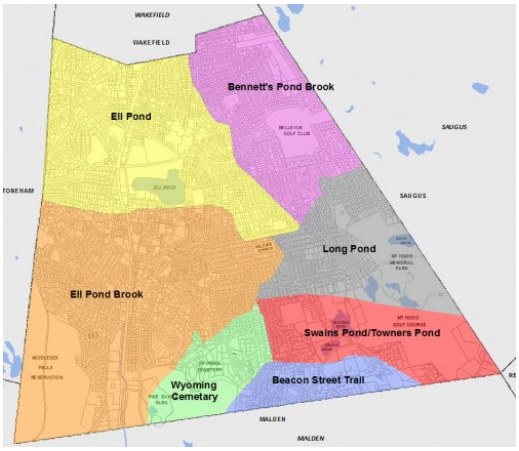
City of Melrose

Stormwater Management Program



Updated SEPTEMBER 2022

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Introduction

This document presents the Stormwater Management Program (SWMP) for the City of Melrose. This SWMP was developed to meet the requirements of the Environmental Protection Agency's (EPA) updated National Pollutant Discharge Elimination System (NPDES) Phase II stormwater regulations, which became effective on July 1, 2018.

I.1 Background on the Phase II Program

In 1987, the Environmental Protection Agency (EPA) amended the Clean Water Act to require a two-phased national program to address water pollution from stormwater. Phase I, promulgated in 1990, addressed stormwater discharges in approximately 900 of the nation's largest cities.

Phase II of the stormwater program was published in the Federal Register on December 8, 1999. The Phase II regulations require operators of municipal separate storm sewer systems (MS4s) located in urbanized areas with populations of fewer than 100,000 people to obtain a NPDES permit for their stormwater discharges. In Massachusetts, permits are issued jointly by EPA - Region I and the Massachusetts Department of Environmental Protection (MassDEP).

As determined by the 2000 census, the City of Melrose is an urbanized area and must obtain a NPDES stormwater permit. The original permit for Melrose took effect in 2003. This SWMP presents an updated version of the prior Stormwater Management Plan, pursuant to the regulations issued on April 4, 2016 and effective July 1, 2018.

I.2 Stormwater Management Program

The guidance document for the NPDES Phase II permit is the SWMP. Each permittee designs its own SWMP with the goals of reducing the discharge of pollutants from the MS4 to the maximum extent practicable and protecting water quality.

To meet the "maximum extent practicable" standard, the City must develop and implement best management practices (BMPs) for the following six minimum control measures:

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Post-construction Stormwater Management in New Development and Redevelopment
- Pollution Prevention/ Good Housekeeping for Municipal Operations

The BMPs are the core of the SWMP and are described in Sections 1 through 6 of this document. The subsequent sections and appendices provide supplemental information.

I.3 Reliance on another Entity for Satisfying One or More of the Control Measures

The City may rely on other entities (such as a non-profit organization or a different City department) to help perform one or more of the BMPs included in the SWMP. Once an arrangement is established it may be appropriate for the entities to consider a memorandum of understanding or a legal agreement that outlines the individual responsibilities of each party.

Best Management Practices included in the NOI become a part of the SWMP, even if the BMPs are administered by outside groups. If the outside group becomes unable to continue administering the program, the City is still responsible for compliance with the permit terms.

EPA and MassDEP will allow adjustments in the SWMP, so the City may be able to replace a failing program with a different program.

I.4 Executing the Stormwater Management Program

This document describes the stormwater best management practices that Melrose will complete during the next five years. The BMPs described herein are consistent with the City's Notice of Intent that was submitted in September 2018 and is included in Appendix A of this report. The BMPs build upon the important work conducted since the 2003 permit took effect, as reported in the City's annual reports since 2003.

The City's Department of Public Works Engineering Division serves as the coordinating entity for the NPDES permit program and associated compliance. Implementation of the permit requirements involves coordination with the DPW Operations and Facilities Divisions, as well as other City departments, boards, and commissions and the public. Compliance with this program is a regulatory requirement and is of utmost importance.

I.5 Existing Stormwater Programs in Melrose

The City of Melrose has implemented or supports many programs that help reduce stormwater pollution, including those developed to meet the 2003 permit. Those programs that will continue into this new permit term are included within the relevant sections of this document.

I.6 New or Increased Discharge, Surface Drinking Water

Documentation is required for all new or increased discharges granted by MassDEP. The City has not increased or developed any new discharges to Massachusetts waters. Furthermore, the City does not drain to any surface public drinking water, or tributaries of such water sources.

I.7 Names and Titles

The following individuals play important roles in the implementation of this SWMP:

- Mayor Paul Brodeur
- DPW Director: Elena Proakis Ellis, P.E.
- DPW City Engineer: Vonnie Reis, P.E.
- Deputy City Engineer: Jay Coy, P.E.
- Operations Manager: Joe Hobbs
- Facilities Manager: Jay McNeil
- City Solicitor: Shannon Phillips
- City Clerk: Kristin Foote
- Director of Planning and Community Development: Denise Gaffey
- Building Commissioner: Stephen Doucet

I.8 Updates to the SWMP

This SWMP is intended to be a living document and will be updated as changes or additions may be made to BMPs. Additionally, annual reporting documents will become part of the SWMP as they are created, and added to the applicable appendix. Updates to the names of responsible parties and other stakeholders will be made when personnel changes occur, and any changes or updates to impaired waters, endangered species mapping, or other regulatory items will also be reflected herein.

I.9 Receiving Waters and Priority Resource Areas

The primary goal of this SWMP is to protect water quality in Melrose's receiving waters. Melrose's MS4 discharges stormwater to the following receiving waters:

- Ell Pond
- Towners Pond
- Swains Pond
- First Pond
- Spot Pond Brook
- Long Pond/Long Pond Brook
- Penney Road Brook
- Bennetts Pond Brook
- Unnamed waterways

All of these water bodies are in the Mystic River and Boston Harbor basins. No public swimming beaches, Outstanding Resource Waters, shell fishing areas, or cold water fisheries are present within Melrose. Also, there are no active potable water supplies in the City, as Melrose's potable water comes from the Massachusetts Water Resources Authority.

As described further in Section 7, one receiving water body within Melrose is on the 303(d) list of impaired waters: Ell Pond. Another water body is subject to a completed Total Maximum Daily Load (TMDL) program under the Massachusetts Year 2016 Integrated List of Waters: Bennetts Pond Brook. In addition, a portion of Melrose is tributary to the Mystic River which is impaired for phosphorus.

Because of their listing as impaired waters, and because of Ell Pond's aesthetic value, Ell Pond and Bennetts Brook Pond are considered priority resource areas for the purposes of this SWMP.

Section 1
Control Measure 1: Public Education and Outreach

Control Measure 1, Public Education and Outreach, requires the City to educate its residents about the impacts of their activities on stormwater, and the impacts of polluted stormwater discharges on water quality. Educating the public about the importance of stormwater management can help lead to greater support for and compliance with the Stormwater Management Program.

The objective of Control Measure #1 is to "implement an education program that includes educational goals based on stormwater issues of significance within the MS4 area. The ultimate objective of a public education program is to increase knowledge and change behavior of the public so that pollutants in stormwater are reduced."

The permit requires that the education and outreach efforts target the following four audiences: "(1) residents, (2) businesses, institutions (churches, hospitals), and commercial facilities, (3) developers (construction), and (4) industrial facilities, unless one of these audiences in not present in the MS4 community." Note that Melrose does not have any industrial facilities; therefore, outreach targeting industry is not included herein. The City is required by the permit to distribute two educational messages over the permit term to each applicable audience, spaced at least one year apart. In addition, due to the bacteria impairment in Bennetts Pond Brook, the requirements of Part A.III of Appendix F of the permit must also be met.

The following public education/outreach BMPs may be implemented in Melrose to fulfill the requirements of Control Measure 1. These measures are presented as options to select from or modify over the course of the permit term, in order to meet the permit requirements.

BMP #1-1: Message on stormwater issues included with water and sewer bills

Description: The City's water and sewer bills have space for brief notices and information. The City will provide a message concerning stormwater management issues to be mailed to residences and businesses in Melrose.

Measurable Goal: Distribute message with water and sewer bills at least once during the permit term

Targeted Audience: Residents & Businesses, Institutions and Commercial Facilities

Schedule: Distribute message in Year 3 of the Permit term.

Responsible Department: Department of Public Works

Cost: $5,000

BMP #1-2: Make brochures available on stormwater topics

Description: The City has brochure racks at various locations, including the Public Works office, Engineering Division at City Hall, library, kiosks at city hall plaza, and at trailheads to two conservation lands. Typical topics have included water conservation, consumer confidence reports, lead information, backflow prevention, solid waste and recycling rules, etc. The City will select and/or develop applicable brochures covering stormwater topics and stock them at these locations. Potential topics include impacts on local water bodies from stormwater pollution, proper disposal of wastes, picking up after pets, etc.

Measurable goal: Select and stock brochures at DPW office, City Hall, and kiosks continuously beginning in Year 2 of the permit term

Targeted Audience: Residents & General Public

Schedule: Select brochures during Year 1. Stock brochures during Years 2 through end of the permit term.

Responsible department/person: Department of Public Works

Cost: 8 hours per year plus $200 printing expenses

BMP #1-3: Update City website to include information on stormwater management

Description: Update the City website to include information on stormwater management issues. In addition to posting information on the potential topics listed under BMP #1-2, the City will post this SWMP and links to other stormwater education and outreach materials on the webpage.

Measurable goal: Update City website to include information on stormwater management issues throughout the permit term.

Targeted Audience: Residents, General Public, Developers, Businesses, Institutions and Commercial Facilities

Schedule: By the end of the first permit year, post information on stormwater management issues on the City website. Maintain website thereafter.

Responsible department/person: Department of Public Works

Cost: 24 hours of staff time per year to update and maintain the website, as needed.

BMP #1-4: Staff a booth at the annual Victorian Fair

Description: The Melrose Chamber of Commerce, along with City merchants, conduct an annual festival called the Victorian Fair. Each September, the City will staff a booth at the fair to discuss stormwater management issues and distribute brochures on stormwater management.

Measurable goal: Staff booth at the annual Victorian Fair

Targeted Audience: Residents, General Public, & Businesses

Schedule: Once annually starting in Year 2 of the permit

Responsible department/person: Department of Public Works

Cost: Assuming two people staff the booth, 8 hours per year to prepare materials and 16 hours per year to staff the booth

BMP #1-5: Install and maintain signs for stormwater management and pet waste clean-up at schools and parks

Description: Publicize the importance of stormwater management and pet waste control and the impact of these measures on public health and the environment through posting signs at public facilities, such as schools and athletic fields in the Ell Pond vicinity. Signs should be inspected twice per year (spring and fall) and repaired or replaced as necessary.

Measurable goal: Maintain signs at the athletic fields near Ell Pond and inspect the signs at least annually

Targeted Audience: General Public

Schedule: The signs were installed under the prior permit. Inspect all signs at least annually.

Responsible department/person: Parks Department/ School Department / Department of Public Works

Cost: Relatively low cost. Inspections will require minimal time.

BMP #1-6: Provide stormwater information at the City's DPW Day

Description: The Department of Public Works conducts and annual "DPW Day" for all public elementary school children in grades K-2, as well as anyone from the public who would like to bring their kids to the event. The event includes entertainment and tables on a variety of topics. Age-appropriate stormwater information is disseminated at this event.

Measurable Goal: Staff booth at annual DPW Day and hand out "Dwayne the Storm Drain" coloring book to students at DPW Day

Targeted Audience: General Public

Schedule: This event is held annually in the spring. Begin in Year 1 of the permit term and continue throughout the term as long as this event continues.

Responsible Department: Department of Public Works

Cost: $100 for materials, plus 30 hours of total staff time to prepare for and work the event

BMP #1-7: Post information on stormwater management issues on local access television channel

Description: Prepare informational advertising or announcements for stormwater management issues to appear on the local access television channel during periods of no programming. Information would be flashed on the screen periodically along with other topics of interest.

Measurable goal: Stormwater information posted and updated on local access cable television channel during periods of non-programming.

Targeted Audience: General Public

Schedule: Variable throughout the permit term, beginning in Year 2 of the permit.

Responsible department/person: Department of Public Works.

Cost: 16 hours of staff time each year to prepare and update information for posting on local access channel, and 16 hours of staff time each year to coordinate postings with the local access channel

BMP #1-8: Distribute information on low impact development to developers via the Planning Department

Description: Distribute information about low impact development principles and technologies to developers when requests for site plan review or subdivision approvals are made, and discuss green infrastructure with developers during DPW reviews of development projects.

Measurable Goal: Distribute to developers seeking Site Plan Review or Subdivision approvals.

Targeted Audience: Developers (construction)

Schedule: Begin distribution at the end of Year 2 of the permit term.

Responsible Department: Planning Department and Department of Public Works

Cost: 4 hours of staff time to identify and stock materials

BMP #1-9: Revisit stormwater ordinances and consider updated requirements for new development and redevelopment projects

Description: Review stormwater ordinances to determine if said ordinances still uphold the proper sediment and erosion control practices for new development and redevelopment.

Measurable Goal: Update stormwater ordinances if deemed appropriate upon review

Targeted Audience: Developers (construction)

Schedule: Review ordinances during Year 3 of the permit term

Responsible Department: Department of Public Works, City Solicitor, City Council

Cost: 24 hours of staff time

BMP #1-10: Provide informational brochures on low impact development to the Building Department to make available to contractors

Description: The city will select brochures that best describe low impact development practices and technologies to distribute to contractors who work with the City's building department.

Measurable Goal: Provide applicable brochures to Building Department to have available to contractors.

Targeted Audience: Contractors

Schedule: Choose informational brochures in Year 2 of the permit term and make available by Year 3

Responsible Department: Department of Public Works

Cost: 8 hours per year of staff time to identify and stock brochures

BMP #1-11: Broadcast targeted messages about stormwater quality, pet waste, and fertilizer use using social media

Description: A variety of topics covering stormwater health that relate to the general public, businesses, and commercial facilities will be included in different social media messages distributed throughout the permit term. The messages will be released according to research which determines the most effective time of year for specific stormwater tips to be consumed by the targeted audience.

Measurable Goal: Broadcast messages using social media at least two times per year starting in Year 2.

Targeted Audience: General Public, Businesses, Commercial Facilities

Schedule: In the first year of the permit term the city will conduct research to determine what stormwater information should be released and what time of year the messages should be released. The messages will be released, two a year, for the next 4 years.

Responsible Department: Department of Public Works

Cost: 24 hours per year to develop and post materials to social media

BMP #1-12: Send message out using Mayor's Blog directing to information on stormwater webpage and other resources

Description: Release directional message from the Mayor's Blog to the City's stormwater information webpage as well as other useful stormwater information resources.

Measurable Goal: Send Mayor's Blog message directing to new information on stormwater webpage when finalized.

Targeted Audience: Residents, Businesses, Commercial Facilities

Schedule: The stormwater webpage will be finalized by the City in the first permit year. Following completion, the Mayor's Blog will release the directional message, targeted for early in Year 2.

Responsible Department: Department of Public Works and Mayor's Office

Cost: 4 hours of staff time

BMP #1-13: Provide information to residents seeking dog licenses

Description: The City will distribute informative brochures on pet waste to residents who are obtaining dog licenses.

Measurable Goal: Provide brochures to residents applying for dog licenses pertaining to appropriate handling of pet waste.

Targeted Audience: Residents

Schedule: The City will select a brochure to provide in the first year of the permit term and begin distributing throughout the permit term thereafter.

Responsible Department: City Clerk's Office

Cost: 4 hours of staff time per year to select and stock the brochures

Control Measure 1: Public Education and Outreach – Year 4 Update

BMP# 1-1: Distributed Sewer Infiltration and Inflow Brochure in water bills to the entire city during Year 2. This brochure included information about stormwater interconnections.

BMP #1-2: Brochures are stocked at City Hall, DPW City Yard Office, Planning Department, and the Building Department.

BMP #1-3: The City continued to maintain the stormwater outreach website that was created in year 1. (https://www.cityofmelrose.org/engineering/pages/keep-our-waterways-clean)

BMP #1-4: The Victorian Fair was held in September 2021. DPW was on hand to discuss stormwater issues using the EnviroScape model.

BMP #1-5: No update necessary.

BMP #1-6: Due to COVID-19, the City's DPW Day was cancelled this year. However, DPW will staff any future DPW Days to educate on stormwater issues.

BMP #1-7: Stormwater management information was posted on the City's local access cable station.

BMP #1-8: A flyer was selected and copies made for distribution in the Planning Department. Flyers were provided to the Planning Department early on in Year 3 and continued through Year 4. In addition, a PSA video on Low-Impact Development was posted on the City's website.

(https://www.cityofmelrose.org/engineering/files/melrose-stormwater-management-program)

BMP #1-9: The City's Stormwater Ordinance and Regulations were updated, accepted by the City Council, and posted to the website in June 2021.

BMP #1-10: Flyers were been provided to the Building Department early on in Year 3 and maintained through Year 4.

BMP #1-11: Stormwater quality, pet waste, and fertilizer use informational messages were broadcasted using social media with the following information and dates:

Do Your Doody – 7/8/2021, 8/3/2021
No Pool Water in Storm Drains – 10/13/2021, 10/14/2021
Bag Leaves to Keep Out of Waterways/Storm Drains – 10/20/2021
Keep Drains Free from Debris and Litter – 10/25/2021
Limit Road Salt Use to Keep Out of Waterways – 12/29/2021
Identify Storm Drains – 2/18/2022
Where does Litter Come From (video) – 5/12/2022
Street Sweeping – 5/13/2022
Rubber Ducky (video) – 5/16/2022
Stormwater Proofing Your Dumpster – 9/13/2022

BMP #1-12: The Mayor's blog is no longer used. Facebook, Twitter, and the City's website is now host to all stormwater quality updates.

BMP #1-13: Information on picking up after your dog is provided upon application to all residents seeking a dog license.

Section 2
Control Measure 2: Public Participation and Involvement

To comply with Control Measure 2, the City must comply with applicable state and local public notice requirements. In addition, EPA encourages other BMPs to involve the public. The objective of this control measure is to "provide opportunities to engage the public to participate in the review and implementation of the permittee's SWMP."

The following BMPs have been identified to comply with Control Measure 2.

BMP #2-1: Comply with state public notification guidelines at MGL Chapter 39 Section 23B

Description: Post notices announcing upcoming meetings as required by state law.

Measurable goal: Notices posted in designated locations announcing upcoming meetings as required by state law

Schedule: Ongoing throughout the permit term

Responsible department/person: City Clerk

Cost: Negligible.

BMP #2-2: Stencil catch basins with don't dump message (i.e. "Don't Dump - Drains to Pond")

Description: Stencil catch basins throughout the City by working with a volunteer group, such as the High School, Boy/Girl Scouts and/or local environmental group such as the Ell Pond Restoration Committee. A reasonable goal is to stencil 25 catch basins per year for four years. Stenciling will be prioritized to address catch basins that drain to more sensitive areas (such as Ell Pond) first.

Measurable goal: Stencil 25 catch basins per year for Years 2 through 5 of the first permit term.

Schedule: Each spring during Years 2 through 5 of the permit term.

Responsible department/person: Department of Public Works

Cost: Approximately $300 for materials for stenciling 100 catch basins, including stencil, latex yellow traffic paint, maps, paint rollers/pans/stirrers, plastic work gloves, brooms,

safety vests and cones. 24 hours of staff time per year will be required to identify the priority storm drains and train the volunteers. A police detail may be required, which would add additional costs.

BMP #2-3: Cleanups – Shoreline/Waterbody

Description: The Ell Pond Restoration Committee conducts an annual clean-up of the area surrounding Ell Pond. The City assists the clean-up effort by providing trucks and other equipment and removing the trash collected by the committee. The City will continue to assist with this and similar efforts.

Measurable goal: Continue to assist the Ell Pond Committee on its annual clean up events

Schedule: At least once annually throughout the permit term, unless the events are cancelled

Responsible department/person: Department of Public Works

Cost: Two people for 8 hours plus use of equipment

BMP #2-4: Stormwater Management Program Review

Description: The City's SWMP will be made available to the public on the City's webpage and will be available for review and comment from that time forward. This document is a living document that can be updated as needed throughout the permit term to reflect the implementation of the plan. Annual reports will also be posted to the website.

Measurable Goal: Make plan available on website and advertise via the Mayor's Blog.

Schedule: Upon the finalization of this Stormwater Management Program, the document will be made available and advertised via the Mayor's Blog. After that, any updated versions of the document will be posted online and available for review and comment. Annual reports will also be posted.

Responsible Department: Department of Public Works

Cost: 2 hours of staff time to post online and prepare blog post

Control Measure 2: Public Participation and Involvement – Year 4 Update

BMP #2-1: The City Clerk's office posts notices announcing upcoming meetings.

BMP #2-3: The DPW assists the Ell Pond Committee with its annual cleanup and also assists with other citywide cleanup events such as Earth Day cleanups. A few cleanups

took place including a city-wide earth day cleanup, which included the Litter Letter Project, on April 2022. In addition, an Ell Pond Cleanup Day took place in April 2022.

The City conducted two household hazardous waste collection days, one in October 2021 and one in June 2022. We also conducted two events to collect motor oil, gas, and antifreeze in September 2021 and April 2022.

Victorian Fair was held on September 12, 2021. Engineering staff used the EnviroScape to educate about stormwater issues.

BMP #2-4: The Stormwater Management Program was reviewed during the Year 4 compliance period and updated to reflect those comments and progress.

Section 3
Control Measure 3: Illicit Discharge Detection and Elimination

Control Measure 3, Illicit Discharge Detection and Elimination, requires the City to map its storm drain outfalls and eliminate illicit connections from the storm drain system. The objective, according to the permit, is "to systematically find and eliminate sources of non-stormwater discharges to its municipal separate storm sewer system and implement procedures to prevent such discharges."

Illicit discharges are contributions to the stormwater system that are not entirely composed of stormwater. These discharges include residential sewer connections inadvertently, but illegally, connected to the stormwater system, non-permitted industrial discharges, and accidental and intentional dumping into the stormwater system. Specifically, sanitary wastewater, septic tank effluent, commercial car wash waters, improperly disposed oil, radiator flush water, laundry wastewater, roadway accident spills, and improperly disposed auto/household toxics are not permitted in the storm drain system. EPA studies have found pollutant levels from these types of non-stormwater flows to be high enough to degrade the quality of the receiving waters, and even to threaten human and aquatic health. Accordingly, under this program, federal regulations require the development of programs to locate and eliminate these sources of pollution.

The City has had little evidence of illicit connections. Nonetheless, the City is undertaking a significant program to check its system for illicit connections, and to remove any that are found.

Illicit discharges are also being addressed by the City through public education measures, discussed above, which emphasize the importance of proper waste management and disposal, and pollution prevention measures, discussed later in this section, which help prevent or reduce the impacts of illicit discharges.

Other sources of illicit discharges include underdrain systems that discharge directly to receiving waters, or twin-invert manholes that provide open access to both sanitary and storm drain systems. Underdrain systems have been discovered and corrected in the past. There are no known twin-invert manholes in the City.

The following BMPs have been identified to fulfill the requirements of this control measure.

BMP #3-1: Storm sewer system map

Description: Maintain a map showing all known stormwater infrastructure and update the map during IDDE program implementation. The City has developed an online form that automatically populates Geographic Information System (GIS) attribute data based on outfall evaluations, which are being conducted as outfall locations are confirmed using GPS. The system map will also be updated to include the information shown in Part 2.3.4.5 of the permit.

Measurable goal: Inventory and re-confirm via GPS all outfall locations shown in the GIS.

Schedule: Reconfirm outfall locations via GPS and update the map with the required features within two years of effective date of permit. The map will be updated

Responsible department/person: Department of Public Works

Cost: 64 hours (4 days, 2 employees)

BMP #3-2: In-stream monitoring (dry weather)

Description: Conduct dry weather outfall screening in accordance with outfall screening procedure and permit conditions. Locate and evaluate all stormwater outfalls during dry weather and make water quality observations on flowing outfalls for evidence of contamination. Sediment buildup will also be noted. Based on the water quality observations, the City will rank outfalls to determine their priority for further investigations to search for illicit connections in storm drains tributary to the outfalls.

Measurable goal: Percent of outfalls screened.

Schedule: Dry weather field screening will be conducted by the end of Year 3.

Responsible department/person: Department of Public Works

Cost: 128 hours (2-person crew for eight days)

BMP #3-3: In-stream monitoring (wet weather)

Description: Conduct wet weather screening in accordance with outfall screening procedure and permit conditions. When one or more System Vulnerability Factor (SVF) is identified at a catchment, a wet weather investigation will be conducted and included in each annual report.

Measurable Goal: Conduct in accordance with outfall screening procedure and permit conditions.

Schedule: Wet weather sampling will be conducted beginning in Year 2 of the permit term.

Responsible Department: Department of Public Works

Cost: 64 hours (2-person crew for four days)

BMP #3-4: Map the stormwater collection system in a GIS

Description: Develop protocol for keeping stormwater GIS layers up to date.

Measurable goal: Implement a new protocol for GIS data updates to further data accuracy. Maintain drainage GIS layers and update when known changes are made or connections are identified.

Schedule: Determine updated protocol in Year 1 of the permit term

Responsible department/person: Department of Public Works

Cost: Negligible

BMP #3-5: Written IDDE program development

Description: Develop and implement a plan to identify and remove non-stormwater discharges to the MS4.

Measurable goal: Develop and implement written IDDE plan following permit protocols.

Schedule: The City will finalize a written IDDE plan during Year 1 of the permit. Implementation of the plan will extend into the remainder of the permit term, with milestones as required in the permit. The IDDE protocol has now been appended to this document. See Appendix D.

Responsible department/person: Department of Public Works.

Cost: 8 hours for development of the written plan

BMP #3-6: SSO inventory

Description: Track sanitary sewer overflows (SSOs) and add data to the City's GIS layers. The City tracks a wealth of information using its GIS but has historically not tracked sewer backups and/or SSOs. The City will begin tracking SSOs using the GIS, including associated attribute data such as the cause and other pertinent information.

Measurable Goal: Develop SSO inventory within one year of effective date of permit and track using GIS layer.

Schedule: Develop inventory during Year 1 of the permit.

Responsible Department: Department of Public Works

Cost: 8 hours

BMP #3-7: IDDE program implementation

Description: Once catchment areas are identified and ranked, infrastructure information will be collected by the City for all catchment structures. Further investigations including wet weather screening will be conducted by the City if one or more SVFs are identified.

Measurable Goal: Implement catchment investigations according to program and permit conditions.

Schedule: After the initial IDDE program requirements for screening have been met, ongoing screening will be conducted in accordance with Part 2.3.4.10 of the permit for the remainder of the permit term.

Responsible Department: Department of Public Works

Cost: The cost to implement this screening is unknown at this time and will need to be more fully evaluated once the IDDE program begins and the extent of SVFs is better understood.

BMP #3-8: Employee training

Description: Provide training on IDDE procedures for applicable DPW employees. Employees involved with the IDDE program will receive appropriate training on identification of illicit discharges and SSO's.

Measurable Goal: Train annually after IDDE program is in place.

Schedule: The City will provide training to staff annually in Years 2 through 5.

Responsible Department: Department of Public Works

Cost: 20 hours per year

BMP #3-9: IDDE Plan - Illegal Dumping Program.

Description: Maintain ordinance that gives the City authority to access buildings to search for illicit connections and allows the City to require redirection of any found. The City will update this ordinance if new information indicates that updates are appropriate.

Measurable Goal: Continue to enforce ordinance established on 4/7/2008.

Schedule: Maintain ordinance throughout the entirety of the permit term and update as may be required.

Responsible Department: Department of Public Works and City Solicitor

Cost: Negligible

BMP #3-10: IDDE Ordinance/Bylaw

Description: Maintain ordinance to require inspection of new construction for correct connection of sanitary and storm sewer connections. The City will update this ordinance if new information indicates that updates are appropriate.

Measurable goal: Continue to enforce ordinance established on 4/7/2008.

Schedule: Maintain ordinance throughout the entirety of the permit term and update as may be required.

Responsible department/person: Department of Public Works/City Solicitor

Cost: Negligible

Control Measure 3: Illicit Discharge Detection and Elimination – Year 4 Update

BMP #3-1: Outfall locations were confirmed and GPS'd in August 2020

BMP #3-2: Dry weather sampling was conducted in June 2020 for all Melrose outfalls

BMP #3-3: No update. Wet weather sampling for all outfalls with SVFs are not due until Permit Year 10.

BMP #3-4: The stormwater GIS data is maintained and updated as necessary.

BMP #3-5: The updated outfall mapping has been used to update catchment areas for the IDDE program.

BMP #3-6: The SSO inventory is updated annually and included in the appendices.

BMP #3-7: No update.

BMP #3-8: Employee training was conducted in June 2022.

BMP #3-9: The IDDE Plan - Illegal Dumping Program was maintained during the year 3 permit term. All stormwater related ordinances were reviewed by consultants from Weston & Sampson and recommendations for revisions were made as necessary. These revisions were brought before the City Council and accepted in June 2021.

BMP #3-10: The IDDE Ordinance/Bylaw was updated during the year 3 permit term. All stormwater related ordinances were reviewed by consultants from Weston & Sampson and recommendations for revisions were made as necessary. These revisions were brought before the City Council and accepted in June 2021.

Section 4
Control Measure 4: Construction Site Stormwater Runoff Control

Control Measure 4, Construction Site Runoff Control, is designed to reduce impacts to stormwater from construction sites. Specifically, the objective is to “minimize or eliminate erosion and maintain sediment on site so that it is not transported in stormwater and allowed to discharge to a water of the U.S through a permittee’s MS4.”

To comply with control measure 4, the City must “implement and enforce a program to reduce pollutants in any stormwater runoff discharged to the MS4 from all construction activities that result in a land disturbance of greater than or equal to one acre within the regulated area." The City’s program must also include “disturbances less than one acre if that disturbance is part of a larger common plan of development or sale that would disturb one or more acres.”

The program for this control measure must include:

- An ordinance or other regulatory mechanism to require erosion and sediment controls, as well as other wastes such as demolition debris, litter, and sanitary wastes
- Written procedures for site plan review, site inspections, and enforcement, including who is responsible and who has the authority to implement enforcement procedures
- Requirements for construction site operators to implement BMPs appropriate for the site conditions, possibly through references to BMP design standards or manuals
- Requirements to control other wastes such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste
- Procedures for receipt and consideration of information submitted by the public to the MS4 operators

The following best management practices (BMPs) for construction sites may be implemented to fulfill the requirements of Control Measure 4.

BMP #4-1: Site inspection and enforcement of Erosion and Sediment Control (ESC) measures

Description: Maintain Construction Site Erosion and Sediment Control ordinance for construction sites greater than one acre in area. Complete written procedures of site inspections and enforcement procedures.

Measurable goal: Ordinance approved by the City Council on 4/7/2008. Continue to enforce ordinance and update as deemed necessary.

Schedule: Continue to enforce ordinance throughout the permit term, and update if additional needs are identified.

Responsible department/person: Planning Board, Zoning Board of Appeals Inspectional Services and Department of Public Works.

Cost: 80 hours per year for reviews, inspections, and enforcement

BMP #4-2: Review site plans for stormwater impacts

Description: Review all construction site plans greater than 1 acre to be sure that adequate erosion and sediment controls will be in place during construction. Complete written procedures of site plan review and begin implementation.

Measurable goal: Continue following internal protocol for reviewing plans going through the Site Plan Review, Subdivision, or Zoning Board of Appeals processes and continue development reviews for stormwater impacts.

Schedule: Maintain internal protocol for reviewing plans, including identification/ training of appropriate town departments to conduct reviews. Begin site plan reviews for stormwater impacts starting in the first year.

Responsible department/person: Planning Board, Department of Inspectional Services, Department of Public Works

Cost: 20 hours per year for project reviews

BMP #4-3: Erosion and sediment control

Description: Maintain requirements for construction operators to implement a sediment and erosion control program.

Measurable Goal: Review proposed new developments going before the Planning Board or Zoning Board of Appeals with regard to the adequacy of both construction and post-construction stormwater quantity and quality considerations.

Schedule: Maintain current procedures, continue to enforce.

Responsible Department: Department of Public Works, Zoning Board of Appeals, and Department of Inspectional Services

Cost: 20 hours per year

BMP #4-4: Public input for Construction Projects.

Description: Conduct public outreach meetings for Public Works projects when appropriate. Obtain NPDES construction permits where applicable. Maintain communication with residents throughout the duration of projects at neighborhood meetings and via office availability.

Measurable goal: Hearings and neighborhood meetings to continue as needed on City construction projects and DPW contact information routinely provided for complaints.

Schedule: Implementation in first year of permit continuing through permit term.

Responsible department/person: Department of Public Works and Department of Inspectional Services.

Cost: 16 hours per year for public meetings for construction projects

BMP #4-5: Adopt waste control requirements for construction sites

Description: Adopt requirements to control wastes, including but not limited to, discarded building materials, concrete truck wash out, chemicals, litter and sanitary wastes. The City presently has ordinances related to both temporary and permanent waste containers, solid waste handling, and sanitary waste handling. These will be reviewed and updated as necessary to encompass the items included in the permit.

Measurable Goal: Develop and enforce ordinance, bylaw, or policy

Schedule: Review ordinance for construction site waste management in Year 1 of the permit and identify opportunities for improvements. Enhance ordinances as deemed appropriate in Year 2 of the permit term.

Responsible Department: Department of Public Works, Department of Planning

Cost: 12 hours of staff time

Control Measure 4: Construction Site Stormwater Runoff Control – Year 4 Update

BMP #4-1: The Site Inspection and enforcement of Erosion and Sediment Control (ESC) measure regulations were updated and adopted into the new Stormwater Ordinance and also will be included in the Stormwater Design and Construction Standards. Site inspections were conducted at all applicable construction sites on a routine basis throughout Permit Year 4.

BMP #4-2: All new site plans are reviewed for stormwater impacts. All stormwater related ordinances were reviewed by consultants from Weston & Sampson and

recommendations for revisions were made as necessary. These revisions were brought before the City Council and accepted in June 2021.

BMP #4-3: Erosion and sediment control best practices were updated and will be maintained.

BMP #4-4: Public input for construction projects is requested during public hearings.

BMP #4-5: The solid waste control requirements and regulations are currently being reviewed and updated as necessary.

Section 5
Control Measure 5: Post-construction Stormwater Management in New Development and Redevelopment

The objective of Control Measure 5 is to "reduce the discharge of pollutants found in stormwater through the retention or treatment of stormwater after construction on new or redeveloped sites." Permittees under the 2003 permit are required to continue to implement and enforce their programs and to modify them as necessary to meet the new permit. Specifically, the City must develop or modify, as appropriate, ordinances or other regulatory mechanisms to require the following:

- Low impact development site planning and design strategies be used to the maximum extent feasible
- The design of treatment and infiltration practices to follow the guidance in Volume 2 of the Massachusetts Stormwater Handbook or other approved guidance manual
- Stormwater management systems for new development to not allow new, untreated discharges, control peak runoff rates, recharge groundwater, eliminate or reduce the discharge of high pollutant loads, protect public water supplies, and meet specific goals for runoff volumes and removal of total suspended solids (TSS) and total phosphorus (TP)
- Stormwater management systems for redevelopment to meet Massachusetts Stormwater Standard Nos. 1, 2, 3, 5, and 6 and to improve existing conditions by meeting specific goals for runoff volumes and removal of TSS and TP
- Submittal of as-built plans and implementation of long-term maintenance practices

This control measure also requires the City to:

- Evaluate current street and parking lot design guidelines and make modifications as feasible to advance the goals of the SWMP
- Evaluate existing regulations to allow BMPs such as green roofs, rain gardens, curb extensions, and other infiltration practices and water harvesting devices
- Identify a minimum of five City-owned properties that could be retrofitted with BMPs to reduce the frequency, volume, and pollutant loads of stormwater

The following best management practices (BMPs) for new development and redevelopment may be implemented to fulfill the requirements of Control Measure 5.

BMP #5-1: As-built plans and operations and maintenance (O&M) for on-site stormwater control

Description: As part of the review process for all projects that go before the Planning Board (e.g., Site Plan Review, Subdivision approvals, etc.), the DPW's Engineering Division requires the submission and approval of an as-built plan. This condition is included in the Planning Board's decision, and final occupancy is not approved until the as-built has been received, is modified based on any City comments, and has been approved by the Engineering Division. As-built plans are required to include all stormwater infrastructure, including locations, materials, and sizes. In addition, the review comments from DPW and the Planning decision also include a condition that a written O&M plan must be provided for all stormwater infrastructure. As-built drawings and O&M plans will be used to ensure long term operation and maintenance of privately owned BMPs. Similarly, final occupancy is not approved until this plan has been submitted. In the case of projects that will involve multiple property owners, a homeowner's or condominium association agreement is also required specifying the need to maintain the stormwater systems per the O&M plan. These requirements are standard conditions of the Engineering Division's review documents and the Planning Board's decisions.

Measurable Goal: Continue to require submission of as-built plans and O&M procedures for completed projects.

Schedule: Begin requirements in 2018 and continue enforcing throughout permit term.

Responsible Department: Department of Public Works

Cost: 16 hours per year to review and ensure these requirements are met prior to occupancy

BMP #5-2: Allow green infrastructure

Description: Develop a report assessing existing local regulations to determine the feasibility of making green infrastructure practices, such as green roofs, infiltration practices, and water harvesting, allowable when appropriate site conditions exist.

Measurable Goal: Complete four years after the effective date of the permit and implement recommendations of the report.

Schedule: Begin development of the report by Year 3 of the permit and complete by Year 4.

Responsible Department: Department of Public Works

Cost: 30 hours to review and develop appropriate ordinances

BMP #5-3: Street design and parking lot guidelines

Description: Develop a report assessing requirements that affect the creation of impervious cover. The assessment will help determine if design standards for streets and parking lots can be modified to support low impact design options.

Measurable Goal: Complete four years after the effective date of the permit and implement recommendations of the report.

Schedule: Begin development of the report by Year 3 of the permit and complete by Year 4.

Responsible Department: Department of Public Works

Cost: 12 hours of staff time

BMP #5-4: Adoption, amendment, or modification of a regulatory mechanism to meet permit requirements

Description: Ensure any stormwater controls or management practices for new development and redevelopment meet the retention or treatment requirements of the permit and all applicable requirements of the Massachusetts Stormwater Handbook.

Measurable Goal: Adopt, amend, or modify the existing regulatory mechanisms to meet the permit requirements.

Schedule: Complete 2 years after effective date of permit.

Responsible Department: Department of Public Works, Planning Board, Zoning Board of Appeals

Cost: 12 hours of staff time

BMP #5-5: Inventory and priority ranking of MS4-owned properties that may be retrofitted with BMPs

Description: Conduct a detailed inventory of MS4-owned properties and rank for retrofit potential. Identify at least 5 permittee-owned properties that could be modified or retrofitted with BMPs to reduce impervious areas and update annually. Recently, three properties have been identified as good locations for retrofits when other modifications are planned and funding sources allow: the City Hall municipal parking lot, the Friends municipal parking lot, and a park on Crystal Street adjacent to Ell Pond. These locations have all been included in the most recent 5-year capital improvement plan for the City, and grant funds will be sought when projects are eligible. Additionally, the prior 604(b) funded stormwater report identifies a handful of potentially viable projects, including rain gardens and subsurface treatment systems in several City parks and rights-of-way. A grant application was submitted for one of these projects, beneath Franklin Field, but

the project unfortunately was not selected. These projects will all be included on the final list when developed and ranked.

Measurable Goal: Complete 4 years after permit effective date.

Schedule: Conduct research on municipal properties that could be retrofitted with BMPs from the effective date of the permit until Year 4. Decide in Year 4 which properties could be modified to reduce stormwater pollution.

Responsible Department: Department of Public Works

Cost: 20 hours of staff time

BMP #5-6: Maintain post construction ordinance

Description: Maintain the ordinance to apply the appropriate standards of the Massachusetts Stormwater Policy (MSP) to developments disturbing more than 1 acre throughout the City. Update the ordinance as needed.

Measurable goal: Ordinance was approved by the Aldermen on 4/7/08.

Schedule: Maintain the current ordinance and continue to enforce it; update the ordinance as deemed appropriate during the permit term.

Responsible department/person: Planning Board, Zoning Board of Appeals, Department of Inspectional Services, Department of Public Works.

Cost: 4 hours of staff time

BMP #5-7: Maintain post construction design standards.

Description: Maintain reference to stormwater BMP manual to be used for consistent design and performance standards.

Measurable goal: The Site Plan Review ordinance references a requirement for consistency with the MassDEP Stormwater Management Policy (Ordinance #235-16.1).

Schedule: Continue to enforce the ordinance throughout the permit term and update as deemed necessary to meet the permit conditions.

Responsible department/person: Planning Board, Conservation Commission, Department of Inspectional Services, Department of Public Works.

Cost: 4 hours of staff time

BMP #5-8: Maintain BMP operations and maintenance program

Description: Maintain ordinance to ensure long-term maintenance of both City-owned and privately owned structural BMPs. Continue to require project proponents to submit to the City a description of all new BMPs, including location, design and installation plans, vendor and manufacturer, and manufacturer's recommended maintenance requirements. As noted previously, the City requires developers to submit O&M plans with maintenance schedules, along with documents confirming responsibilities for O&M, prior to signing off on occupancy permits.

Measurable goal: Ordinance was approved by the Aldermen 4/7/08. Maintain and enforce ordinance.

Schedule: Continue to enforce ordinance and updated as deemed necessary during the permit term.

Responsible department/person: Department of Inspectional Services, Department of Public Works

Cost: 16 hours of staff time annually to track developments and ensure O&M is being performed

Control Measure 5: Post-construction Stormwater Management in New Development and Redevelopment – Year 4 Update

BMP #5-1: As-built plans and operations and maintenance (O&M) for on-site stormwater control are required to ensure long term operation and maintenance of privately owned BMPs.

BMP #5-2: The Green Infrastructure Draft Report was completed and appended to this SWMP.

BMP #5-3: The Street Design and Parking Lots Draft Report was completed and appended to this SWMP.

BMP #5-4: All stormwater related ordinances were reviewed by consultants from Weston & Sampson and recommendations for revisions were made as necessary. These revisions were brought before the City Council and accepted in June 2021.

BMP #5-5: The City has identified multiple areas for BMP retrofits. The portion of the City in the Mystic River Watershed has various BMP Retrofit projects identified in the PSIR as well.

BMP #5-6: The post construction ordinance is currently being maintained. During Permit Year 2, the post-construction ordinance and design standards were reviewed and those

updates were drafted to bring the ordinance into compliance with the MS4 Permit. These revisions were brought before the City Council and accepted in June 2021.

BMP #5-7: The post construction design standards are currently being maintained. During Permit Year 2, the post-construction ordinance and design standards were reviewed and that updates were drafted to bring the ordinance into compliance with the MS4 Permit. These revisions were brought before the City Council and accepted in June 2021.

BMP #5-8: The BMP operations and maintenance program is currently being maintained.

Section 6
Control Measure 6: Good Housekeeping and Pollution Prevention for Permittee-owned Operations

The objective of Control Measure 6 is for the City to "implement an operations and maintenance program for permittee-owned operations that has a goal of preventing or reducing pollutant runoff and protecting water quality from all permittee-owned operations."

