS-stagnent
MR-3	-	-	-	-	-	-	-	-	-	NF
MR-4	-	-	-	-	-	-	-	-	-	8.6
MR-4.1	-	-	-	-	-	-	-	-	-	NF
MR-5	-	-	-	-	-	-	-	-	-	NF
MR-6	-	-	-	-	-	-	-	580	-	1.0
MR-6.1	-	-	-	-	-	-	-	-	-	NF
MR-7	-	-	-	-	-	-	-	-	-	NF
MR-8	292	-	-	-	-	-	-	-	-	5.2
MR-8.1	-	-	-	-	-	-	-	-	-	NF
MR-9	-	-	-	-	-	-	-	-	-	NF
MR-10	-	-	-	-	-	-	-	-	-	NF
MR-11	-	-	-	-	-	-	-	-	-	ND (2.0)
MR-11.1	-	-	-	-	-	-	-	-	-	NF
MR-12	-	-	-	-	-	-	-	-	-	-
MR-12.1	-	-	-	-	-	-	-	-	-	NF
MR-12.2	-	-	-	-	-	-	-	-	-	-
MR-13	-	-	-	-	-	-	-	-	-	-
LSP-0-Channel <sup>2</sup>	-	-	-	-	-	-	-	-	-	-
LSP-3	-	-	-	-	-	-	-	-	-	-
LSP-4	-	2,000	110,000	3,200	-	-	-	-	-	-
LSP-9	-	-	-	-	-	-	-	-	-	-
LSP-10-Channel <sup>2</sup>	-	-	-	-	-	-	-	-	-	-
CH-1	-	-	-	-	-	<1	-	-	-	-
C15-MH8.1	-	-	-	-	-	-	-	1,200	-	-
C46-MH19	-	-	-	-	500	-	-	-	-	-
E13-MH4 (Elrich)	-	2,000	-	-	-	-	-	-	-	-
E28-MH8	-	-	-	-	-	-	-	-	-	-
E28-SP1	-	-	-	-	-	-	-	-	-	-
E28-SP2	-	-	-	-	-	-	-	-	-	-
E28-MH1	-	-	-	-	-	19,000	140,000	>483,920	-	-
E28-MH2W	-	-	-	-	-	9,000	-	-	-	-
E28-MH2N	-	-	-	-	-	3.1	-	-	-	-
E28-MH4	-	-	-	-	-	4,500	-	-	-	-
E28-MH4A	-	-	-	-	-	-	-	-	-	-
E28BY-MH1	-	-	-	-	82,000	9,800	10,000	5,800	-	-
F26-MH3	-	-	-	-	-	6,700	>483,920	>483,920	-	-
NG-C1	-	-	-	-	-	-	-	-	-	-
P27-MH10	-	-	-	-	-	39	-	-	-	-
P27-MH12	-	-	-	-	-	-	27	-	-	-
S29-MH1	-	-	-	-	-	-	-	-	-	-
S29-MH3	-	-	-	-	-	-	-	-	-	-
S39-MH1	-	-	-	-	-	34	30	-	-	-
Little Creek										
LC-0	-	-	-	-	3,700	460	-	-	-	NS-stagnent
LC-N	-	-	-	-	2,400	-	-	-	-	NS-submerged
LC-S	-	-	-	-	-	-	-	-	-	NS-submerged
Saugus Branch										
MR-2	550	-	-	-	-	-	-	-	-	NS-stagnent
MR-2N	-	-	150	490	390	35	310	3,100	-	NS-stagnent
MR-2S	-	-	130	440	440	75	290	440	-	NS-stagnent
Town Line Brook										
TL-0 <sup>3</sup>	-	-	-	-	-	-	-	-	-	-
TL-3	-	-	-	-	-	-	-	-	-	-
TL-9	-	-	-	-	-	-	-	-	-	-
TL-13	-	-	-	-	-	-	-	-	-	-
B53-MH7	-	-	-	-	-	-	-	-	-	-
BP-MH3	-	-	-	-	-	-	-	-	-	-
S3-MH12 <sup>3</sup>	-	-	-	-	-	-	-	-	-	-
S14-MH4	-	-	ND (1.0)	4.1	-	-	-	-	-	-
Linden Brook										
B46-MH2	-	<1	-	-	-	-	-	-	-	-
C18-MH5	-	23,000	11,000	1,300	-	-	-	-	-	-
C36-MH1	-	-	-	-	-	-	-	-	-	-
D17-MH1	-	-	-	-	-	-	-	-	-	-
F1-MH4	-	-	-	-	-	-	-	-	-	-
F23-MH2	-	13	-	-	-	-	-	-	-	-
G36-MH2	-	-	1,700	290	-	-	-	-	-	-
H43-MH1	-	12	-	1,000	-	-	-	-	-	-
K6-MH1	-	-	-	-	-	-	-	-	-	-
L5-MH1	-	-	-	-	-	-	-	-	-	-
LBR-1	-	-	520	88	-	-	-	-	-	-
M31-MH1	-	12	-	-	-	-	-	-	-	-
O10-MH1	-	-	-	-	-	-	-	-	-	-
P24-MH1	-	-	-	-	-	-	-	-	-	-
S27-MH2	-	-	-	17	-	-	-	-	-	-
S45-MH4	-	-	-	8.5	-	-	-	-	-	-
V1-MH1	-	-	-	-	-	-	-	-	-	-
W26-MH1	-	-	-	-	-	-	-	-	-	-
W47-MH1	-	-	3,500	1,700	-	-	-	-	-	-

NS-not sampled

NF-no flow

- not evaluated

ND - None Detected above Reported Detection Limit  
(results in parentheses represent the detection limit)

Laboratory certificates contained within attachments



**Figure 1 - Malden River Outfalls**

0 55 110 220 330 440 Feet



**Figure 2 - Lower Spot Pond Brook Outfalls**



**Figure 3 - Town Line Brook Outfalls**



**NANGLE CONSULTING ASSOCIATES, INC.**  
 Environmental Engineering and Land Use Planning  
 45 Dan Road • Suite 115 • Canton • Massachusetts 02021

**Figure 4 - Dry and Wet Weather Sampling Program-Linden Brook**  
 MALDEN, MASSACHUSETTS