To comply with this minimum control measure, the City must develop and implement written operations and maintenance procedures for all applicable municipal activities and incorporate them into this SWMP. Several of these procedures are already in place, as described within the BMPs in this section. Others will be added to this SWMP as they are developed, within two years of the effective date of the permit.

The following specific tasks are required to meet this control measure:

- Review and inventory annually all permittee-owned parks and open space, buildings and facilities where pollutants are exposed to stormwater, and vehicles and equipment. Specific requirements for each type of facility are detailed in Part 2.3.7.a.ii of the permit.
- Develop and implement an infrastructure O&M plan detailing procedures to ensure MS4 infrastructure is maintained in a timely manner to reduce the discharges of pollutants.
- Optimize routine inspections, cleaning, and maintenance of catch basins, including tracking of catch basins cleaned, volumes removed, and basins requiring more frequent attention.
- Establish and implement procedures for street sweeping of roadways and parking lots and track the miles cleaned or volume or mass of material removed.
- Manage catch basin cleanings and street sweepings in compliance with MassDEP policies.
- Implement procedures for winter road maintenance and storage of salt and sand.
- Implement maintenance activities, maintenance schedules, and inspection procedures for all structural and non-structural stormwater controls.
- Develop a stormwater pollution prevention plan for the DPW City Yard facility within two years of the effective date of the permit, and determine whether any other City-owned locations require SWPPPs. Facilities noted in the permit include maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater.

The following pollution prevention/ good housekeeping best management practices (BMPs) may be implemented to fulfill the requirements of Control Measure 6.

BMP #6-1: Inventory all permittee-owned parks and open spaces, buildings and facilities, and vehicles and equipment

Description: Create inventory of the City's infrastructure.

Measurable Goal: Complete two years after the effective date of permit and implement annually.

Schedule: Begin taking inventory of City infrastructure in Year 1 of the permit using existing GIS layers and complete the inventory in Year 2. Continue inventory upkeep for the remainder of the permit term.

Responsible Department: Department of Public Works

Cost: 16 hours annually of staff time

BMP #6-2: Operation and maintenance procedures

Description: Create written O&M procedures including all requirements contained in 2.3.7.a.ii for parks and open spaces, buildings and facilities, and vehicles and equipment.

Measurable Goal: Complete and implement two years after effective date of permit.

Schedule: Initiate the collection of inventory data necessary for O & M procedures in Year 1 and establish written procedures meeting all requirements in Year 2 of the permit term.

Responsible Department: Department of Public Works

Cost: 40 hours of staff or consultant time

BMP #6-3: Infrastructure O&M

Description: Establish and implement program for repair and rehabilitation of MS4 infrastructure. The existing drainage GIS layers will be used to assist with this task, to catalog and track existing infrastructure condition and maintenance.

Measurable Goal: Complete two years after effective date of permit.

Schedule: In the first two years of the permit term, draft than establish a written or electronic program for the procedures the City will undertake to repair and rehabilitate its drainage infrastructure.

Responsible Department: Department of Public Works

Cost: 80 hours of staff time plus consultant assistance of unknown value

BMP #6-4: Stormwater Pollution Prevention Plan (SWPPP)

Description: Create SWPPPs for maintenance garages, transfer stations, and other waste-handling facilities. As noted above, the DPW City Yard has been identified as a facility that requires a SWPPP. The City will also determine whether any other City-owned property requires a SWPPP per the permit.

Measurable Goal: The SWPPP will be completed and actively implemented. The City will determine if any other SWPPPs are required and, if so, will develop and implement those as well.

Schedule: Complete and within two years of the effective date of the permit.

Responsible Department: Department of Public Works

Cost: Estimated at $30,000 of consultant effort

BMP #6-5: Catch basin cleaning

Description: The City has established a catch basin cleaning program such that each catch basin is no more than 50% full when cleaned. While the City has committed to cleaning at least 1/3 of catch basins Citywide each year, Melrose is presently split into four quadrants for catch basin cleaning, and two of the areas are typically cleaned each year. Thus, cleaning is routinely taking place of half of the City's basins each year, such that within any two year period, all basins have been cleaned. In addition, the City maintains a "drain periodicals" list of catch basins and pipelines that have been noted to have more debris than others and thus need to be cleaned more often. These drains are cleaned at least every other month, with the ideal goal being cleaned monthly. The "drain periodicals" list is cleaned using in-house forces and the City's vactor truck, while the Citywide catch basin cleaning is done through an annual on-call contract with an outside contractor, who is hired to clean the basins by quadrant of the City.

Measurable Goal: Clean catch basins on the established schedule and report the number of catch basins cleaned annually. Clean at least 1/3 of the City's catch basins annually. Clean prioritized catch basins and clean drain pipes as necessary. Ensure proper disposal of residuals.

Schedule: The schedule noted above has already been established and will be implemented throughout the permit term.

Responsible Department: Department of Public Works

Cost: Under our current contract, the City pays approximately $50,000 per year plus 40 hours per year staff time for oversight and records maintenance. The ultimate cost varies depending whether the City opts to use clam shell or vactor technology for the removal of debris, and whether the City or the contractor is responsible for disposal of the materials removed.

BMP #6-6: Street Sweeping Program

Description: Sweep all streets and permittee-owned parking lots in accordance with the permit conditions. The City presently has both a fall and a spring sweeping program. The City hires and outside contractor through an annual contract to perform the fall sweeping of all City-owned streets and parking lots. The spring cleanup is typically accomplished using the City's sweeper and in-house labor, with the exception of the main drags, which are swept by the outside contractor. Under this program, all major roads and parking lots are swept at a minimum twice per year, and smaller roadways are swept either once or twice per year. Commercial areas are swept in-house twice per week in non-winter months. All roadways where construction has taken place are also swept more frequently, including prior to final paving. Proper disposal of all debris is ensured.

Measurable Goal: Sweep all streets and permittee-owned parking lots at least once per year in the spring. Maintain records of the schedule and daily volume of residuals collected.

Schedule: This protocol is followed now and will be ongoing throughout the permit term.

Responsible Department: Department of Public Works

Cost: Under the present street sweeping contract, sweeping of the entire City during one season costs approximately $40,000. The total estimated cost to implement the program as described is $50,000 plus 160 hours of staff time.

BMP #6-7: Road salt use optimization program

Description: Continue to implement the existing program to minimize the use of road salt and update the plan as becomes necessary based on new information during the permit term. The current procedures include the following:

- Use appropriate sand/salt mixture
- Calibrate spreaders at the beginning of each winter (at least once per year)
- Maintain calibration and deicer volume records after each storm
- Keep salt stored in an enclosed shed, never outside
- Minimize the time any salt or sand is uncovered

The City also monitors industry standards and practices to continually evaluate new technologies that cost-effectively minimize deicer usage and modifies deicing practices as appropriate.

Measurable Goal: Implement the salt use optimization protocol during the deicing season using the measures noted above.

Schedule: The use of this protocol will be ongoing throughout permit term and updated as deemed necessary.

Responsible Department: Department of Public Works

Cost: 30 hours per year to implement the protocol during winter operations

BMP #6-8: Inspections and maintenance of stormwater treatment structures.

Description: Establish and implement inspection and maintenance procedures and frequencies. Current treatment structures include the structures within the City Yard, known structures at the Melrose Veterans Memorial Middle School parking lot, and the four rain gardens installed in 2018 on Orient Avenue. The rain gardens are currently inspected monthly for condition, operability, and identifying maintenance needs. They are then maintained as needs are identified. The structures at the Middle School parking lot are scheduled to be cleaned in Year 2 and will continue to be cleaned annually. Any other treatment structures owned and maintained by the City will be identified and added to the O&M plan.

Measurable Goal: Inspect and maintain treatment structures at least annually.

Schedule: Establish procedures in Year 1 of the permit term and implement yearly thereafter.

Responsible Department: Department of Public Works

Cost: 20 hours of annual staff time plus approximately $2,000 for outside maintenance contractors

BMP #6-9: O&M program for vehicle maintenance

Description: Continue to train mechanics in the use and disposal of motor vehicle gasoline and oil, solvents, diesel, etc. The current protocol dictates the following:

- Hazardous materials are properly managed
- All vehicle maintenance is done inside the garage
- Hazardous waste removal from DPW is performed by a licensed company

The City will minimizing impacts from vehicle maintenance through employee education and proper hazardous materials management, as well as use reduction.

Measurable Goal: Continue to properly handle and dispose of materials used in vehicle maintenance.

Schedule: Train mechanics every year throughout the permit term to ensure compliance.

Responsible Department: Department of Public Works

Cost: 8 hours per year of staff time

BMP #6-10: O&M program for vehicle washing

Description: The City will continue to wash small vehicles at a commercial car wash, use biodegradable phosphate free soap, and implement outdoor vehicle washing procedures. During the prior permit term, the City:

- Instituted the use of biodegradable phosphate free soap,
- Installed a gas/oil and silt separator at the City Yard to catch washing runoff from all vehicles, and
- Performed small vehicle washing at a commercial car wash.

During this permit term, the City intends to continue these practices.

Measurable Goal: Continue the practices listed above to minimize the impacts to stormwater of vehicle washing.

Schedule: Procedures will be implemented for the entirety of the permit term.

Responsible Department: Department of Public Works

Cost: $500 per year

BMP #6-11: Forestation: tree planting and maintenance program

Description: Continue practice of planting at least 50 trees per year and maintaining trees as needed. The City has a robust tree planting program. Whenever a City tree is removed, a work order is entered into the DPW's work order management system. In addition, residents can request to have street trees planted. In some instances where a street tree cannot fit within the right-of-way, when a street is planted following roadway rehabilitation, the City also offers "setback" trees on private property near the right-of-way as an alternative. While the commitment herein is to plant at least 50 trees per year, in years when the budget has allowed, such as 2018, the City has planted upwards of 150 trees.

Measurable goal: Number of trees planted.

Schedule: Ongoing throughout the permit term.

Responsible department/person: Department of Public Works

Cost: $26,000 per year at the City's present contract price for supplying and planting trees, plus 40 hours of associated staff time per year

BMP #6-12: Trash management: illegal dumping control

Description: Continue illegal dumping control. Signs are posted at dead end streets and other possible illegal dumping locations. The City will continue to maintain and monitor the sites and signs and will clean-up sites where illegal dumping is identified.

Measurable Goal: Continue to monitor sites and signs. If needed, post additional signs at dead end streets and other possible illegal dumping locations.

Schedule: Maintain signs throughout the permit term and post additional signs when identified as necessary. Monitoring of sites and signs will be ongoing throughout the permit term.

Responsible Department: Department of Public Works

Cost: 24 hours per year for record keeping plus $50 per year for new or replacement signs

BMP #6-13: Household Hazardous Waste Collection

Description: Hold two annual Household Hazardous Waste Collection Days for residents to dispose of waste items. The City has been conducting two events per year for this purpose for several years, as well as a variety of other waste and recycling collection days. The City is continually expanding the array of items that it collects at these special collection days.

Measurable goal: Conduct two Household Hazardous Waste Collection Days annually.

Schedule: Hold Household Hazardous Waste Day twice per year during each year of the permit term.

Responsible department/person: Department of Public Works

Cost: Negligible, as these days are already routinely held and are budgeted.

BMP #6-14: City Yard Drainage

Description: Perform annual evaluation and maintenance of drainage structures, including oil/water separator(s) at the City Yard.

Measurable Goal: Maintain drainage system and separators at the City Yard. Perform maintenance and inspection annually. Clean catch basins at the City Yard at least twice per year.

Schedule: Perform annual maintenance and biannual catch basin cleaning at the City Yard throughout the permit term.

Responsible Department: Department of Public Works

Cost: $1,000 plus 12 hours annually

BMP #6-15: Employee training program

Description: Provide stormwater training to Department of Public Works employees.

Measurable Goal: Provide stormwater-related training, at a minimum, for the four DPW Foremen (water, sewer, drainage, and highway) who oversee DPW employees whose day-to-day activities include maintenance of the stormwater system, street cleaning, snow removal operations, or similar activities. Other foreman should also be considered for training, as well as laborers who work within the sewer and drain division.

Schedule: Ongoing during permit term, beginning in Year 2.

Responsible Department: Department of Public Works

Cost: 24 hours of staff time annually

BMP #6-16: Park and landscape maintenance

Description: Train appropriate staff as deemed necessary during the permit term to minimize the application of herbicides, pesticides, and fertilizers. While this BMP was not included in the fall 2018 Notice of Intent, it has been added as it provides significant benefits for stormwater quality. Proper application of fertilizers can minimize the runoff of nutrients into local waterways, and education can prevent over-application.

Measurable goal: Training of applicable personnel will be conducted annually in the spring beginning in Year 2 of the permit.

Schedule: Training will be conducted once per year starting in Year 2 of the permit term.

Responsible department/person: Parks Department, Department of Public Works, Cemeteries

Cost: 24 hours per year of staff time

Control Measure 6: Good Housekeeping and Pollution Prevention for Permittee-owned Operations – Year 4 Update

BMP #6-1: In Year 2, the City developed and maintained an inventory of all municipally owned parks and open spaces, buildings and facilities, and vehicles and equipment.

BMP #6-2: All operation and maintenance procedures were created and were implemented in 2020. The Standard Operating Procedures are located in Appendix F.

BMP #6-3: Infrastructure O&M is included in the standard operation procedures that were developed in 2020.

BMP #6-4: A Stormwater Pollution Prevention Plan (SWPPP) was created for the DPW City Yard and the Wyoming Cemetery and was implemented in 2020.

BMP #6-5: Catch basins are cleaned every other year and a catch basin optimization plan is being created.

BMP #6-6: The Street Sweeping Program protocol is currently being implemented.

BMP #6-7: Road salt use optimization program is currently being implemented.

BMP #6-8: All stormwater treatment structures are inspected and maintained as required.

BMP #6-9: The O&M program for vehicle maintenance is currently being implemented.

BMP #6-10: The O&M program for vehicle washing is currently being implemented.

BMP #6-11: Forestation: tree planting and maintenance program is currently being implemented. The City planted 77 trees in the fall of 2021, 102 trees in the Spring of 2022, and plans to plant approximately 200 trees in the fall of 2021 and spring of 2022.

BMP #6-12: Trash management: illegal dumping control is currently being implemented. The DPW conducted an inventory of all municipal trash receptables, including the types and condition.

BMP #6-13: Household Hazardous Waste Collection is currently being implemented.

BMP #6-14: The City Yard drainage is inspected and maintained in accordance with the current permit requirements.

BMP #6-15: In-person training was completed in June 2022.

BMP #6-16: In-person training was completed in June 2022.

Section 7
Permit Eligibility

This section assesses Melrose's NPDES Phase II permit eligibility with respect to endangered species, historic places, and impaired waters.

The Phase II rule prohibits stormwater discharges (or discharge-related activities) that "are likely to jeopardize the continued existence of any species that are listed as endangered or threatened under the Endangered Species Act (ESA) or result in the adverse modification or destruction of habitat that is designated as critical under the ESA." The rule also prohibits discharges that jeopardize Essential Fish Habitats, adversely affect properties listed (or eligible to be listed) on the National Register of Historic Places, or that cause or contribute to instream exceedances of water quality standards. If a municipality does not meet these requirements, it must apply for the more stringent individual permit, rather than the general permit.

Melrose meets eligibility requirements for the general permit, as detailed below.

7.1 Endangered Species

Appendix C to the EPA final NPDES Phase II General MS4 Permit effective July 1, 2018 requires that activities regulated by the small MS4 (municipal separate stormwater system) general permit do not adversely affect federally protected species or their critical habitat. Small MS4 operators need to assess the impacts of their stormwater discharges, allowable non-storm water discharges, and discharge related activities on federally protected species and their habitat and, prior to obtaining general permit coverage, applicants must meet the eligibility provisions of this permit.

Appendix C of the permit presents three criteria to determine whether an applicant can meet the Endangered Species Act requirements. The City of Melrose is eligible per by Criterion C. As discussed with the U.S. EPA prior to submission of the City's Notice of Intent, the actions of the City of Melrose pertaining to the MS4 permit will not adversely affect the Northern Long-eared Bat or its habitat.

7.2 Historic Places

Appendix D to the EPA Final NPDES Phase II General MS4 Permit requires that applicants determine whether their MS4' s storm water discharges, allowable non-stormwater discharges, or construction of best management practices to control such discharges, has potential to affect a property that is listed or eligible for listing on the National Register of Historic Places. Appendix D provides three scenarios describing how applicants can meet the permit eligibility criteria for protection of historic properties. The first scenario states (among other things) that if there are no historic properties identified in the path of an MS4' s discharges, then the applicant has met the National Historic Preservation Act (NHPA) eligibility criteria for the permit.

The City of Melrose has the following properties on the National Register of Historic Places:

- Beebe Estate, 235 W. Foster St., listed since May 1981.
- Larrabee' s Brick Block, 500-504 Main St., listed since March 1984.
- Melrose Public library, 63 W. Emerson St., listed since June 1988.
- Melrose Town Center Historic District, Main St., listed since March 1982.
- Trinity Episcopal Church, 131 W. Emerson St., listed since May 1995.
- Upham, Phineas, House, 255 Upham St., listed since March 1990.

None of these historic properties are in the path of the City's discharges. Therefore, the City meets the NHPA eligibility per Criterion A of Appendix D for the permit.

7.3 Impaired Waters

One water body that lies within or borders the City of Melrose is listed on the Massachusetts Year 2016 Integrated List of Waters as subject to a TMDL.

- Bennetts Pond Brook (93-48) – 2.4 miles, addresses the pollutants Fecal Coliform and Escherichia coli (E. coli).

If a Total Maximum Daily Load (TMDL) has been developed and approved for any water body in a municipality, then the permittee must include enhanced BMPs that will specifically address the impaired water body and be consistent with the TMDL. Bennetts Pond Brook is subject to TMDL #50120: Final Pathogen TMDL for the Northern Coastal Watershed.

The City of Melrose shall implement the following BMPs in addition to the BMPs previously covered in this SWMP.

- **Public education on pet waste management and septic systems**

  Description: The City of Melrose will distribute an annual message via social media including relevant information on the responsible management of pet waste. The City will distribute brochures on the proper management of pet waste to dog owners seeking permits. Catchment maintenance information to owners of septic systems that discharge to Bennetts Pond Brook, if applicable. At this time, the City is not aware of any septic system owners in Melrose within the Bennetts Pond Brook watershed.

Measurable Goal: Release social media message annually, provide waste management information to dog owners and septic system owners.

Schedule: Release social media message each year, release dog waste information and septic system information throughout the permit term after materials are produced during Year 1 of the permit term.

Responsible Department: Department of Public Works

Cost: 3 hours of time to develop social media message, 6 hours of total time to develop both pet waste and septic system discharge informational materials.

- **Illicit Discharge Detection:**

  Description: Catchments draining to Bennetts Pond Brook shall be designated high priority for the implementation of the City's Illicit Discharge Detection and Elimination program.

  Measurable Goal: List Bennetts Pond Brook catchments as highest priority in the City's IDDE program

  Schedule: The IDDE catchment investigation procedure will be completed by Year 2, including the listing of high priority catchments.

  Responsible Department: Department of Public Works

  Cost: Negligible

Other water bodies that lies within or borders the City of Melrose is listed on the Massachusetts Year 2016 Integrated List of Waters (303(d) list):

Approximately 60% of the City of Melrose's land area is located within the Mystic River Watershed. Runoff from the western portion of the City drains to Ell Pond or Ell Pond Brook, which flows into the Malden River and eventually reaches the Mystic River just upstream of the Amelia Earhart Dam. On the Final 2018/2020 303(d) List of Impaired Waters, Ell Pond, the Malden River and the portion of the Mystic River upstream of the Amelia Earhart Dam are impaired for phosphorus, which requires the development of a TMDL (in addition to the Final Report issued for Alternative TMDL Development for the Mystic River Watershed, which was published in January 2020) as noted below.

- Ell Pond (MA71014) - 23 acres, due to Chlorophyll-a, Fecal Coliform, Harmful Algal Blooms, Phosphorus (Total), Total Suspended Solids (TSS) and Transparency/Clarity.
- Malden River (MA71-05) – 2 miles from culverted portion south of Charles Street, Malden to confluence with Mystic River, Everett/Medford – impaired due to (Debris*), (Water Chestnut*), Chlordane in Fish Tissue, DDT in Fish Tissue,

Dissolved Oxygen Saturation, Dissolved Oxygen Supersaturation, E.Coli, Fecal Coliform, Flocculant Masses, Odor, Oil and Grease, PCBs in Fish Tissue, High pH, Phosphorus (Total), Scum/Foam, Sediment Bioassay [Chronic Toxicity Freshwater], Temperature, Total Suspended Solids (TSS), Transparency / Clarity, Trash.

- Mystic River (MA71-02) – 5 miles from Outlet Lower Mystic Lake, Arlington/Medford to Amelia Earhart Dam, Somerville/Everett – impaired due to (Eurasian Water Milfoil, Myriophyllum Spicatum*), (Non-Native Aquatic Plants*), (Water Chestnut*), Arsenic, Chlordane in Fish Tissue, Chlorophyll-a, DDT in Fish Tissue, Dissolved Oxygen, Dissolved Oxygen Supersaturation, E.Coli, PCBs in Fish Tissue, High pH, Total Phosphorus, Sediment Bioassay [Chronic Toxicity Freshwater], Transparency / Clarity.
  *TMDL not required (non-pollutant)

The City has a number of outfalls, which discharge directly or indirectly, to each of these receiving waters and therefore, the City is subject to the requirements of Appendix H of the MS4 Permit, which outlines requirements related to discharges to water quality limited water bodies and their tributaries where phosphorus is the cause of the impairment. Requirements include additional public education and outreach regarding phosphorus controls, regulatory updates, targeted good housekeeping and pollution prevention activities, and development of a Phosphorus Source Identification Report.

Phosphorus Source Identification

During Permit Year 4, the City developed a comprehensive Phosphorous Source Identification Report. This report includes the following elements:

- Calculation of the total MS4 regulated area draining to those receiving waters tributary to the Mystic River. This includes Ell Pond, which also has a phosphorus impairment. This analysis reflects any updated MS4 mapping and catchment delineations.
- All screening and monitoring results for outfalls tributary to the Mystic River. Outfalls discharging directly to Ell Pond were tested for phosphorus during dry weather sampling events, where flowing, and will be analyzed for phosphorus during wet weather as well, when sampling is performed.
- Calculation of Impervious Area and Directly Connected Impervious Area for each catchment.
- Identification, delineation and prioritization of potential catchments with high phosphorous loading.
- Identification of potential retrofit opportunities or opportunities for the installation of structural BMPs during redevelopment, including the removal of impervious area to reduce phosphorous loadings.

This report is appended to this SWMP in Appendix I.

After the submission of the report, the City must evaluate all permittee-owned properties within the drainage area that could be candidates for a BMP retrofit. This evaluation must include:

- The next planned infrastructure, resurfacing or redevelopment activity planned for the property or planned retrofit date;
- The estimated cost of redevelopment or retrofit BMPs; and
- The engineering and regulatory feasibility of redevelopment of retrofit BMPs.

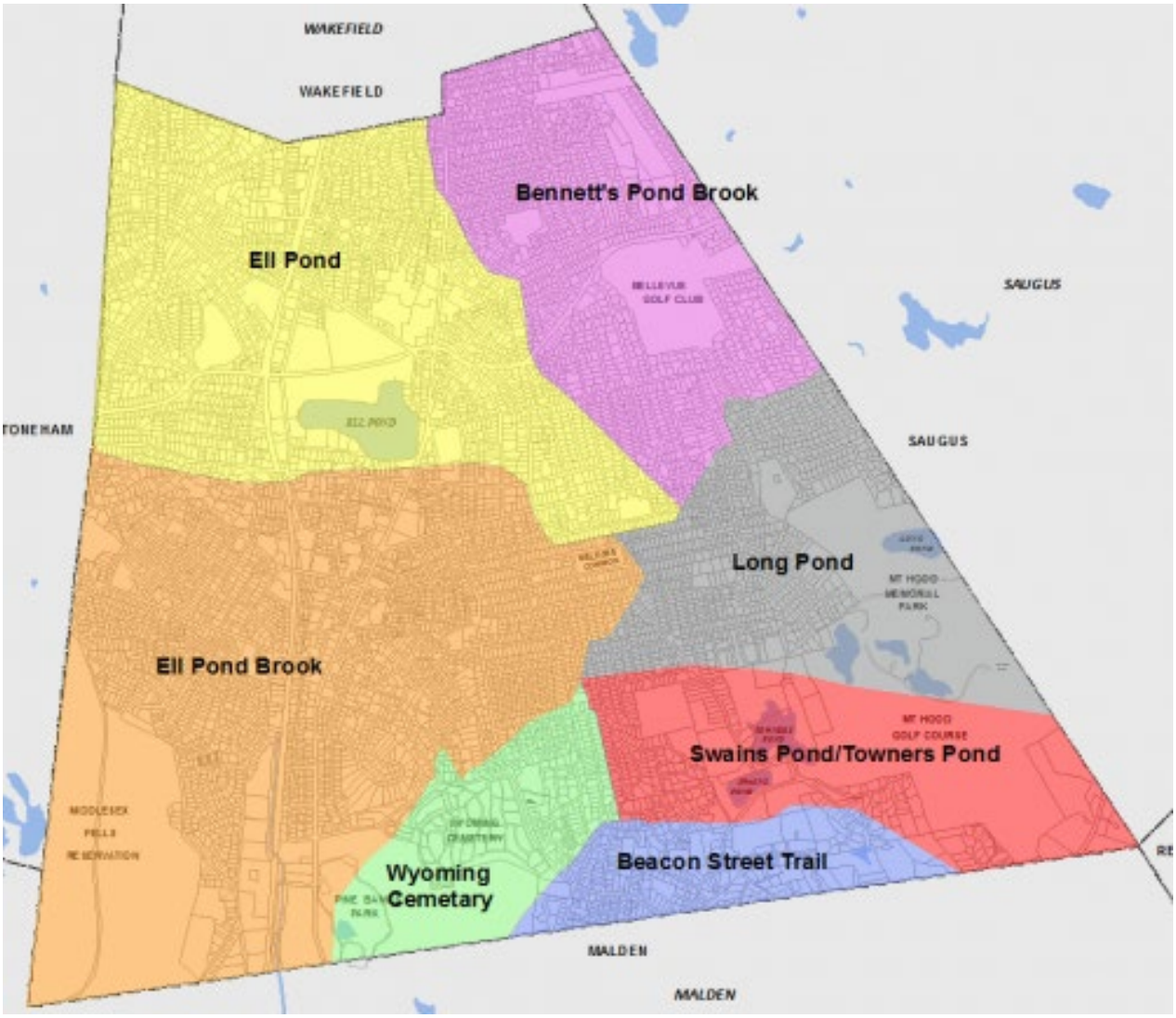
This analysis must be complete within 5 years of the permit effective date, and a plan and schedule for implementation must be included in the Year 5 Annual Report. The City must plan and install at least one structural BMP as a demonstration project within the drainage area of the Mystic River within 6 years of the permit effective date. This BMP must target a catchment with high phosphorus load potential. Any other identified BMP retrofit project must be installed according to the schedule outlined in the Year 5 Annual Report. For those structural BMPs installed, the City must document the following in each MS4 Annual Report:

- BMP type
- Total area treated by the BMP
- Design storage volume of the BMP
- Estimated phosphorus removed in mass per year by the BMP

If a Total Maximum Daily Load (TMDL) has been developed and approved for any water body in a municipality, then the permittee must include BMPs that will specifically address the impaired water body and be consistent with the TMDL. However, TMDLs have not been developed for this impaired water body in Melrose. Pathogens may be caused by illicit connections to storm drains, pet waste, and wildlife populations (e.g. large flocks of Canada geese), and phosphorus inputs are likely caused by stormwater runoff containing fertilizers and other pollutants.

The watershed map below shows the locations of the Bennett's Pond Brook and Ell Pond watersheds. Given their large coverage within the City, all of the BMPs described in this SWMP will help mitigate against the priority pollutants listed above.

Figure 7-1: Melrose Watershed Map



In particular, the public education and outreach BMPs are aimed at increasing public awareness of stormwater issues and modifying behaviors that can ultimately improve stormwater quality. The implementation of the IDDE protocol should result in the elimination of certain sources of bacteria, which will help reduce the bacteria impairments in both watersheds. When construction and development activities are within the Ell Pond watershed, both short and long-term sedimentation and erosion control measures will mitigate the introduction of solids and phosphorus into Ell Pond. Finally, with the location of the DPW City Yard directly across the street from Ell Pond and within its watershed, implementation of the good housekeeping practices will also protect the pond's water quality.

7.4 Permit Eligibility Conclusions

The City of Melrose is in compliance with NPDES Phase II permit eligibility requirements. The general permit is therefore applicable.

Appendix A
Notice of Intent

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MA 02109-3912

VIA EMAIL

April 5, 2019

Gail Infurna
Mayor

And;

Elena Proakis Ellis
City Engineer
562 Main Street
Melrose, MA. 02176
eproakis@cityofmelrose.org

Re: National Pollutant Discharge Elimination System Permit ID #: MAR041050, City of Melrose

Dear Elena Proakis Ellis:

The 2016 NPDES General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts (MS4 General Permit) is a jointly issued EPA-MassDEP permit. Your Notice of Intent (NOI) for coverage under this MS4 General Permit has been reviewed by EPA and appears to be complete. You are hereby granted authorization by EPA and MassDEP to discharge stormwater from your MS4 in accordance with the applicable terms and conditions of the MS4 General Permit, including all relevant and applicable Appendices. This authorization to discharge expires at midnight on **June 30, 2022.**

For those permittees that certified Endangered Species Act eligibility under Criterion C in their NOI, this authorization letter also serves as EPA's concurrence with your determination that your discharges will have no effect on the listed species present in your action area, based on the information provided in your NOI.

As a reminder, your first annual report is due by **September 30, 2019** for the reporting period from May 1, 2018 through June 30, 2019.

Information about the permit and available resources can be found on our website: https://www.epa.gov/npdes-permits/massachusetts-small-ms4-general-permit. Should you have

any questions regarding this permit please contact Newton Tedder at tedder.newton@epa.gov or (617) 918-1038.

Sincerely,

Thelma Murphy, Chief
Stormwater and Construction Permits Section
Office of Ecosystem Protection
United States Environmental Protection Agency, Region 1

and;

Lealdon Langley, Director
Wetlands and Wastewater Program
Bureau of Water Resources
Massachusetts Department of Environmental Protection

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part I: General Conditions

General Information

Name of Municipality or Organization: City of Melrose State: MA

EPA NPDES Permit Number (if applicable): MA041050

Primary MS4 Program Manager Contact Information

Name: Elena Proakis Ellis Title: City Engineer

Street Address Line 1: 562 Main Street

Street Address Line 2:

City: Melrose State: MA Zip Code: 02176

Email: eproakis@cityofmelrose.org Phone Number: (781) 979-4172

Fax Number:

Other Information

Stormwater Management Program (SWMP) Location (web address or physical location, if already completed): 2003 SWMP: City Hall Engineering Office, 562 Main Street, Melrose, MA 02176 (web address to be added upon completion of updated plan)

Eligibility Determination

Endangered Species Act (ESA) Determination Complete? Yes

Eligibility Criteria (check all that apply): ☐ A ☐ B ☒ C

National Historic Preservation Act (NHPA) Determination Complete? Yes

Eligibility Criteria (check all that apply): ☒ A ☐ B ☐ C

☑ Check the box if your municipality or organization was covered under the 2003 MS4 General Permit

MS4 Infrastructure (if covered under the 2003 permit)

Estimated Percent of Outfall Map Complete? *(Part II, III, IV or V, Subpart B.3.(a.) of 2003 permit)* 100%

If 100% of 2003 requirements not met, enter an estimated date of completion (MM/DD/YY):

Web address where MS4 map is published:

If outfall map is unavailable on the internet an electronic or paper copy of the outfall map must be included with NOI submission (see section V for submission options)

PDF version included with NOI submission

Regulatory Authorities (if covered under the 2003 permit)

Illicit Discharge Detection and Elimination (IDDE) Authority Adopted? *(Part II, III, IV or V, Subpart B.3.(b.) of 2003 permit)* Yes

Effective Date or Estimated Date of Adoption (MM/DD/YY): 04/07/08

Construction/Erosion and Sediment Control (ESC) Authority Adopted? *(Part II,III,IV or V, Subpart B.4.(a.) of 2003 permit)* Yes

Effective Date or Estimated Date of Adoption (MM/DD/YY): 04/07/08

Post- Construction Stormwater Management Adopted? *(Part II, III, IV or V, Subpart B.5.(a.) of 2003 permit)* Yes

Effective Date or Estimated Date of Adoption (MM/DD/YY): 04/07/08

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part II: Summary of Receiving Waters

Please list the waterbodies to which your MS4 discharges. For each waterbody, please report the number of outfalls discharging into it and, if applicable, the segment ID and any impairments.

Massachusetts list of impaired waters: Massachusetts 2014 List of Impaired Waters- http://www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf

Waterbody that receives flow from the MS4 and segment ID if applicable	Number of outfalls into receiving water segment	Chloride	Chlorophyll-a	Dissolved Oxygen/ DO Saturation	Nitrogen	Oil & Grease/ PAH	Phosphorus	Solids/ TSS/ Turbidity	E. coli	Enterococcus	Other pollutant(s) causing impairments
Ell Pond	4	☐	☒	☐	☐	☐	☒	☒	☐	☐	Fecal Coliform, Secchi Disk Turbidity
Towner's Pond	3	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Swains Pond	2	☐	☐	☐	☐	☐	☐	☐	☐	☐	Non-Native Aquatic Plants
First Pond	4	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Spot Pond Brook	5	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Long Pond/Long Pond Brook	1	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Penney Road Brook	2	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Bennetts Bond Brook	1	☐	☐	☐	☐	☐	☐	☐	☐	☐	Fecal Coliform
Unnamed waterways	12	☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
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Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary

Identify the Best Management Practices (BMPs) that will be employed to address each of the six Minimum Control Measures (MCMs). For municipalities/organizations whose MS4 discharges into a receiving water with an approved Total Maximum Daily Load (TMDL) and an applicable waste load allocation (WLA), identify any additional BMPs employed to specifically support the achievement of the WLA in the TMDL section at the end of part III.

For each MCM, list each existing or proposed BMP by category and provide a brief description, responsible parties/departments, measurable goals, and the year the BMP will be employed (public education and outreach BMPs also requires a target audience). **Use the drop-down menus in each table or enter your own text to override the drop down menu.**

MCM 1: Public Education and Outreach

BMP Media/Category (enter your own text to override the drop down menu)	**BMP Description**	**Targeted Audience**	**Responsible Department/Parties** (enter your own text to override the drop down menu)	**Measurable Goal**	**Beginning Year of BMP Imple-mentation**
Brochures/Pamphlets	Message on stormwater issues included with water and sewer bills	Residents & Businesses, Institutions ar	Department of Public Works	Distribute message with water and sewer bills at least once during permit term	2021
Brochures/Pamphlets	Make brochures available on stormwater topics	Residents & General Public	Department of Public Works	Select and stock brochures at DPW office, City Hall, and kiosks continuously beginning in Year 2 of the permit term	2019
Web Page	Update City website to include information on stormwater management	Residents, General Public, Developers, Businesses, Institutions & Commercial Facilities	Department of Public Works	Update City website to include information on stormwater management issues throughout the permit term	2018
Special Events/Festivals/Fairs	Staff a booth at the annual Victorian Fair	Residents, General Public, & Businesses	Department of Public Works	Staff booth at annual Victorian Fair	2019
Displays/Posters/Kiosks	Install and maintain signs for stormwater management and pet waste clean-up at schools and parks	General Public	Parks Department/School Department/Department of Public Works	Maintain signs at athletic fields near Ell Pond and inspect signs at least annually	2018

Special Events/Festivals/Fairs	Provide Stormwater information at City's DPW Day	General Public	Department of Public Works	Staff booth at annual DPW Day and hand out "Dwayne the Storm Drain" coloring book to students annually at DPW Day	2019
Local Public Service Announcements	Post information on stormwater management issues on local access television channel	General Public	Department of Public Works	Post stormwater information on local access cable television channel during periods of non-programming	2020
Brochures/Pamphlets	Distribute information on low impact development to developers via the Planning Department	Developers (construction)	Planning Department & Department of Public Works	Distribute to developers seeking Site Plan Review or Subdivision approvals	2019
Ordinance	Revisit stormwater ordinances and consider updated requirements for new development and redevelopment projects	Developers (construction)	Department of Public Works & City Attorney	Update stormwater ordinances if deemed appropriate upon review	2020
Brochures/Pamphlets	Provide informational brochures on low impact development to the Building Department to make available to contractors	Contractors	Department of Public Works	Provide applicable brochures to Building Department to have available to contractors	2020
Web Page	Broadcast targeted messages about stormwater quality, pet waste, and fertilizer use using social media	General Public, Businesses, Commercial Faciliti	Department of Public Works	Broadcast messages using social media at least two times per year	2019
Web Page	Send message out using Mayor's Blog directing to information on stormwater webpage and other resources	Residents, Businesses, Commercial Facilities	Department of Public Works and Mayor's Office	Send Mayor's Blog message directing to new information on stormwater webpage when finalized	2019

Brochures/Pamphlets	Provide information to residents seeking dog licenses	Residents	City Clerk's Office	Provide brochures to residents applying for dog licenses pertaining to appropriate handling of pet waste	2019
	N/A	Industrial Facilities	Melrose does not have any industrial facilities.		

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

MCM 2: Public Involvement and Participation

BMP Categorization	Brief BMP Description (enter your own text to override the drop down menu)	Responsible Department/Parties (enter your own text to override the drop down menu)	Additional Description/ Measurable Goal	Beginning Year of BMP Imple-mentation
Public Review	Comply with state public notification guidelines at MGL Chapter 39 Sec	City Clerk	Notices posted in designated locations announcing upcoming meetings as required by state law	2018
Public Participation	Stencil catch basins with don't dump message (i.e. "Don't Dump - Drain	Department of Public Works	Look for opportunities to work with community partners to perform stenciling	2020
Public Participation	Cleanups - Shoreline/Waterbody	Department of Public Works	Continue to assist the Ell Pond Committee on its annual clean up events	2019
Public Review	SWMP Review	Department of Public Works	Make plan available on website and advertise via the Mayor's Blog	2019

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

MCM 3: Illicit Discharge Detection and Elimination (IDDE)

BMP Categorization (enter your own text to override the drop down menu)	**BMP Description**	**Responsible Department/Parties** (enter your own text to override the drop down menu)	**Measurable Goal** (all text can be overwritten)	**Beginning Year of BMP Imple-mentation**
Storm sewer system map	Maintain map showing all known stormwater outfalls and update during IDDE program implementation	Department of Public Works	Inventory and re-confirm via GPS all outfall locations shown in the GIS. Update map within 2 years of effective date of permit.	2019
IDDE Plan - In-stream Monitoring (Dry Weather)	Conduct dry weather outfall screening in accordance with outfall screening procedure and permit conditions	Department of Public Works	Conduct in accordance with outfall screening procedure and permit conditions.	2019
IDDE Plan - In-stream Monitoring (Wet Weather)	Conduct wet weather screening in accordance with outfall screening procedure and permit conditions.	Department of Public Works	Conduct in accordance with outfall screening procedure and permit conditions.	2019
Map stormwater collection system in a GIS	Develop protocol for keeping stormwater GIS layers up to date	Department of Public Works	Implement new protocol for GIS data updates to further data accuracy. Maintain drainage GIS layers and update when known changes are made or connections are identified	2018
Written IDDE program development	Develop and implement a plan to identify and remove non-stormwater discharges to the MS4	Department of Public Works	Develop and implement written IDDE plan following permit protocols. Complete within 1.5 years of the effective date of the permit	2020
SSO inventory	Track SSOs and add data to the GIS	Department of Public Works	Develop SSO inventory within 1 year of effective date of permit and track using GIS layer	2019

Implement IDDE Program	IDDE program implementation	Department of Public Works	Implement catchment investigations according to program and permit conditions	2020
Employee Training	Provide training on IDDE procedures for applicable DPW employees	Department of Public Works	Train Annually	2019
IDDE Plan - Illegal Dumping Program	Maintain ordinance that gives the City authority to access buildings to search for illicit connections and allows the City to require redirection of any found	Department of Public Works/City Solicitor	Continue to enforce ordinance established on 4/7/2008	2018
IDDE Ordinance/Bylaw	Maintain ordinance to require inspection of new construction for correct connection of sanitary and storm sewer connections	Department of Public Works/City Solicitor	Continue to enforce ordinance established on 4/7/2008	2018

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

MCM 4: Construction Site Stormwater Runoff Control

BMP Categorization (enter your own text to override the drop down menu or entered text)	**BMP Description**	**Responsible Department/Parties** (enter your own text to override the drop down menu)	**Measurable Goal** (all text can be overwritten)	**Beginning Year of BMP Imple-mentation**
Site inspection and enforcement of Erosion and Sediment Control (ESC) measures	Maintain Construction Site Erosion and Sediment Control ordinance for construction sites greater than 1 acre in area. Complete written procedures of site inspections and enforcement procedures.	Planning Board, Zoning Board of Appeals, Inspectional Services & Department of	Ordinance approved by Alderman 4/7/08. Continue to enforce ordinance.	2018
Review site plans for stormwater impacts	Review all construction site plans greater than 1 acre to be sure that adequate erosion and sediment controls will be in place during construction. Complete written procedures of site plan review and begin implementation	Planning Board, Inspectional Services, and Department of Public Works	Continue following internal protocol for reviewing plans going through the Site Plan Review, Subdivision, or Zoning Board of Appeals processes and continue development reviews for stormwater impacts	2018
Erosion and Sediment Control	Maintain requirements for construction operators to implement a sediment and erosion control program.	Department of Public Works, Zoning Board of Appeals, & Inspectional Services	Review proposed new developments going before the Planning Board or Zoning Board of Appeals with regard to the adequacy of both construction and post-construction stormwater quantity and quality considerations.	2018

Public Input for Construction Projects	Conduct public outreach meetings for Public Works projects when appropriate. Obtain NPDES construction permits where applicable. Maintain communication with residents throughout the duration of projects at neighborhood meetings and via office availability.	Department of Public Works & Inspectional Services	Hearings and neighborhood meetings to continue as needed on City construction projects and DPW contact information routinely provided for complaints.	2018
Waste Control	Adoption of requirements to control wastes, including but not limited to, discarded building materials, concrete truck wash out, chemicals, litter and sanitary wastes	DPW, Planning Department	Develop and enforce ordinance, bylaw, or policy	2019

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

MCM 5: Post-Construction Stormwater Management in New Development and Redevelopment

BMP Categorization (enter your own text to override the drop down menu or entered text)	**BMP Description**	**Responsible Department/Parties** (enter your own text to override the drop down menu)	**Measurable Goal** (all text can be overwritten)	**Beginning Year of BMP Imple-mentation**
As-built plans and O & M for on-site stormwater control	The procedures to require submission of as-built drawings and ensure long term operation and maintenance will be a part of the SWMP	Department of Public Works	Require submission of as-built plans and O&M procedures for completed projects	2018
Allow green infrastructure	Develop a report assessing existing local regulations to determine the feasibility of making green infrastructure practices allowable when appropriate site conditions exist	Department of Public Works	Complete 4 years after effective date of permit and implement recommendations of report	2022
Street design and parking lot guidelines	Develop a report assessing requirements that affect the creation of impervious cover. The assessment will help determine if changes to design standards for streets and parking lots can be modified to support low impact design options.	Department of Public Works	Complete 4 years after effective date of permit and implement recommendations of report	2022

Ensure any stormwater controls or management practices for new development and redevelopment meet the retention or treatment requirements of the permit and all applicable requirements of the Massachusetts Stormwater Handbook	Adoption, amendment, or modification of a regulatory mechanism to meet permit requirements	Department of Public Works, Planning Board, Zoning Board of Appeals	Complete 2 years after effective date of permit	2020
Inventory and priority ranking of MS4-owned properties that m	Conduct detailed inventory of MS4-owned properties and rank for retrofit potential. Identify at least 5 permittee-owned properties that could be modified or retrofitted with BMPs to reduce impervious areas and update annually.	Department of Public Works	Complete 4 years after permit effective date	2022
Post-Construction Ordinance/Bylaw	Maintain bylaw to apply appropriate standards of the Massachusetts Stormwater Policy (MSP) to developments disturbing more than 1 acre throughout the City.	Planning Board, Zoning Board of Appeals, Department of Public Works and Inspe	Ordinance approved by Alderman 4/7/08. Continue to enforce ordinance.	2018
Post-Construction Design Standards	Maintain reference to stormwater BMP manual to be used for consistent design and performance standards.	Planning Board, Department of Public Works, Inspection Services, Conservation C	The Site Plan Review ordinance references a requirement for consistency with the MassDEP Stormwater Management Policy (Ordinance #235-16.1). Continue to enforce ordinance	2018

BMP O&M Program	Maintain bylaw to ensure long-term maintenance of both City-owned and privately owned structural BMPs	Department of Public Works & Inspection Services	Ordinance approved by Alderman 4/7/08. Continue to enforce ordinance.	2018

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

MCM 6: Municipal Good Housekeeping and Pollution Prevention

BMP Categorization (enter your own text to override the drop down menu or entered text)	**BMP Description**	**Responsible Department/Parties** (enter your own text to override the drop down menu)	**Measurable Goal** (all text can be overwritten)	**Beginning Year of BMP Imple-mentation**
Inventory all permittee-owned parks and open spaces, buildings and facilities, and vehicles and equipment	Create inventory	Department of Public Works	Complete 2 years after effective date of permit and implement annually	2020
O&M procedures	Create written O&M procedures including all requirements contained in 2.3.7.a.ii for parks and open spaces, buildings and facilities, and vehicles and equipment	Department of Public Works	Complete and implement 2 years after effective date of permit	2020
Infrastructure O&M	Establish and implement program for repair and rehabilitation of MS4 infrastructure	Department of Public Works	Complete 2 years after effective date of permit	2020
Stormwater Pollution Prevention Plan (SWPPP)	Create SWPPPs for maintenance garages, transfer stations, and other waste-handling facilities	Department of Public Works	Complete and implement 2 years after effective date of permit	2020
Catch basin cleaning	Establish schedule for catch basin cleaning such that each catch basin is no more than 50% full and clean catch basins on that schedule.	Department of Public Works	Clean catch basins on established schedule and report number of catch basins cleaned annually. Clean at least 1/3 of the City's catch basins annually. Clean prioritized catch basins and clean drain pipes as necessary. Ensure proper disposal of residuals.	2018

Street sweeping program	Sweep all streets and permitee-owned parking lots in accordance with permit conditions	Department of Public Works	Sweep all streets and permitee-owned parking lots at least once per year in the spring. Maintain records of schedule and daily volume of residuals collected.	2018
Road salt use optimization program	Establish and implement a program to minimize the use of road salt.	Department of Public Works	Implement salt use optimization during deicing season. Continue existing roadway deicing procedures: ☒ Use appropriate sand/salt mixture ☒ Calibrate spreaders at beginning of each winter (at least once a year) ☒ Maintain calibration and deicer volume records after each storm ☒ Keep salt stored in an enclosed shed, never outside ☒ Minimize time salt/ sand is uncovered	2018
Inspections and maitenance of stormwater treatment structures	Establish and implement inspection and maitenance procedures and frequencies	Department of Public Works	Inspect and maintain treatment structures at least annually.	2019

O&M Program (Vehicle Maintenance)	Continue to train mechanics in the use and disposal of motor vehicle gasoline and oil, solvents, diesel, etc. Ensure that: ☒ Hazardous materials are properly managed ☒ All vehicle maintenance is done inside the garage ☒ Hazardous waste removal from DPW is performed by a licensed company	Department of Public Works	Continue to properly handle and dispose of materials used in vehicle maintenance.	2018
O&M Program (Vehicle Washing)	Small vehicles washed at commercial car wash, use of biodegradable phosphate free soap, implement outdoor vehicle washing procedures.	Department of Public Works	Instituted the use of biodegradable phosphate free soap in previous permit term. Installed a gas/oil and silt separator at City Yard to catch washing runoff from all vehicles in previous permit term. Continue to use biodegradable phosphate free soap and wash small vehicles at commercial car washes.	2018
Forestation Program	Continue tree planting and maintenance program.	Department of Public Works	Plant a minimum of 50 trees annually and maintain existing City trees.	2018
Trash Management	Continue illegal dumping control. Signs posted at dead end streets and other possible illegal dumping locations; clean up sites where illegal dumping is identified	Department of Public Works	Continue to monitor sites and signs. If needed, post additional signs at dead end streets and other possible illegal dumping locations.	2018
Household Hazardous Waste Collection	Household Hazardous Waste Collection Day held annually.	Department of Public Works	Hold two Hazardous Waste Collection Days annually	2018

City Yard Drainage	Perform annual evaluation and maintenance of drainage structures, including oil/ water separator(s) at City Yard.	Department of Public Works	Maintain drainage system and separators at City Yard. Perform maintenance and inspection annually. Clean catch basins at City Yard at least 2x/ year.	2018
Employee Training	Provide stormwater training to Department of Public Works employees	Department of Public Works	Provide stormwater-related training for the three DPW Foremen (water, sewer, and drainage) who oversee DPW employees whose day-to-day activities include maintenance of the stormwater system, street cleaning, snow removal operations, or similar activities.	2019

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

Actions for Meeting Total Maximum Daily Load (TMDL) Requirements

Use the drop-down menus to select the applicable TMDL, action description to meet the TMDL requirements, and the responsible department/parties. If no options are applicable, or more than one, **enter your own text to override drop-down menus.**

Applicable TMDL	**Action Description**	**Responsible Department/Parties** (enter your own text to override the drop down menu)
Bennetts Pond Brook (North Coastal --> Saugus River)	Adhere to requirements in part A.III of Appendix F	Department of Public Works

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

Actions for Meeting Requirements Related to Water Quality Limited Waters

Use the drop-down menus to select the pollutant causing the water quality limitation and enter the waterbody ID(s) experiencing excursions above water quality standards for that pollutant. In addition, if you are subject to additional requirements due to a downstream nutrient impairment (see Part 2.2.2 of the permit) select the pollutant of concern and indicate applicable waterbody IDs or write "all waterbodies" if applicable. Choose the action description from the dropdown menu and indicate the responsible party. If no options are applicable, or more than one, **enter your own text to override drop-down menus.**

Pollutant	Waterbody ID(s)	Action Description	Responsible Department/Parties (enter your own text to override the drop down menu)
E. Coli	MA93-48	Adhere to requirements in part III of Appendix H	Department of Public Works
Fecal Coliform	MA93-48	Adhere to requirements in part III of Appendix H	Department of Public Works
Fecal Coliform	MA71014	Adhere to requirements in part III of Appendix H	Department of Public Works
Chlorophyll-a	MA71014	Adhere to requirements in part II of Appendix H	Department of Public Works
Harmful Algal Bloom	MA71014	Adhere to requirements in part II of Appendix H	Department of Public Works
Phosphorus	MA71014	Adhere to requirements in part II of Appendix H	Department of Public Works
Turbidity	MA71014	Adhere to requirements in part V of Appendix H	Department of Public Works
TSS	MA71014	Adhere to requirements in part V of Appendix H	Department of Public Works

Part IV: Notes and additional information

Use the space below to indicate the part(s) of 2.2.1and 2.2.2 that you have identified as not applicable to your MS4 because you do not discharge to the impaired water body or a tributary to an impaired water body due to nitrogen or phosphorus. Provide all supporting documentation below or attach additional documents if necessary.
Also, provide any additional information about your MS4 program below.

The actions of the City of Melrose pertaining to the Small MS4 permit will not adversely affect the Northern Long-eared Bat or its habitat.

Part V: 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, I certify that 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.

Name: Title:

Signature: Date:

[To be signed according to Appendix B, Subparagraph B.11, Standard Conditions]

Note: When prompted during signing, save the document under a new file name

Part V: 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, I certify that 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.

Name:	Gail Infurna	Title:	Mayor
Signature:	Gail M Infurna	Date:	09/28/18

[To be signed according to Appendix B, Subparagraph B.11, Standard Conditions]

Note: When prompted during signing, save the document under a new file name

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Middlesex County, Massachusetts

Local office

New England Ecological Services Field Office

(603) 223-2541
(603) 223-0104

70 Commercial Street, Suite 300
Concord, NH 03301-5094

http://www.fws.gov/newengland

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS

Northern Long-eared Bat Myotis septentrionalis Threatened

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/9045

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
American Oystercatcher *Haematopus palliatus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8935	Breeds Apr 15 to Aug 31
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Oct 15 to Aug 31
Black Skimmer *Rynchops niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31
Buff-breasted Sandpiper *Calidris subruficollis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9488	Breeds elsewhere

Canada Warbler Cardellina canadensis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Dunlin Calidris alpina arcticola This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Eastern Whip-poor-will Antrostomus vociferus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Hudsonian Godwit Limosa haemastica This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Kentucky Warbler Oporornis formosus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Least Tern Sterna antillarum This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Apr 20 to Sep 10
Lesser Yellowlegs Tringa flavipes This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Nelson's Sparrow Ammodramus nelsoni This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 15 to Sep 5
Prairie Warbler Dendroica discolor This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Prothonotary Warbler Protonotaria citrea This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Purple Sandpiper Calidris maritima This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere

Red-throated Loon Gavia stellata This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Ruddy Turnstone Arenaria interpres morinella This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Rusty Blackbird Euphagus carolinus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Semipalmated Sandpiper Calidris pusilla This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Short-billed Dowitcher Limnodromus griseus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	Breeds elsewhere
Snowy Owl Bubo scandiacus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Willet Tringa semipalmata This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 5
Wood Thrush Hylocichla mustelina This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be

used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

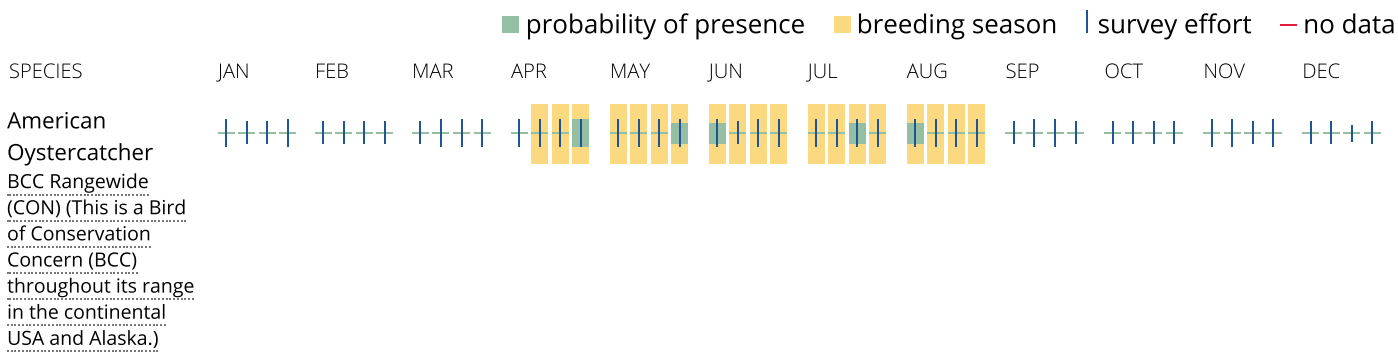
Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

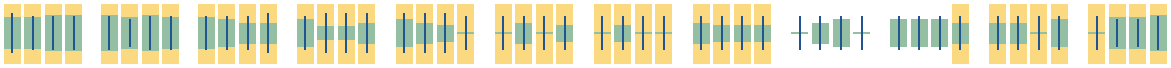
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

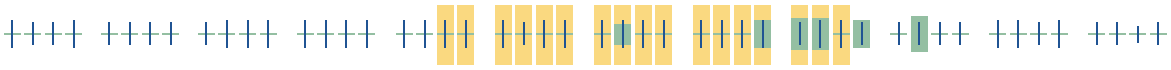
Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Bald Eagle
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Black Skimmer
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



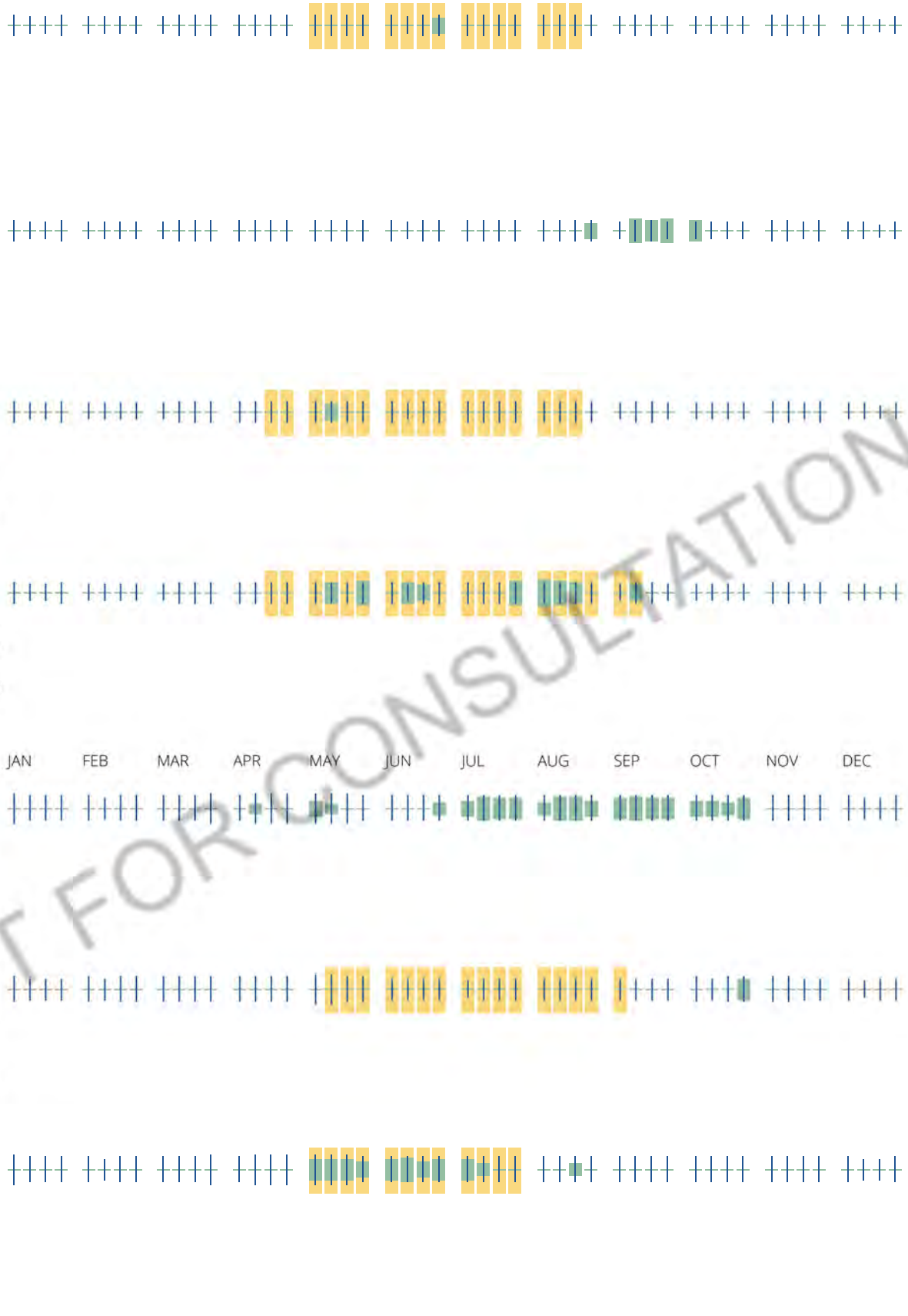
Black-billed Cuckoo
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Bobolink
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

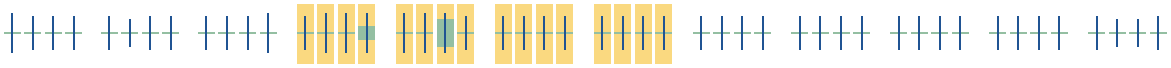
Buff-breasted Sandpiper
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Canada Warbler
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Dunlin
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)



Prothonotary Warbler
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Purple Sandpiper
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

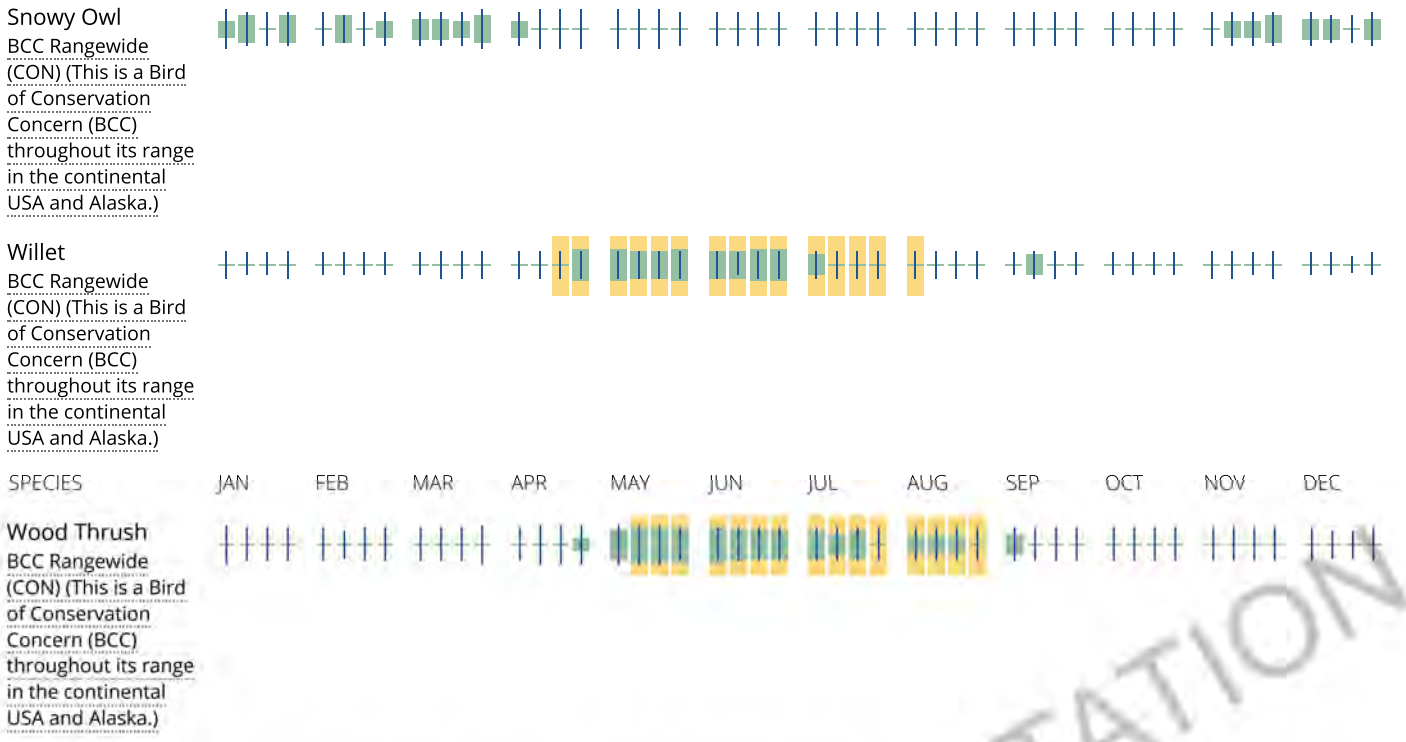
Red-throated Loon
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Ruddy Turnstone
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

Rusty Blackbird
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Semipalmated Sandpiper
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Short-billed Dowitcher
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the E-bird Explore Data Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the *nanotag studies* or *contact Caleb Spiegel or Pam Loring*.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ “What does IPaC use to generate the migratory birds potentially occurring in my specified location”. Please be aware this report provides the “probability of presence” of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look

carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

- PEM1E
- PEM1/SS1E
- PEM1Ed

PEM1F

FRESHWATER FORESTED/SHRUB WETLAND

PFO1E
PSS1E
PFO1C
PFO1A
PSS1F

FRESHWATER POND

PUBHh
PUBHx
PUBH
PUBFx
PUBF

LAKE

L1UBHh

RIVERINE

R4SBC
R3UBH
R2UBHx
R4SBCx
R5UBH

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Appendix B
Annual Reports

Year 1 Annual Report
Massachusetts Small MS4 General Permit
Reporting Period: May 1, 2018-June 30, 2019

Please DO NOT attach any documents to this form. Instead, attach all requested documents to an email when submitting the form

Unless otherwise noted, all fields are required to be filled out. If a field is left blank, it will be assumed the requirement or task has not been completed.

Part I: Contact Information

Name of Municipality or Organization: City of Melrose

EPA NPDES Permit Number: MAR041050

Primary MS4 Program Manager Contact Information

Name: Elena Proakis Ellis Title: City Engineer

Street Address Line 1: 562 Main Street

Street Address Line 2:

City: Melrose State: MA Zip Code: 02176

Email: eproakis@cityofmelrose.org Phone Number: (781) 979-4172

Fax Number:

Stormwater Management Program (SWMP) Information

SWMP Location (web address): https://www.cityofmelrose.org/engineering/files/melrose-stormwater-management-program

Date SWMP was Last Updated: 9/27/2019

If the SWMP is not available on the web please provide the physical address and an explanation of why it is not posted on the web:

Part II: Self Assessment

First, in the box below, select the impairment(s) and/or TMDL(s) that are applicable to your MS4.

Impairment(s)

☒ Bacteria/Pathogens ☐ Chloride ☐ Nitrogen ☒ Phosphorus
☒ Solids/ Oil/ Grease (Hydrocarbons)/ Metals

TMDL(s)

In State: ☐ Assabet River Phosphorus ☐ Bacteria and Pathogen ☐ Cape Cod Nitrogen
☐ Charles River Watershed Phosphorus ☐ Lake and Pond Phosphorus

Out of State: ☐ Bacteria/Pathogens ☐ Metals ☐ Nitrogen ☐ Phosphorus

Clear Impairments and TMDLs

Next, check off all requirements below that have been completed. ***By checking each box you are certifying that you have completed that permit requirement fully.*** *If you have not completed a requirement leave the box unchecked. Additional information will be requested in later sections.*

Year 1 Requirements

- ☒ Develop and begin public education and outreach program
- ☒ Identify and develop inventory of all known locations where SSOs have discharged to the MS4 in the last 5 years
  - ◉ The SSO inventory is attached to the email submission
  - ○ The SSO inventory can be found at the following website:
- ☒ Develop written IDDE plan including a procedure for screening and sampling outfalls
- ☒ IDDE ordinance complete
- ☒ Identify each outfall and interconnection discharging from MS4, classify into the relevant category, and priority rank each catchment for investigation
  - ○ The priority ranking of outfalls/interconnections is attached to the email submission
  - ◉ The priority ranking of outfalls/interconnections can be found at the following website:

    Included in SWMP in Appendix D. https://www.cityofmelrose.org/engineering/files/melrose-stormwater-management-program
- ☒ Construction/ Erosion and Sediment Control (ESC) ordinance complete
- ☒ Develop written procedures for site inspections and enforcement of sediment and erosion control measures
- ☒ Develop written procedures for site plan review
- ☒ Keep a log of catch basins cleaned or inspected
- ☒ Complete inspection of all stormwater treatment structures

Annual Requirements

- ☒ Annual opportunity for public participation in review and implementation of SWMP
- ☒ Comply with State Public Notice requirements
- ☒ Keep records relating to the permit available for 5 years and make available to the public
- ☒ Properly store and dispose of catch basin cleanings and street sweepings so they do not discharge to receiving waters
- ☐ Annual training to employees involved in IDDE program
- ☒ All curbed roadways have been swept a minimum of one time per year

Phosphorus (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

- ☒ Distribute an annual message in the spring (April/May) that encourages the proper use and disposal of grass clippings and encourages the proper use of slow-release and phosphorus-free fertilizers
- ☒ Distribute an annual message in the summer (June/July) encouraging the proper management of pet waste, including noting any existing ordinances where appropriate
- ☒ Distribute an annual message in the fall (August/September/October) encouraging the proper disposal of leaf litter

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

- ☐ Increase street sweeping frequency of all municipal owned streets and parking lots subject to Permit part 2.3.7.a.iii.(c) to a minimum of two times per year (spring and fall)

Potential structural BMPs

- ☐ Any structural BMPs listed in Attachment 3 to Appendix F already existing or installed in the regulated area by the permittee or its agents shall be tracked and the permittee shall estimate the phosphorus removal by the BMP consistent with Attachment 1 to Appendix H. Document the BMP type, total area treated by the BMP, the design storage volume of the BMP and the estimated phosphorus removed in mass per year by the BMP in each each annual report

Solids, Oil and Grease (Hydrocarbons), or Metals

Annual Requirements

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

- ☒ Increase street sweeping frequency of all municipal owned streets and parking lots to a schedule to target areas with potential for high pollutant loads
- ☒ Prioritize inspection and maintenance for catch basins to ensure that no sump shall be more than 50 percent full; Clean catch basins more frequently if inspection and maintenance activities indicate excessive sediment or debris loadings

Use the box below to input additional details on any unchecked boxes above or any additional information you would like to share as part of your self assessment:

Since the IDDE program was just developed and is just beginning to be implemented, there has been no applicable training to perform yet. Training will begin in Year 2. Street sweeping is performed every fall on all City roads and parking lots, then performed twice per month in April through August on all main roads and

parking areas. Therefore, while a large portion of the City is being swept upwards of 10-12 times per year, smaller roads are presently only swept in the fall and as-needed in the spring. The City does not have existing BMPs in the phosphorus-limited areas for which there is enough data to evaluate specific phosphorus removal loads. Consultant assistance will be solicited in Year 2 in order to better estimate phosphorus removal from the three known sediment removal devices owned by the City (two at the City Yard and one at the Middle School). All other requirements listed above have been met.

Part III: Receiving Waters/Impaired Waters/TMDL

Have you made any changes to your lists of receiving waters, outfalls, or impairments since the NOI was submitted?

Yes ☒ No ☐

If yes, describe below, including any relevant impairments or TMDLs:

One additional outfall to Ell Pond was discovered during field investigations that was not previously included in the stormwater GIS as an outfall.

Part IV: Minimum Control Measures

Please fill out all of the metrics below. If applicable, include in the description who completed the task if completed by a third party.

MCM1: Public Education

Number of educational messages completed during the reporting period: 4

Below, report on the educational messages completed during the first year. For the measurable goal(s) please describe the method/measures used to assess the overall effectiveness of the educational program.

BMP: Brochures/Pamplets

Message Description and Distribution Method:

Stormwater outreach materials were produced and prominently displayed in the Engineering Division/Water and Sewer Billing at City Hall. Topics included pet waste, leaf litter, and fertilizers. Some of these materials were developed with assistance from the Mystic River Watershed Association.

Targeted Audience: Residents

Responsible Department/Parties: DPW/Engineering

Measurable Goal(s):

Selected and stocked brochures and posters at DPW and City Hall.

Message Date(s): Began fall 2018 and continued through permit year

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☐

Was this message different than what was proposed in your NOI? Yes ☐ No ☒

If yes, describe why the change was made:

BMP:Webpage

Message Description and Distribution Method:

A stormwater outreach website was created with a wealth of material for a variety of audiences, described in layman's terms. The webpage includes and interactive map where property owners can determine which watershed they are in. The webpage is located here: https://www.cityofmelrose.org/engineering/pages/stormwater-outreach

Targeted Audience: Residents, General Public, Developers, Businesses, Institutions, Commercial Facilities

Responsible Department/Parties: DPW/Engineering

Measurable Goal(s):

The City website was updated to include the new information on stormwater management issues.

Message Date(s): Webpage was launched in June 2019

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ☐ No ☒

If yes, describe why the change was made:

BMP:Special Events - DPW Day

Message Description and Distribution Method:

Provided stormwater education information at annual DPW Day, which includes all K-2 public school students and many parents in Melrose. Staffed booth at annual DPW Day and handed out Dwayne the Storm Drain books to children.

Targeted Audience: Residents

Responsible Department/Parties: DPW

Measurable Goal(s):

Staffed booth at annual DPW Day and handed out Dwayne the Storm Drain books.

Message Date(s): May 2019

Message Completed for: Appendix F Requirements ☐ Appendix H Requirements ☐

Was this message different than what was proposed in your NOI? Yes ☐ No ☒

If yes, describe why the change was made:

BMP: Signs at Parks for Pet Waste

Message Description and Distribution Method:

Maintained signs at parks, especially around Ell Pond, regarding proper pet waste cleanup.

Targeted Audience: Residents

Responsible Department/Parties: Department of Public Works

Measurable Goal(s):

Continued to inspect and maintain signs educating the public about pet waste cleanup at parks, especially where adjacent to waterways.

Message Date(s): Ongoing

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☐

Was this message different than what was proposed in your NOI? Yes ☐ No ☒

If yes, describe why the change was made:

BMP: Information for Dog Licensees

Message Description and Distribution Method:

A pamphlet has been provided to the City Clerk's office for distribution to dog licensees. In reviewing this program, it was determined that the majority of residents applying for dog licenses do so through the mail along with their annual City census. Therefore, distribution of the materials to walk-ins will only be minimally effective. In future permit years, the City will continue to provide the document to walk-ins for dog licenses, but we will also distribute the flyer via email or mail to the distribution list of dog licensees. Email and mailing addresses are collected from residents when they apply for licenses whether through the mail or in person.

Targeted Audience: Residents

Responsible Department/Parties: Department of Public Works and City Clerk's Office

Measurable Goal(s):

Pamphlet provided to walk-in dog licensees at this time but will be expanded to include the email list in future years.

Message Date(s): Ongoing

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ☐ No ☒

If yes, describe why the change was made:

For now, no changes have been made; however, as described above, changes will be made in future years.

Add an Educational Message

MCM2: Public Participation

Describe the opportunity provided for public involvement in the development of the Stormwater Management Program (SWMP) during the reporting period:

The SWMP has been posted to the City's website and is a living document and will be modified as comments

are received that warrant updates. The webpage includes an email address and phone number for those wishing to submit comments.

Was this opportunity different than what was proposed in your NOI? Yes ☐ No ☒

Describe any other public involvement or participation opportunities conducted during the reporting period:

As noted in the NOI, public meetings are posted in accordance with state public notification guidelines. In addition, the City assisted with two Ell Pond cleanups during the reporting period, as we have in previous years, by providing DPW operations assistance for trash removal and other assistance as needed by the volunteers. These events were held on May 5, 2018 and May 4, 2019.

MCM3: Illicit Discharge Detection and Elimination (IDDE)

Sanitary Sewer Overflows (SSOs)

Below, report on the number of SSOs identified in the MS4 system and removed during this reporting period.

Number of SSOs identified: 0

Number of SSOs removed: 0

Below, report on the total number of SSOs identified in the MS4 system and removed to date. At a minimum, report SSOs identified since 2013.

Total number of SSOs identified: 0

Total number of SSOs removed: 0

MS4 System Mapping

Describe the status of your MS4 map, including any progress made during the reporting period:

City staff attempted to field-locate all outfalls shown on the GIS maps and then returned to begin GPSing and inspecting each outfall location. An online form was created using PeopleForms to gather the outfall inspection data. Inconsistencies found within the stormwater GIS layer are recorded and later provided to the City's GIS administrator to update the applicable GIS layer and/or attribute data.

Screening of Outfalls/Interconnections

If conducted, please submit any outfall monitoring results from this reporting period. Outfall monitoring results should include the date, outfall/interconnection identifier, location, weather conditions at time of sampling, precipitation in previous 48 hours, field screening parameter results, and results from all analyses.

○ The outfall screening data is attached to the email submission

◉ The outfall screening data can be found at the following website:

The outfall data is being collected in PeopleGIS: https://www.mapsonline.net/melrosema/

forms/standalone.html.php?id=478352624&sid=80ce01b00882d60f4977c38876cd2ab0#

Below, report on the number of outfalls/interconnections screened during this reporting period.

Number of outfalls screened: 5

Below, report on the percent of total outfalls/ interconnections screened to date.

Percent of total outfalls screened: 14%

Catchment Investigations

If conducted, please submit all data collected during this reporting period as part of the dry and wet weather investigations. Also include the presence or absence of System Vulnerability Factors for each catchment.

- ○ The catchment investigation data is attached to the email submission
- ○ The catchment investigation data can be found at the following website:

Below, report on the number of catchment investigations completed during this reporting period.

Number of catchment investigations completed this reporting period: 0

Below, report on the percent of catchments investigated to date.

Percent of total catchments investigated: 0

Optional: Provide any additional information for clarity regarding the catchment investigations below:

Formal catchment investigations have not yet begun.

IDDE Progress

If illicit discharges were found, please submit a document describing work conducted over this reporting period, and cumulative to date, including location source; description of the discharge; method of discovery; date of discovery; and date of elimination, mitigation, or enforcement OR planned corrective measures and schedule of removal.

- ○ The illicit discharge removal report is attached to the email submission
- ○ The illicit discharge removal report can be found at the following website:

Below, report on the number of illicit discharges identified and removed, along with the volume of sewage removed during this reporting period.

Number of illicit discharges identified: 0

Number of illicit discharges removed: 0

Estimated volume of sewage removed: 0 [UNITS]

Below, report on the total number of illicit discharges identified and removed to date. At a minimum, report on the number of illicit discharges identified and removed since the effective date of the permit.

Total number of illicit discharges identified: 0

Total number of illicit discharges removed: 0

Optional: Provide any additional information for clarity regarding illicit discharges identified, removed, or planned to be removed below:

Because the IDDE protocol was recently completed and outfalls are still being inspected and field-verified, no illicit connections have yet been identified. The online form that was developed can be located here: https://www.mapsonline.net/melrosema/forms/standalone.html.php?id=478352624&sid=80ce01b00882d60f4977c38876cd2ab0#

Employee Training

Describe the frequency and type of employee training conducted during the reporting period:

Again, because the IDDE protocol was recently completed, training has not yet begun on IDDE procedures.

MCM4: Construction Site Stormwater Runoff Control

Below, report on the construction site plan reviews, inspections, and enforcement actions completed during this reporting period.

Number of site plan reviews completed: 37

Number of inspections completed: 8

Number of enforcement actions taken: 1 (develope

MCM5: Post-Construction Stormwater Management in New Development and Redevelopment

Ordinance Development

Describe the status of the post-construction ordinance required to be complete in year 2 of the permit term:

The ordinance for post-construction stormwater conditions has not been modified but continues to be enforced, as described in detail in the SWMP.

As-built Drawings

Describe the status of the measures the MS4 has utilized to require the submission of as-built drawings and ensure long term operation and maintenance of completed construction sites required to be complete in year 2 of the permit term:

The City continues to require all projects that underwent Planning Board review to submit as-built plans, including information regarding all stormwater conveyance and treatment infrastructure. Prior to signing off on occupancy for these projects, the City ensures that adequate as-built plans have been provided and that an operations and maintenance plan has been submitted meeting manufacturer's recommendations for the cleaning and maintenance of stormwater infrastructure. For units owned by homeowners' associations or condo associations, the City also requires the agreements that document the responsibility for O&M of these systems prior to signing off on occupancy.

Street Design and Parking Lots Report

Describe the status of the street design and parking lots assessment due in year 4 of the permit term, including any planned or completed changes to local regulations and guidelines:

No update.

Green Infrastructure Report

Describe the status of the green infrastructure report due in year 4 of the permit term, including the findings and progress towards making the practice allowable:

No update.

Retrofit Properties Inventory

Describe the status of the inventory, due in year 4 of the permit term, of permittee-owned properties that could be modified or retrofitted with BMPs to mitigate impervious areas and report on any properties that have been modified or retrofitted:

Two properties have been identified thus far and have been included in the City's 5-year Capital Improvement Plan for desired funding. These are retrofits to the City Hall Parking Lot and the Friends Parking Lot to add green infrastructure components prior to repaving. Grant funding is actively being sought for these projects. The formal inventory has not yet been completed Citywide.

MCM6: Good Housekeeping

Catch Basin Cleaning

Describe the status of the catch basin cleaning optimization plan:

The City's plan involves cleaning all catch basins a minimum of once every two years. The City also maintains

If complete, attach the catch basin cleaning optimization plan or the schedule to gather information to develop the optimization plan:

- (●) The catch basin cleaning optimization plan or schedule is attached to the email submission
- ( ) The catch basin cleaning optimization plan or schedule can be found at the following website:

Areas 2 and 4 were cleaned during this reporting year. Areas 1 and 3 will be cleaned in Year 2.

Below, report on the number of catch basins inspected and cleaned, along with the total volume of material removed from the catch basins during this reporting period.

Number of catch basins inspected: 742

Number of catch basins cleaned: 742

Total volume or mass of material removed from all catch basins: 105 tons

Below, report on the total number of catch basins in the MS4 system, if known.

Total number of catch basins: 1633

If applicable:

Report on the actions taken if a catch basin sump is more than 50% full during two consecutive routine inspections/cleaning events:

If a catch basin is found to be frequently filling up, it is added to the "drain periodicals" list. DPW staff aim to visit these sites monthly, and at a minimum once every two months, and perform cleaning depending on the conditions found at each visit.

Street Sweeping

Describe the status of the written procedures for sweeping streets and municipal-owned lots:

The City has a contract for street sweeping, as well as in-house street sweeping equipment. The contracted sweeper sweeps all City roads and parking lots every fall. The City also sweeps all main roadways two times per month between April and August, and sweeps other roadways as needed during this period. The estimate below is conservatively based on 91 miles of roadways swept each fall, plus 15 miles of main roads swept 10 times during the period of April through August. Since other roadways are swept as needed during this period, including after construction, after storms, etc., the total is higher than this conservative estimate.

Report on street sweeping completed during the reporting period using one of the three metrics below.

- (●) Number of miles cleaned: 240
- ( ) Volume of material removed: [UNITS]
- ( ) Weight of material removed: [UNITS]

If applicable:

For rural uncurbed roadways with no catch basins, describe the progress of the inspection, documentation, and targeted sweeping plan:

Winter Road Maintenance

Describe the status of the written procedures for winter road maintenance including the storage of salt and sand:

The following procedures are followed, as indicated in the Notice of Intent and the SWMP:
1) Use appropriate sand/salt mixture
2) Calibrate spreaders at the beginning of each winter at a minimum
3) Maintain calibration and deicer volume records after each storm
4) Keep salt stored in an enclosed shed and never outside
5) Minimize the time salt and sand is uncovered.

In addition, five members of the DPW (Operations Manager, Highway, Water, and Sewer Foremen) attended APWA snow training in 2019 which included training on proper salt management and application to minimize overuse of salt. Furthermore, the City has switched from using calcium chloride to a product called Magic Minus which has reduced our overall salt usage and is said to be more environmentally friendly. The City used approximately 20-30 gallons of Magic Minus during the 2018-19 snow season.

Inventory of Permittee-Owned Properties

Describe the status of the inventory, due in year 2 of the permit term, of permittee-owned properties, including parks and open spaces, buildings and facilities, and vehicles and equipment, and include any updates:

O&M Procedures for Parks and Open Spaces, Buildings and Facilities, and Vehicles and Equipment

Describe the status of the operation and maintenance procedures, due in year 2 of the permit term, of permittee-owned properties (parks and open spaces, buildings and facilities, vehicles and equipment) and include maintenance activities associated with each:

Stormwater Pollution Prevention Plan (SWPPP)

Describe the status of any SWPPP, due in year 2 of the permit term, for permittee-owned or operated facilities including maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater:

Below, report on the number of site inspections for facilities that require a SWPPP completed during this reporting period.

Number of site inspections completed: 1

Describe any corrective actions taken at a facility with a SWPPP:

The City inspects the two structures at the City Yard annually.

O&M Procedures for Stormwater Treatment Structures

Describe the status of the written procedure for stormwater treatment structure maintenance:

The City maintains the treatment structures at the City Yard by having them inspected and pumped out annually. They were most recently inspected and cleaned by Clean Harbors on April 25 and May 2, 2019. The only other known structure is at the Melrose Veterans Memorial Middle School and was only recently discovered to be a City-owned treatment structure. This structure is scheduled for cleaning in Year 2 and will be cleaned annually thereafter. This structure is upstream of the outfall that was not previously included in the GIS and was located during outfall inspections around Ell Pond in 2019.

The City also installed three rain gardens and one subsurface BMP within/beneath the grass strips on Orient Avenue in 2018. The rain gardens are inspected monthly to determine if maintenance is needed. Since this was intended to be a pilot project, they are also photographed each month to have a year-round documentation of their condition. Sampling is planned to be undertaken at some point during the permit term to further evaluate their effectiveness.

Additional Information

Monitoring or Study Results

Results from any other stormwater or receiving water quality monitoring or studies conducted during the reporting period not otherwise mentioned above, where the data is being used to inform permit compliance or permit effectiveness must be attached.

- (●) Not applicable
- ( ) The results from additional reports or studies are attached to the email submission

○ The results from additional reports or studies can be found at the following website(s):

If such monitoring or studies were conducted on your behalf or if monitoring or studies conducted by other entities were reported to you, a brief description of the type of information gathered or received shall be described below:

Additional Information

Optional: Enter any additional information relevant to your stormwater management program implementation during the reporting period. Include any BMP modifications made by the MS4 if not already discussed above:

The City conducted three household hazardous waste collection days, one in June 2018, one in October 2018, and one in June 2019. There are normally two collection days each year, one in June and one in October.

Activities Planned for Next Reporting Period

Please confirm that your SWMP has been, or will be, updated to comply with all applicable permit requirements including but not limited to the year 2 requirements summarized below. (Note: impaired waters and TMDL requirements are not listed below)

Yes, I agree ☒

- Complete system mapping Phase I
- Begin investigations of catchments associated with Problem Outfalls
- Develop or modify an ordinance or other regulatory mechanism for post-construction stormwater runoff from new development and redevelopment
- Establish and implement written procedures to require the submission of as-built drawings no later than two years after the completion of construction projects
- Develop, if not already developed, written operations and maintenance procedures
- Develop an inventory of all permittee owned facilities in the categories of parks and open space, buildings and facilities, and vehicles and equipment; review annually and update as necessary
- Establish a written program detailing the activities and procedures the permittee will implement so that the MS4 infrastructure is maintained in a timely manner
- Develop and implement a written SWPPP for maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater
- Enclose or cover storage piles of salt or piles containing salt used for deicing or other purposes
- Develop, if not already developed, written procedures for sweeping streets and municipal-owned lots
- Develop, if not already developed, written procedures for winter road maintenance including storage of salt and sand
- Develop, if not already developed, a schedule for catch basin cleaning
- Develop, if not already developed, a written procedure for stormwater treatment structure maintenance

- Develop a written catchment investigation procedure *(18 months)*

Annual Requirements

- Annual report submitted and available to the public
- Annual opportunity for public participation in review and implementation of SWMP
- Keep records relating to the permit available for 5 years and make available to the public
- Properly store and dispose of catch basin cleanings and street sweepings so they do not discharge to receiving waters
- Annual training to employees involved in IDDE program
- Update inventory of all known locations where SSOs have discharged to the MS4 in the last 5 years
- Continue public education and outreach program
- Update outfall and interconnection inventory and priority ranking and include data collected in connection with the dry weather screening and other relevant inspections conducted
- Implement IDDE program
- Review site plans of construction sites as part of the construction stormwater runoff control program
- Conduct site inspection of construction sites as necessary
- Inspect and maintain stormwater treatment structures
- Log catch basins cleaned or inspected
- Sweep all uncurbed streets at least annually

Provide any additional details on activities planned for permit year 2 below:

Please see the Notice of Intent and SWMP for additional items noted that are targeted for completion in Year 2.

Part V: Certification of Small MS4 Annual Report 2019

40 CFR 144.32(d) 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, I certify that 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.

Name:	Gail Infurna	Title:	Mayor
Signature:		Date:	09/30/19

[Signatory may be a duly authorized representative]

Year 2 Annual Report
Massachusetts Small MS4 General Permit
Reporting Period: July 1, 2019-June 30, 2020

Please DO NOT attach any documents to this form. Instead, attach all requested documents to an email when submitting the form

Unless otherwise noted, all fields are required to be filled out. If a field is left blank, it will be assumed the requirement or task has not been completed. Please ONLY report on activities between July 1, 2019 and June 30, 2020 unless otherwise requested.

Part I: Contact Information

Name of Municipality or Organization: City of Melrose

EPA NPDES Permit Number: MAR041050

Primary MS4 Program Manager Contact Information

Name: Elena Proakis Ellis Title: Director of Public Works/City Engineer

Street Address Line 1: 562 Main Street

Street Address Line 2:

City: Melrose State: MA Zip Code: 02176

Email: eproakis@cityofmelrose.org Phone Number: (781) 979-4172

Stormwater Management Program (SWMP) Information

SWMP Location (web address): https://www.cityofmelrose.org/engineering/files/melrose-stormwater-management-program

Date SWMP was Last Updated: Sep 25, 2020

If the SWMP is not available on the web please provide the physical address:

Part II: Self-Assessment

First, in the box below, select the impairment(s) and/or TMDL(s) that are applicable to your MS4. Make sure you are referring to the most recent EPA approved Section 303(d) Impaired Waters List which can be found here: https://www.epa.gov/tmdl/region-1-impaired-waters-and-303d-lists-state

Impairment(s)

☒ Bacteria/Pathogens ☐ Chloride ☐ Nitrogen ☒ Phosphorus
☒ Solids/ Oil/ Grease (Hydrocarbons)/ Metals

TMDL(s)

In State: ☐ Assabet River Phosphorus ☒ Bacteria and Pathogen ☐ Cape Cod Nitrogen
☐ Charles River Watershed Phosphorus ☐ Lake and Pond Phosphorus

Out of State: ☐ Bacteria/Pathogens ☐ Metals ☐ Nitrogen ☐ Phosphorus

Clear Impairments and TMDLs

Next, check off all requirements below that have been completed. ***By checking each box you are certifying that you have completed that permit requirement fully.*** *If you have not completed a requirement leave the box unchecked. Additional information will be requested in later sections.*

Year 2 Requirements

☒ Completed Phase I of system mapping

☒ Developed a written catchment investigation procedure and added the procedure to the SWMP

☒ Developed written procedures to require the submission of as-built drawings and ensure the long term operation and maintenance of completed construction sites and added these procedures to the SWMP

☒ Enclosed or covered storage piles of salt or piles containing salt used for deicing or other purposes

☒ Developed written operations and maintenance procedures for parks and open space, buildings and facilities, and vehicles and equipment and added these procedures to the SWMP

☒ Developed an inventory of all permittee owned facilities in the categories of parks and open space, buildings and facilities, and vehicles and equipment and added this inventory to the SWMP

☒ Completed a written program for MS4 infrastructure maintenance to reduce the discharge of pollutants

☒ Developed written SWPPPs, included in the SWMP, for all of the following permittee owned or operated facilities: maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater

Optional: If you would like to describe progress made on any incomplete requirements listed above, provide any additional information, and/or if any of the above year 2 requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

The SWPPPs are attached to the email containing the annual report.

Annual Requirements

- ☒ Provided an opportunity for public participation in review and implementation of SWMP and complied with State Public Notice requirements
- ☒ Kept records relating to the permit available for 5 years and made available to the public
- ☒ The SSO inventory has been updated, including the status of mitigation and corrective measures implemented
  - ○ This is not applicable because we do not have sanitary sewer
  - ○ This is not applicable because we did not find any new SSOs
  - ○ The updated SSO inventory is attached to the email submission
  - ◉ The updated SSO inventory can be found at the following website:

    The updated SSO inventory is an appendix to the SWMP found here: https://www.cityofmelrose.org/engineering/files/melrose-stormwater-management-program
- ☒ Properly stored and disposed of catch basin cleanings and street sweepings so they did not discharge to receiving waters
- ☐ Provided training to employees involved in IDDE program within the reporting period
- ☒ All curbed roadways were swept at least once within the reporting period
- ☒ Updated outfall and interconnection inventory and priority ranking as needed

Optional: If you would like to describe progress made on any incomplete requirements listed above, provide any additional information, and/or if any of the above annual requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

An IDDE training was developed but in-person training was not conducted due to COVID. The City did not think IDDE training could be effectively conducted remotely. IDDE training will be held during Permit Year 3.

Bacteria/ Pathogens (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

- ☒ Annual message was distributed encouraging the proper management of pet waste, including noting any existing ordinances where appropriate
- ☒ Permittee or its agents disseminated educational material to dog owners at the time of issuance or renewal of dog license, or other appropriate time
- ☐ Provided information to owners of septic systems about proper maintenance in any catchment that discharges to a water body impaired for bacteria

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

The city does not have any septic systems that are located within catchments that discharge to a water body

impaired for bacteria.

Phosphorus (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

☒ Distributed an annual message in the spring (April/May) encouraging the proper use and disposal of grass clippings and encouraging the proper use of slow-release and phosphorus-free fertilizers

☒ Distributed an annual message in the summer (June/July) encouraging the proper management of pet waste, including noting any existing ordinances where appropriate

☒ Distributed an annual message in the fall (August/September/October) encouraging the proper disposal of leaf litter

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

☒ Increased street sweeping frequency of all municipal owned streets and parking lots subject to Permit part 2.3.7.a.iii.(c) to a minimum of two times per year (spring and fall)

Potential structural BMPs

☐ Any structural BMPs already existing or installed in the regulated area by the permittee or its agents was tracked and the phosphorus removal by the BMP was estimated consistent with Attachment 3 to Appendix F. The BMP type, total area treated by the BMP, the design storage volume of the BMP and the estimated phosphorus removed in mass per year by the BMP were documented.

- ○ The BMP information is attached to the email submission
- ○ The BMP information can be found at the following website:

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

Melrose does not discharge to a waterbody with an existing TMDL for phosphorus, thus requirement is not applicable to the City. The City will begin accounting for phosphorus removed by structural BMPs installed as a result of the BMP retrofit analysis conducted in the Phosphorus Source Identification Report, which is not due until Permit Year 4.

Solids, Oil and Grease (Hydrocarbons), or Metals

Annual Requirements

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

☒ Increased street sweeping frequency of all municipal owned streets and parking lots to a schedule that targets areas with potential for high pollutant loads

☒ Prioritized inspection and maintenance for catch basins to ensure that no sump shall be more than 50 percent full; Cleaned catch basins more frequently if inspection and maintenance activities indicated excessive sediment or debris loadings

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

Street sweeping is performed two times per year (spring and fall) on all streets in the City, as well as weekly in the summer on main roads. A new catch basin cleaning inspection form was launched with the spring 2020 cleaning; the form has since been modified to be available on portable devices using ESRI Survey 123 software, which will be used to gather data during future cleanings. The City is still working to collect the remaining data needed to develop a Catch Basin Optimization Plan to ensure that no catch basin is ever more than 50% full.

Optional: Use the box below to provide any additional information you would like to share as part of your self-assessment:

Our annual DPW Day was not held in spring 2020 due to the pandemic. This is usually used as another opportunity for stormwater outreach to elementary school aged students. Starting in FY21, the City has joined the Mystic River Stormwater Education Collaborative to further our outreach efforts in Year 3.

Part III: Receiving Waters/Impaired Waters/TMDL

Have you made any changes to your lists of receiving waters, outfalls, or impairments since the NOI was submitted?

- (●) Yes
- ( ) No

If yes, describe below, including any relevant impairments or TMDLs:

10 additional outfalls were discovered during dry-weather sampling that were not previously included in the stormwater GIS as outfalls. These are now listed in the SWMP and included in the updated drainage map. There has been no change in the list of impaired waterbodies applicable to Melrose since the NOI was filed, and none of those 10 previously unmapped outfalls discharge to an impaired waterbody that was not previously identified as receiving point source stormwater discharges.

Part IV: Minimum Control Measures

Please fill out all of the metrics below. If applicable, include in the description who completed the task if completed by a third party.

MCM1: Public Education

Number of educational messages completed **during this reporting period**: 14

*Below, report on the educational messages completed **during this reporting period**. For the measurable goal(s) please describe the method/measures used to assess the overall effectiveness of the educational program.*

BMP:1-1 Message on Stormwater Issues included with the Water and Sewer Bills

Message Description and Distribution Method:

Distributed sewer infiltration and inflow brochure to all water customers in the entire city. This brochure included information about stormwater interconnections.

Targeted Audience: Residents, Businesses, Institutions, and Commercial Facilities

Responsible Department/Parties: DPW - Engineering & Water/Sewer Billing Divisions

Measurable Goal(s):

Distributed with water and sewer bills in Year 2

Message Date(s): Spring 2020

Message Completed for: Appendix F Requirements ☐ Appendix H Requirements ☐

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-2 Make Brochures Available on Stormwater Topics

Message Description and Distribution Method:

Stormwater outreach materials were produced and prominently displayed in the Engineering Division/Water and Sewer Billing at City Hall. Topics include pet waste, leaf litter, and fertilizers. Some of these materials were developed with the assistance from the Mystic River Watershed Association.

Targeted Audience: Residents and General Public

Responsible Department/Parties: DPW/Engineering

Measurable Goal(s):

Selected and stocked brochures and posters at DPW and City Hall.

Message Date(s): Began fall 2018 and currently ongoing.

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-3 Update City Website to include Information on Stormwater Management

Message Description and Distribution Method:

The stormwater management webpage on the City's website was kept current during Year 2, providing information to all target audiences. Posts included stormwater information about pesticides, pet waste, and motor oil. Those posts can be found on our website at https://www.cityofmelrose.org/home/news/stormwater-management-tips-dpw

Targeted Audience: Residents, General Public, Developers, Businesses, Institutions, and Commercial Facilities

Responsible Department/Parties: DPW - Engineering Division

Measurable Goal(s):

The City's stormwater website was live during the majority of Year 2.

Message Date(s): Continuous

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-4 Staff a Booth at the Annual Victorian Fair

Message Description and Distribution Method:

The City participated in the annual Victorian Fair in September 2019, providing brochures on a variety of stormwater management and pollution prevention topics. A map was also available for residents to view what watershed they live in, to better understand the local impacts of stormwater pollution.

Targeted Audience: Residents, General Public, Businesses

Responsible Department/Parties: DPW - Engineering Division

Measurable Goal(s):

Booth staffed at Victorian Fair

Message Date(s): September 8, 2019

Message Completed for: Appendix F Requirements ☐ Appendix H Requirements ☐

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-5 Maintain Signs for Stormwater Management and Pet Waste Cleanup at Schools and Parks

Message Description and Distribution Method:

Signs maintained throughout permit year and inspected.

Targeted Audience: General Public

Responsible Department/Parties: DPW - Operations & Parks

Measurable Goal(s):

Signs inspected and maintained

Message Date(s): Ongoing

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ○

If yes, describe why the change was made:

BMP:1-7 Post Information on Stormwater Management Issues on Local Access Television Channel

Message Description and Distribution Method:

The Think Blue Massachusetts "ducky" video was sent to MMTV to broadcast between programming and was aired beginning in June 2020 and was also shared to their social media outlets.

Targeted Audience: General Public

Responsible Department/Parties: DPW - Administration

Measurable Goal(s):

Video sent to MMTV to broadcast and was aired in Year 2.

Message Date(s): June 2020

Message Completed for: Appendix F Requirements ☐ Appendix H Requirements ☐

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-8 & 1-10 Distribute Information on Low Impact Development to Developers via the Planning Dep

Message Description and Distribution Method:

Brochure selected and provided to Planning Department in spring 2020 but was not able to be distributed due to City Hall closure from March through July 2020.

Targeted Audience: Developers and Builders

Responsible Department/Parties: DPW & Planning Department & Inspectional Services

Measurable Goal(s):

Brochure provided

Message Date(s): Delayed to Year 3 due to pandemic

Message Completed for: Appendix F Requirements ☐ Appendix H Requirements ☐

Was this message different than what was proposed in your NOI? Yes ◉ No ○

If yes, describe why the change was made:

Distribution began in Year 3 with City Hall reopening

BMP: 1-11 Broadcast Targeted Messages about Stormwater Quality, Pet Waste, and Fertilizer Use using

Message Description and Distribution Method:

Stormwater quality, pet waste, and fertilizer and pesticide use informational messages were broadcast using social media in Year 2. These were broadcast using a combination of Facebook and Twitter pages, as well as the City's website.

Targeted Audience: General Public, Businesses, Commercial Facilities

Responsible Department/Parties: DPW - Administration

Measurable Goal(s):

Separate posts made to Twitter and Facebook on each topic.

Message Date(s): June 2020

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-12 Send Message out using Mayor's Blog

Message Description and Distribution Method:

The Mayor's blog was used to broadcast updates to the Stormwater Management Program document in fall 2019. In June 2020, the Melrose Recycles blog was also used to broadcast stormwater messages.

Targeted Audience: Residents, Businesses, Commercial Facilities

Responsible Department/Parties: DPW - Administration

Measurable Goal(s):

Mayor's blog and Recycling Blog stormwater posts were created and posted.

Message Date(s): Fall 2019 and Spring 2020

Message Completed for: Appendix F Requirements ☐ Appendix H Requirements ☐

Was this message different than what was proposed in your NOI? Yes ○ No ○

If yes, describe why the change was made:

BMP:1-13 Provide Information to Residents Seeking Dog Licenses

Message Description and Distribution Method:

The dog license application now has a section on pet waste management and stormwater.

Targeted Audience: Residents

Responsible Department/Parties: DPW and City Clerk's Office

Measurable Goal(s):

Dog license applicants receive information about pet waste management from the City Clerk's office.

Message Date(s): Throughout Year 2

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

Add an Educational Message

MCM2: Public Participation

Describe the opportunity provided for public involvement in the development of the Stormwater Management Program (SWMP) **during this reporting period**:

The SWMP has been posted to the City's website and is a living document and will be modified as comments are received that warrant updates. The webpage includes an email address and phone number for those wishing to submit comments. This link was live during the majority of Year 2.

Was this opportunity different than what was proposed in your NOI? Yes ○ No ◉

Describe any other public involvement or participation opportunities conducted **during this reporting period**:

As noted in the NOI, public meetings are posted in accordance with state and public notification guidelines. Due to COVID, no in-person events were scheduled starting in March 2020, aside from one Ell Pond cleanup held in April 2020 for which the City provided trash and recycling cleanup.

MCM3: Illicit Discharge Detection and Elimination (IDDE)

Sanitary Sewer Overflows (SSOs)

Check off the box below if the statement is true.

☐ This SSO section is NOT applicable because we DO NOT have sanitary sewer

*Below, report on the number of SSOs identified in the MS4 system and removed **during this reporting period**.*

Number of SSOs identified: 0

Number of SSOs removed: 0

MS4 System Mapping

Below, check all that apply.

The following elements of the Phase I map have been completed:

- ☒ Outfalls and receiving waters
- ☒ Open channel conveyances
- ☒ Interconnections
- ☒ Municipally-owned stormwater treatment structures
- ☒ Waterbodies identified by name and indication of all use impairments
- ☐ Initial catchment delineations

Optional: Describe any additional progress you made on your map during this reporting period or provide additional status information regarding your map:

Due to the discovery of ten new outfalls during outfall screening, we are still working on finalizing and confirming catchment delineations.

Screening of Outfalls/Interconnections

If conducted, please submit any outfall monitoring results from this reporting period. Outfall monitoring results should include the date, outfall/interconnection identifier, location, weather conditions at time of sampling, precipitation in previous 48 hours, field screening parameter results, and results from all analyses.

- ◉ The outfall screening data is attached to the email submission
- ○ The outfall screening data can be found at the following website:

*Below, report on the number of outfalls/interconnections screened **during this reporting period**.*

Number of outfalls screened: 44

Catchment Investigations

If conducted, please submit all data collected during this reporting period as part of the dry and wet weather investigations. Also include the presence or absence of System Vulnerability Factors for each catchment.

- ○ The catchment investigation data is attached to the email submission
- ◉ The catchment investigation data can be found at the following website:

None of these options should be checked. The form won't allow us to uncheck the options.

*Below, report on the number of catchment investigations completed **during this reporting period**.*

Number of catchment investigations completed this reporting period: 0

*Below, report on the percent of catchments investigated **to date.***

Percent of total catchments investigated: 0

Optional: Provide any additional information for clarity regarding the catchment investigations below:

Outfall investigations were delayed due to COVID-19 in spring 2020 and were completed close to the end of the reporting period. The dry-weather screening results are attached to the email containing this annual report. The City has developed a catchment investigation procedure, which is included in the IDDE Plan attached to the SWMP. Since dry-weather outfall screening was conducted near the end of Permit Year 2 and 10 new outfalls were discovered at that time, the City is still working to finalize its system vulnerability analysis.

Once finalized, catchment investigations will proceed according to the IDDE plan. The City will submit the finalized SVF analysis with the Year 3 annual report. Despite the fact that the SVF analysis is not complete, wet weather sampling will likely be required at every outfall due to the size of the contributing catchment areas and the likelihood that they have deteriorating and aging sewers.

IDDE Progress

If illicit discharges were found, please submit a document describing work conducted over this reporting period, and cumulative to date, including location source; description of the discharge; method of discovery; date of discovery; and date of elimination, mitigation, or enforcement OR planned corrective measures and schedule of removal.

- ○ The illicit discharge removal report is attached to the email submission
- ○ The illicit discharge removal report can be found at the following website:

*Below, report on the number of illicit discharges identified and removed, along with the volume of sewage removed **during this reporting period.***

Number of illicit discharges identified: 0

Number of illicit discharges removed: 0

Estimated volume of sewage removed: 0 gallons/day

*Below, report on the total number of illicit discharges identified and removed to date. At a minimum, report on the number of illicit discharges identified and removed **since the effective date of the permit (July 1, 2018)**.*

Total number of illicit discharges identified: 0

Total number of illicit discharges removed: 0

Optional: Provide any additional information for clarity regarding illicit discharges identified, removed, or planned to be removed below:

While no IDDE investigations were started in Year 2, many segments of drain pipes were CCTV inspected, including those located on all streets that were paved in Year 2, as well as in the City Hall parking lot. No evidence of illicit connections was observed during any of these investigations.

Employee Training

Describe the frequency and type of employee training conducted **during the reporting period**:

IDDE training was developed by Weston & Sampson Engineers during Year 2 but was not conducted because the City did not believe remote training would suffice for this topic.

MCM4: Construction Site Stormwater Runoff Control

*Below, report on the construction site plan reviews, inspections, and enforcement actions completed **during this reporting period**.*

Number of site plan reviews completed: 4

Number of inspections completed: 0

Number of enforcement actions taken: 0

Optional: Enter any additional information relevant to construction site plan reviews, inspections, and enforcement actions:

There were no projects that had stormwater permits (over 1 acre) where site work was being performed during Year 2. Several new projects were reviewed and approved for construction, but construction will be starting in Year 3. These include: 99 Washington Street, Patrick's Place (Hillside Park subdivision), 12-16 Essex Street (project denied), and 138 Main Street. The former two projects are each greater than 1 acre.

MCM5: Post-Construction Stormwater Management in New Development and Redevelopment

Ordinance or Regulatory Mechanism

Below, select the option that describes your ordinance or regulatory mechanism progress.

- ○ Bylaw, ordinance, or regulations are updated and adopted consistent with permit requirements
- ◉ Bylaw, ordinance, or regulations are updated consistent with permit requirements but are not yet adopted
- ○ Bylaw, ordinance, or regulations have not been updated or adopted

As-built Drawings

Describe the measures the MS4 has utilized to require the submission of as-built drawings and ensure long term operation and maintenance of completed construction sites:

The City continues to require all projects that underwent Planning Board review to submit as-built plans, including information regarding all stormwater conveyance and treatment infrastructure. Prior to signing off on occupancy for these projects, the City ensures that adequate as-built plans have been provided and that an operations and maintenance plan has been submitted meeting manufacturer's recommendations for the cleaning and maintenance of stormwater infrastructure. For units owned by homeowners' associations or condo associations, the City also requires the agreements that document the responsibility for O&M of these systems prior to signing off on occupancy.

Street Design and Parking Lots Report

Describe the status of the street design and parking lots assessment due in year 4 of the permit term, including any planned or completed changes to local regulations and guidelines:

No update

Green Infrastructure Report

Describe the status of the green infrastructure report due in year 4 of the permit term, including the findings and progress towards making the practice allowable:

No update

Retrofit Properties Inventory

Describe the status of the inventory, due in year 4 of the permit term, of permittee-owned properties that could be modified or retrofitted with BMPs to mitigate impervious areas and report on any properties that have been modified or retrofitted:

No update

MCM6: Good Housekeeping

Catch Basin Cleaning

*Below, report on the number of catch basins inspected and cleaned, along with the total volume of material removed from the catch basins **during this reporting period**.*

Number of catch basins inspected: 891

Number of catch basins cleaned: 891

Total volume or mass of material removed from all catch basins: 150 tons

Below, report on the total number of catch basins in the MS4 system.

Total number of catch basins: 1,633

If applicable:

Report on the actions taken if a catch basin sump is more than 50% full during two consecutive routine inspections/cleaning events:

If a catch basin is found to be frequently filling up, it is added to the "drain periodicals" list. DPW staff aim to visit these sites monthly, and at a minimum once every two months, and perform cleaning depending on the conditions found at each visit.

Street Sweeping

*Report on street sweeping completed **during this reporting period** using one of the three metrics below.*

- (•) Number of miles cleaned: 240
- ( ) Volume of material removed: [Select Units]
- ( ) Weight of material removed: [Select Units]

O&M Procedures and Inventory of Permittee-Owned Properties

Below, check all that apply.

The following permittee-owned properties have been inventoried:

- ☒ Parks and open spaces
- ☒ Buildings and facilities
- ☒ Vehicles and equipment

The following O&M procedures for permittee-owned properties have been completed:

- ☒ Parks and open spaces
- ☒ Buildings and facilities
- ☒ Vehicles and equipment

Stormwater Pollution Prevention Plan (SWPPP)

*Below, report on the number of site inspections for facilities that require a SWPPP completed **during this reporting period**.*

Number of site inspections completed: 2

Describe any corrective actions taken at a facility with a SWPPP:

SWPPPs were developed for the DPW City Yard and the Wyoming Cemetery garage in Year 2. Training was developed in Year 2 but was modified due to COVID to be a remote learning module for each building. The first module (City Yard) was delivered to all managers and foremen at the DPW City Yard in September 2020. No immediate corrective actions were identified as necessary, although improvements are being considered for Year 3 and subsequent years.

Additional Information

Monitoring or Study Results

Results from any other stormwater or receiving water quality monitoring or studies conducted during the reporting period not otherwise mentioned above, where the data is being used to inform permit compliance or permit effectiveness must be attached.

- (•) Not applicable
- ( ) The results from additional reports or studies are attached to the email submission
- ( ) The results from additional reports or studies can be found at the following website(s):

If such monitoring or studies were conducted on your behalf or if monitoring or studies conducted by other entities were reported to you, a brief description of the type of information gathered or received shall be described below:

Additional Information

Optional: Enter any additional information relevant to your stormwater management program implementation during the reporting period. Include any BMP modifications made by the MS4 if not already discussed above:

The City conducted two household hazardous waste collection days, one in October 2019 and one in June 2020. We also conducted one event to collect motor oil, gas, and antifreeze.

COVID-19 Impacts

Optional: If any of the above year 2 requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

In person IDDE training was not conducted due to COVID restrictions. Also, DPW Day was not held, as noted above, and outfall screening took place later in Year 2 than originally intended, which led to a delay in the follow-up confirmation of catchment delineations.

Activities Planned for Next Reporting Period

Please confirm that your SWMP has been, or will be, updated to comply with all applicable permit requirements including but not limited to the year 3 requirements summarized below. (Note: impaired waters and TMDL requirements are not listed below)

Yes, I agree ☒

- Inspect all outfalls/ interconnections (excluding Problem and Excluded outfalls) for the presence of dry weather flow
- Complete follow-up ranking as dry weather screening becomes available

Annual Requirements

- Annual report submitted and available to the public
- Annual opportunity for public participation in review and implementation of SWMP
- Keep records relating to the permit available for 5 years and make available to the public
- Properly store and dispose of catch basin cleanings and street sweepings so they do not discharge to

receiving waters
- Annual training to employees involved in IDDE program
- Update inventory of all known locations where SSOs have discharged to the MS4
- Continue public education and outreach program
- Update outfall and interconnection inventory and priority ranking and include data collected in connection with the dry weather screening and other relevant inspections conducted
- Implement IDDE program
- Review site plans of construction sites as part of the construction stormwater runoff control program
- Conduct site inspection of construction sites as necessary
- Inspect and maintain stormwater treatment structures
- Log catch basins cleaned or inspected
- Sweep all uncurbed streets at least annually
- Continue investigations of catchments associated with Problem Outfalls
- Review inventory of all permittee owned facilities in the categories of parks and open space, buildings and facilities, and vehicles and equipment; update if necessary

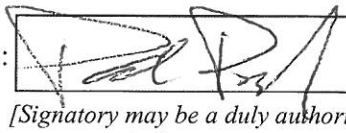
Provide any additional details on activities planned for permit year 3 below:

Please see the Notice of Intent and SWMP for additional items noted that are targeted for completion in Year 3.

Part V: Certification of Small MS4 Annual Report 2020

40 CFR 144.32(d) 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, I certify that 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.

Name:	Paul Brodeur	Title:	Mayor
Signature:		Date:	9/20/2020

[Signatory may be a duly authorized representative]

Year 3 Annual Report
Massachusetts Small MS4 General Permit
Reporting Period: July 1, 2020-June 30, 2021

Please DO NOT attach any documents to this form. Instead, attach all requested documents to an email when submitting the form

Unless otherwise noted, all fields are required to be filled out. If a field is left blank, it will be assumed the requirement or task has not been completed. Please ONLY report on activities between July 1, 2020 and June 30, 2021 unless otherwise requested.

Part I: Contact Information

Name of Municipality or Organization: City of Melrose

EPA NPDES Permit Number: MAR041050

Primary MS4 Program Manager Contact Information

Name: Elena Proakis Ellis Title: Director of Public Works

Street Address Line 1: 562 Main Street

Street Address Line 2:

City: Melrose State: MA Zip Code: 02176

Email: eproakis@cityofmelrose.org Phone Number: (781) 979-4172

Stormwater Management Program (SWMP) Information

SWMP Location (web address): https://www.cityofmelrose.org/engineering/files/melrose-stormwater-management-program

Date SWMP was Last Updated: 9/25/2020

If the SWMP is not available on the web please provide the physical address:

Part II: Self-Assessment

First, in the box below, select the impairment(s) and/or TMDL(s) that are applicable to your MS4. Make sure you are referring to the most recent EPA approved Section 303(d) Impaired Waters List which can be found here: https://www.epa.gov/tmdl/region-1-impaired-waters-and-303d-lists-state

Impairment(s)

☒ Bacteria/Pathogens ☐ Chloride ☐ Nitrogen ☒ Phosphorus
☒ Solids/ Oil/ Grease (Hydrocarbons)/ Metals

TMDL(s)

In State: ☐ Assabet River Phosphorus ☒ Bacteria and Pathogen ☐ Cape Cod Nitrogen
☐ Charles River Watershed Phosphorus ☐ Lake and Pond Phosphorus

Out of State: ☐ Bacteria/Pathogens ☐ Metals ☐ Nitrogen ☐ Phosphorus

Clear Impairments and TMDLs

Next, check off all requirements below that have been completed. ***By checking each box you are certifying that you have completed that permit requirement fully.*** *If you have not completed a requirement leave the box unchecked. Additional information will be requested in later sections.*

Year 3 Requirements

☒ Inspected and screened all outfalls/interconnections (excluding Problem and Excluded outfalls)

☒ Updated outfall/interconnection priority ranking based on the information collected during the dry weather inspections as necessary

☒ Post-construction bylaw, ordinance, or other regulatory mechanism was updated and adopted consistent with permit requirements

Optional: If you would like to describe progress made on any incomplete requirements listed above, provide any additional information, and/or if any of the above year 3 requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

Annual Requirements

☒ Provided an opportunity for public participation in review and implementation of SWMP and complied with State Public Notice requirements

☒ Kept records relating to the permit available for 5 years and made available to the public

☒ The SSO inventory has been updated, including the status of mitigation and corrective measures implemented

- ○ This is not applicable because we do not have sanitary sewer
- ○ This is not applicable because we did not find any new SSOs

- ○ The updated SSO inventory is attached to the email submission
- ◉ The updated SSO inventory can be found at the following website:

https://www.cityofmelrose.org/engineering/files/melrose-stormwater-management-program

- ☒ Properly stored and disposed of catch basin cleanings and street sweepings so they did not discharge to receiving waters
- ☒ Provided training to employees involved in IDDE program within the reporting period
- ☒ All curbed roadways were swept at least once within the reporting period
- ☒ Updated system map due in year 2 as necessary
- ☒ Enclosed all road salt storage piles or facilities and implemented winter road maintenance procedures to minimize the use of road salt
- ☒ Implemented SWPPPs for all permittee owned or operated maintenance garages, public works yards, transfer stations, and other waste handling facilities
- ☒ Updated inventory of all permittee owned facilities as necessary
- ☒ O&M programs for all permittee owned facilities have been completed and updated as necessary
- ☒ Implemented all maintenance procedures for permittee owned facilities in accordance with O&M programs
- ☒ Implemented program for MS4 infrastructure maintenance to reduce the discharge of pollutants
- ☒ Inspected all permittee owned treatment structures (excluding catch basins)

Optional: If you would like to describe progress made on any incomplete requirements listed above, provide any additional information, and/or if any of the above annual requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

Bacteria/ Pathogens (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

- ☒ Annual message was distributed encouraging the proper management of pet waste, including noting any existing ordinances where appropriate
- ☒ Permittee or its agents disseminated educational material to dog owners at the time of issuance or renewal of dog license, or other appropriate time
- ☐ Provided information to owners of septic systems about proper maintenance in any catchment that discharges to a water body impaired for bacteria

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

The city does not have any septic systems that are located within catchments that discharge to a water body impaired for bacteria.

Phosphorus (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

☒ Distributed an annual message in the spring (April/May) encouraging the proper use and disposal of grass clippings and encouraging the proper use of slow-release and phosphorus-free fertilizers

☒ Distributed an annual message in the summer (June/July) encouraging the proper management of pet waste, including noting any existing ordinances where appropriate

☒ Distributed an annual message in the fall (August/September/October) encouraging the proper disposal of leaf litter

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

☒ Increased street sweeping frequency of all municipal owned streets and parking lots subject to Permit part 2.3.7.a.iii.(c) to a minimum of two times per year (spring and fall)

Potential structural BMPs

☐ Any structural BMPs already existing or installed in the regulated area by the permittee or its agents was tracked and the phosphorus removal by the BMP was estimated consistent with Attachment 3 to Appendix F. The BMP type, total area treated by the BMP, the design storage volume of the BMP and the estimated phosphorus removed in mass per year by the BMP were documented.

- ○ The BMP information is attached to the email submission
- ○ The BMP information can be found at the following website:

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

Melrose does not discharge to a waterbody with an existing TMDL for phosphorous, thus the requirement is not applicable to the City. The City will being accounting for phosphorous removed by structure BMPs installed as a result of the BMP retrofit analysis conducted in the Phosphorous Source Identification Report, which is not due until Permit Year 4.

Solids, Oil and Grease (Hydrocarbons), or Metals

Annual Requirements

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

☒ Increased street sweeping frequency of all municipal owned streets and parking lots to a schedule that targets areas with potential for high pollutant loads

☒ Prioritized inspection and maintenance for catch basins to ensure that no sump shall be more than 50 percent full; Cleaned catch basins more frequently if inspection and maintenance activities indicated excessive sediment or debris loadings

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

Street sweeping is performed two times per year (spring and fall) on all streets in the City, as well as weekly in the summer on main roads. A new catch basin cleaning inspection form was launched with the spring 2020 cleaning; the form has since been modified to be available on portable devices using ESRI Survey 123 software, which will be used to gather data during future cleanings. The City is working on developing a Catch Basin Optimization Plan to ensure that no catch basin is ever more than 50% full.

Optional: Use the box below to provide any additional information you would like to share as part of your self-assessment:

Our annual DPW Day was not held in spring 2021 due to the pandemic. This is usually used as another opportunity for stormwater outreach to elementary school aged students. Starting in FY21, the City has joined the Mystic River Stormwater Education Collaborative to further our outreach efforts in Year 3 and on.

Part III: Receiving Waters/Impaired Waters/TMDL

Have you made any changes to your lists of receiving waters, outfalls, or impairments since the NOI was submitted?

- ○ Yes
- ◉ No

If yes, describe below, including any relevant impairments or TMDLs:

Part IV: Minimum Control Measures

Please fill out all of the metrics below. If applicable, include in the description who completed the task if completed by a third party.

MCM1: Public Education

Number of educational messages completed **during this reporting period**: 19

*Below, report on the educational messages completed **during this reporting period**. For the measurable goal(s) please describe the method/measures used to assess the overall effectiveness of the educational program.*

BMP:1-2 Make Brochures Available on Stormwater Topics

Message Description and Distribution Method:

Stormwater outreach materials were produced and prominently displayed in the Engineering Division/Water and Sewer Billing at City Hall. Topics include pet waste, leaf litter, and fertilizers. Some of these materials were developed with the assistance from the Mystic River Watershed Association.

Targeted Audience: Residents and General Public

Responsible Department/Parties: DPW/Engineering

Measurable Goal(s):

Selected and stocked brochures and posters at DPW and City Hall.

Message Date(s): Began fall 2018 and currently ongoing.

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-3 Update City Website to include Information on Stormwater Management

Message Description and Distribution Method:

The stormwater management webpage on the City's website was kept current during Year 2, providing information to all target audiences. Posts included stormwater information about pesticides, pet waste, and motor oil. Those posts can be found on our website at https://www.cityofmelrose.org/home/news/stormwater-management-tips-dpw

Targeted Audience: Residents, General Public, Developers, Businesses, Institutions, and Commercial Facilities

Responsible Department/Parties: DPW/Engineering

Measurable Goal(s):

The City's stormwater website was live during the majority of Year 2 and continuously updated.

Message Date(s): Continuous

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-5 Maintain Signs for Stormwater Management and Pet Waste Cleanup at Schools and Parks

Message Description and Distribution Method:

Signs maintained throughout permit year and inspected.

Targeted Audience: General Public

Responsible Department/Parties: DPW - Operations & Parks

Measurable Goal(s):

Signs inspected and maintained.

Message Date(s): Ongoing

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-7 Post Information on Stormwater Management Issues on Local Access Television Channel

Message Description and Distribution Method:

The Think Blue Massachusetts "ducky" video was sent to MMTV to broadcast between programming and was aired beginning in June 2020 and periodically broadcasted throughout this reporting period and was also shared to their social media outlets.

Targeted Audience: General Public

Responsible Department/Parties: DPW - Administration

Measurable Goal(s):

Video sent to MMTV to broadcast and was aired Starting in Year 2 and periodically throughout Year 3.

Message Date(s): July 2021-Present

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-8 & 1-10 Distribute Information on Low Impact Development to Developers via the Planning De

Message Description and Distribution Method:

Brochure selected and provided to Planning Department in spring 2020 and is available in the Planning Department.

Targeted Audience: Developers

Responsible Department/Parties: DPW/Engineering and Planning Department

Measurable Goal(s):

Selected and stocked brochures and posters at DPW and City Hall.

Message Date(s): Spring 2020 and currently ongoing.

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-11 Broadcast Targeted Messages about Stormwater Quality, Pet Waste, and Fertilizer Use using

Message Description and Distribution Method:

Stormwater quality, pet waste, grass clippings, and fertilizer and pesticide use informational messages were broadcast using social media in Year 3. These were broadcast using a combination of Facebook and Twitter pages, as well as the City's website.

Targeted Audience: General Public, Businesses, Commercial Facilities

Responsible Department/Parties: DPW - Administration

Measurable Goal(s):

Separate posts made to Twitter and Facebook on each topic.

Message Date(s): August 2020, May 2021

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-12 Send Message out using Mayor's Blog

Message Description and Distribution Method:

The Mayor's blog was used to broadcast clean water tips in the fall of 2020 and spring of 2021.

Targeted Audience: Residents, Businesses, Commercial Facilities

Responsible Department/Parties: DPW - Administration

Measurable Goal(s):

Mayor's blog stormwater posts were created and posted.

Message Date(s): Fall 2020 and Spring 2021

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-13 Provide Information to Residents Seeking Dog Licenses

Message Description and Distribution Method:

The dog license application now has a section on pet waste management and stormwater.

Targeted Audience: Residents

Responsible Department/Parties: DPW and City Clerk's Office

Measurable Goal(s):

Dog license applicants receive information about pet waste management from the City Clerk's office.

Message Date(s): Continuous

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

Add an Educational Message

MCM2: Public Participation

Describe the opportunity provided for public involvement in the development of the Stormwater Management Program (SWMP) **during this reporting period**:

The SWMP has been posted to the City's website and is a living document and will be modified as comments are received that warrant updates. The webpage includes an email address and phone number for those wishing to submit comments. This link was live during the majority of Year 2.

Was this opportunity different than what was proposed in your NOI? Yes ○ No ◉

Describe any other public involvement or participation opportunities conducted **during this reporting period**:

As noted in the NOI, public meetings are posted in accordance with state and public notification guidelines. Due to COVID, no in-person events were scheduled starting in March 2020, however, a few cleanups took place including a city-wide earth day cleanup, which included the Litter Letter Project, on April 24th. In addition, an Ell Pond Cleanup Day took place in May 2021.

MCM3: Illicit Discharge Detection and Elimination (IDDE)

Sanitary Sewer Overflows (SSOs)

Check off the box below if the statement is true.

☐ This SSO section is NOT applicable because we DO NOT have sanitary sewer

*Below, report on the number of SSOs identified in the MS4 system and removed **during this reporting period**.*

Number of SSOs identified: 0

Number of SSOs removed: 0

MS4 System Mapping

Optional: Provide additional status information regarding your map:

Screening of Outfalls/Interconnections

If conducted, please submit any outfall monitoring results from this reporting period. Outfall monitoring results should include the date, outfall/interconnection identifier, location, weather conditions at time of sampling, precipitation in previous 48 hours, field screening parameter results, and results from all analyses. Please also include the updated inventory and ranking of outfalls/interconnections based on monitoring results.

- (•) No outfalls were inspected
- ( ) The outfall screening data is attached to the email submission
- ( ) The outfall screening data can be found at the following website:

Below, report on the number of outfalls/interconnections screened ***during this reporting period****.*

Number of outfalls screened: 0

Below, report on the percent of outfalls/interconnections screened ***to date****.*

Percent of outfalls screened: 0

Optional: Provide additional information regarding your outfall/interconnection screening:

Catchment Investigations

If conducted, please submit all data collected during this reporting period as part of the dry and wet weather investigations. Also include the presence or absence of System Vulnerability Factors for each catchment.

- (•) No catchment investigations were conducted
- ( ) The catchment investigation data is attached to the email submission
- ( ) The catchment investigation data can be found at the following website:

Below, report on the number of catchment investigations completed ***during this reporting period****.*

Number of catchment investigations completed this reporting period: 0

Below, report on the percent of catchments investigated ***to date.***

Percent of total catchments investigated: 0

Optional: Provide any additional information for clarity regarding the catchment investigations below:

Despite the fact that the SVF analysis is not complete, in essence, the SVY analysis is effectively complete because wet weather sampling will be required at every outfall due to the size of the contributing catchment

areas and the likelihood that they have deteriorating and aging sewers. The SVY analysis document will be submitted in a future year report.

IDDE Progress

If illicit discharges were found, please submit a document describing work conducted over this reporting period, and cumulative to date, including location source; description of the discharge; method of discovery; date of discovery; and date of elimination, mitigation, or enforcement OR planned corrective measures and schedule of removal.

- (•) No illicit discharges were found
- ( ) The illicit discharge removal report is attached to the email submission
- ( ) The illicit discharge removal report can be found at the following website:

*Below, report on the number of illicit discharges identified and removed, along with the volume of sewage removed **during this reporting period.***

Number of illicit discharges identified: 0

Number of illicit discharges removed: 0

Estimated volume of sewage removed: 0 gallons/day

*Below, report on the total number of illicit discharges identified and removed to date. At a minimum, report on the number of illicit discharges identified and removed **since the effective date of the permit (July 1, 2018)**.*

Total number of illicit discharges identified: 0

Total number of illicit discharges removed: 0

Optional: Provide any additional information for clarity regarding illicit discharges identified, removed, or planned to be removed below:

While no IDDE investigations were started in Year 3, many segments of drain pipes were CCTV inspected, including those located on all streets that were paved in Year 3. No evidence of illicit connections was observed during any of these investigations.

Employee Training

Describe the frequency and type of employee training conducted **during this reporting period**:

IDDE training was developed by Weston & Sampson Engineers during Year 2 and was conducted in person in June 2021.

MCM4: Construction Site Stormwater Runoff Control

*Below, report on the construction site plan reviews, inspections, and enforcement actions completed **during this reporting period**.*

Number of site plan reviews completed: 6

Number of inspections completed: 6

Number of enforcement actions taken: 3

Optional: Enter any additional information relevant to construction site plan reviews, inspections, and enforcement actions:

Two projects (both over an acre) started construction during Year 3. There have been 6 total site inspections with 3 enforcement actions taken. These actions include installing and replacing runoff erosion control, cleaning catch basins, and street sweeping.

MCM5: Post-Construction Stormwater Management in New Development and Redevelopment

As-built Drawings

*Below, report on the number of as-built drawings received **during this reporting period**.*

Number of as-built drawings received: 0

Optional: Enter any additional information relevant to the submission of as-built drawings:

No developments have been completed during this reporting year.

Street Design and Parking Lots Report

Describe the status of the street design and parking lots assessment due in year 4 of the permit term, including any planned or completed changes to local regulations and guidelines:

The street design and parking lot assessment has not been started but will be completed during Year 4.

Green Infrastructure Report

Describe the status of the green infrastructure report due in year 4 of the permit term, including the findings and progress towards making the practice allowable:

The green infrastructure report has not been started but will be completed during Year 4.

Retrofit Properties Inventory

Describe the status of the inventory, due in year 4 of the permit term, of permittee-owned properties that could be modified or retrofitted with BMPs to mitigate impervious areas and report on any properties that have been modified or retrofitted:

The property inventory for retrofitted BMPs has not been started but will be completed during Year 4.

MCM6: Good Housekeeping

Catch Basin Cleaning

*Below, report on the number of catch basins inspected and cleaned, along with the total volume of material removed from the catch basins **during this reporting period**.*

Number of catch basins inspected: 742

Number of catch basins cleaned: 742

Total volume or mass of material removed from all catch basins: 99 tons

Below, report on the total number of catch basins in the MS4 system.

Total number of catch basins: 1,633

If applicable:

Report on the actions taken if a catch basin sump is more than 50% full during two consecutive routine inspections/cleaning events:

If a catch basin is found to be frequently filling up, it is added to the "drain periodicals" list. DPW staff aim to visit these sites monthly, and at a minimum once every two months, and perform cleaning depending on the conditions found at each visit.

Street Sweeping

*Report on street sweeping completed **during this reporting period** using one of the three metrics below.*

- (●) Number of miles cleaned: 240
- ( ) Volume of material removed: [Select Units]
- ( ) Weight of material removed: [Select Units]

Stormwater Pollution Prevention Plan (SWPPP)

*Below, report on the number of site inspections for facilities that require a SWPPP completed **during this reporting period**.*

Number of site inspections completed: 1

Describe any corrective actions taken at a facility with a SWPPP:

Erosion control was request at the backfill/gravel stockpile area as sediment was being transported during a high intensity rainfall event.

Additional Information

Monitoring or Study Results

Results from any other stormwater or receiving water quality monitoring or studies conducted during the reporting period not otherwise mentioned above, where the data is being used to inform permit compliance or permit effectiveness must be attached.

- (•) Not applicable
- ( ) The results from additional reports or studies are attached to the email submission
- ( ) The results from additional reports or studies can be found at the following website(s):

If such monitoring or studies were conducted on your behalf or if monitoring or studies conducted by other entities were reported to you, a brief description of the type of information gathered or received shall be described below:

Additional Information

Optional: Enter any additional information relevant to your stormwater management program implementation during the reporting period. Include any BMP modifications made by the MS4 if not already discussed above:

The City conducted two household hazardous waste collection days, one in October 2020 and one in June 2021. We also conducted one event to collect motor oil, gas, and antifreeze.

COVID-19 Impacts

Optional: If any of the above year 3 requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

DPW Day nor the Victorian Fair were held, as noted above.

Activities Planned for Next Reporting Period

Please confirm that your SWMP has been, or will be, updated to comply with all applicable permit requirements including but not limited to the year 4 requirements summarized below. (Note: impaired waters and TMDL requirements are not listed below)

Yes, I agree ☒

- Develop a report assessing current street design and parking lot guidelines and other local requirements within the municipality that affect the creation of impervious cover
- Develop a report assessing existing local regulations to determine the feasibility of making green infrastructure practices allowable when appropriate site conditions exist
- Identify a minimum of 5 permittee-owned properties that could potentially be modified or retrofitted with BMPs to reduce impervious areas

Annual Requirements

- Annual report submitted and available to the public
- Annual opportunity for public participation in review and implementation of SWMP
- Keep records relating to the permit available for 5 years and make available to the public
- Properly store and dispose of catch basin cleanings and street sweepings so they do not discharge to receiving waters
- Annual training to employees involved in IDDE program
- Update inventory of all known locations where SSOs have discharged to the MS4
- Continue public education and outreach program
- Update outfall and interconnection inventory and priority ranking and include data collected in connection with the dry weather screening and other relevant inspections conducted
- Implement IDDE program
- Review site plans of construction sites as part of the construction stormwater runoff control program
- Conduct site inspection of construction sites as necessary
- Inspect and maintain stormwater treatment structures
- Log catch basins cleaned or inspected
- Sweep all curbed streets at least annually
- Continue investigations of catchments associated with Problem Outfalls
- Implemented SWPPPs for all permittee owned or operated maintenance garages, public works yards, transfer stations, and other waste handling facilities
- Review inventory of all permittee owned facilities in the categories of parks and open space, buildings and facilities, and vehicles and equipment; update if necessary
- Review O&M programs for all permittee owned facilities; update if necessary
- Implement all maintenance procedures for permittee owned facilities in accordance with O&M

programs
- Implement program for MS4 infrastructure maintenance to reduce the discharge of pollutants
- Enclose all road salt storage piles or facilities and implemented winter road maintenance procedures to minimize the use of road salt
- Review as-built drawings for new and redevelopment to ensure compliance with post construction bylaws, regulations, or regulatory mechanism consistent with permit requirements
- Inspect all permittee owned treatment structures (excluding catch basins)

Provide any additional details on activities planned for permit year 4 below:

Please see the Notice of Intent and SWMP for additional items noted that are targeted for completion in Year 4.

Part V: Certification of Small MS4 Annual Report 2021

40 CFR 144.32(d) 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, I certify that 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.

Name:	Paul Brodeur	Title:	Mayor
Signature:		Date:	9/22/2021

[Signatory may be a duly authorized representative]

Year 4 Annual Report
Massachusetts Small MS4 General Permit
Reporting Period: July 1, 2021-June 30, 2022

Please DO NOT attach any documents to this form. Instead, attach all requested documents to an email when submitting the form

Unless otherwise noted, all fields are required to be filled out. If a field is left blank, it will be assumed the requirement or task has not been completed. Please ONLY report on activities between July 1, 2021 and June 30, 2022 unless otherwise requested.

Part I: Contact Information

Name of Municipality or Organization: City of Melrose

EPA NPDES Permit Number: MAR041050

Primary MS4 Program Manager Contact Information

Name: Elena Proakis Ellis Title: Director of Public Works

Street Address Line 1: 562 Main Street

Street Address Line 2:

City: Melrose State: MA Zip Code: 02176

Email: eproakis@cityofmelrose.org Phone Number: (781) 979-4172

Stormwater Management Program (SWMP) Information

SWMP Location (web address): https://www.cityofmelrose.org/engineering/files/melrose-stormwater-management-program

Date SWMP was Last Updated: 9/25/2022

If the SWMP is not available on the web please provide the physical address:

Part II: Self-Assessment

First, in the box below, select the impairment(s) and/or TMDL(s) that are applicable to your MS4. Make sure you are referring to the most recent EPA approved Section 303(d) Impaired Waters List which can be found here: https://www.epa.gov/tmdl/region-1-impaired-waters-and-303d-lists-state

Impairment(s)

☒ Bacteria/Pathogens ☐ Chloride ☐ Nitrogen ☒ Phosphorus
☒ Solids/ Oil/ Grease (Hydrocarbons)/ Metals

TMDL(s)

In State: ☐ Assabet River Phosphorus ☒ Bacteria and Pathogen ☐ Cape Cod Nitrogen
☐ Charles River Watershed Phosphorus ☐ Lake and Pond Phosphorus

Out of State: ☐ Bacteria/Pathogens ☐ Metals ☐ Nitrogen ☐ Phosphorus

Clear Impairments and TMDLs

Next, check off all requirements below that have been completed. ***By checking each box you are certifying that you have completed that permit requirement fully.*** *If you have not completed a requirement leave the box unchecked. Additional information will be requested in later sections.*

Year 4 Requirements

☒ Developed a report assessing current street design and parking lot guidelines and other local requirements within the municipality that affect the creation of impervious cover, made it available as part of the SWMP, and:

- ○ No updates were recommended
- ◉ Updates were recommended. The anticipated date or date of completion for updates is/was:

June 2024

☒ Developed a report assessing local regulations to determine the feasibility of making green infrastructure practices allowable when appropriate site conditions exist, made it available as part of the SWMP, and:

- ○ No updates were recommended
- ◉ Updates were recommended. The anticipated date or date of completion for updates is/was:

June 2024

☒ Identified a minimum of 5 permittee-owned properties that could potentially be modified or retrofitted with BMPs to reduce impervious cover

Optional: If you would like to describe progress made on any incomplete requirements listed above, provide an update on previous incomplete milestones, or provide any additional details, please use the box below:

Annual Requirements

- ☒ Provided an opportunity for public participation in review and implementation of SWMP and complied with State Public Notice requirements
- ☒ Kept records relating to the permit available for 5 years and made available to the public
- ☐ The SSO inventory has been updated, including the status of mitigation and corrective measures implemented
  - ○ This is not applicable because we do not have sanitary sewer
  - ◉ This is not applicable because we did not find any new SSOs
  - ○ The updated SSO inventory is attached to the email submission
  - ○ The updated SSO inventory can be found at the following website:
- ☒ Updated system map due in year 2 as necessary
- ☒ Provided training to employees involved in IDDE program within the reporting period
- ☒ Properly stored and disposed of catch basin cleanings and street sweepings so they did not discharge to receiving waters
- ☒ All curbed roadways were swept at least once within the reporting period
- ☒ Enclosed all road salt storage piles or facilities and implemented winter road maintenance procedures to minimize the use of road salt
- ☒ Implemented SWPPPs for all permittee owned or operated maintenance garages, public works yards, transfer stations, and other waste handling facilities
- ☒ Updated inventory of all permittee owned facilities as necessary
- ☒ O&M programs for all permittee owned facilities have been completed and updated as necessary
- ☒ Implemented all maintenance procedures for permittee owned facilities in accordance with O&M programs
- ☒ Implemented program for MS4 infrastructure maintenance to reduce the discharge of pollutants
- ☒ Inspected all permittee owned treatment structures (excluding catch basins)

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

Bacteria/ Pathogens (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

- ☒ Annual message was distributed encouraging the proper management of pet waste, including noting any existing ordinances where appropriate
- ☒ Permittee or its agents disseminated educational material to dog owners at the time of issuance or renewal of dog license, or other appropriate time

☐ Provided information to owners of septic systems about proper maintenance in any catchment that discharges to a water body impaired for bacteria

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

The city does not have any septic systems that are located within catchments that discharge to a water body impaired for bacteria.

Phosphorus (Combination of Impaired Waters Requirements and TMDL Requirements as Applicable)

Annual Requirements

*Public Education and Outreach**

☒ Distributed an annual message in the spring (April/May) encouraging the proper use and disposal of grass clippings and encouraging the proper use of slow-release and phosphorus-free fertilizers

☒ Distributed an annual message in the summer (June/July) encouraging the proper management of pet waste, including noting any existing ordinances where appropriate

☒ Distributed an annual message in the fall (August/September/October) encouraging the proper disposal of leaf litter

** Public education messages can be combined with other public education requirements as applicable (see Appendix H and F for more information)*

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

☒ Increased street sweeping frequency of all municipal owned streets and parking lots subject to Permit part 2.3.7.a.iii.(c) to a minimum of two times per year (spring and fall)

Phosphorus Source Identification Report

☒ Completed the Phosphorus Source Identification Report

○ The Phosphorus Sourchace Identification Report is attached to the email submission

◉ The Phosphorus Source Identification Report can be found at the following website:

https://www.cityofmelrose.org/engineering/files/melrose-stormwater-management-program

Potential structural BMPs

☐ Any structural BMPs already existing or installed in the regulated area by the permittee or its agents was tracked and the phosphorus removal by the BMP was estimated consistent with Attachment 3 to Appendix F. The BMP type, total area treated by the BMP, the design storage volume of the BMP and the estimated phosphorus removed in mass per year by the BMP were documented.

○ The BMP information is attached to the email submission

○ The BMP information can be found at the following website:

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

The City of Melrose does not currently have any impaired water bodies with an approved TMDL for phosphorus. The City does have direct discharges to water bodies that are impaired for phosphorus or that are tributary to water bodies that are impaired for phosphorus without an approved TMDL. Appendix H requires the Town to track and estimate the amount of phosphorus removed by structural BMPs installed as a result of the retrofit inventory conducted as a part of the Phosphorus Source Identification Report. As required by the permit, at least one structural BMP must be installed by the end of Permit Year 6. Appendix H does not require permittees to estimate the amount of phosphorus removed by existing structural BMPs -- that is only a requirement for permittees discharging to a waterbody with an existing TMDL for phosphorus and therefore not applicable to Melrose. However, once the City begins installation of structural BMPs as identified in their Phosphorus Source Identification Report, the City will track and estimate the phosphorus removed by each BMP consistent with Attachment 3 to Appendix F.

Solids, Oil and Grease (Hydrocarbons), or Metals

Annual Requirements

Good Housekeeping and Pollution Prevention for Permittee Owned Operations

☐ Increased street sweeping frequency of all municipal owned streets and parking lots to a schedule that targets areas with potential for high pollutant loads

- ○ The street sweeping schedule is attached to the email submission
- ◉ The street sweeping schedule can be found at the following website:

https://www.cityofmelrose.org/engineering/files/melrose-stormwater-management-program

☒ Prioritized inspection and maintenance for catch basins to ensure that no sump shall be more than 50 percent full; Cleaned catch basins more frequently if inspection and maintenance activities indicated excessive sediment or debris loadings

Optional: If you would like to describe progress made on any incomplete requirements listed above or provide any additional details, please use the box below:

Street sweeping is performed two times per year (spring and fall) on all streets in the City, as well as weekly in the summer on main roads. At this point in time, we aren't doing any street sweeping above what we are doing City wide. We are considering targeting the impaired watershed on a more regular basis. A new catch basin cleaning inspection form was launched with the spring 2020 cleaning; the form has since been modified to be available on portable devices using ESRI Survey 123 software, which will be used to gather data during future cleanings. The City is working on developing a Catch Basin Optimization Plan to ensure that no catch basin is ever more than 50% full.

Optional: Use the box below to provide any additional information you would like to share as part of your self-assessment:

Our annual DPW Day was not held in spring 2022 due to the pandemic. This is usually used as another opportunity for stormwater outreach to elementary school aged students. In FY21, the City joined the Mystic River Stormwater Education Collaborative to further our outreach efforts in Year 3 and on.

Part III: Receiving Waters/Impaired Waters/TMDL

Have you made any changes to your lists of receiving waters, outfalls, or impairments since the NOI was submitted?

- (●) Yes
- ( ) No

If yes, describe below, including any relevant impairments or TMDLs:

The updates are reflected in the latest version of the City's Stormwater Management Program and can be found on the City's website here: https://www.cityofmelrose.org/engineering/files/melrose-stormwater-management-program

Part IV: Minimum Control Measures

Please fill out all of the metrics below. If applicable, include in the description who completed the task if completed by a third party.

MCM1: Public Education

Number of educational messages completed **during this reporting period**: 12

*Below, report on the educational messages completed **during this reporting period**. For the measurable goal(s) please describe the method/measures used to assess the overall effectiveness of the educational program.*

BMP:1-2 Make Brochures Available on Stormwater Topics

Message Description and Distribution Method:

Stormwater outreach materials were produced and prominently displayed in the Engineering Division/Water and Sewer Billing at City Hall. Topics include pet waste, leaf litter, and fertilizers. Some of these materials were developed with the assistance from the Mystic River Watershed Association.

Targeted Audience: Residents and General Public

Responsible Department/Parties: DPW/Engineering

Measurable Goal(s):

Selected and stocked brochures and posters at DPW and City Hall.

Message Date(s): Began fall 2018 and currently ongoing.

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-3 Update City Website to include Information on Stormwater Management

Message Description and Distribution Method:

The stormwater management webpage on the City's website was kept current during Year 4, providing information to all target audiences. Posts included stormwater information about pesticides, pet waste, and motor oil. Those posts can be found on our website at https://www.cityofmelrose.org/home/news/stormwater-management-tips-dpw

Targeted Audience: Residents, General Public, Developers, Businesses, Institutions, and Commercial Facilities

Responsible Department/Parties: DPW/Engineering

Measurable Goal(s):

The City's stormwater website was live during the majority of Year 2 and continuously updated.

Message Date(s): Continuous

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-5 Maintain Signs for Stormwater Management and Pet Waste Cleanup at Schools and Parks

Message Description and Distribution Method:

Signs maintained throughout permit year and inspected.

Targeted Audience: General Public

Responsible Department/Parties: DPW - Operations & Parks

Measurable Goal(s):

Signs inspected and maintained.

Message Date(s): Ongoing

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-7 Post Information on Stormwater Management Issues on Local Access Television Channel

Message Description and Distribution Method:

The Think Blue Massachusetts "ducky" video was sent to MMTV to broadcast between programming and was aired beginning in June 2020 and periodically broadcasted throughout this reporting period and was also shared to their social media outlets.

Targeted Audience: General Public

Responsible Department/Parties: DPW - Administration

Measurable Goal(s):

Video sent to MMTV to broadcast and was aired Starting in Year 2 and periodically throughout Years 3 & 4. The Mystic River Watershed Collaborative released an advertising campaign report with the following impressions for the Think Blue video: Facebook/Instagram (English) - 11,466; Facebook/Instagram (Spanish)

- 1,763; Youtube (English) - 19,104; Youtube (Spanish) - 2,265

Message Date(s): July 2021-Present

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-8 & 1-10 Distribute Information on Low Impact Development to Developers via the Planning De

Message Description and Distribution Method:

Brochure selected and provided to Planning Department in spring 2020 and is available in the Planning Department.

Targeted Audience: Developers

Responsible Department/Parties: DPW/Engineering and Planning Department

Measurable Goal(s):

Selected and stocked brochures and posters at DPW and City Hall.

Message Date(s): Spring 2020 and currently ongoing.

Message Completed for: Appendix F Requirements ☐ Appendix H Requirements ☐

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-11 Broadcast Targeted Messages about Stormwater Quality, Pet Waste, and Fertilizer Use using

Message Description and Distribution Method:

Stormwater quality, pet waste, grass clippings, and fertilizer and pesticide use informational messages were broadcast using social media in Year 4. These were broadcast using a combination of Facebook and Twitter pages, as well as the City's website.

Targeted Audience: General Public, Businesses, Commercial Facilities

Responsible Department/Parties: DPW - Administration

Measurable Goal(s):

Separate posts made to Twitter and Facebook on each topic.

Message Date(s): Periodically

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-12 Send Message out using Mayor's Blog

Message Description and Distribution Method:

Targeted Audience:

Responsible Department/Parties:

Measurable Goal(s):

Message Date(s):

Message Completed for: Appendix F Requirements ☐ Appendix H Requirements ☐

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

BMP:1-13 Provide Information to Residents Seeking Dog Licenses

Message Description and Distribution Method:

The dog license application now has a section on pet waste management and stormwater.

Targeted Audience: Residents

Responsible Department/Parties: DPW and City Clerk's Office

Measurable Goal(s):

Dog license applicants receive information about pet waste management from the City Clerk's office.

Message Date(s): Continuous

Message Completed for: Appendix F Requirements ☒ Appendix H Requirements ☒

Was this message different than what was proposed in your NOI? Yes ○ No ◉

If yes, describe why the change was made:

Add an Educational Message

MCM2: Public Participation

Describe the opportunity provided for public involvement in the development of the Stormwater Management Program (SWMP) **during this reporting period**:

The SWMP has been posted to the City's website and is a living document and will be modified as comments are received that warrant updates. The webpage includes an email address and phone number for those wishing to submit comments.

Was this opportunity different than what was proposed in your NOI? Yes ○ No ◉

Describe any other public involvement or participation opportunities conducted **during this reporting period**:

As noted in the NOI, public meetings are posted in accordance with state and public notification guidelines. A few cleanups took place including a city-wide earth day cleanup, which included the Litter Letter Project, on April 2022. In addition, an Ell Pond Cleanup Day took place in April 2022.

The City conducted two household hazardous waste collection days, one in October 2021 and one in June 2022. We also conducted two events to collect motor oil, gas, and antifreeze in September 2021 and April 2022.

Victorian Fair was held on September 12, 2021. Engineering staff used the EnviroScape to educate about stormwater issues.

MCM3: Illicit Discharge Detection and Elimination (IDDE)

Sanitary Sewer Overflows (SSOs)

Check off the box below if the statement is true.

☐ This SSO section is NOT applicable because we DO NOT have sanitary sewer

*Below, report on the number of SSOs identified in the MS4 system and removed **during this reporting period**.*

Number of SSOs identified: 0

Number of SSOs removed: 0

MS4 System Mapping

Optional: Provide additional status information regarding your map:

Updates to the catchment delineations have been made in Year 4. In addition to catch basin locations during our annual cleaning program.

Screening of Outfalls/Interconnections

If conducted, please submit any outfall monitoring results from this reporting period. Outfall monitoring results should include the date, outfall/interconnection identifier, location, weather conditions at time of sampling, precipitation in previous 48 hours, field screening parameter results, and results from all analyses. Please also include the updated inventory and ranking of outfalls/interconnections based on monitoring results.

- (●) No outfalls were inspected
- ( ) The outfall screening data is attached to the email submission
- ( ) The outfall screening data can be found at the following website:

*Below, report on the number of outfalls/interconnections screened **during this reporting period**.*

Number of outfalls screened: 0

*Below, report on the percent of outfalls/interconnections screened **to date**.*

Percent of outfalls screened: 0

Optional: Provide additional information regarding your outfall/interconnection screening:

All outfalls were screened during dry weather screening in Year 2. The percentage of outfalls and interconnections screened to date is 100% as you have screened all during dry weather. I would add a comment that you have not yet started screening and sampling of outfalls/interconnections during wet weather.

Catchment Investigations

If conducted, please submit all data collected during this reporting period as part of the dry and wet weather investigations. Also include the presence or absence of System Vulnerability Factors for each catchment.

- (●) No catchment investigations were conducted
- ( ) The catchment investigation data is attached to the email submission
- ( ) The catchment investigation data can be found at the following website:

*Below, report on the number of catchment investigations completed **during this reporting period**.*

Number of catchment investigations completed this reporting period: 0

*Below, report on the percent of catchments investigated **to date.***

Percent of total catchments investigated: 0

Optional: Provide any additional information for clarity regarding the catchment investigations below:

Catchment investigations for Ell Pond Watershed begun in Year 5. Also, the SVF analysis was completed and attached to the annual report.

IDDE Progress

If illicit discharges were found, please submit a document describing work conducted over this reporting period, and cumulative to date, including location source; description of the discharge; method of discovery; date of discovery; and date of elimination, mitigation, or enforcement OR planned corrective measures and schedule of removal.

- (•) No illicit discharges were found
- ( ) The illicit discharge removal report is attached to the email submission
- ( ) The illicit discharge removal report can be found at the following website:

*Below, report on the number of illicit discharges identified and removed, along with the volume of sewage removed **during this reporting period.***

Number of illicit discharges identified: 0

Number of illicit discharges removed: 0

Estimated volume of sewage removed: 0 gallons/day

*Below, report on the total number of illicit discharges identified and removed to date. At a minimum, report on the number of illicit discharges identified and removed **since the effective date of the permit (July 1, 2018)**.*

Total number of illicit discharges identified: 0

Total number of illicit discharges removed: 0

Optional: Provide any additional information for clarity regarding illicit discharges identified, removed, or planned to be removed below:

While no IDDE investigations were started in Year 4, many segments of drain pipes were CCTV inspected, including those located on all streets that were/are going to be paved in Year 4. No evidence of illicit connections was observed during any of these investigations.

Employee Training

Describe the frequency and type of employee training conducted **during this reporting period**:

IDDE training was developed by Weston & Sampson Engineers during Year 2 and was conducted in person in June 2022.

MCM4: Construction Site Stormwater Runoff Control

*Below, report on the construction site plan reviews, inspections, and enforcement actions completed **during this reporting period**.*

Number of site plan reviews completed: 11

Number of inspections completed: 4

Number of enforcement actions taken: 2

Optional: Enter any additional information relevant to construction site plan reviews, inspections, and enforcement actions:

Two projects (both over an acre) started construction during Year 3. There have been 4 total site inspections with 2 enforcement actions taken. These actions include installing and replacing runoff erosion control, cleaning catch basins, and street sweeping.

MCM5: Post-Construction Stormwater Management in New Development and Redevelopment

Ordinance or Regulatory Mechanism

Date update was completed (due in year 3): June 2021

As-built Drawings

*Below, report on the number of as-built drawings received **during this reporting period**.*

Number of as-built drawings received: 0

Optional: Enter any additional information relevant to the submission of as-built drawings:

No developments were completed during the Year 4 time period.

Retrofit Properties Inventory

Below, list the permittee-owned properties that could be modified or retrofitted with BMPs to mitigate impervious areas (at least 5):

The City of Melrose received a CZM grant to design and install Infiltration Trenches - various locations within Mystic River Watershed. This will be taking place during Year 5.

Other possible City owned properties that could be modified or retrofitted with BMPs are:
- Ell Pond Park
- Franklin Field
- City Yard
- Melrose High/Middle School

MCM6: Good Housekeeping

Catch Basin Cleaning

*Below, report on the number of catch basins inspected and cleaned, along with the total volume of material removed from the catch basins **during this reporting period**.*

Number of catch basins inspected: 1,020

Number of catch basins cleaned: 1,020

Total volume or mass of material removed from all catch basins: 174 tons

Below, report on the total number of catch basins in the MS4 system.

Total number of catch basins: 1,633

If applicable:

Report on the actions taken if a catch basin sump is more than 50% full during two consecutive routine inspections/cleaning events:

If a catch basin is found to be frequently filling up, it is added to the "drain periodicals" list. DPW staff aim to visit these sites monthly, and at a minimum once every two months, and perform cleaning depending on the conditions found at each visit.

Street Sweeping

*Report on street sweeping completed **during this reporting period** using one of the three metrics below.*

- (●) Number of miles cleaned: 240
- ( ) Volume of material removed: [Select Units]
- ( ) Weight of material removed: [Select Units]

Stormwater Pollution Prevention Plan (SWPPP)

*Below, report on the number of site inspections for facilities that require a SWPPP completed **during this reporting period**.*

Number of site inspections completed: 2

Describe any corrective actions taken at a facility with a SWPPP:

No corrective actions at the time of inspections.

Additional Information

Monitoring or Study Results

Results from any other stormwater or receiving water quality monitoring or studies conducted during the reporting period not otherwise mentioned above, where the data is being used to inform permit compliance or permit effectiveness must be attached.

- (●) Not applicable
- ( ) The results from additional reports or studies are attached to the email submission
- ( ) The results from additional reports or studies can be found at the following website(s):

If such monitoring or studies were conducted on your behalf or if monitoring or studies conducted by other entities were reported to you, a brief description of the type of information gathered or received shall be described below:

Additional Information

Optional: Enter any additional information relevant to your stormwater management program implementation during the reporting period. Include any BMP modifications made by the MS4 if not already discussed above:

The City conducted two household hazardous waste collection days, one in October 2021 and one in June 2022. We also conducted two events to collect motor oil, gas, and antifreeze in September 2021 and April 2022.

COVID-19 Impacts

Optional: If any of the above year 4 requirements could not be completed due to the impacts of COVID-19, please identify the requirement that could not be completed, any actions taken to attempt to complete the requirement, and reason the requirement could not be completed below:

DPW Day was not held this year due to COVID.

Activities Planned for Next Reporting Period

Please confirm that your SWMP has been, or will be, updated to comply with all applicable permit requirements including but not limited to the year 5 requirements summarized below. (Note: impaired waters and TMDL requirements are not listed below)

Yes, I agree ☒

Annual Requirements

- Annual report submitted and available to the public
- Annual opportunity for public participation in review and implementation of SWMP
- Keep records relating to the permit available for 5 years and make available to the public
- Properly store and dispose of catch basin cleanings and street sweepings so they do not discharge to receiving waters
- Annual training to employees involved in IDDE program
- Update inventory of all known locations where SSOs have discharged to the MS4
- Continue public education and outreach program
- Update outfall and interconnection inventory and priority ranking and include data collected in connection with the dry weather screening and other relevant inspections conducted
- Implement IDDE program
- Review site plans of construction sites as part of the construction stormwater runoff control program
- Conduct site inspection of construction sites as necessary
- Inspect and maintain stormwater treatment structures
- Log catch basins cleaned or inspected
- Sweep all curbed streets at least annually
- Continue investigations of catchments associated with Problem Outfalls
- Implemented SWPPPs for all permittee owned or operated maintenance garages, public works yards, transfer stations, and other waste handling facilities
- Review inventory of all permittee owned facilities in the categories of parks and open space, buildings and facilities, and vehicles and equipment; update if necessary
- Review O&M programs for all permittee owned facilities; update if necessary
- Implement all maintenance procedures for permittee owned facilities in accordance with O&M programs
- Implement program for MS4 infrastructure maintenance to reduce the discharge of pollutants
- Enclose all road salt storage piles or facilities and implemented winter road maintenance procedures to minimize the use of road salt
- Review as-built drawings for new and redevelopment to ensure compliance with post construction bylaws, regulations, or regulatory mechanism consistent with permit requirements
- Inspect all permittee owned treatment structures (excluding catch basins)
- Identify additional permittee-owned properties that could potentially be modified or retrofitted with BMPs to reduce impervious areas so that the permittee maintains a minimum of 5 sites in their inventory, until such a time when the permittee has less than 5 sites remaining

Provide any additional details on activities planned for permit year 5 below:

Please see the Notice of Intent and SWMP for additional items noted that are targeted for completion in Year 5.

Part V: Certification of Small MS4 Annual Report 2021

40 CFR 144.32(d) 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, I certify that 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.

Name:	Paul Brodeur	Title:	Mayor
Signature:	Paul B/	Date:	9/25/2022

[Signatory may be a duly authorized representative]

Appendix C
Sanitary Sewer Overflow Inventory

Sanitary Sewer Overflow Inventory

Pursuant to Section 2.3.4.4.b of the 2016 MS4 permit, this section summarizes sanitary sewer overflows that have, or could have, resulted in flows of sanitary wastewater to the MS4.

Melrose Sewer System Backups and Call-outs 2014-2022

The City of Melrose has received 228 call-outs for potential sewer backups since the start of 2014. Of these, 124 were investigated and determined to be private property issues. The other 104 required clearing of blockages in the City's sewer mains.

In reviewing individual reports for all 228 incidents, only two appeared to have the potential for any sanitary flows to enter the MS4 system. These were as follows:

- On March 23, 2015, wastewater was coming out of a manhole in the street near 45-65 North Cedar Park. The backup in the mainline was jetted, and asphalt and bricks were found in the line. This is suspected to be related to paving activities that took place in 2013 on North Cedar Park.

- On May 24, 2017, wastewater was coming out of a manhole in the street near 223 North Forest Street. The line was jetted downstream and a blockage was cleared.

Other blockages that occurred in the City's sewer mains were identified through either odors or other evidence of blockages (e.g., slow running sewer laterals), or through sewer backups up private laterals. These types of mainline backups are unlikely to result in any input of wastewater into the MS4 system.

There are no notes in the reports for the three incidents listed above that indicate that wastewater flowed into or toward any catch basins or waterways or that noted the volume of wastewater that may have entered the roadway. The nearest catch basin to the manhole that surcharged on North Cedar Park is approximately 90 feet away, and the nearest catch basin to the manhole on North Forest Street is 27 feet away.

Should similar events occur in the future, note will be taken of whether the wastewater migrated to any MS4 structures, and a volume will be estimated. Any wastewater within the roadway will be cleaned in a manner that will prevent it from migrating further toward any MS4 structures as soon as the surcharge is identified.

Appendix D
Illicit Discharge Detection and Elimination Program

City of Melrose

Illicit Discharge Detection and Elimination (IDDE) Program

The intent of this program is to detect, identify, and eliminate non-stormwater discharges to the Melrose stormwater drainage system. The authority to implement this program is provided in City of Melrose Ordinance 228-36, Untreated Discharge to Natural Outlet Prohibited. This ordinance, enacted on April 7, 2008, specifies the following:

> "§ 228-36. Untreated discharge to natural outlet prohibited. [Amended 4-7-2008 by Ord. No. 08-129]
>
> A. Illicit discharges. No person shall dump, discharge, or cause or allow to be discharged any pollutant or nonstormwater discharge into the municipal separate storm sewer system (MS4), into a receiving water, or into the waters of the commonwealth. Discharge or flow resulting from fire-fighting activities is exempt from this requirement. The following additional nonstormwater discharges or flows are exempt from the prohibition of nonstormwaters, provided that the source is not a significant contributor of a pollutant to the municipal storm drain system:
>
> (1) Waterline flushing;
> (2) Flow from potable water sources;
> (3) Springs;
> (4) Natural flow from riparian habitats and wetlands;
> (5) Diverted stream flow;
> (6) Rising groundwater;
> (7) Uncontaminated groundwater infiltration as defined in 40 CFR 35.2005(20) or uncontaminated pumped groundwater;
> (8) Water from exterior foundation drains, footing drains (not including active groundwater dewatering systems), crawl space pumps, or air-conditioning condensation;
> (9) Discharge from landscape irrigation or lawn watering;
> (10) Water from individual residential car washing;
> (11) Discharge from dechlorinated swimming pool water (less than one ppm chlorine), provided the water is allowed to stand for one week prior to draining and the pool is drained in such a way as not to cause a nuisance;
> (12) Discharge from street sweeping;
> (13) Dye testing, provided verbal notification is given to the the Board prior to the time of the test;
> (14) Nonstormwater discharge permitted under an NPDES permit or a surface water

discharge permit, waiver, or waste discharge order administered under the authority of the United States Environmental Protection Agency or the Department of Environmental Protection, provided that the discharge is in full compliance with the requirements of the permit, waiver, or order and applicable laws and regulations; and

(15) Discharge for which advanced written approval is received from the Department as necessary to protect public health, safety, welfare or the environment.

B. Illicit connections. No person shall construct, use, allow, maintain or continue any illicit connection to the municipal storm drain system, regardless of whether the connection was permissible under applicable law, regulation or custom at the time of connection.

C. Obstruction of municipal storm drain system. No person shall obstruct or interfere with the normal flow of stormwater into or out of the municipal storm drain system without prior written approval from the City Engineer. [Amended 5-21-2012 by Ord. No. 2012-158]"

The imposition of penalties in response to violations of this ordinance and others in this section of the City's ordinances is described later in Section 228.

The implementation of this program is the responsibility of the Melrose Department of Public Works (DPW). The Melrose DPW will work with the Health Department and Inspectional Services Department with regard to identifying potential issues related to septic systems and interior plumbing systems, respectively. When inspections are performed by the Health and Inspectional Services Departments, any suspected issues related to illicit discharges will be reported to the DPW Engineering Division to determine the next course of action in investigating and eliminating those sources.

The following outlines the phases of the City's IDDE program, to be implemented over the course of the permit term.

Phase I – Mapping

Geographic Information System (GIS) mapping serves as the backbone for planning and phasing of IDDE investigations. The first step in the IDDE program is to delineate catchment areas and subcatchments within each catchment area of the City's MS4 drainage system. The existing GIS drainage layers will be used to begin this task. This will be completed by the end of Year 2 of the permit term. Individual catchment and subcatchment maps will be developed with legends and schedules for testing. At a minimum, the maps will include:

1) Outfalls and receiving waters
2) Open channel conveyances
3) Interconnections with other MS4s, if applicable
4) Municipally owned stormwater treatment structures
5) Waterbodies and their use impairments
6) Catchment delinations for each outfall

In addition, the following will be included on the maps insofar as the information is available within the City's GIS:

1) Outfall spatial locations (latitude and longitude) based on GPSed locations
2) Pipes
3) Manholes

4) Catch basins
5) Municipal sanitary sewer system
6) Privately owned stormwater treatment structures
7) Topography (2-foot contours)
8) Orthophotography

As field results are received, maps will be updated to show those results, including suspected, confirmed, and corrected illicit discharges. The maps will also be updated as necessary to reflect newly discovered information, corrections or modifications, including refined catchment delineations based on information collected. Final maps with all information listed above will be completed by July 1, 2028. These maps will also include the following information if it becomes available by July 1, 2028:

1) Storm sewer material, diameter, and age
2) Sanitary sewer material, diameter, and age
3) Properties with septic systems and MS4 infrastructure that could receive inputs from these systems
4) Seasonal high water table elevations impacting sanitary sewers

Phase II – Prioritization of Catchment Areas

The Melrose drainage system discharges to 44 known outfalls. At the time of submission of the Notice of Intent, 34 outfalls were listed. Over the course of dry-weather sampling and beginning to GPS outfalls in 2020, nine additional outfalls were identified.

The City has categorized outfalls as High Priority, Low Priority, Problem Outfalls, or Excluded Outfalls. Problem outfalls are those which, based on existing information, are suspected as having likely sewer inputs. Excluded outfalls are those with no potential for illicit discharges. At this time, the City has not designated any outfalls as Problem or Excluded outfalls, as existing information does not warrant designation into either category. This will be updated as further information becomes available. Per the permit requirements, high priority outfalls include those which discharge to an area of concern to public health due to proximity of public beaches, recreational areas, drinking water supplies, or shellfish beds. No such areas exist within Melrose, thus no outfalls were designated High Priority using these criteria. Based on all of this background and the results from the dry-weather sampling, the City has prioritized outfalls based on their discharge locations, with impaired waters receiving the highest priority, and all other receiving waters categorized as Low Priority. The resulting prioritization is shown in Table 1 below.

During outfall screening, three outfalls were identified that were just beyond the City limit in Saugus. These outfalls are not considered interconnections and are considered City of Melrose outfalls. Saugus has no inflow to these outfalls. However, there are 4 covered brooks and 4 drain interconnections that come in from Stoneham and Wakefield.

Table 1: Outfall/Catchment Prioritization Summary

Outfall ID	Location	Receiving Water	Priority (New)	Comment
OF-29	Ell Pond Park behind Melrose Skatepark	Ell Pond	High Priority	Dry-weather flow exceeded water quality standards for bacteria, impaired for chlorophyll-a, phosphorus, solids, fecal coliform, secchi disk/turbidity
OF-42	Across from 743 Main St	Ell Pond	High Priority	Dry-weather flow exceeded water quality standards for bacteria, impaired for chlorophyll-a, phosphorus, solids, fecal coliform, secchi disk/turbidity
OF-27	Bellevue Golf Club across from 736 Lynn Fells Pkwy	Bennetts Pond Brook	High Priority	Dry-weather flow observed, impaired for fecal coliform
OF-36	Near 17 Sweetwater Street, Saugus	Bennetts Pond Brook	High Priority	Impaired for fecal coliform
OF-28	Ell Pond Park across from 50 Tremont St	Ell Pond	High Priority	Dry-weather flow observed, impaired for chorophyll-a, phosphorus, solids, fecal coliform, secchi disck/turbidity
OF-30	Ell Pond Park near intersection of Lynn Fells Pkwy and Melrose St	Ell Pond	High Priority	Impaired for chlorophyll-a, phosphorus, solids, fecal coliform, secchi disk/turbidity
OF-37	Across from 37 Crystal St	Ell Pond	High Priority	Impaired for chlorophyll-a, phosphorus, solids, fecal coliform, secchi disk/turbidity
OF-47A	Wetland Area near Melrose High School	Ell Pond	High Priority	Impaired for chlorophyll-a, phosphorus, solids, fecal coliform, secchi disk/turbidity
OF-47B	Ell Pond Park behind soccer fields	Ell Pond	High Priority	Impaired for chlorophyll-a, phosphorus, solids, fecal coliform, secchi disk/turbidity
OF-50	Ell Pond Park near intersection of Lynn Fells Pkwy and Melrose St	Ell Pond	High Priority	Impaired for chlorophyll-a, phosphorus, solids, fecal coliform, secchi disk/turbidity
OF-20	Mt Hood Golf Course Parking Area	First Pond	High Priority	Dry-weather flow observed, low density development, golf course
OF-25	Swains Pond Ave & Maple Terr	Overland/Unnamed Wetland Area	High Priority	Dry-weather flow observed
OF-44	Behind 33 Fairfield Ave	Overland/Unnamed Wetland Area	High Priority	Dry-weather flow observed
OF-45	Forested area between Cliff Rd and Hawthorne St	Unnamed Wetland Area	High Priority	Dry-weather flow observed
OF-2A	Behind 43 Cranmore Lane	Overland/Bennetts Pond Brook Wetland	High Priority	Impaired for fecal coliform
OF-11	End of Harold St	Overland/Swains Pond wetland	Low Priority	Non-native aquatic plants

OF-12	Grove St & Burnett St	Unnamed Wetland Area	Low Priority	Low density development, golf course
OF-14	Behind 19 Penny Hill Rd	Penney Road Brook	Low Priority	Low density development, golf course
OF-15	Behind 27 Penny Hill Rd	Penney Road Brook	Low Priority	Low density development, golf course
OF-17	Mt Hood Golf Course Parking Area	First Pond	Low Priority	Low density development, golf course
OF-18	Mt Hood Golf Course Parking Area	First Pond	Low Priority	Low density development, golf course
OF-19	Mt Hood Golf Course Parking Area	First Pond	Low Priority	Low density development, golf course
OF-1A	Off Banks Place behind 16 Island Hill Ave	Ell Pond Brook	Low Priority	Medium/low density development
OF-21	Behind backyard of 23 Philip Cir	Overland/Towners Pond Wetlands	Low Priority	Medium/low density development
OF-23	Across from 287 Swains Pond Ave	Swains Pond	Low Priority	Non-native aquatic plants
OF-24	Mt Hood Golf Course near Laurel St	Wetland area in Mt Hood Golf Course	Low Priority	Medium/low density development
OF-26	Swains Pond Ave & Maple Terr	Overland/Unnamed Wetland Area	Low Priority	Medium density development
OF-3	Swains Pond Ave near Swains Pond	Swains Pond	Low Priority	Non-native aquatic plants
OF-48	Swains Pond Ave near Swains Pond	Swains Pond	Low Priority	Non-native aquatic plants
OF-31	Near 209 Pleasant St	Ell Pond Brook	Low Priority	Medium/high density development
OF-33	Behind 355 Pleasant St	Ell Pond Brook	Low Priority	Medium/high density development
OF-34	Near 209 Pleasant St	Ell Pond Brook	Low Priority	Medium/high density development
OF-35	Near 171 Boardman Ave	Detention Basin to Unnamed Wetland Area	Low Priority	Medium density development, mixed age
OF-38	In Bellvue Golf Club near off Apple Hill Rd	Unnamed pond in Bellvue Golf Club	Low Priority	Medium density development, golf course
OF-39A	Behind 37 Carlida Rd	Unnamed Wetland Area	Low Priority	Medium/high density development
OF-4	Behind 333 Swains Pond Ave	Towners Pond	Low Priority	Medium/low density development
OF-40	Behind 118 Ellis Farm Lane	Overland/Unnamed Wetland Area	Low Priority	Medium/high density development
OF-41	Behind 48 Pilgrim Rd	Overland/Unnamed Wetland Area	Low Priority	Medium/low density development
OF-43	At the end of Cedarwood Lane	Long Pond	Low Priority	Medium density development, mixed age
OF-46	Across from 287 Swains Pond Ave	Swains Pond Wetlands	Low Priority	Non-native aquatic plants
OF-6	In the culvert under Banks Place behind 100 Main St	Ell Pond Brook	Low Priority	Medium/high density development

OF-7	Near the intersection of Indian Hill Lane and Ellis Farm Lane	Overland/Unnamed Wetland Area	Low Priority	Medium density development
OF-8	Behind 3 Hemenway Ave	Overland/Unnamed Wetland Area	Low Priority	Medium/low density development
OF-9	Wetlands behind Wyoming Cemetery	Wetlands behind Wyoming Cemetery	Low Priority	Medium/low density development, cemetery

Phase III – Dry Weather Outfall and Interconnection Screening and Sampling

The next phase of the IDDE program is performing dry-weather screening and sampling at each outfall. In June 2020, the City completed dry-weather sampling for all the outfalls listed above. The City has developed an online screening form using ArcGIS/Collector. This form is being filled out upon initial inspection of each outfall, and the outfall location is confirmed via a GPS unit that provides survey-grade accuracy. Outfall locations in the GIS database are being refined based on this new GPS data. The data gathered in ArcGIS automatically populates a GIS attribute table with information on each outfall.

The online form allows the field investigator to populate information such as the outfall type/material (e.g., concrete headwall, stone headwall, pipe only), shape, size, condition, and any other observations of note. During these investigations, the presence or absence of flow is also noted, along with any evidence of non-stormwater discharges, including odor, color, turbidity, floatables, or oils.

Dry weather is defined as when no more than 0.1 inches of rainfall has occurred in the previous 24-hour period and no significant snow melt is occurring. Sample collection and analysis was be conducted in accordance with Step III of the EPA New England Stormwater Outfall Sampling Protocol, which is attached to and incorporated into this document. Field kits were used to analyze for chlorine, ammonia, and surfactants, and a temperature, conductivity, and salinity probe was used to measure those parameters. Samples of any flowing outfalls were collected at the same time to be sent for laboratory analysis for E. coli and other pollutants of concern. As required by the permit, methods used will be sufficient to detect at or below 0.5 mg/L of ammonia, 0.25 mg/L for surfactants, and 0.02 mg/L of residual chlorine. Although some testing has previously been performed in association with an administrative consent order pertaining to Ell Pond, the City will not use those sampling events for compliance with the new MS4 permit but instead performed consistent dry-weather sampling across all outfalls at which dry-weather flow is discovered. Based on the results, catchment rankings were updated.

Phase IV - Drainage Catchment Investigations

A. Identification of System Vulnerability Factors (SVFs) and other Preliminary Actions

Plans and other records of each catchment area will be reviewed to evaluate the likelihood of cross connections between the sanitary sewer and stormwater systems. Based on this information and GIS data, SVFs will be identified and documented for each catchment area. Catchments with a minimum of one SVF will be subject to wet weather sampling. Wet weather sampling will also be performed in accordance with the EPA New England Stormwater Outfall Sampling Protocol. Given the urbanized nature of the City of Melrose and the average age of the stormwater infrastructure, wet weather screening will be conducted at all 44 outfalls.

In addition, to facilitate investigations, storm drain infrastructure will be evaluated for the need to be cleaned to remove debris or blockages that could compromise investigations. Such material will be

removed to the extent possible by the City prior to investigations; however, some cleaning may occur concurrently as problems manifest themselves (i.e. dog waste should be cleaned from catch basins and excessive leaves and yard waste should be removed from the system prior to any investigation).

B. Manhole Inspection and Flow Monitoring

When an outfall is confirmed to have elevated levels of E. coli, an upstream IDDE investigation shall be initiated. A preliminary assessment to determine the extents of the investigation will be performed prior to IDDE procedures. Using GIS maps, a junction manhole shall be selected approximately bisecting the drainage network associated with the outfall. This manhole will be sampled and inspected for visual evidence to determine if illicit flows are present in the system upstream of the selected manhole. If illicit flow is present in the selected manhole, the process should be repeated at a second observation manhole approximately ¾ of the way upstream from the outfall. Alternately, should the first observation manhole be free of illicit flows, the second observation manhole should be located ¼ of the way upstream from the manhole and the process repeated. This preliminary effort will identify the extent to which the IDDE procedure should be implemented and whether any large catchment areas can be eliminated from further investigation up-front.

For all areas remaining after the preliminary assessment, the following procedure will be implemented. Beginning at the uppermost significant junction manhole(s) [see Figure 1] within each tributary area, drainage manholes are opened and first inspected for visual evidence of contamination. Where flow is observed and determined to be contaminated through visual observation (e.g. excrement or toilet paper present) or through the field monitoring process described below, the tributary storm sewer alignment will be isolated for investigation (e.g. dye testing, CCTV). No additional downstream manhole inspections are performed unless the observed flow is determined to be uncontaminated or until all upstream illicit connections are identified and removed.

Where flow is not observed in a junction manhole, all inlets to the structure are partially dammed for the next 48 hours when no precipitation is forecasted. Inlets are dammed by blocking a minimal percentage (approximately 20% +/- depending on pipe slope) of the pipe diameter at the invert using sandbags, weirs/plates, or other temporary barriers (See Figure 2). The manholes are thereafter re-inspected (prior to any precipitation or snow melt) for the capture of periodic or intermittent flows behind any of the inlet dams. The same visual observations and field testing are completed on any captured flow, and where contamination is identified, abatement is completed prior to inspecting downstream manholes. If after 48 hours no flow is captured, it is determined that there are no illicit connections in the upstream section and the investigation should proceed to the next downstream junction manhole. The sandbagging procedure is effective for isolating up to 1,000 feet of drain pipe. After 1,000 feet, additional sandbags should be placed on non-junction manholes to further isolate reaches of drain pipe suspected of discharging illicit flows. Sandbags utilized for isolating more than 1,000 ft of pipe may be ineffective.

Where flow is observed and does not demonstrate obvious olfactory or visual evidence of contamination, samples are collected and analyzed with field instruments (ammonia, surfactants, and pH readings) along with laboratory analysis [E. Coli], if necessary, to determine the likely prominent source of the flow. Measured values can then be compared with historic benchmark values (if available). The table below indicates typical ranges for ammonia, surfactants, and E. coli levels encountered at stormwater outfalls during dry weather sampling and can be referred to for guidance in prioritizing IDDE investigations. If field results show an absence of all indicators, it is determined that there are no illicit connections in the upstream section and the investigation should proceed to the next downstream junction manhole.

Table 2: Contaminant Ranges by Outfall Size

Outfall Size	6-24 inch			24-48 inch			> 48 inch		
Priority Ranking	High	Medium	Low	High	Medium	Low	High	Medium	Low
E. coli (CFU/100mL)	>350	350-100	<100	>1,000	1,000-500	<500	>3,500	3,500-1,000	<1,000
Ammonia (mg/l)	>0.3	0.3-0.2	0.1	>0.5	0.5-0.3	0.2	>0.6	0.6-0.4	0.3
Surfactants (mg/l)	>0.5	0.5	0.25	>.75	0.75	0.5	>1.0	1.0-0.75	0.75-0.5

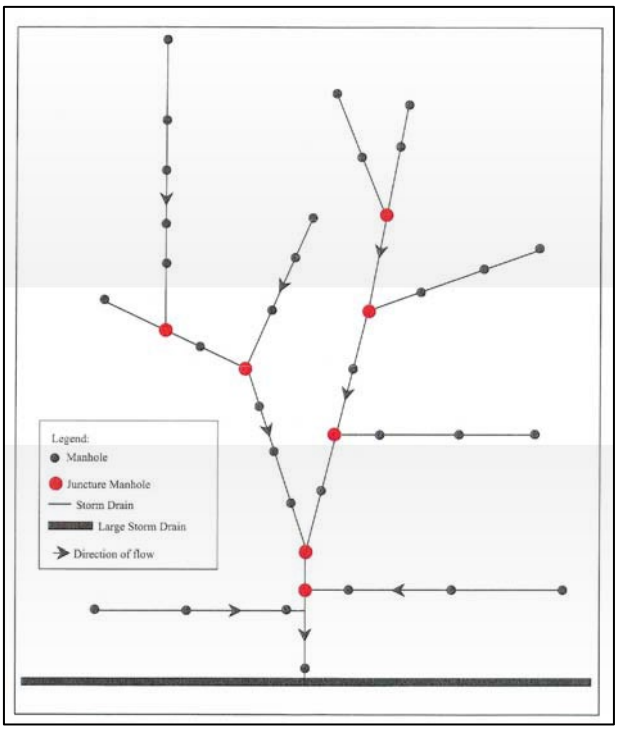


Figure 1: Junction Manholes

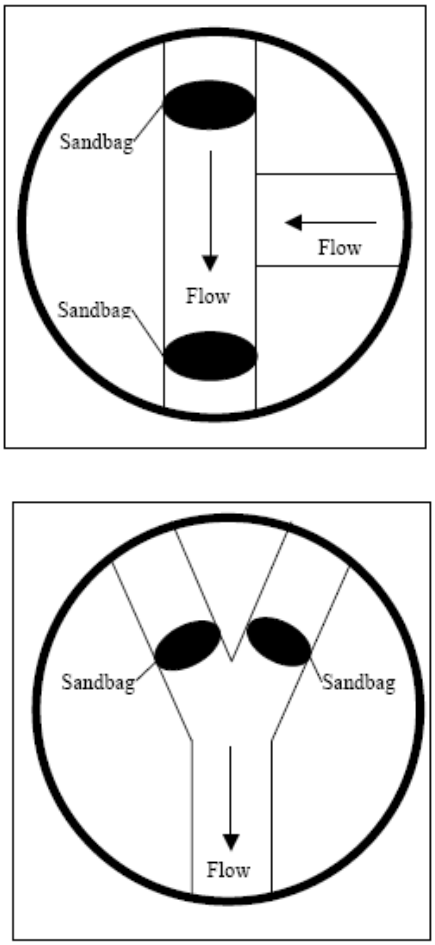


Figure 2: Sandbag Configuration

C. Isolation and confirmation of illicit sources

Where field monitoring has identified drain reaches influenced by sanitary flows or washwaters, the tributary area is isolated for implementation of more detailed investigations. Additional manholes along the tributary alignment are inspected to refine the location of potential contamination sources (e.g. ideally a single reach of drain between two manholes). Manholes upstream are opened and inspected until an uncontaminated manhole is identified. The buildings between the uncontaminated manhole and the downstream contaminated manhole are identified as possible sources of illicit inflow. Residents and businesses are notified by mail that their buildings / houses will be dye tested to determine if their sanitary sewer service connection is to a storm drain or sewer. Internal plumbing inspections and /or dye testing (or CCTV) inspections are then employed to more efficiently confirm discrete flow sources.

D. Outreach/Public Notification of Dye Testing

Residents and building owners located within subject investigation areas will be notified of the scope and schedule of field work being conducted in the area. Notification will include general information such as anticipated dates of the work, identification of field staff (DPW staff, private consultant, etc.), and contact information for inquiries.

Once a reach of drainage has been isolated for dye testing and the potential need to gain access to private residences or businesses has been identified, a second notification to property owners will be required. Notification of property owners through a letter, door hanger, or otherwise will be required to gain entry to their property to inspect plumbing fixtures. Assessor's records and GIS information will provide property owner identification. A sample letter is attached to the end of this document.

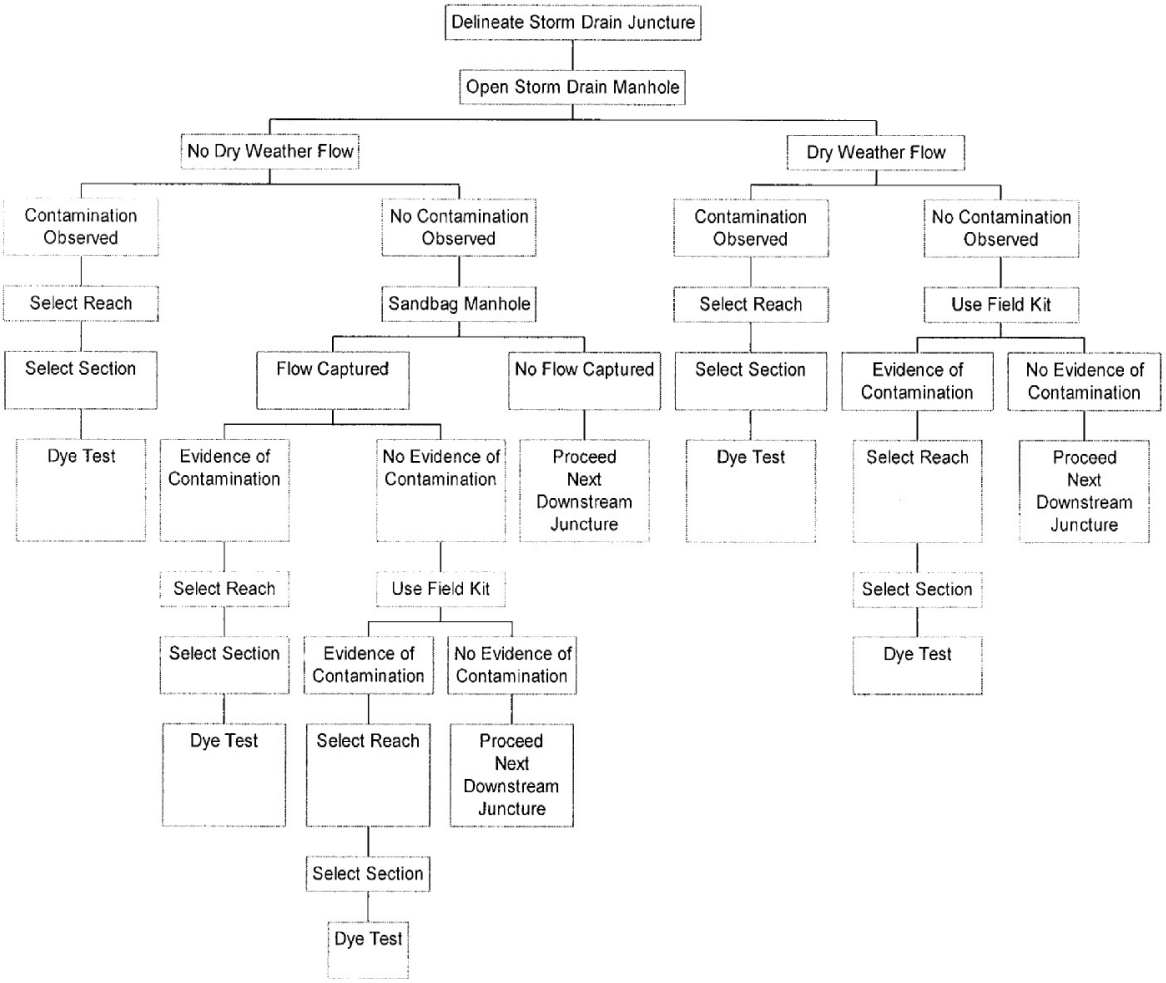
E. Post-Removal confirmation

After completing the removal of illicit discharges from a subdrainage area and before beginning the investigation of downstream areas, the subdrainage area is re-inspected to verify corrections. Depending on the extent and timing of corrections, verification monitoring can be done at the initial junction manhole or the closest downstream manhole to each correction. Verification is accomplished by using the same visual inspection, field monitoring, and damming techniques as described above.

Updates to this IDDE Protocol

Updates to this protocol may be incorporated as the program is implemented or as deemed necessary to continue to meet the goals of the MS4 permit related to IDDE investigations. Updates will be incorporated into the SWMP when they are made, by replacing this document in Appendix D.

Figure 3: IDDE Flow Chart



City of Melrose

Illicit Discharge Detection & Elimination Program

Dear Resident,

The City of Melrose is currently conducting a Citywide illicit discharge detection and elimination program. The goal of this program is to identify sources of contamination in the City's storm drain system resulting from improperly connected or aging sewer services and cross connections. Storm drains in the City of Melrose discharge directly to waterbodies such as Ell Pond, Bennetts Pond Brook, Ell Pond Brook, and other open waterways. Sanitary sewer connections to the storm drain system are inappropriate and violate U.S. Environmental Protection Agency (EPA) and City of Melrose regulations. Eliminating these connections is essential to the health of the entire community, and is a priority for the Public Works Department.

Your property's sanitary sewer pipe could be inadvertently connected to the drain system or damaged due to aging infrastructure. The City of Melrose's consultant, _____ will be conducting dye testing in your neighborhood over the next few days. Dye testing is a quick and proven way to determine if building connections to the municipal sewer are functioning properly.

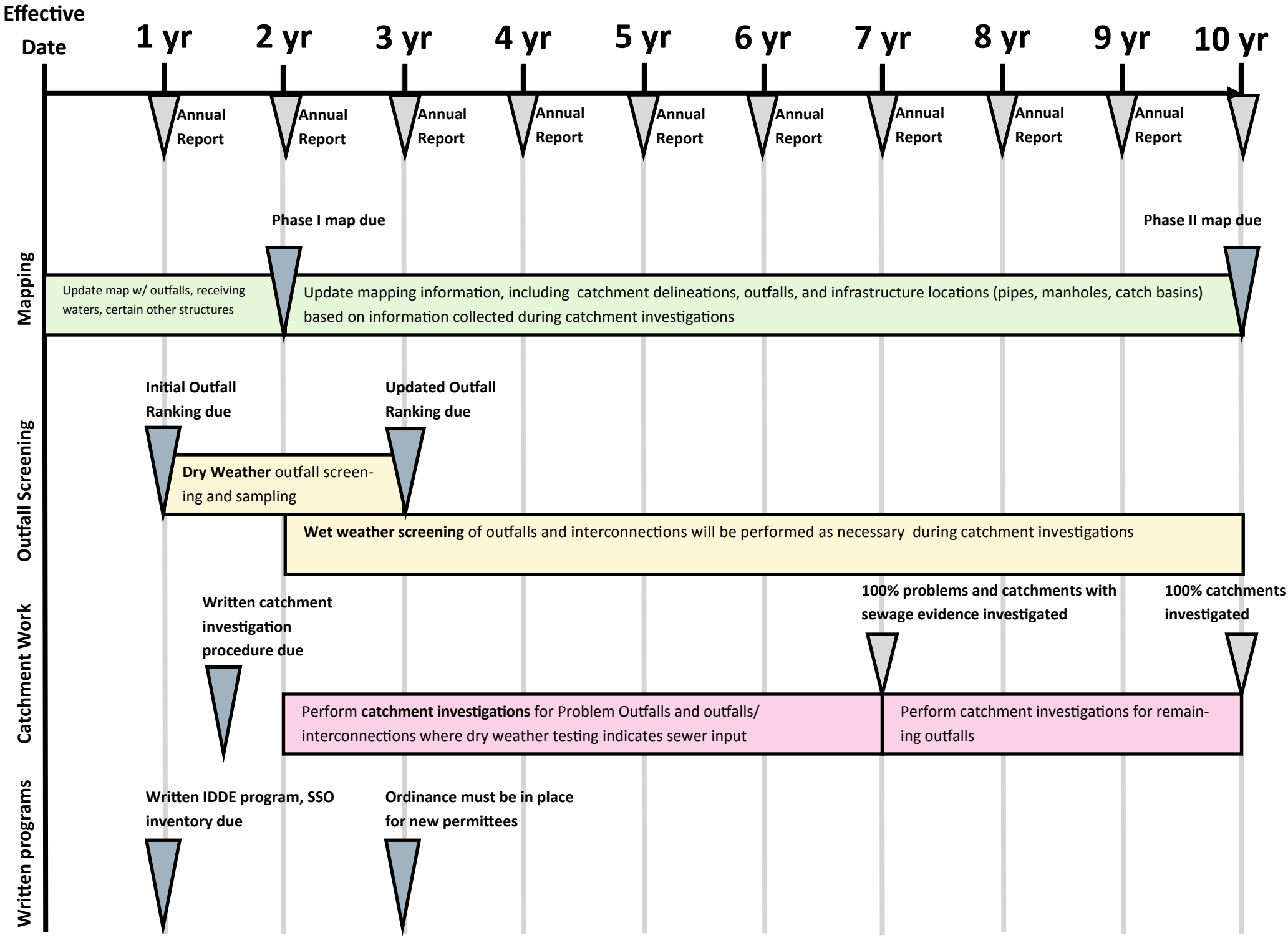
Dye testing will occur on <u>Day</u>, <u>Month</u> XXth from 7:30 to 10:30 am.

You may schedule a dye test time at your convenience. Please contact _____ at _____ to schedule an appointment time.

If you choose not to have a scheduled time, please make sure an appropriate member of the household is home to accommodate staff during this time frame. Your participation in this program is essential to its success.

You may direct any questions about this program to:

Elena Proakis Ellis, P.E.
Director of Public Works
562 Main Street
Melrose, MA 02176
781-979-4172


Effective Date
1 yr
2 yr
3 yr
4 yr
5 yr
6 yr
7 yr
8 yr
9 yr
10 yr
Annual Report
Mapping
Phase I map due
Phase II map due
Update map w/ outfalls, receiving waters, certain other structures
Update mapping information, including catchment delineations, outfalls, and infrastructure locations (pipes, manholes, catch basins) based on information collected during catchment investigations
Outfall Screening
Initial Outfall Ranking due
Updated Outfall Ranking due
Dry Weather outfall screening and sampling
Wet weather screening of outfalls and interconnections will be performed as necessary during catchment investigations
Catchment Work
Written catchment investigation procedure due
100% problems and catchments with sewage evidence investigated
100% catchments investigated
Perform catchment investigations for Problem Outfalls and outfalls/ interconnections where dry weather testing indicates sewer input
Perform catchment investigations for remaining outfalls
Written programs
Written IDDE program, SSO inventory due
Ordinance must be in place for new permittees

EPA New England Stormwater Outfall Sampling Protocol
Draft - April 2011

Purpose

This document provides a common framework for EPA New England ("EPA-NE") staff to develop and implement stormwater outfall sampling events, and provides a recommended approach to State and local watershed association personnel. Adopted from Boston Water and Sewer Commission ("BWSC") (2004), Pitt (2004), and based upon fieldwork conducted and data collected by EPA-NE, the protocol relies primarily on visual observations and the use of field test kits and portable instrumentation during dry and wet weather to complete a screening-level investigation of stormwater outfall discharges or flows within the drainage system. When necessary, the addition of more conclusive chemical markers may be included. The protocol is applicable to most typical Municipal Separate Storm Sewer Systems ("MS4s") and smaller tributary streams. The smaller the upstream catchment area and/or more concentrated the flow, the greater the likelihood of identifying an upstream wastewater source.

Introduction

The protocol is structured into several phases of work that progress logically through elements of investigation planning and design, laboratory coordination, sample collection, and data evaluation. The protocol involves the concurrent collection and analyses of water samples for surfactants, ammonia, total chlorine, and bacteria. When more precise confirmation regarding the presence or absence of human sanitary sewage is necessary, and laboratory capacity is available, the additional concurrent collection of Pharmaceutical and Personal Care Product ("PPCP") samples is advised. When presented with a medium to large watershed or numerous stormwater outfalls, the recommended protocol is the screening of all outfalls using the surfactant, ammonia, total chlorine, and bacterial analyses, and using the resulting data to prioritize and sample a subset of outfalls for all parameters, including PPCP compounds and additional analyses as appropriate. Ideally, screening-level analyses can be conducted by state, municipal, or local watershed association personnel, and a prioritized sub-set of outfalls can be sampled by EPA-NE using more advanced confirmatory techniques.

Step I – Reconnaissance and Investigation Design

Each sample event should be designed to answer a specific problem statement and work to identify the source of contamination. Any relevant data or reports from State, municipal, or local watershed associations should be reviewed when selecting sample locations. Aerial photography, mapping services, or satellite imagery resources are available free to the public through the internet, and offer an ideal way to pre-select locations for either field verification or sampling.

Sample locations should be selected to segregate outfall sub-catchment areas or surface waters into meaningful sections. A common investigative approach would be the identification of a specific reach of a surface water body that is known to be impaired for bacteria. Within this

specific reach, stormwater outfalls and smaller tributary streams would be identified by desktop reconnaissance, municipal outfall mapping, and field investigation when necessary. Priority outfalls or areas to field verify the presence of outfalls should be selected based on a number of factors, including but not limited to the following: those areas with direct discharges to critical or impaired waters (e.g. water supplies, swimming beaches); areas served by common/twin-invert manholes or underdrains; areas with inadequate levels of sanitary sewer service, Sanitary Sewer Overflows ("SSOs"), or the subject of numerous/chronic sanitary sewer customer complaints; formerly combined sewer areas that have been separated; culverted streams, and; outfalls in densely populated areas with older infrastructure. Pitt (2004) provides additional detailed guidance.

When investigating an area for the first time, the examination of outfalls in dry-weather is recommended to identify those with dry-weather flow, odor, and the presence of white or gray filamentous bacterial growth that is common (but not exclusively present) in outfalls contaminated with sanitary sewage (see Attachment 1 for examples). For those outfalls with dry-weather flow and no obvious signs of contamination, one should never assume the discharge is uncontaminated. Sampling by EPA-NE staff has identified a number of outfalls with clear, odorless discharges that upon sampling and analyses were quite contaminated. Local physical and chemical conditions, in addition to the numerous causes of illicit discharges, create outfall discharges that can be quite variable in appearance. Outfalls with no dry-weather flow should be documented, and examined for staining or the presence of any obvious signs of past wastewater discharges downstream of the outfall.

As discussed in BWSC (2004), the protocol may be used to sample discreet portions of an MS4 sub-catchment area by collecting samples from selected junction manholes within the stormwater system. This protocol expands on the BWSC process and recommends the concurrent collection of bacteria, surfactant, ammonia, and chlorine samples at each location to better identify and prioritize contributing sources of illicit discharges, and the collection of PPCP compounds when a more conclusive source verification is necessary.

Finally, as discussed further in Step IV, application of this sampling protocol in wet-weather is recommended for most outfalls, as wet-weather sampling data may indicate a number of illicit discharge situations that may not be identified in dry weather.

Step II – Laboratory Coordination

All sampling will be conducted in accordance with an approved EPA Quality Assurance Project Plan ("QAPP"). A model QAPP is included as Attachment 2. While the QAPP details sample collection, preservation, and quality control requirements, detailed coordination with the appropriate laboratory staff will be necessary. Often sample events will need to be scheduled well in advance. In addition, the sampling team must be aware of the strict holding time requirements for bacterial samples – typically samples analysis must begin within 6 hours of sample collection. For sample analyses conducted by a commercial laboratory, appropriate coordination must occur to determine each facilities respective procedures and requirements.

Currently, the EPA-NE laboratory has a limited capacity for PPCP sampling, and any proposed PPCP sample events must be coordinated with the appropriate staff.

Step III – Sample Collection

Once those outfalls with dry-weather flow have been identified, concurrent sampling and analyses for surfactants, ammonia, and total chlorine (which can all be done through the use of field kits), in addition to bacteria (via laboratory analysis) should be conducted. When numerous outfalls with dry-weather flow exist, sample locations should be prioritized according to the criteria mentioned above. In addition, field screening using only the field kits may occur during the field reconnaissance. However, it must be emphasized that the concurrent sampling and analyses of bacteria, surfactant, ammonia, and total chlorine parameters is the most efficient and cost-effective screening method.

When first observed, the physical attributes of each outfall or sampling location should be noted for construction materials, size, flow volume, odor, and all other characteristics listed on the data collection form (Attachment 3). In addition, GPS coordinates should be collected and a photograph of the sample location taken. Whenever possible, the sampling of storm drain outfalls should be conducted as close to the outfall opening as possible. Bacterial samples should be collected first, with care to not disturb sediment materials or collect surface debris/scum as best possible. A separate bottle is used to collect a single water sample from which aliquots will be analyzed for surfactants, ammonia, and total chlorine. A sample for PPCP analysis is recommended to be collected last, as the larger volume required and larger bottle size may cause some sediment disturbance in smaller outfalls or streams. If necessary, a second smaller, sterile and pre-cleaned sampling bottle may be used to collect the surface water which can then be poured into the larger PPCP bottle. Last, a properly calibrated temperature/specific conductance/salinity meter should be used to record all three parameters directly from the stream or outfall. When flow volume or depth is insufficient to immerse the meter probe, a clean sample bottle may be utilized to collect a sufficient volume of water to immerse the probe. In such instances, meter readings should be taken immediately.

As soon as reasonably possible, sample aliquots from the field kit bottle should be analyzed. When concurrent analyses are not possible, ammonia and chlorine samples should be processed first, followed by surfactants analysis, according to each respective Standard Operating Procedures contained in Attachments 4, 5, and 6, or as appropriate based on the particular brand and type of field test kit being used. All waste from the field test kits should be retained and disposed of according to manufacture instructions. Results should be recorded, samples placed in a cooler on ice, and staff should proceed to the next sample location.

Upon completion of sampling and return to the laboratory, all samples will be turned over to the appropriate sample custodian(s) and accompanied by an appropriate Chain-of-Custody ("COC") form (an example form is included in Attachment 7).

Step IV – Data Evaluation

Bacterial results should be compared to the applicable water quality standards. Surfactant and ammonia concentrations should be compared to the thresholds listed in Table 1. Evaluation of the data should include a review for potential positive results due to sources other than human wastewater, and for false negative results due to chemical action or interferences. In the EPA-NE region, field sampling has indicated that the biological breakdown of organic material in historically filled tidal wetlands may cause elevated ammonia readings, as can the discharge from many landfills. In addition, salinity levels greater than 1 part per thousand may cause elevated surfactant readings, the presence of oil may likewise indicate elevated levels, and fine suspended particulate matter may cause inconclusive surfactant readings (for example, the indicator ampule may turn green instead of a shade of blue). Finally, elevated chlorine from leaking drinking water infrastructure or contained in the illicit wastewater discharge may inhibit bacterial growth and cause very low bacterial concentrations. Any detection of total chlorine above the instrument Reporting Limit should be noted.

Table 1 – Freshwater Water Quality Criteria, Threshold Levels, and Example Instrumentation [1]

Analyte/ Indicator	Threshold Levels/ Single Sample[3]	Instrumentation
E. coli [2]	235 cfu/100ml	Laboratory via approved method
Enterococci [2]	61 cfu/100ml	Laboratory via approved method
Surfactants (as MBAS)	≥ 0.25 mg/l	MBAS Test Kit (e.g. CHEMetrics K-9400)
Ammonia (NH_3)	≥ 0 .5 mg/l	Ammonia Test Strips (e.g. Hach brand)
Chlorine	> Reporting Limit	Field Meter (e.g. Hach Pocket Colorimeter II)
Temperature	≥83°F(28.3°C) and change 5°C(2.8°C) in rivers[2]	Temperature/Conductivity/Salinity Meter (e.g. YSI Model 30)

[1] The mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. EPA

[2] 314 CMR 4.00 MA - Surface Water Quality Standards - Class B Waters.

[3] Levels that may be indicative of potential wastewater or washwater contamination

Once dry-weather data has been examined and compared to the appropriate threshold values, outfalls or more discreet reaches of surface water can be selected for sampling or further investigation. Wet-weather sampling is also recommended for all outfalls, in particular for those that did not have flow in dry weather or those with dry-weather flow that passed screening thresholds. Wet-weather sampling will identify a number of situations that would otherwise pass unnoticed in dry weather. These wet-weather situations include, but are not limited to the following: elevated groundwater that can now cause an exchange of wastewater between cracked or broken sanitary sewers, failed septic systems, underdrains, and storm drains; increased sewer

volume that can exfiltrate through cracks in the sanitary piping; increased sewer volume that can enter the storm drain system in common manholes or directly-piped connections to storm drains; areas subject to capacity-related SSO discharges, and; illicit connections that are not carried through the storm drain system in dry-weather.

Step V – Costs

Use of field test kits and field instruments for a majority of the analytical parameters allows for a significantly reduced analytical cost. Estimated instrument costs and pro-rated costs per 100 samples are included in Table 2. The cost per 100 samples metric allows averaged costs to account for reagent refills that are typically less expensive as they do not include the instrument cost, and to average out the initial capital cost for an instrument such as a temperature/ conductivity/salinity meter. For such capital costs as the meters, the cost over time will continue to decrease.

Table 2 – Estimated Field Screening Analytical Costs [1]

Analyte/ Indicator	Instrument or Meter [2]	Instrument or Meter Cost/No. of Samples	Cost per Sample (Based on 100 Samples) [3]
Surfactants (as MBAS)	Chemetrics K-9400	$77.35/20 samples ($58.08/20 sample refill)	$3.09
Ammonia (NH_3)	Hach brand 0 – 6 mg/l	$18.59/25 samples	$0.74
Total Chlorine	Hach Pocket Colorimeter II	$389/100 samples ($21.89 per 100 sample refill)	$3.89
Temperature/ Conductivity/ Salinity	YSI	$490 (meter and cable probe)	$4.90

1 Estimated costs as of February 2011

2 The mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. EPA

3 One-time meter costs and/or refill kits will reduce sample costs over time

From Table 2, the field analytical cost is approximately $13 per outfall. Typical bacterial analyses costs can vary depending on the analyte, method, and total number of samples to be performed by the laboratory. These bacterial analyses costs can range from $20 to $60. Therefore, the analytical cost for a single outfall, based on the cost per 100 samples, ranges from $33 to $73. As indicated above, these costs will decrease slightly over time due to one-time capitals costs for the chlorine and temperature/conductivity/salinity meters.

Step VI – Follow-Up

Once all laboratory data has been reviewed and determined final in accordance with appropriate quality assurance controls, results should be reviewed with appropriate EPA staff to determine next steps. Those outfalls or surface water segments that fail to meet the appropriate water quality standard, and meet or exceed the surfactant and ammonia threshold values, in the absence of potential interferences mentioned in Step IV, indicate a high likelihood for the presence of illicit connections upstream in the drainage system or surface water. Whereas illicit discharges are quite variable in nature, the exceedance of the applicable water quality standard and only the ammonia or surfactant threshold value may well indicate the presence of an illicit connection. When available, the concurrent collection and analyses of PPCP data can greatly assist in confirming the presence of human wastewater. However, such data will not be available in all instances, and the collective data set and information regarding the physical characteristics of each sub-catchment or surface water reach should be used to prioritize outfalls for further investigation. As warranted, data may be released to municipal representatives, and should be accompanied by an explanation of preliminary findings. Release of such data should be fully discussed with the case team or other appropriate EPA staff.

References Cited

Boston Water & Sewer Commission, 2004, *A systematic Methodology for the Identification and Remediation of Illegal Connections.* 2003 Stormwater Management Report, chap. 2.1.

Pitt, R. 2004 *Methods for Detection of Inappropriate Discharge to Storm Drain Systems. Internal Project Files*. Tuscaloosa, AL, *in* The Center for Watershed Protection and Pitt, R., *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*: Cooperative Agreement X82907801-0, U.S. Environmental Protection Agency, variously paged. Available at: http://www.cwp.org.

Instrumentation Cited (Manufacturer URLs)

MBAS Test Kit - CHEMetrics K-9400: http://www.chemetrics.com/Products/Deterg.htm

Portable Colorimeter – Hach Pocket Colorimeter II: http://www.hach.com/

Ammonia (Nitrogen) Test Strips: http://www.hach.com/

Portable Temperature/Conductivity/Salinity Meter: YSI Model 30:
http://www.ysi.com/productsdetail.php?30-28

Disclaimer: The mention of trade names or commercial products in this protocol does not constitute endorsement or recommendation for use by the U.S. EPA.

EPA NE Stormwater Outfall Sampling Protocol – Attachment 1
Stormwater Outfalls With Indicators of Illcit Discharges

Note white, gray, or off-white filamentous bacterial growth

EPA NE Stormwater Outfall Sampling Protocol – Attachment 1
Stormwater Outfalls With Indicators of Illcit Discharges

Note off-white filametous bacterial growth

Note gray bacterial growth, suds, cloudy and gray plunge pool

Stormwater Monitoring Quality Assurance Project Plan
2011-2016

RFA #

Sampling Plan Acceptance

EPA OES Enforcement and Project Manager/Coordinator **Signature:**	**Date:**
EPA OEME Project Managers/Coordinator **Signature:**	**Date:**
EPA OEME QA Officer Charlie Porfert **Signature:**	**Date:**
EPA Chemistry Team Lead Dan Boudreau **Signature:**	**Date:**

1.0 Background

U.S. EPA Administrative Order 5360.1 requires that "all projects involving environmental monitoring performed by or for the U.S. EPA shall not be undertaken without an adequate Quality Assurance Project Plan (QAPP)." The purpose of this document is to describe the process used to develop, select, manage, and finalize stormwater monitoring projects. In describing this process, quality assurance goals and methods will be established, thus ensuring that the overall program and each monitoring project will meet or exceed EPA requirements for quality assurance.

The objective of these projects will be to collect data that is usable by EPA OES enforcement staff for enforcement actions and information requests. The primary focus of this project will be on urban water stormwater outfalls in the New England Region watersheds.

2.0 Sampling overview

Monitoring will be conducted on pre-scheduled days with the Laboratory. Samples will be retrieved from surface water, in stream or outfalls at suspected hotspots or areas that need further delineation. Sample sites will be located using GPS, with an accuracy goal of $\pm$ 1 meter and PDOP less than 6. Less accurate GPS reading or coordinates from maps will be accepted when site or other conditions do not allow $\pm$ 1 meter accuracy.

The primary focus of this sampling will be used to identify illegal discharges.
Results from the sampling will be used by EPA enforcement staff for enforcement purposes. For this project, sampling will be conducted according to EPA's Ambient Water Sampling SOP (Table 3). Volunteers and watershed association staff may assist in sampling. All procedures will be followed that are specified in Table 3. Parameter to be sampled will be predetermined by enforcement (OES) and OEME staff, based on data needs.

A. Locations

Site locations will be determined from field or desktop reconnaissance by project staff. Sample analyses will be predetermined based on conditions known about the sampling location prior to sampling. These may include data from previous sampling or from data collected from Mass DEP or local watershed associations. Any of the parameters listed in table 2 may be analyzed.

B. Analytical Methods and Reporting limits

Sample analyses will be conducted by EPA Laboratories.

This effort will test and compare the most appropriate analytical methods including, but not limited to; laboratory analysis, test kits and field analysis to determine the most effective and cost-efficient outfall and in-stream sampling approach.
Multiple and repeated testing will occur at each location to compare different method for identifying sewage contamination.

PPCPs, E.coli and enterococcus will be analyzed by EPA's Laboratory. Surfactants, ammonia, total chlorine will be analyzed with field test kits. Potential additional laboratory analyses include nitrogen (nitrate/nitrite), TSS, BOD, surfactants, ammonia and TPH. The Laboratory used

for each sampling event will be determined prior to sampling by the OEME Project Manager based on required analyses Laboratory availability and contract funds available.

Where available, a known concentration sample will be used to evaluate the performance of each test method. The known concentration sample will be processed in the field and Laboratory as a routine sample. The analyst or field technician will not know the concentration of the sample prior to analyzing and reporting the sample result. Sampling for PPCP testing will be done using extreme care not to contaminate the sample. No caffeine products should be consumed prior to sampling.

Table 1: Parameter specifications

Parameter (lab - equipment)	Preservation	Holding time
PH	None	Immediate
Temperature	None	Immediate
Sp Cond	None	Immediate
DO	None	Immediate
Total Phosphorus (EPA)	H_2SO_4 (pH <2) + Ice	28 days
TSS (EPA)	Ice	7 days
TSS (Alpha)	Ice	7 days
BOD (Alpha)	Ice	48 hours
Surfactants (Alpha)	Ice	48 hours
Surfactants (field kit – Chemetrics)	None	Immediate
Ammonia (alpha)	H_2SO_4 (pH <2) + Ice	28 days
Ammonia (test strips)	None	Immediate
TPH Petroleum ID (alpha)	Ice	7 Days to extraction 40 days after extraction
E. Coli (EPA)	Ice	6 hrs to lab
Enterococcus (EPA)	Ice	6 hrs to lab
PPCP	Ice (acidified in Lab)	7 day to extraction 40 days after extraction
Chlorine (Field kit – Hach)	None	Immediate

Table 2: Analytical References and Quality Control Goals

		Water Quality Criteria or Guidelines	Quality Assurance Goals		
Parameter (lab- equipment)	Reporting Limits	(MA or EPA)	Precision	Accuracy	Completeness
PH	4 to 10 units	6.5 - 8.3	0.02 unit	± 0.3 units	90%
Temperature	0 to +40°C	28.3°C	0.1 °C	± 0.15°C	90%
Sp Cond	0 to 100 mS/cm	NA	5 uS/cm	±10% cal std (µS/cm)	90%
DO	0.5mg/l to Sat	≥5 mg/l , ≥60% saturation	0.02mg/l	± .5 mg/l	90%
Total Phosphorus (EPA)	5.0 ug/l	NA	Field dup 30% RPD	MS 70-130%	90%
TSS (EPA)	5mg/L	NA	Field dup 30% RPD	See SOP	
TSS (Alpha)	5 mg/L	NA	Field dup 30% RPD	See SOP	90%
BOD (Alpha)	2 mg/L	NA	Field dup 30% RPD	See SOP	90%
Surfactants (field kit – Chemetrics)	0.25 mg/L[1]	0.25 mg/L	Field dup 30% RPD	TBD	90%
Ammonia (test strips)	0.25 mg/L[1]	1.0 mg/L	Field dup 30% RPD	TBD	90%
TPH Petroleum ID (alpha)	Variable	NA	Field dup 30% RPD	See SOP	
E. Coli (EPA)	4 col./ 100 ml	<=126 col./100 ml* <= 235 col./100 ml	±100 col/100ml or 30% RPD	N/A	90%
Enterococcus (EPA)	1 col/100ml	<=33 col./100 ml* <= 61 col./100 ml	±100 col/100ml or 30% RPD	See SOP	90%
PPCP	TBD	NA	Field dup 50% RPD	TBD	90%
Chlorine (Field kit – Hach)	0.02 mg/l	NA	Field dup 30% RPD	TBD	90%

Note
*Geometric mean Criteria
TBD = To be determined, Field methods and some colorimeter methods do not have accuracy criteria determined.
[1] Needs field verification to confirm

Table 3: Field and Laboratory References

Parameter	Analytical Method Reference	SOP reference
	Field References- 5/2005	
pH		
Conductivity		
Temperature		
dissolved oxygen	n/a	ECASOP-YSISondes9
Ambient water samples	n/a	ECASop-Ambient Water Sampling2
Chain of custody of samples	n/a	EIASOP-CHAINOFCUST
Sample login, tracking, disposition	n/a	EIASOP-ADMLOG14
	Lab. References- 5/ 2005	
Total Phosphorus (EPA)	EPA 365.3	EIASOP-INGTP8
TSS (EPA)	EPA 160.2	EIASOP-INGTSS-TDS-VRES5
TSS (Alpha)	EPA 160.2,SM2540D	SOP/07-29
BOD (Alpha)	EPA 405.1,SM5210B	SOP/07-13
Surfactants (field kit – Chemetrics)	Chemetrics	Draft
Ammonia (test strips)	Hach	Draft
TPH Petroleum ID (alpha)	8015B (M)	0-017
E. Coli (EPA)	SM9230	ECASOP- TC/EC Colilert2
Enterococcus (EPA)	SM9230	ECASOP-Enterolert1
PPCP	EPA 1694	TBD
Chlorine (Field kit – Hach)	Hach	TBD

*Specific conductance is the only parameter identified as non critical

Bottle list

Table 4: Bottle Sampling List

Parameter (lab - equipment)	Bottle	Preservation
Primary analyses		
E. Coli (EPA)	(2) 120ml or 250ml sterile	Ice
Enterococcus (EPA)		Ice
PPCP	1 Liter Amber	Ice (acidified in Lab)
Optional analyses		
Chlorine (Alpha)	500 ml	Ice
Total Phosphorus (EPA)	125 ml	H_2SO_4 (pH <2) + Ice
TSS (EPA)	1 liter	Ice
TSS (Alpha)	1 liter	Ice
BOD (Alpha)	1 Liter	Ice
TPH Petroleum ID (alpha)	2 -1 Liter Amber Glass tephlon lined	Ice
E. Coli (Alpha)	120 ml sterile	Ice
Enterococcus (Alpha)	120 ml sterile	Ice

C. Quality Control

Calibration:	EPA will calibrate its sondes according to the EPA sonde calibration SOP.
Field duplicate:	One duplicate sample will be collected per sampling event or approximately for every ten samples.
Trip Blank:	OEME Chemist will run appropriate QA samples for PPCP's. One blank sample will be collected for approximately every ten bacteria samples. Reported data that is less than 5 times the trip (field) blank concentration will be flagged.
QC Criteria:	Are specified in table 2, data not meeting this criteria will be reviewed by the Project Manager. Data that does not meet laboratory QA/QC criteria will be flagged by the laboratory.

D. Chain of Custody

Chain of custody procedures will follow the OEME/Investigations Office SOP (Table 3)

3.0 Data Review

EPA Microbiology data will be reviewed by the Biology QAO. Alpha generated microbiology samples will be reviewed by the OEME Project Manager. All field data and draft data reports will be reviewed by the OEME Project manager. Laboratory generated data (from Alpha and EPA) will be reviewed by the Chemistry Team Leader.

4.0 Data reports

Data reports will be reviewed by the Project Coordinator and the OEME Project Manager before a final report is release to the Enforcement Coordinator. Draft reports may be released without a complete review.

5.0 Attachments (Q:\share\RARE\QAPP)

1) Standard Operating Procedure Enterococcus (SM9230B), Multiple Tube Technique. SOP/07-01 *Alpha Analytical, Inc. May 28, 2005*

2) Standard Operating Procedure E. Coli (SM9213D). SOP/07-41 *Alpha Analytical, Inc. May 28, 2005*

3) Standard Operating Procedure MBAS, Ionic Surfactants. Draft SOP *EPA Laboratory. January 28, 2010*

4) Standard Operating Procedure Nitrogen Ammonia. Draft SOP *EPA Laboratory. February 10, 2011*

5) Standard Operating Procedure Total Chlorine. Draft SOP *EPA Laboratory. February 12, 2010*

6) Standard Operating Procedure TSS/ TVSS (SM2540 D, EPA 160.2). SOP/07-29 *Alpha Analytical, Inc. September 29, 2007*

7) Standard Operating Procedure BOD-5day, SBOD-5day, and cBOD-5day (SM 5210B, and EPA 405.1). SOP/07-13 *Alpha Analytical, Inc. September 29, 2007*

8) Standard Operating Procedure TPH 8015D – Modified 0-017 (EPA 8015D Modified) *Alpha Analytical, Inc. March 04, 2008*

9) Standard Operating Procedure determination of Trace Elements in Water and Wastes by Inductively Coupled Plasma- Mass Spectrometry (200.8). SOP/06-11 Alpha Analytical, Inc. July 13, 200

10) Standard Operating Procedure Inductively Coupled Plasma – Mass Spectrometry (6020). SOP/06-10 Alpha Analytical, Inc. October 25, 2007

STORMWATER MONITORING

Field Collection Requirements (To be recorded at each site)

Sample-
Site Name _____

Time collected_____

Date collected_____

Inspection-
****Take picture at site****
Outfall diameter_____('na' if open stream)

Flow estimate_____('na' if open stream)

Odor_____

Color_____

Turbidity_____

Floatables_____

Other observations_____

_____

YSI Meter (calibrate in lab)-
Salinity_____

Temp_____

Conductivity (give both #'s)

_____

Location information-
Short description of where sample was collected at site_____

_____

_____

GPS_____

_____

Field Kits listed in the order they should be conducted in, include any applicable notes-

NH3 strip_____

Cl2 kit_____
Hach meter – (3 min wait)

Surfactant_____
Chemetrics K-9400 Blue box/detergent test kit

Additional Notes:

(Note any changes in weather conditions)_____

_____

_____

_____

_____

STORMWATER MONITORING (PAGE 2)

Field Equipment List

Waste Containers (2 total – clearly labeled):

1 liter amber plastic for surfactants/detergents kit waste
1 liter amber plastic for Cl2 kit waste

Sample Bottles (3 total for each sample location)-
120ml sterile – E.coli/entero
1 Liter amber glass: PPCP, *EPA* (Peter Philbrook)
120ml-250ml plastic – Field Kit Bottle – to be used on site for kits listed above

***Fill out chain of custody

In Carboy Container
☐Log book
☐COC forms
☐Extra sample bottles
☐Colored tape
☐Sharpies
☐Write-On-Rain Pens
☐Paper towels
☐GPS
☐Sampling plan & GPS locations
☐Regular length Powder Free Gloves
☐Squirt bottle of DI Water
☐Coolers with Ice
☐Waders/Boots
☐YSI multi parameter Meter

ENVIRONMENTAL PROTECTION AGENCY

REGION 1

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	NO. OF CONTAINERS							REMARKS
SAMPLERS: *(Signature)*									
STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION				

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

1-17[illegible]

Appendix E
Written Procedures for Site Plan Review, Construction Site Inspection and Enforcement of Erosion and Sedimentation Control

City of Melrose

Procedures for Site Plan Review, Construction Site Inspection and Enforcement of Erosion and Sedimentation Control

Construction sites that lack adequate sedimentation and erosion controls can contribute a significant amount of sediment to nearby bodies of water. The City of Melrose regulates sedimentation and erosion from construction sites through several ordinances, including the following:

- Chapter 228 (Water, Sewers, and Drains), which requires all projects disturbing one acre or more of land to obtain a permit from the Department of Public Works (DPW). Applications for this permit must include a stormwater management plan, erosion and sediment control plan, waste control plan, and an operations and maintenance plan. This ordinance also gives the DPW or its agent the authority to enter the site to verify the information in the application and to inspect for compliance.
- Chapter 231 of the City Ordinances (Wetlands Protection), which applies predominately to projects that require Conservation Commission review.
- Chapter 235 (Zoning), specifically in sections pertaining to the City's Slope Protection Bylaw, to removal and filling of material, and to site plan review requirements.
- Rules and Regulations Governing the Subdivision of Land in Melrose, MA, Section IV.C.4, which requires proposed subdivisions to conform to the standards outlined in Chapter 228.

The purpose of this protocol is to summarize the actions that must be taken for the above ordinances to be effective in minimizing erosion and sedimentation from construction sites.

A. Construction Site Inventory

The DPW's Engineering Division reviews all projects submitted for review by the Planning Board and the Zoning Board of Appeals. All larger projects, including, but not limited to, all projects disturbing one acre or more of land, or sites that disturb less than one acre of land but are part of a larger common plan of development that disturbs one acre or more of land, are cataloged through addition to a development-review spreadsheet maintained by the Engineering Division. This includes subdivision projects, which are also subject to the Rules and Regulations Governing the Subdivision of Land in

Melrose MA. In addition, when Engineering Division permits are subsequently issued for site work, those projects are all tracked in a spreadsheet dedicated to tracking permits issued by the DPW. All projects on both lists receive inspections from Engineering Division staff, with more frequent attention paid to the larger projects on the development-review list, as those are the larger and more complex projects.

B. Project Review Considerations

When reviewing projects submitted to the Planning Board, the Engineering Division performs a detailed review of the required stormwater mitigation documents, including, but not limited to:

1) The stormwater design plans
2) The hydraulic analysis showing changes in impervious area and impacts to both onsite and off-site drainage
3) The erosion and sedimentation controls proposed for the construction projects
4) The plan to control wastes on the construction site
5) The long-term operations and maintenance plan
6) The ability of the project to meet the stormwater goals outlined in the Site Plan Review ordinance

It is the responsibility of the Engineering Division to perform this review for all projects submitted to the Planning Board, including all those disturbing one acre or more.

Ordinance 235.16.1 (12) outlines the requirements during the Site Plan Review process for stormwater management, against which each project must be checked during the Engineering Division's review. This section reads as follows:

> "**(a)** Stormwater systems shall be designed to protect the public and environment from flooding, siltation, pollutants and related drainage impacts and shall conform to the applicable performance standards included in the most recent edition of the Massachusetts Department of Environmental Protection Stormwater Handbook, the requirements of §228-77, Stormwater Permits for Parcels of Land Equal to or Greater than One Acre, or any successor legislation.
>
> **(b)** Stormwater systems shall be designed to use low-impact design (LID) methodologies to mitigate drainage impact. Low-impact design (LID) methodologies may include porous pavements, bioretention cells, infiltration trenches, rainwater collection cisterns and other design methods that maximize the use of landscaped areas for stormwater control and promote the reuse of runoff.
>
> **(c)** Stormwater flood mitigation shall be provided through the use of best management practices (BMPs) to further reduce the frequency and intensity of flooding otherwise generated at the

proposed site. To the extent practicable, BMPs shall be sized to capture, retain, and percolate to ground all runoff from impermeable surfaces generated by the five-year, twenty-four-hour storm event. Preferred BMPs shall include, but not be limited to, constructed wetlands, pocket wetlands, rain gardens, vegetated swales, retention/detention ponds, and subsurface leaching systems."

Ordinance 228-77 outlines required erosion and sedimentation standards and stormwater standards for new development and redevelopment projects disturbing one acre or more, and new development and redevelopment projects that disturb less than one acre but are part of a larger common plan development disturbing one acre or more. For the purposes of stormwater management, "new development" and "redevelopment" have the following definitions:

- New Development: Construction or land alteration on an area that has not previously been developed to include impervious cover.
- Redevelopment: Construction or land alteration on an area that does not meet the definition of New Development above.

Each project shall also be checked against Ordinance 228-77 during the Engineering Division's review.

After receiving the review comments from the Engineering Division, the Planning Board conducts a public meeting, at which interested parties may ask questions and raise potential issues. Comments can also be submitted in writing by interested parties to the Planning Board.

The Site Plan Review Committee (SPRC), composed of the Melrose Planning Board, shall make a decision on the project within 35 days of the close of the public hearing. Failure of the SPRC to take action within 35 days of the close of the public hearing or within an agreed upon extended time frame is considered an automatic approval. A certificate of approval will be issued by the City Clerk.

Site plan approval lasts for two years from the date of approval, after which time the approval will lapse if substantial progress has not been made. The Planning Board may extend approval for good cause upon written request from the applicant.

C. Stormwater Construction Inspections

As outlined in Ordinance 228-77, Section B.2, inspections relating to erosion and sediment control and construction of the stormwater management system must, at a minimum, be conducted by the City at the following stages of construction:

- Erosion and sedimentation controls must be inspected prior to land disturbance.
- The excavation for the stormwater management system must be inspected to ensure adequate separation of the stormwater system from groundwater and to confirm the presence of the approved soil type.
- The completed stormwater management system must be inspected prior to backfilling of any underground drainage structures.
- Final inspection to confirm the as-built features.

When conducting site inspections during construction, the City will do the following:

- Inspections will be tracked by the Engineering Division and/or the Inspectional Services Department, indicating when construction sites are visited.
- As each site with disturbance of greater than one acre is identified, a construction inspection frequency will be assigned. At a minimum, monthly inspections will take place.
- The results of the inspections will be documented, including the condition of erosion and sedimentation controls and any issues observed.
- The current ordinances specify violation penalties which can be instituted as needed to enforce this program.
- Municipal staff responsible for inspections will receive training on the applicable regulatory requirements, BMPs, inspections, and enforcement.

The attached Construction Site Stormwater Inspection Report will be used by the inspector during site visits. Construction site inspectors should abide by the following guidelines:

1. Inspections to monitor stormwater compliance should be performed at least once per month at each active construction site, with priority placed on sites that require coverage under the USEPA 2012 Construction General Permit (i.e., that disturb one or more acres), and sites that are located in the watershed of any 303(d) water bodies.
2. The inspection shall begin at a low point and work uphill, observing all discharge points and any off-site support activities.
3. Written and photographic records shall be maintained for each site visit.
4. During the inspection, the inspector should ask questions of the contractor. Understanding the selection, implementation, and maintenance of BMPs is an important goal of the inspection process, and requires site-specific input.
5. The inspector should not recommend or endorse solutions or products. The inspector may offer appropriate advice, but all decisions must be made by the contractor.
6. The inspector shall always wear personal protective equipment appropriate for the site.
7. The inspector shall abide by the contractor's site-specific safety requirements.
8. The inspector has legal authority to enter the site. However, if denied permission to enter the site, the inspector should never force entry.
9. If a site requires coverage under the USEPA's general construction permit, the inspector shall visit the EPA Region 1 website and locate and downloand the eNOI for the site, to confirm that the contractor has filed for coverage. (http://cfpub.epa.gov/npdes/stormwater/cgpenoi.cfm or http://cfpub.epa.gov/npdes/stormwater/ noi/noisearch.cfm)
10. If the project disturbs one or more acres and is under construction, but does not show up in either database, the project is in violation of the Construction General Permit. Call the contractor to determine if the NOI process has been started. If not, notify the contractor verbally of this requirement and the violation. Work cannot proceed on the site until a Notice

of Intent (NOI) for coverage has been approved by USEPA. The inspector may choose to print instructions on how to file an NOI and meet with the contractor to review these. Issue a written Stop Work Order until the NOI has been approved by USEPA. Once it has been determined that the site is in compliance with the 2012 Construction General Permit, the site inspection can continue.

The site inspection will involve the following steps:

1. Plan the inspection before visiting the construction site
    a. Obtain and review permits, site plans, previous inspection reports, and any other applicable information.
    b. Print or download the approved NOI from the USEPA 2012 Construction General Permit NOI website, listed previously.
2. Meet with the contractor
    a. Review the Construction SWPPP (if the site includes over one acre of disturbance) or other document, as required by the municipality's legal authority. Compare BMPs in the approved site plans with those shown in the SWPPP.
    b. Review the project's approved NOI and confirm that information shown continues to be accurate.
    c. Get a general overview of the project from the contractor.
    d. Review inspections done by the contractor.
    e. Review the status of any issues or corrective actions noted in previous inspection reports.
    f. Discuss any complaints or incidents since the last meeting.
3. Inspect perimeter controls
    a. Examine perimeter controls to determine if they are adequate, properly installed, and properly maintained.
    b. For each structural BMP, check structural integrity to determine if any portion of the BMP needs to be replaced or requires maintenance.
4. Inspect slopes and temporary stockpiles
    a. Determine if sediment and erosion controls are effective.
    b. Look for slumps, rills, and tracking of stockpiled materials around the site.
5. Compare BMPs in the site plan with the construction site conditions
    a. Determine whether BMPs are in place as specified in the site plan and if the BMPs have been adequately installed and maintained.
    b. Note any areas where additional BMPs may be needed which are not specified in the site plans.
6. Inspect site entrances/exits
    a. Determine if there has been excessive tracking of sediment from the site.
    b. Look for evidence of additional entrances/exits which are not on the site plan and are not properly stabilized.

7. Inspect sediment basins
    a. Look for signs that sediment has accumulated beyond 50% of the original capacity of the basin.
8. Inspect pollution prevention and good housekeeping practices
    a. Inspect trash areas and material storage/staging areas to ensure that materials are properly maintained and that pollutant sources are not exposed to rainfall or runoff.
    b. Inspect vehicle/equipment fueling and maintenance areas for the presence of spill control measures and for evidence of leaks or spills.
9. Inspect discharge points and downstream, off-site areas
    a. Walk down the street and/or in other directions off-site to determine if erosion and sedimentation control measures are effective in preventing off-site impacts.
    b. Inspect down-slope catch basins to determine if they are protected, and identify whether sediment buildup has occurred.
10. Meet with the contactor again prior to leaving
    a. Discuss the effectiveness of current controls and whether modifications are needed.
    b. Discuss possible violations or concerns noted during the site inspection, including discrepancies between approved site plans, the SWPPP, and/or the implementation of stormwater controls.
    c. Agree on a schedule for addressing all discrepancies, and schedule a follow-up inspection.
11. Follow up as determined in conjunction with the contractor.
12. Use Stop Work orders, as needed, until compliance with the 2012 Construction General Permit and/or other document, as required by the municipality's legal authority, can be achieved.

Stormwater Construction Site Inspection Report

General Information			
Project Name			
NPDES Tracking No.		**Location**	
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Describe present phase of construction			

Type of Inspection:

❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event

Weather Information
Has there been a storm event since the last inspection? ❑Yes ❑No
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**

Site-specific BMPs

- *Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
1		❑Yes ❑No	❑Yes ❑No	
2		❑Yes ❑No	❑Yes ❑No	
3		❑Yes ❑No	❑Yes ❑No	
4		❑Yes ❑No	❑Yes ❑No	
5		❑Yes ❑No	❑Yes ❑No	
6		❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	
8		❑Yes ❑No	❑Yes ❑No	
9		❑Yes ❑No	❑Yes ❑No	
10		❑Yes ❑No	❑Yes ❑No	

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
6	Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
12	(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"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 gathered and evaluated 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."

Print name and title: _____

Signature:_____ Date:_____

Appendix F
Standard Operating Procedures

SOP 3: Catch Basin Inspection and Cleaning

Introduction

Catch basins help minimize flooding and protect water quality by removing trash, sediment, decaying debris, and other solids from stormwater runoff. These materials are retained in a sump below the invert of the outlet pipe (older catch basins may not have a sump). Catch basin cleaning reduces foul odors, prevents clogs in the storm drain system, and reduces the loading of trash, suspended solids, nutrients, bacteria, and other pollutants to receiving waters. The goal of this written Standard Operating Procedure (SOP) is to provide guidance to municipal employees on catch basin inspection and cleaning to reduce the discharge of pollutants from the MS4. If services are contracted, this SOP should be provided to the contractor. The contract should specify that the contractor is responsible for compliance with all applicable laws.

This SOP can also be used for inspection of catch basins or manholes for the purpose of conducting catchment investigations as part of the municipality's Illicit Discharge Detection and Elimination program.

The Department of Public Works performs routine inspections, cleaning, and maintenance of the approximately 1600 catch basins that are located within the MS4 regulated area. The City of Melrose (City) will include an optimization plan for catch basin cleaning and inspection in its annual report.

The City's catch basins are split into four zones. Two zones (~half of the catch basins) are inspected and cleaned each year and alternate so all catch basins are cleaned on a bi-annual basis. The City subcontracts this work out and the contractor disposes cleanings. In addition, the City is aware of problem catch basins that need to be cleaned out more frequently. The DPW utilizes their own vacuum truck for these areas. Catch basins are rebuilt or repaired if damages or deficiencies are identified during inspection.

The City will implement the following catch basin inspection and cleaning procedures to reduce the discharge of pollutants from the MS4:

Procedures

Inspection and Cleaning Frequency

- Each catch basin should be cleaned and inspected at least bi-annually.
- Catch basins near construction activities (roadway construction, residential, commercial, or industrial development or redevelopment) or high-use areas should be inspected and cleaned more frequently if inspection finds excessive sediments or debris loadings.
- Catch basins should be cleaned to ensure that they are no more than 50 percent full[1] at any time. Establish inspection and maintenance frequencies needed to meet this "50 percent" goal. If a catch basin sump is more than 50 percent full during two consecutive inspections, document the findings, investigate the contributing drainage area for sources of excessive sediment loading, and, if possible, address the contributing sources. If no contributing sources are found, increase the inspection and cleaning frequencies of the sump.

[1] A catch basin sump is more than 50 percent full if the contents within the sump exceed one half the distance between the bottom interior of the catch basin to the invert of the deepest outlet of the catch basin

- Street sweeping performed on an appropriate schedule will reduce the amount of sediment, debris, and organic matter entering the catch basins, which will in turn reduce the frequency with which they need to be cleaned.

Reference SOP 16: Streets and Parking Lots for information on appropriate street sweeping frequencies. Street sweeping schedules should also be adjusted based on catch basin inspection findings, with more frequent sweepings for areas with higher catch basin loads.

Inspection and Cleaning Procedures

Catch basin inspection and cleaning procedures should address both the grate opening and the catch basin structure, including the sump and any inlet and outlet pipes. Document any and all observations about the condition of the catch basin structure and water quality (an inspection form and log of catch basins cleaned or inspected are included in the attachments). Collect data on the condition of the physical basin structure, its frame, and the grate, as well as on the quality of stormwater conveyed by the structure. Observations like those below can indicate sources of pollution within the storm drain system:

- Oil sheen
- Discoloration
- Trash and debris

Both oil and bacteria can create a sheen on the water's surface. The source of a sheen can be differentiating by disturbing it (e.g., with a pole). A sheen caused by oil will remain intact and move in a swirl pattern, while a sheen caused by bacteria will separate and appear "blocky." The bacteria that cause this sheen are naturally occurring iron bacteria – they are not considered a pollutant but should be noted. Other types of bacteria, such as fecal bacteria, are considered pollutants and their discovery should be recorded.

Observations like those below can indicate a potential connection of a sanitary sewer to the storm drain system, which is an illicit discharge:

- Indications of sanitary sewage, including fecal matter or sewage odors
- Foaming, such as from detergent
- Optical enhancers, fluorescent dye added to laundry detergent

In general, adhere to the following procedures when inspecting and cleaning catch basins. Record the findings in the log in the attachments:

1. Implement appropriate traffic safety procedures (e.g., traffic cones) prior to and during the catch basin inspection and cleaning process.
2. Work upstream to downstream in a given drainage network.
3. Clean sediment and trash off of the grate.
4. Visually inspect the outside of the grate.
5. Remove the grate and visually inspect the inside of the catch basin to determine cleaning needs.
6. Inspect the catch basin for structural integrity.
7. Determine the most appropriate equipment and method for cleaning the basin:
    a. Manually use a shovel to remove accumulated sediments.
    b. Use a bucket loader to remove accumulated sediments.
    c. Use a high pressure washer to clean any remaining material out of the catch basin while capturing the slurry with a vacuum.
    d. If necessary, after the catch basin is cleaned, use the rodder of the vacuum truck to clean the downstream pipe and pull back sediment that might have entered it.
8. If contamination is suspected, chemical analysis will be required to determine if the materials comply with the Massachusetts Department of Environmental Protection (MassDEP) Hazardous Waste Regulations, 310 CMR 30.000 (https://www.mass.gov/files/documents/2016/08/xl/310cmr30_7883_54357.pdf). The chemical analysis required will depend on suspected contaminants. Note the identification number of the catch basin on the sample

label and note sample collection on the Catch Basin Inspection Form.

Handling and Disposal of Catch Basin Cleanings

- Properly dispose of collected sediments and catch basin cleanings (solid material, such as leaves, sand, and twigs removed from stormwater collection systems during cleaning operations).
- The subcontractor disposes of catch basin cleanings in accordance with all necessary regulations. In addition, when the City's DPW staff cleans catch basins, the cleanings are disposed of at the City's stockpile facility. The subcontractor removes and disposes of these catch basin cleanings as well.
- Cleanings from stormwater-only drainage systems may be disposed at any landfill that is permitted by MassDEP to accept solid waste. MassDEP does not routinely require stormwater-only catch basin cleanings to be tested before disposal, unless there is evidence that they have been contaminated by a spill or some other means.
- Screenings may need to be placed in a drying bed to allow water to evaporate before proper disposal. In this case, ensure that the screenings are managed properly to prevent pollution.
- Catch basin cleanings must be handled and disposed in accordance with compliance with the applicable MassDEP regulations, policies, and guidance (https://www.mass.gov/files/documents/2018/03/09/catch-basins.pdf).

Documentation and Reporting

The following information should be documented and included in the municipality's annual report – use the catch basin inspection log provided in the attachments to document the information to include in the report (alternatively, obtain records of volume of debris removed to include in the report):

- Metrics and other information used to reach the determination that the established plan for cleaning and maintenance is optimal for the MS4 (include in the SWMP and first annual report)
- Any action taken in response to excessive sediment or debris loadings
- Total number of catch basins
- Number of catch basins inspected
- Number of catch basins cleaned
- Total volume or mass of material removed from catch basins.

Employee Training

- Employees who perform catch basin cleaning and inspection are trained annually on these procedures and the proper operation of related equipment.
- Employees are also being trained on stormwater pollution prevention, illicit discharge detection and elimination (IDDE) procedures, and spill and response procedures.
- If services are contracted, the contractor should be given a copy of this and any applicable SOPs to ensure compliance with MS4 regulations.

Attachments

1. Catch Basin Inspection Form and Log

Related Standard Operating Procedures

1. SOP 16: Streets and Parking Lots

City of Melrose Department of Public Works

CATCH BASIN INSPECTION & CLEANING FORM

Catchbasin ID Number (from map)**:** _____

Map Number (if applicable)**:** _____

Date : / /

Weather Conditions (circle one):

Sunny Mostly Sunny Mostly Cloudy Cloudy Rain Snow

Company and Inspector's Name: _____

Location (Closest address, pole number, etc):

Overall Structure Condition (circle one): 1 is poor, 2 is fair, 3 is average, 4 is above average, 5 is new

1 2 3 4 5

Depth to top of sediment before cleaning (feet to rim)**:** _____feet

Depth to bottom of the basin after cleaning (feet to rim)**:** _____feet

Depth to invert of the outlet pipe (feet to rim)**:** _____feet

Any Pollutants Present ? (circle one or many)

None	Trash	Pet Waste
Sanitary Odor	Oil/Oil Sheen	Algae/Bacteria
Foam	Other:_____	

Additional Notes About Sediment:

Requires Follow-up by Engineering or DPW? (circle one) YES NO If yes explain:

SOP 4: Spill Response and Cleanup

Introduction

Municipalities are responsible for any contaminant spill or release that occurs on property that they own or operate. Particular areas of concern include any facilities that use or store chemicals, fuel oil, or hazardous waste, including schools, garages, and landfills. Implementation of proper spill response and cleanup procedures can help to mitigate the effects of a contaminant release. The goal of this written Standard Operating Procedure (SOP) is to provide guidance to municipal employees to help reduce the discharge of pollutants from the MS4 as a result of spills or releases.

The City of Melrose, MA (City) undertakes various precautions with spill response and cleanup procedures.

Procedures

The City will implement the following spill response and cleanup procedures to reduce the discharge of pollutants from the MS4:

Responding to a Spill

Employees should be trained in proper spill response specific to the materials used at their site and appropriate personal protective equipment (PPE). In the event of a spill, follow these spill response and cleanup procedures:

- If the facility has a Stormwater Pollution Prevention Plan (SWPPP), notify a member of the facility's Pollution Prevention Team, the facility supervisor, and/or the facility safety officer (fill out the attached spill response contact list). If not, continue to follow the procedures outlined below.
- Assess the contaminant release site for potential safety issues and for direction of flow.
- Complete the following:
    - Stop the contaminant release.
    - Contain the contaminant release through the use of spill containment berms or absorbents.
    - Protect all drains and/or catch basins with the use of absorbents, booms, berms or drain covers.
    - When a spill occurs inside the City Yard facility it is contained and cleaned up by the City. When a spill happens outside, a contractor in contacted to clean up the spill.
    - Dispose of all contaminated products in accordance with applicable federal, state and local regulations.
        i. Soil contaminated with petroleum should be handled and disposed of as described in MassDEP policy WCS-94-400, Interim Remediation Waste Management Policy for Petroleum Contaminated Soils (https://www.mass.gov/files/documents/2016/08/mq/94-400.pdf).
        ii. Products saturated with petroleum products or other hazardous chemicals require special handling and disposal by licensed transporters. Licensed transporters will pick up spill contaminated materials for recycling or disposal. Save the shipping records for at least three years.
        iii. Waste oil contaminated industrial wipes and sorptive minerals:
            1. Perform the "one drop" test to ensure absorbents do not contain enough oil to be considered hazardous, as described in the MassDEP Waste Oil

Management Guide (https://www.mass.gov/files/documents/2018/12/18/oilwiper.pdf).

2. Wring absorbents through a paint filter. If doing so does not generate one drop of oil, the materials are not hazardous.
3. If absorbents pass the "one drop" test they may be discarded in the trash unless contaminated with another hazardous waste.
    a. It is acceptable to mix the following fluids and handle them as waste oil:
        i. Waste motor oil
        ii. Hydraulic fluid
        iii. Power steering fluid
        iv. Transmission fluid
        v. Brake fluid
        vi. Gear oil
    b. **Do not mix** the following materials with waste oil. Store each separately:
        i. Gasoline
        ii. Antifreeze
        iii. Brake and carburetor cleaners
        iv. Cleaning solvents
        v. Other hazardous wastes
4. If absorbents do not pass the "one drop" test they should be placed in separate metal containers with tight fitting lids, labeled "Oily Waste Absorbents Only."

- If you need assistance containing and/or cleaning up the spill, or preventing it from discharging to a surface water (or an engineered storm drain system), contact your local fire department using the number listed below. **In the case of an emergency call 911**.
    - MELROSE FIRE DEPARTMENT: (781) 979-4404
- Contact the MassDEP 24-hour spill reporting notification line, toll-free at **(888)-304-1133**;
    - The following scenarios **are exempt** from MassDEP reporting requirements (see the MassDEP factsheet on oil and hazardous materials handling for more information: https://www.mass.gov/files/documents/2016/08/xm/spillmgm.pdf).
        i. Spills that are less than 10 gallons of petroleum and do not impact a water body
        ii. Spills that are less than one pound of hazardous chemicals and do not present an imminent health or safety hazard
        iii. Fuel spills from passenger vehicle accidents
        iv. Spills within a vault or building with a watertight floor and walls that completely contain all released chemicals

Reporting a Spill

When contacting emergency response personnel or a regulatory agency, or when reporting the contaminant release, be prepared to provide the following information:

1. Your name and the phone number you are calling from.
2. The exact address and location of the contaminant release.
3. Specifics of release, including:

   a. What was released;
   b. How much was released, which may include:
      i. Pounds
      ii. Gallons
      iii. Number of containers
4. Where was the release sent/what was contaminated, addressing:
   a. Pavement
   b. Soil
   c. Drains
   d. Catch basins
   e. Water bodies
   f. Public streets
   g. Public sidewalks
5. The concentration of the released contaminant.
6. What/who caused the release.
7. Is the release being contained and/or cleaned up or is the response complete.
8. Type and amount of petroleum stored on site, if any.
9. Characteristics of contaminant container, including:
   a. Tanks
   b. Pipes
   c. Valves

Maintenance and Prevention Guidance

Prevention of spills is preferable to even the best response and cleanup. To mitigate the effects of a contaminant release, provide proper maintenance and inspection at each facility. To protect against contaminant release adhere to the following guidance:

- Ensure all employees are properly trained to respond in the case of a spill, understand the nature and properties of the contaminant, and understand the spill control materials and personnel safety equipment. Maintain training records of current personnel on site and retain training records of former personnel for at least three years from the date last worked at the facility.
- Provide yearly maintenance and inspection at all municipal facilities, paying particular attention to underground storage tanks. Maintain maintenance and inspection records on site.
- Implement good management practices where chemicals and hazardous wastes are stored:
   a. Ensure storage in closed containers inside a building and on an impervious surface wherever possible.
   b. If storage cannot be provided inside, ensure secondary containment for 110 percent of the maximum volume of the storage container.
   c. Locate storage areas near maintenance areas to decrease the distance required for transfer.
   d. Provide accurate labels, Safety Data Sheets (SDS) information, and warnings for all stored materials.
   e. Regularly inspect storage areas for leaks.
   f. Ensure secure storage locations, preventing access by untrained or unauthorized persons.
   g. Maintain accurate records of stored materials.
- Where practicable, replace traditional hazardous materials such as pesticides and cleansers with non-hazardous products such as bio-lubricants which can reduce response costs in the case of a spill.

Maintain appropriately stocked spill response kits at each facilities and locations where oil, chemicals, or other hazardous materials are handled and stored.

Employee Training

- Employees who perform work with potential stormwater pollutants annually on proper spill procedures.
- Employees are also being trained on stormwater pollution prevention and illicit discharge detection and elimination (IDDE) procedures.
- If services are contracted, the contractor should be given a copy of this and any applicable SOPs to ensure compliance with MS4 regulations.

Attachments

1. None.

SOP 7: Fuel and Oil Handling

Introduction

Spills, leaks, and overfilling can occur during handling of fuels and petroleum-based materials, representing a potential source of stormwater pollution, even in small volumes. The goal of this written Standard Operating Procedure (SOP) is to provide guidance to municipal employees on a variety of ways by which fuels and petroleum-based materials can be delivered, as well as steps to be taken when petroleum products (such as waste oil) are loaded onto vehicles for offsite disposal or recycling. Delivery, unloading, and loading of waste oils are hereafter referred to as "handling." Attached is a fuel delivery form checklist.

The City of Melrose, MA (City) undertakes various procedures and precautions in handling fuel and oil.

Procedures

The City will implement the following fuel and oil handling procedures to help reduce the discharge of pollutants from the MS4:

General Guidelines

For all manners of fuel and oil handling described below, a member of the facility's Pollution Prevention Team (if the facility has a SWPPP) or another knowledgeable person familiar with the facility should be present during handling procedures. This person should ensure that the following are observed:

- There is no smoking while fuel handling is in process or underway.
- Sources of flame are kept away while fuel handling is being completed. This includes smoking, lighting matches, carrying any flame, or carrying a lighted cigar, pipe, or cigarette.
- The delivery vehicle's hand brake is set and wheels are chocked while the activity is being completed.
- Catch basins and drain manholes are adequately protected.
- No tools are to be used that could damage fuel or oil containers or the delivery vehicle.
- No flammable liquid should be unloaded from any motor vehicle while the engine is operating, unless the engine of the motor vehicle is required to be used for the operation of a pump.
- Ensure that local traffic does not interfere with fuel transfer operations. If it does, make appropriate accommodations.
- The attending persons should watch for any leaks or spills:
    - Any small leaks or spills should be immediately stopped, and spilled materials absorbed and disposed of properly. Follow the procedures in SOP 4: Spill Response and Cleanup.
    - In the event of a large spill or one that discharges to surface waters or an engineered storm drain system, the facility representative should activate the facility's Stormwater Pollution Prevention Plan (SWPPP) and report the incident as specified in the document.

Delivery by Bulk (Tanker) Truck

Procedures for the delivery of bulk fuel should include the following:

- The truck driver should check in with the facility upon arrival.
- The facility representative should ensure that the appropriate spill cleanup and response equipment and personal protective equipment are readily available and easily accessible. Refer to SOP 4: Spill Response and Cleanup for examples of spill cleanup and response materials.

- The facility representative should check to ensure that the amount of delivery does not exceed the available capacity of the tank.
    - A level gauge can be used to verify the level in the tank.
    - If a level gauge is not functioning or is not present on the tank, the tank should be stick tested prior to filling.
- The truck driver and the facility representative should both remain with the vehicle during the delivery process.
- The truck driver and the facility representative should inspect all visible lines, connections, and valves for leaks.
- When delivery is complete and the hoses are removed, buckets should be placed underneath connection points to catch drippings.
- The delivery vehicle should be inspected prior to departure to ensure that the hose is disconnected from the tank.
- The facility representative should inspect the fuel tank to verify that no leaks have occurred, or that any leaked or spilled material has been cleaned and disposed of properly.
- The facility representative should gauge tank levels to ensure that the proper amount of fuel is delivered, and collect a receipt from the truck driver.

Delivery of Drummed Materials

Drummed materials may include motor oil, wiper fluid, asphalt, cleaning solution for tools, hydraulic fluid, or transmission fluid. Procedures for the delivery of drummed materials should include the following:

- The truck driver should check in with the facility upon arrival.
- The facility representative should ensure that the appropriate spill cleanup and response equipment and personal protective equipment are readily available and easily accessible Refer to SOP 4: Spill Response and Cleanup for examples of spill cleanup and response materials. The facility representative should closely examine the shipment for damaged drums.
    - If damaged drums are found, they should be closely inspected for leaks or punctures.
    - Breached drums should be removed to a dry, well-ventilated area and the contents transferred to other suitable containers.
    - Drums should be disposed of in accordance with all applicable regulations.
- Drummed materials should not be unloaded outdoors during wet weather events.
- The truck driver and the facility representative should both remain with the vehicle during the delivery process.
- Drums should be handled and unloaded carefully to prevent damage.
- Upon completion of unloading, the facility representative should inspect the unloading point and the drums to verify that no leaks have occurred, that any leaked or spilled material has been cleaned up and disposed of properly, and that the unloaded drums are not leaking.
- The facility representative should check to ensure that the proper amount of fuel or other material is delivered, and collect a receipt from the truck driver.

Removal of Waste Oil from the Facility

When waste oil or similar oil products need to be removed from the premises, only haulers certified to transport waste oil should be utilized. Procedures should include the following:

- The disposal truck driver should check in with the facility upon arrival.
- The facility representative should ensure that the appropriate spill cleanup and response equipment and personal protective equipment are readily available and easily accessible. Refer to SOP 4: Spill Response and Cleanup for examples of spill cleanup and response materials. The truck driver and the facility representative should both remain with the vehicle during the tank draining process.
- When draining is complete and the hoses are removed, buckets should be placed underneath connection points to catch drippings.
- The facility representative should inspect the loading point and the tank to verify that no leaks have occurred, or that any leaked or spilled material has been cleaned up and disposed of properly.
- The facility representative should collect a receipt from the truck driver.
- When draining bulk oil tanks:
    - The facility representative should verify that the volume of waste oil in the tank does not exceed the available capacity of the disposal hauler's vehicle.
    - The disposal hauler vehicle should be inspected prior to departure to ensure that the hose is disconnected from the tank.

Employee Training

- Employees who handle or receive delivery of fuel and/or oil are trained annually on proper procedures.
- Employees are also bring trained on stormwater pollution prevention, illicit discharge detection and elimination (IDDE) procedures, and spill and response procedures.
- If services are contracted, the contractor should be given a copy of this and any applicable SOPs to ensure compliance with MS4 regulations.

Related Standard Operating Procedures

- SOP 4: Spill Response and Cleanup

Structural BMP Inspection Form
City of Melrose, MA

This document describes the operation and maintenance activities for the proposed stormwater management facilities.

Oil/Water Separators

- Inspect all oil/water separators at a minimum four times per year, or after every major storm, for depth of sediment and physical condition of the structure.
- Clean out all oil/water separators two times per year, or more frequently, if needed.
- Dispose of cleaning at a landfill or other facility permitted by MassDEP to accept solid waste, without any prior approval by MassDEP, unless the sediments are contaminated.

Stormwater Treatment Units

- The stormwater treatment units are a proprietary separator device located in the City Yard and Middle School parking lots and serves as pretreatment devices. Routine maintenance should follow manufacturer's instructions, which are attached.

Rain Garden

- The rain gardens should be inspected on a monthly basis to remove trash. Periodically, the plantings should be pruned and weeded to control the growth of unwanted plants. Zero-phosphorus fertilizers, if needed, should be used to promote growth of the plantings. The underlying mulch should be replaced on a yearly basis. During the winter months it is not recommended to store plowed snow in the rain gardens. Sediment accumulation may occur, causing the surface or subsurface media to become clogged; therefore, regular inspections of the system will determine the frequency at which the sediment needs to be removed. On average, replacement or rehabilitation of the filtration media will occur every 8 years.

Stormwater Management Facility Inspection Form

Location:
- ☐ City Yard – Oil/Water Separator
- ☐ City Yard – Stormwater Treatment Unit
- ☐ Middle School – Stormwater Treatment Unit
- ☐ Orient Avenue – Rain Gardens

Inspected By:_____

Inspection Date:_____

BMP Measure	Status/Inspection	Action Taken
City Yard - Oil/Water Separator		
City Yard - Stormwater Treatment Unit		
Middle School – Stormwater Treatment Unit		
Orient Ave – Rain Gardens		

SOP 12: Storage and Use of Pesticides and Fertilizer

Introduction

The use and improper storage of pesticides, herbicides, and fertilizers can contribute to the discharge of nutrients and toxic compounds to the municipal storm drainage system and surface waters. The goal of this Standard Operating Procedure (SOP) is to provide guidance on municipal employees on proper handling and storage of pesticides, herbicides, and fertilizers to prevent the discharge of pollutants from the MS4.

The City of Melrose (City) hires an outside contractor to handle and apply all pesticides, herbicides, and fertilizers. A small stockpile of bagged fertilizer is stored in a covered room at the DPW City Yard.

Procedures

Below are procedures for the storage and use of fertilizers, pesticides, and herbicides by municipal employees. In this section, the term "pesticide" include products used as herbicides. Refer to SOP 4: Spill Response and Cleanup and SOP 17: Hazardous Materials Storage and Handling for information on and handling spills and hazardous materials.

Storage

- Store pesticides and fertilizers in high, dry locations in accordance with the manufacturer's specifications.
- Store in cool, well-ventilated, and insulated areas to protect against temperature extremes.
- Store in areas that have been constructed in accordance with local fire codes for storing flammable or combustible materials.
    - Flammable products should be stored separately from non-flammable products, preferably in a fire-proof cabinet.
    - Small quantities (less than 500 lbs. or 220 gallons) of pesticides can be stored in cabinets constructed of double-walled 18-gauge sheet metal.
    - Large quantities (greater than 500 lbs. or 220 gallons) of pesticides can be stored in a prefabricated Hazardous Material Storage building or in a purpose-built storage facility. It is not anticipated that many municipal facilities will store quantities in excess of 500 lbs. or 220 gallons of pesticides.
    - Building walls should have a two-hour fire rating and be impervious to the stored materials.
    - Floors should be watertight, impervious, and provide spill containment.
- Store materials in an enclosed area or in covered, impervious containment, such as a locked cabinet. The cabinet should be located in a first story room or one that has direct access to the outdoors. Storage areas should be equipped with easily accessible spill cleanup materials and portable firefighting equipment. Regularly inspect storage areas for leaks and spills. Emergency eyewash stations and emergency drench showers should be located near the storage area.
- For pesticides, storage cabinets should be kept locked and the door to the storage area should contain a weather proof sign that warns of the existence and danger of the pesticides inside. The door should be kept locked. The sign should be visible at a distance of 25 feet and should read as follows:

DANGER
PESTICIDE STORAGE AREA
ALL UNAUTHORIZED PERSONS KEEP OUT
KEEP DOORS LOCKED WHEN NOT IN USE

The sign should be posted in both English and any other language used by maintenance workers.

- Pesticides should not be stored in the same place as ammonium nitrate fertilizer.
- Separate pesticides and fertilizers from other chemical storage and other flammable materials.
- Label all containers with date of purchase. Clearly label all secondary containers. Use older materials first.
- Order for delivery as close to the time of use as possible to reduce the amount of chemicals stored at the facility.
- Order only the amount of materials needed in order to minimize excess or obsolete materials, which require storage and disposal.
- Never leave unlabeled or unstable pesticides and fertilizers in uncontrolled locations.
- Maintain a current written inventory of all pesticides and fertilizers at the storage site.
- Ensure that contaminated waste materials are kept in designated containers and stored in labeled, designated, covered, and contained areas.
- Dispose of excess or obsolete pesticides/fertilizers and associated waste materials in accordance with the manufacturer's specification and all applicable regulations.

Use and Application of Fertilizers

- All fertilizer products manufactured or distributed in the State of Massachusetts must be registered with the Department of Agricultural Resources.
- Perform soil testing before choosing a fertilizer. The quantity of available nutrients already present in the soil will determine the type and amount of fertilizer that is recommended. The soil test will also determine the soil pH, humic matter, texture, and exchangeable acidity, which will indicate whether pH adjustment is required for fertilizer to work efficiently. A soil test should be completed at each facility, as soil type can vary widely within a single community.
    - Soil tests are recommended every 3-4 years for turf and plantings (more frequently for problem or newly planted areas) and every year for soil where phosphorus-containing fertilizers are used. Soil pH tests should be conducted every year for all sites.
    - When collecting soil samples, take multiple samples for each target area at a four-inch depth; mix the samples together in a container and properly label the sample with property information and site use type. Separately sample areas that have discoloration, abnormal plant growth, or other problems. Take the sample at approximately the same time every year. If the area has been fertilized, wait eight weeks after fertilizing to test the soil to ensure nutrients have been absorbed.
- When selecting the optimal type of fertilizer to use on an area, consider the soil test results, type of turf, and type of turf use. Slow-use fertilizer should be used for turf grass.
- Calibrate application equipment regularly to ensure proper application and loading rates.
- Mix fertilizers using clean application equipment under cover in an area where accidental spills will not enter surface water or groundwater and will not contaminate the soil.

- Fertilizers should only be applied by properly trained personnel.
- Never apply fertilizers in quantities exceeding the manufacturer's instructions. Instead, apply small amounts throughout the growing season.
- Time fertilizer application methods for maximum plant uptake, usually in the fall and spring (e.g., between April 15 and October 15). When applying at the beginning and end of planting season, take into consideration the slower uptake rate of fertilizer by plants and adjust the fertilizer application accordingly.
- Never apply fertilizer during a drought, when the soil is dry or frozen, when it is raining, or immediately before expected rain.
- Fertilizer should be applied when the ground temperature is above 55° F.
- Apply fertilizers in amounts appropriate for the type of vegetation to minimize losses to surface water and groundwater. Use the results of the soil test to determine optimal fertilizer timing and application rates.
- Where applicable, till fertilizers into the soil rather than dumping or broadcasting (proper application techniques will depend on the type of soil and vegetation).
- Do not hose down paved areas after fertilizer application if drainage will enter into an engineered storm drain system or drainage ditch.
- Limit irrigation after fertilizer application to prevent runoff (approximately ½ inch of water per application for a week following application).
- Turn off irrigation systems during periods of adequate rainfall.
- Do not over-apply fertilizer in late fall to "use it up" before winter. The effectiveness of fertilizer does not reduce when stored.
- If phosphorus fertilizer is used when re-seeding, mix the phosphorus into the root zone. Do not apply directly to the soil surface.
- Avoid combined products such as "weed and feed," which do not target specific problems at the appropriate time.

Use and Application of Pesticides and Herbicides

The State of Massachusetts has a stringent program for registration of pesticides and certification of those authorized to apply them. Once a pesticide has been approved for use by the USEPA, it must be registered by the Massachusetts Pesticide Board Subcommittee prior to being distributed, purchased, or used in Massachusetts. Pesticide classification in Massachusetts is based on the potential adverse effects the pesticide may have on humans or the environment. "Restricted Use" pesticides can only be sold by Licensed Dealers to Certified Applicators, while "State Limited Use" pesticides may be restricted to use by certain individuals or require written permission from the Department of Agricultural Resources prior to use. Legal application of pesticides must be performed by an individual licensed or certified by the Massachusetts Department of Agricultural Resources. A Commercial Applicator License is required for applying general use pesticides, and a Commercial Applicator Certification is required for applying restricted and state limited use products.

Use and Application of Pesticides

- Pesticides should only be applied by licensed or certified applicators.
- Calibrate application equipment regularly to ensure proper application and loading rates.
- Ensure that pesticide application equipment is capable of immediate shutoff in case of emergency.

- Conduct spray applications according to specific label directions and applicable local regulations.
- Never apply pesticides in quantities exceeding the manufacturer's instructions.
- Apply pesticides at the life stage when the pest is most vulnerable.
- Never apply pesticides if it is raining or immediately before expected rain.
- Establish setback distances from pavement, storm drains, and waterbodies, which act as buffers from pesticide application, with disease-resistant plants and minimal mowing.
- Do not apply pesticides within 100 feet of open waters or of drainage channels.
- Spot treat infected areas instead of the entire location.
- Mix pesticides and clean application equipment under cover in an area where accidental spills will not enter surface water or groundwater and will not contaminate soil.
- Do not hose down paved areas after pesticide application to a storm drain or drainage ditch.
- Recycle rinsate from equipment cleaning back into product.
- Choose the least toxic pesticide that is still capable of reducing the infestation to acceptable levels.
- Use alternatives to pesticides, such as manual weed control, biological controls, and Integrated Pest Management strategies (learn more at: https://www.mass.gov/files/documents/2016/08/wk/ipm-kit-for-bldg-mgrs.pdf).
- For the use of herbicides, reduce seed release of weeds by timing cutting and pesticide application at seed set. Select vegetation and landscaping that is low-maintenance in order to tolerate low levels of weeds without interfering with aesthetics.

Employee Training

- Employees who handle pesticides, fertilizers, and herbicides are trained annually on proper handling and storage procedures.
- Employees are also being trained on stormwater pollution prevention, illicit discharge detection and elimination (IDDE) procedures, and spill and response procedures.
- If services are contracted, the contractor should be given a copy of this and any applicable SOPs to ensure compliance with MS4 regulations.

Related Standard Operating Procedures

- SOP 4: Spill Response and Cleanup
- SOP 17: Hazardous Materials Storage and Handling

SOP 16: Streets and Parking Lots

Introduction

Regular sweeping of streets and municipally-owned parking lots is important for maintaining clean and safe roadways. It also plays a vital role in keeping pollutants like sand, trash, and leaves out of the MS4. The goal of this written Standard Operating Procedure (SOP) is to provide guidance to municipal employees on street and parking lot sweeping procedures and frequencies to reduce the discharge of pollutants to the storm drainage system and receiving waters. If sweeping services are contracted, this SOP should be provided to the contractor. The contract should specify that the contractor is responsible for compliance with all applicable laws.

Streets and municipally-owned parking lots are swept twice per year in the spring and fall. Main roads are swept weekly in the summer.

Procedures

The City of Melrose (City) will implement the following street and parking lot sweeping procedures to reduce the discharge of pollutants from the MS4:

Sweeping Frequency

- All streets should be swept and/or cleaned a minimum of twice per year in the spring and fall (with the exception of rural uncurbed roads with no catch basins or high speed limited access highways).
- Sweep as soon as possible after snow melt and following winter activities such as sanding to capture sand and debris before it is washed into the storm drainage system.
- Consider more frequent sweeping for targeted areas based on pollutant load reduction potential, inspections, pollutant loads, catch basin cleaning or inspection results, land use, impaired waters, or other factors.
- For rural uncurbed roadways with no catch basins and limited access highways, the City will either meet the minimum frequencies above, or develop and implement an inspection, documentation, and targeted sweeping plan outlining reduced frequencies within two (2) years of the effective date of the MS4 Permit, and submit such plan with its year one annual report.
- The City's annual report will include the street sweeping schedule developed above to target areas with high pollutant loads.

Sweeping Practices

- Street sweeping should be conducted in dry weather. Sweeping should not be conducted during or immediately after rain storms.
- Dry cleaning methods should be used whenever possible, with the exception of very fine water spray for dust control. Avoid wet cleaning or flushing of the pavement.
- Continue to enforce city-wide parking bans to facilitate sweeping on busy streets.
- Provide notices to residents via blogs, newspapers, website, and social media prior to sweeping to ensure roads are clear.
- Sweep in a manner that avoids depositing debris into storm drains.

- Sweeping equipment (mechanical, regenerative air, vacuum filter, tandem sweeping) should be selected depending on the level of debris. Brush alignment, sweeper speed, rotation rate, and sweeping pattern should be set to optimal levels to manage debris.
- Routinely inspect and perform maintenance on sweeping equipment to reduce the potential for leaks. See SOP 21: Operations and Maintenance of Municipal Vehicles and Equipment for more information.

Sweepings Reuse and Disposal

- The reuse of sweepings is recommended by MassDEP. If street sweepings are reused (e.g., as anti-skid material or fill in parking lots), they should be properly filtered to remove solid waste, such as paper or trash, in accordance with their intended reuse. All reuse and/or disposal of street sweepings will be managed in accordance with current MassDEP policies and regulations.
- Sweepings intended for reuse can be stored for up to one year in approved temporary storage areas. Storage areas should be protected to prevent erosion and runoff and should be located away from wetland resource areas and buffer zones, surface water, or groundwater.
- Sweepings are classified as solid waste. If not reused, they should be disposed of at solid waste disposal sites.
- For additional information on approved reuses of sweepings and storage/disposal policies, refer to MassDEP policy #BAW-18-001: Reuse and Disposal of Street Sweeping (https://www.mass.gov/files/documents/2018/05/14/street-sweepings.pdf).
- The street sweeping contactror disposes of all sweepings in accordance with all applicable regulations. Any street sweepings collected by the City will be disposed of at the Route 99 facility.

Documentation and Reporting

The following information should be documented and included in each annual report:

- Number of miles cleaned.

Employee Training

- Employees who perform street and parking lot sweeping are trained annually on these procedures and the proper operation of related equipment.
- Employees are also being trained on stormwater pollution prevention, illicit discharge detection and elimination (IDDE) procedures, and spill and response procedures.
- If services are contracted, the contractor should be given a copy of this and any applicable SOPs to ensure compliance with MS4 regulations.

Related Standard Operating Procedures

1. SOP 21: Operations and Maintenance of Municipal Vehicles and Equipment

SOP 17: Hazardous Materials Storage and Handling

Introduction

A hazardous material is any biological, chemical, or physical material with properties that make it dangerous or potentially harmful to human health or the environment. Hazardous materials can be released to the environment in a variety of ways. When hazardous materials come into contact with rain or snow, the pollutants are washed into the storm sewer system and to surface waterbodies and/or groundwater. Hazardous materials associated with municipal facilities and their operations include, but are not limited to, oil, gasoline, antifreeze, fertilizers, pesticides, and de-icing agents and additives.

Municipally owned or managed facilities where hazardous materials are commonly stores and handled include:

- Public works yards
- Wyoming Cemetery

Minimizing or eliminating contact of hazardous materials with stormwater can significantly reduce pollution of receiving waters. Proper hazardous material handling and storage also contributes to employee health, an organized workplace, and efficient operations. The goal of this written Standard Operating Procedure (SOP) is to provide guidance to municipal employees to help prevent stormwater pollution resulting from the handling and storage of hazardous materials. If services are contracted, this SOP should be provided to the contractor. The contract should also specify that the contractor is responsible for compliance with all applicable laws.

The City of Melrose, MA (City) undertakes various activities in regards to handling and storing hazardous materials.

Procedures

The City will implement the following procedures for handling and storing hazardous materials to reduce the discharge of pollutants to the MS4:

Handling, Loading, and Unloading

- Avoid loading/unloading materials in the rain and/or provide cover.
- Retrace areas where materials have been transferred to identify spills. If spills are found, immediately clean them up. Follow procedures in SOP 4: Spill Response and Cleanup.
- Time delivery and handling of materials during favorable weather conditions whenever possible (e.g., avoid receiving loads of sand during windy weather).
- Inspect containers for material compatibility and structural integrity prior to loading/unloading any raw or waste materials.
- Use dry cleanup methods (e.g., squeegee and dust pan, sweeping, and absorbents as last step) rather than hosing down surfaces.

Material Storage

- Confine material storage indoors whenever possible. Plug or disconnect floor drains that lead to the

stormwater system.

- Confine outdoor material storage to designated areas that are covered, on impervious surfaces, away from high traffic areas, and outside of drainage pathways.
- Store containers on pallets or equivalent structures to facilitate leak inspection and to prevent contact with wet floors that can cause corrosion. This technique also reduces incidences of container damage by insects and rodents.
- Store materials and waste in materially compatible containment units.
- Keep hazardous materials in their original containers.
- If materials are not in their original containers, clearly label all storage containers with the name of the chemical, the expiration date, and handling instructions.
- Maintain an inventory of all raw and waste materials to identify leakage. Order new materials only when needed.
- Provide sufficient aisle space to allow for routine inspections and access for spill cleanup.
- Inspect storage areas for spills or leaks and containment units for corrosion or other failures.

Waste Treatment, Disposal, and Cleanup

- Adopt a regular schedule for the pick-up and disposal of waste materials.
- Recycle leftover materials whenever possible.
- Substitute nonhazardous or less-hazardous materials for hazardous materials whenever possible.
- Protect empty containers from exposure to stormwater and dispose of them regularly to avoid contamination from container residues.

Employee Training

- Employees who handle and use hazardous materials are trained annually on these procedures.
- Employees are also being trained on stormwater pollution prevention, illicit discharge detection and elimination (IDDE) procedures, and spill and response procedures.
- If services are contracted, the contractor should be given a copy of this and any applicable SOPs to ensure compliance with MS4 regulations.

Related Standard Operating Procedures

1. SOP 4: Spill Response and Cleanup

SOP 21: Operations and Maintenance of Municipal Vehicles and Equipment

Introduction

Regular maintenance of both municipal and contracted vehicles and heavy equipment not only prolongs the life of municipal assets but also helps reduce the potential for leaking of fluids associated with normal wear and tear. Potential pollutants include fuels, oil, antifreeze, brake fluid, solvents, and battery acid. The goal of this written Standard Operating Procedure (SOP) is to provide guidance to municipal employees to help reduce the discharge of pollutants from the MS4 as a result of leaks from vehicles and equipment. If services are contracted with respect to vehicles and equipment, this SOP should be provided to the contractor. The contract should also specify that the contractor is responsible for compliance with all applicable laws.

The City of Melrose, MA (City) undertakes various procedures in regards to its municipal vehicles and equipment.

The Department of Public Works (DPW) stores and maintains all fleet vehicles at the City Yard, located at 72 Tremont Street. The DPW performs vehicle and equipment maintenance and repair inside the DPW Garage. The garage is equipped with floor drains that are believed to discharge to the oil-water separator and eventually to the sewer system. All fluids used for vehicle maintenance, including antifreeze, motor oil, hydraulic fluid, and others are properly stored within the DPW Garage. The DPW performs maintenance on its own fleet, the police department's fleet, and the smaller vehicles in the fire department's fleet.

Vehicle washing is conducted outside in the southern portion of the site. Vehicles and equipment are washed over a catch basin which drains to the oil-water separator before discharging to the drain on Tremont Street. The oil-water separator is pumped annually by an outside contractor. Some newer and smaller vehicles are brought to a car wash.

Within two years of the effective date of the MS4 Permit, the City will create an inventory of all municipal vehicles and equipment and update this inventory annually (refer to the attached vehicles and equipment inventory template).

Procedures

The City will implement the following procedures for municipally owned and operated vehicles and equipment to reduce the discharge of pollutants from the MS4:

Vehicle and Equipment Maintenance

Vehicle Storage

- Monitor vehicles and equipment for leaks and use drip pans as needed until repairs can be performed.
- When drip pans are used, avoid overtopping.
- Drain fluids from leaking or wrecked vehicles and parts as soon as possible. Dispose of fluids

properly.

- Store and park vehicles on impervious surfaces and/or under cover or indoors whenever possible.

Vehicle Maintenance

- Conduct routine inspections of heavy equipment and vehicles to proactively identify maintenance needs or potential leaks.
- Perform routine preventive maintenance to ensure heavy equipment and vehicles are operating optimally.
- Recycle or dispose of waste properly and promptly.
- Sweep and pick up trash and debris as needed.
- Do not dump any liquids or other materials outside, especially near or in storm drains or ditches.

Fueling

- The gasoline fueling area owned or operated by the municipality is covered. However, the diesel fueling area is not.
- Fueling areas should be evaluated to ensure that pollutants (e.g., gasoline or oil) do not enter the MS4. Follow the procedures in SOP 7: Fuel and Oil Handling.

Material Management

- Store materials and waste in labeled containers under cover and in secondary containment.
- Chemicals should not be combined in containers.
- Hazardous waste must be labeled and stored according to hazardous waste regulations. Follow the procedures in SOP 17: Hazardous Materials Storage and Handling.
- Carefully transfer collected fluids from containers into designated storage areas as soon as possible.
- Store new and used batteries securely to avoid breakage. Store indoors or in secondary containment to contain potential acid leaks. Recycle used batteries.
- Conduct periodic inspections of storage areas to detect possible leaks.
- Do not wash or hose down storage areas unless there is prior approval to collect and discharge the water into the sanitary sewer. Use dry cleanup methods whenever possible.
- Keep lids on containers. Store them indoors or under cover to reduce exposure to rain.
- Inspect and maintain all pretreatment equipment, including interceptors, according to the manufacturer's maintenance schedule and at least once per year.
- Proper spill protocol should be followed to prevent chemicals from entering the stormwater system. Follow the procedures in SOP 4: Spill Response and Cleanup.

Parts Cleaning

- Use designated areas for engine, parts, or radiator cleaning. Do not wash or rinse parts outdoors. If parts cleaning equipment is not available then capture parts cleaning fluids.
- Recycle cleaning solution. Never discharge waste to the sanitary sewer or storm sewer.
- Use steam cleaning or pressure washing of parts instead of solvent cleaning. Cleaning equipment must be connected to an oil/water interceptor prior entering the sanitary sewer.
- When using solvents for cleaning, drain parts over the solvent tank to avoid drips to the floor. Catch excess solutions and divert them back to tank. Allow parts to dry over the hot tank.

Vehicle and Equipment Washing

Vehicle washing can result in the discharge of nutrients, sediment, petroleum products, and other contaminants to a surface water body or to a stormwater system. The MS4 Permit does not authorize the discharge of municipal vehicle washing byproducts into the MS4.

Outdoor Vehicle Washing Procedures

Outdoor washing of municipal vehicles should be avoided unless wash water is contained in a tight tank or similar structure. Where no alternative wash system is available, and full containment of wash water cannot be achieved, adhere to the following procedures:

- Avoid discharge of any wash water directly to the storm drainage system or surface water (e.g., stream, pond, or drainage swale)
- Minimize the use of water to the extent practicable.
- Where the use of detergent cannot be avoided, use products that do not contain regulated contaminants. The use of a biodegradable, phosphate-free detergent is preferred.
- Do not use solvents except in dedicated solvent parts washer systems or in areas not connected to a sanitary sewer.
- Do not power wash, steam clean, or perform engine or undercarriage cleaning.
- Grassy and pervious (porous) surfaces may be used to promote direct infiltration of wash water, providing treatment before recharging groundwater and minimizing runoff to an adjacent stormwater system. Pervious surfaces or other infiltration-based systems should not be used within wellhead protection areas or within other protected resources.
- Impervious surfaces discharging to the storm drainage system should not discharge directly to a surface water unless treatment is provided. The treatment device should be positioned such that all drainage must flow through the device, preventing bypassing or short-circuiting.
- Periodic sweeping and/or cleaning should be completed to prevent accumulation from forming on the washing area.
- Maintain absorbent pads and drip pans to capture and collect spills or noticeable leaks observed during washing activities. Follow the procedures in SOP 4: Spill Response and Cleanup.
- Heavily soiled vehicles or vehicles dirtied from salting or snow removal efforts should follow the SOPs in the "Heavy Equipment Washing Procedures" below.

Indoor Vehicle Washing Procedures

- Vehicles and equipment should be washed inside whenever possible to reduce runoff to the stormwater system.
- Where the use of detergent cannot be avoided, use products that do not contain regulated contaminants. The use of biodegradable, phosphate-free detergent is preferred.
- Detergents should not be used in areas where oil/water separators provide pre-treatment of drainage.
- Floor drains should be connected to a sanitary sewer or tight tank. Floor drains discharging to adjacent surface water bodies or engineered storm drain systems should be permanently plugged or otherwise abandoned before any vehicle wash activities are completed.
- Designate separate areas for routine maintenance and vehicle cleaning. This helps prevent contamination of wash water by motor oils, hydraulic lubricants, greases, or other chemicals.

- Dry cleanup methods are recommended within garage facilities. Do not wash down floors and work areas with water.
- Bring smaller vehicles to commercial washing stations.
- Maintain absorbent pads and drip pans to capture and collect spills or noticeable leaks observed during washing activities. Follow the procedures in SOP 4: Spill Response and Cleanup.

Heavy Equipment Washing Procedures

- Mud and heavy debris removal should occur on impervious surfaces or within a retention area.
- Maintain these areas with frequent mechanical removal and proper disposal of waste.
- Impervious surfaces with engineered storm drain systems should not discharge directly to a surface water.
- Floor drains should be connected to a sanitary sewer or tight tank. Floor drains discharging to adjacent surface waterbodies or engineered storm drain systems should be permanently plugged or otherwise abandoned before any vehicle wash activities are completed.
- Where the use of detergent cannot be avoided, use products that do not contain regulated contaminants. The use of biodegradable, phosphate-free detergent is preferred.y
- Detergents should not be used in areas where oil/water separators provide pre-treatment of drainage.
- Maintain absorbent pads and drip pans to capture and collect spills or noticeable leaks observed during washing activities. Follow the procedures in SOP 4: Spill Response and Cleanup.

Engine and Steam Washing Procedures

- Do not wash parts outdoors.
- Maintain drip pans and smaller containers to contain motor oils, hydraulic lubricants, greases, etc. and to capture and collect spills or noticeable leaks observed during washing activities, to the extent practicable. Follow the procedures in SOP 4: Spill Response and Cleanup.
- Where use of detergent cannot be avoided, use products that do not contain regulated contaminants. The use of a biodegradable, phosphate-free detergent is preferred.
- Avoid cleaning with solvents except in dedicated solvent parts washer systems. Make use of pressure washing and steam cleaning.
- Recycle clean solutions and rinse water to the extent practicable.
- Wash water should discharge to a tight tank or a sanitary sewer via an oil/water separator. Detergents should not be used in areas where oil/water separators provide pre-treatment of drainage.

Employee Training

- Employees who perform work on/with municipal vehicles or equipment are trained annually on these procedures and the proper operation of related equipment.
- Employees are also being trained on stormwater pollution prevention, illicit discharge detection and elimination (IDDE) procedures, and spill and response procedures.
- If services are contracted, the contractor should be given a copy of this and any applicable SOPs to ensure compliance with MS4 regulations.

Attachments

1. Inventory of Municipal Vehicles and Equipment

Related Standard Operating Procedures

1. SOP 4: Spill Response and Cleanup
2. SOP 7: Fuel and Oil Handling
3. SOP 17: Hazardous Material Storage and Handling

Department of Public Works - Fleet Vehicles

Melrose, MA
September 2020

Vehicle #	YEAR	MAKE	USE	REG #
1	2008	Chevrolet Trailblazer	Director of Public Works	M-36
2	2007	Chevrolet Colorado PU	City Engineer Pickup	M-2405A
3	2007	Chevrolet Tahoe	Operations Manager	M-97635
4	2017	Chevrolet 2500 Cargo Van	Water Meter Technician Van	M-98647
5	2019	Ford F-350	Sewer Pickup	M-5483A
6	2010	Chevrolet 3500 Dump	Water Division Dump	M2386A
7	2019	Ford F 350	Highway Division Extended Cab	M5869A
8	2004	Chevrolet 2500 PU	Water Division Foreman	M-68941
9	2004	International VT365	Water Division Work Site Truck	M-69678
10	2000	Chevrolet 1500 PU	Highway Division Pickup	M-2403A
11	2020	Ford F-550	Water Utility Truck	
12	1995	Ingersoll P250 Compressor	Water & Sewer Division	M-6153
13	2012	John Deere 3520 Tractor	Green Team Tractor	M-87228
14	2017	John Deere Gator TX	Cemetery Gator	NA
15	2005	International	Sanitation Recycling Metal Dump	M-92938
17	2000	International Roll Off	Misc. Roll-off Truck	M2475A
18	2010	International Packer	Sanitation Division Packer	M-78104
19	2020	Frieghtliner Dump/Spreader	Highway Dept/ Heated Body	M-4894A
20	2019	Frieghtliner Dump/Spreader	Water Dept/ Heated Body	M-3994A
21	1999	International Dump	Highway Division Dump/Spreader	M-80986
22	2017	Chevrolet Crew Cab Pickup	Forestry Division Pickup	M-97339
23	2016	Freightliner 114SD Vactor	Sewer Division Vac Truck	M-95535
24	2015	International Dump/Spreader	Highway Dump/Spreader	M-91825
25	2017	Frieghtliner Dump/Spreader	Highway Division Dump/Spreader	M-96854
26	2005	International Packer	Sanitation Division Packer	M-72753
27	1999	International Packer	Sanitation Division Packer	M-80984
28	2004	International Spreader	Highway Division Spreader	M-94594
29	1997	International Spreader	Highway Division Spreader	M-80985
30	2015	International Dump	Highway Division Dump/Spreader	M-91389
31	2006	International Dump	Forestry Division Dump	M-72125
32	2018	Freightliner Dump/Spreader	Water Division Dump/Spreader/Vivbroter	M-97907
33	2012	Chevrolet 3500 Dump	Parks Division Dump	M-2402A
34	2007	International Bucket Truck	Forestry Division Bucket Truck	M-74064
35	2012	Chevrolet 3500 Dump	Parks Division Dump	M-84665
36	2014	Bobcat S590	Highway Division Bobcat	M-92193
37	2012	Wacker RD12A Roller	Highway Division Roller	NA
38	2009	Chevrolet 3500 Dump	Forestry Division Dump	M3325A
39	1998	Chevrolet 1500 PU	Facilities Pick up	M2404A
40	2004	Chevrolet 1500 Cargo Van	Facilities Van	M71842
41	2016	Prinoth (Bombadier) SW 4S	Sidewalk Tractor	M-97326
42	2011	Case Backhoe	Water Division 4x4 Backhoe	M-87603
43	2015	Chevrolet 2500HD PU	Water/Sewer Foreman	M-91681
44	2004	Elgin Pelican Sweeper	Highway Division	M-87768
46	1999	Ford F250SD Pickup	Cemetery Division Pickup	M-89830
47	2011	Chevrolet 3500 Dump	Cemetery Division Dump	M-85396
48	2009	Chevrolet 3500 Dump	Cemetery Division Dump	M-82340
49	2019	Case Backhoe	Water Dept.	M-5558A
50	1997	Case Backhoe	Cemetery Division 4x4 Backhoe	M-78598

Department of Public Works - Fleet Vehicles

Melrose, MA
September 2020

Vehicle #	YEAR	MAKE	USE	REG #
51	2001	Ford Ambulance	Fleet Division Roadside	M-93051
53	2001	Airman Compressor	Highway Division Air Compressor	M-66011
54	2019	Ford F-350	Facilities Rack Body	M-5482A
55	2005	Chevrolet 3500 Dump	Sewer Division Dump	M-74160
56	2006	Ford F350 SD	Facility Utility	M-6094
57	2001	Ford F350 SD	Facility Dump (Carpenter)	M-66443
58	2008	Ford F350 SD	School Spreader	M-79733
59	2007	Chevy Colorado	Facility Box (Electrician)	M-77188
61	1978	Snowmaster	Snow Blower	M-78599
62	2008	Prinoth (Bombardier) SW 4S	Sidewalk Tractor	M-2398A
63	2015	Prinoth (Bombadier) SW 4S	Sidewalk Tractor	M-91512
64	1997	Ford F350 Utility/Boom	Highway Bucket Truck	M-58086
65	2010	Chevrolet Dump	Highway Division Dump	M-84565
66		Gormann/Rupp	Sewer Pump (6")	NA
67		Gormann/Rupp	Sewer Pump (6")	NA
68	2017	Vermeer Chipper	Forestry Division Chipper	M-97947
76	2017	John Deere 544K Loader	Loader	M-96853
77	1997	Volvo L90C Loader	Highway Division Loader	M-78595
78	2006	John Deere 544J Loader	Operations Loader	M-74172
79	2002	Ford Escape	Engineers Car	M-93654
80	2015	Ford Focus (electric)	Engineers Car	M-92932
81	2016	Ford Focus (electric)	City Hall	M-99401
82	2017	Ford E350 Super Duty	Council on Aging	M-96651
83	2013	Ford E350 Super Duty	Council on Aging	M-86062
97	1996	Cross Country Trailer	Paint Machine Trailer	M-63249
98	2000	Tilt Trailer	Utility Trailer	M-64068
99	2007	Sullair 185 air compressor	Water & Sewer Division Compressor	M-47110
V-1	2012	Giant Vac	Big Vac with box	M-87227
V-2	2012	Giant Vac	Vac without box	M-84463
HT-1	2016	Carry-on	Utility Trailer	M-96453
T-1	2012	Carmate Trailer	Landscape Trailer	M-82728
T-2	2012	Carmate Trailer	Landscape Trailer	M-82727
T-3	2012	Carry-on	Utility Trailer	M-87447
T-5	2012	Carmate Trailer	Water Dept Trailer	M-87248
n/a	2000	ALLU Composting Bucket	Sanitation Recycling	NA
MB-1	2010	Message Trailer	Highway Division	M-83653
MB-2	2012	Message Trailer	Highway Division	M-87247
MB-3	2019	Message Trailer	Highway Division	M3976A
MB-4	2019	Message Trailer	Highway Division	M3977A
LT-1	2019	Light Tower	Water Division	M3300A
R-1	2000	Ford Ecovan	Rec Dept Van	M-90284
R-2	2008	Ford Ecovan	Rec Dept. Van	
R-3	2013	Turtle Utilty Trailer	Concession Trailer	No Reg
P-1	2016	Toyota Tacoma	Parks Dept Pickup (Joan Bell)	M-94388
BC-1	2008	Chevrolet Trailbrazer	Building Commissioner	M-79729
AC-1	2010	Ford Transit Connect	Animal Control	M-85564
W-1	1996	Ford Ranger	Wire Pickup	M-50231

Department of Public Works - Fleet Vehicles

Melrose, MA
September 2020

Vehicle #	YEAR	MAKE	USE	REG #
Fire C1	2010	Ford Explorer	Fire Chief	F- 36
Fire C2	2001	Ford Exursion	Shift Captain/ Fire Prevention	F- 3599
Fire C3	2017	Ford Expedition	Shift Captain	F-C220
Fire K1	2015	Ford Focus (electric)	Fire Prevention	F-841
Eng 5	1999	Ford F350 PU	Brush Truck	F-7847
Alarm 1	1998	International 4700	Fire Alarm Bucket Truck	F-5352
MC1	2013	Harley FLHTP	Police Motorcycle	
S80	2016	Chevy Tahoe	Police Supervisor	
82	2013	Ford Explorer	Police Cruiser	
83	2017	Ford Explorer	Police Cruiser	
84	2013	Ford Explorer	Police Cruiser	
85	2013	Ford Explorer	Police Cruiser	
86	2017	Ford Explorer	Police Cruiser	
87	2013	Ford Explorer	Traffic Unit	
88	2017	Ford Explorer	Police Cruiser	
89	2017	Ford Explorer	K9 Unit	
D1240	2008	Chevy Tahoe	Detective	
D1241	2011	Ford Fusion	Police Detective	
D1242	2011	Ford Fusion	Police Detective	
D1243	2011	Ford Crown Victoria	Prosecutor's Car	
A1249	2013	Ford Taurus	Mark Decroteau	
A1250	2016	Ford Taurus	Police Chief	
1	2010	Dodge Van	School Transportation	
2	2010	Dodge Van	School Transportation	
3	2010	Dodge Van	School Transportation	
4	2014	Dodge Van	School Transportation	
5	2010	Dodge Van	School Transportation	
6	2014	Ford Van	School Transportation	
7	2010	Dodge Van	School Transportation	
8	2010	Dodge Van	School Transportation	
9	2014	Dodge Van	School Transportation	
10	2014	Dodge Van	School Transportation	
11	2014	Dodge Van	School Transportation	
12	2014	Dodge Van	School Transportation	
14	2010	Dodge Van	School Transportation	
15	2014	Dodge Van	School Transportation	
16	2012	Dodge Van	School Transportation	
17	2014	Dodge Van	School Transportation	
18	2014	Ford Van	School Transportation	
19	2010	Dodge Van	School Transportation	
25	2006	Ford Van	School Transportation	

Standard Operating Procedures *Melrose, MA* *Department of Public Works* Snow Removal and De-Icing	**SOP NUMBER:**	**ISSUE DATE:**

APPROVED BY:

_____

Elena Proakis Ellis, P.E. BCEE, Director of Public Works

MA SMALL MS4 PERMIT REQUIREMENT SUMMARY:

Part 2.3.7.a.iii.5.
The permittee shall establish and implement procedures for winter road maintenance including the use and storage of salt and sand; minimize the use of sodium chloride and other salts, and evaluate opportunities for use of alternative materials; and ensure that snow disposal activities do not result in disposal of snow into waters of the United States. For purposes of this MS4 Permit, salt shall mean any chloride-containing material used to treat paved surfaces for deicing, including sodium chloride, calcium chloride, magnesium chloride, and brine solutions.

Personnel

The following personnel are responsible for snow and ice removal. Employees performing the procedures in this SOP shall attend yearly stormwater pollution prevention training.

TABLE 1

Name	Responsibility
Elena Proakis Ellis, P.E. BCEE	DPW Director
Joe Hobbs	DPW Operations Manager
Varies	DPW Operations General Foremen

Equipment

The municipality owns and maintains ice control and snow removal equipment listed in Table 2. Equipment maintenance shall be conducted consistent with the Vehicles and Equipment maintenance SOP found here: SOP21: Operations and Maintenance of Municipal Vehicles and Equipment. The wash bay/ area is located at: DPW City Yard, 72 Tremont Street, Melrose, MA

Plowing
When conditions warrant, plows are installed on the 17 larger trucks to move snow from the traveled roadway. Average time to install a plow is approximately *30* minutes. 4 smaller trucks are available for plowing of residential streets and clearing public lots.

Salt Spreaders and Pre-Wetting Devices
When conditions warrant, salt spreaders are installed on 11 trucks to spread salt on the traveled roadway. Each salt spreader is calibrated prior to the deicing season. Salt application shall be calibrated on a case by case basis depending on the topography of the neighborhood and the specifics of the storm. *6* trucks are

equipped with pre-wetting chemical (Magic Minus) tanks which are calibrated prior to the deicing season. Pre-wetting application shall be calibrated to dispense rates **6-8** gallons of pre-wet liquid to 1 ton of salt.

Materials

The major materials are used in snow and ice control are coarse salt and a pre-wetting chemical. These materials are stockpiled in advance of an event and are immediately available when needed and stocks are replenished between events.

Salt
Salt is used to expedite the melting of snow and ice from the street surface and also to keep the ice from forming a bond to the street surface. Approximately 700 tons of Rock Salt are anticipated to be used per year and are ordered from a competitively bid contract with 2 or 3 selected vendors prior to each deicing season. Salt is stored in the covered facility located at: DPW City Yard, 72 Tremont Street, Melrose, MA. Loading areas and yards are swept weekly to prevent salt build-up and run-off.

Pre-Wetting Chemical
Approximately 50 gallons of Magic Minus is estimated to be needed for pre-wetting. These chemicals are stored at the DPW City Yard in 250 gallon totes in a 1,000 gallon storage tank equipped with appropriate spill control withing the salt shed.

Procedures

Pretreatment (anti-icing)

1. Whenever possible, the pretreatment mix is applied to the roadway prior to the beginning of a storm to prevent snow from bonding to the roadway surface, and also used when heavy frost or black ice is expected to be an issue for commuters. The operations manager will instruct staff when pretreatment is appropriate. Pretreatment will be done prior to a large snow storm or when pavement temperatures are below 25 degrees F.
2. Prior to pretreatment application, equipment will be checked to ensure proper working order and ensure proper calibration of equipment. All fluid levels will be checked and filled to proper levels, all lights must be in working order. A visual walk-around inspection of the truck or equipment must be made. Any repairs must be made and reported to a supervisor or mechanic before leaving the yard.
3. Pretreatment will be applied to priority routes and secondary routes as needed.
4. Pretreatment vehicle optimal speed is 20-25 MPH.

Salt Application

1. Prior to salt application, equipment will be checked to ensure proper working order and ensure proper calibration of equipment. All fluid levels will be checked and filled to proper levels, all lights must be in working order. A visual walk-around inspection of the truck or equipment must be made. Any repairs must be made and reported to a supervisor or mechanic before leaving the yard.

2. Salting will not be done when pavement temperatures are above 40 degrees F, and salt application is reduced when temperature is >32 degrees F.
3. The standard salt application speed is: 20-25 mph.
4. Maps of the routes are located at the DPW City Yard.
5. Washing snow removal equipment is performed at the DPW City Yard upstream of the oil/water separator.

Snow Plowing

1. As the storm develops and 2 to 3 inches of snow has accumulated, all of the drivers and available equipment will begin to plow their assigned routes.
2. Prior to plowing operations, equipment will be checked to ensure proper working order. All fluid levels will be checked and filled to proper levels, all lights must be in working order. A visual walk-around inspection of the truck or equipment must be made. Any repairs must be made and reported to a supervisor or mechanic before leaving the yard.
3. Avoid plowing, pushing, blowing or storing excess snow, deicer, or other debris in or near creeks, watercourses or storm drainage systems.
4. Reduce plowing speed in sensitive areas (near creeks, wetlands or other water courses) to prevent snow and deicing materials from entering waterways.
5. The standard plowing speed is: 20-25 mph.
6. Maps of the routes are located at the DPW City Yard.

Record Keeping and Documentation

1. Maintain a master schedule of prioritized snow and sanding routes and the miles or roads plowed or sanded. DPW City Yard, 72 Tremont Street, Melrose, MA
2. Keep copies of manufacturer's recommendations for equipment calibration, plowing speed and salt/sand application rates. DPW City Yard, 72 Tremont Street, Melrose, MA
3. Keep records of the amounts of salt and pre-wetting chemical applied per season. DPW City Yard, 72 Tremont Street, Melrose, MA
4. Keep a list of all employees trained in the facility's Stormwater Pollution Prevention binder or computer file.

Public Works Snow Removal Fleet

Melrose, MA
September 2020

Vehicle #	YEAR	MAKE	USE	REG #
5	2019	Ford F-350	Sewer Pickup	M-5483A
8	2004	Chevrolet 2500 PU	Water Division Foreman	M-68941
11	2020	Ford F-550	Water Utility Truck	
19	2020	Frieghtliner Dump/Spreader	Highway Dept/ Heated Body	M-4894A
20	2019	Frieghtliner Dump/Spreader	Water Dept/ Heated Body	M-3994A
21	1999	International Dump	Highway Division Dump/Spreader	M-80986
24	2015	International Dump/Spreader	Highway Dump/Spreader	M-91825
25	2017	Frieghtliner Dump/Spreader	Highway Division Dump/Spreader	M-96854
28	2004	International Spreader	Highway Division Spreader	M-94594
29	1997	International Spreader	Highway Division Spreader	M-80985
30	2015	International Dump	Highway Division Dump/Spreader	M-91389
32	2018	Freightliner Dump/Spreader	Water Division Dump/Spreader/Vivbroter	M-97907
33	2012	Chevrolet 3500 Dump	Parks Division Dump	M-2402A
35	2012	Chevrolet 3500 Dump	Parks Division Dump	M-84665
38	2009	Chevrolet 3500 Dump	Forestry Division Dump	M3325A
41	2016	Prinoth (Bombadier) SW 4S	Sidewalk Tractor	M-97326
42	2011	Case Backhoe	Water Division 4x4 Backhoe	M-87603
43	2015	Chevrolet 2500HD PU	Water/Sewer Foreman	M-91681
46	1999	Ford F250SD Pickup	Cemetery Division Pickup	M-89830
47	2011	Chevrolet 3500 Dump	Cemetery Division Dump	M-85396
48	2009	Chevrolet 3500 Dump	Cemetery Division Dump	M-82340
49	2019	Case Backhoe	Water Dept.	M-5558A
50	1997	Case Backhoe	Cemetery Division 4x4 Backhoe	M-78598
54	2019	Ford F-350	Facilities Rack Body	M-5482A
55	2005	Chevrolet 3500 Dump	Sewer Division Dump	M-74160
56	2006	Ford F350 SD	Facility Utility	M-6094
57	2001	Ford F350 SD	Facility Dump (Carpenter)	M-66443
58	2008	Ford F350 SD	School Spreader	M-79733
62	2008	Prinoth (Bombardier) SW 4S	Sidewalk Tractor	M-2398A
63	2015	Prinoth (Bombadier) SW 4S	Sidewalk Tractor	M-91512
65	2010	Chevrolet Dump	Highway Division Dump	M-84565
76	2017	John Deere 544K Loader	Loader	M-96853
77	1997	Volvo L90C Loader	Highway Division Loader	M-78595
78	2006	John Deere 544J Loader	Operations Loader	M-74172

Standard Operating Procedures

Melrose, MA

Department of Public Works

Parks and Open Space Management

Issue Date:

Approved by:

_____

Elena Proakis Ellis, P.E. BCEE, Director of Public Works

MA Small MS4 General Permit Requirement Summary:

Part 2.3.7.a.i.

Within two (2) years from the effective date of the permit, the permittee shall develop, if not already developed, written (hardcopy or electronic) operations and maintenance procedures for [Parks and open space]. These written procedures shall be included as part of the SWMP.

Part 2.3.7.a.ii.1.

Establish procedures to address the proper use, storage, and disposal of pesticides, herbicides, and fertilizers including minimizing the use of these products and using only in accordance manufacturer's instruction. Evaluate lawn maintenance and landscaping activities to ensure practices are protective of water quality. Protective practices include reduced mowing frequencies, proper disposal of lawn clippings, and use of alternative landscaping materials (e.g., drought resistant planting). Establish pet waste handling collection and disposal locations at all parks and open space where pets are permitted, including the placing of proper signage concerning the proper collection and disposal of pet waste. Establish procedures to address waterfowl congregation areas where appropriate to reduce waterfowl droppings from entering the MS4. Establish procedures for management of trash containers at parks and open space (scheduled cleanings; sufficient number). Establish procedures to address erosion or poor vegetative cover when the permittee becomes aware of it; especially if the erosion is within 50 feet of a surface water.

Municipal Parks and Open Space Inventory

The following is a list of properties covered by these procedures. This inventory shall be updated annually during SWMP review.

Park	Address/Location	Lawn Mowing	Landscaping	Fertilizing	Pesticide/Herbicide	Trash mgmt.	Pet waste mgmt.	Waterfowl mgmt. (where necessary)	Other maintenance:
See attached list		X	X	X	X	X	X	X	

Standard Operating Procedures *Melrose, MA* *Department of Public Works* **Parks and Open Space Management**	**Issue Date:**

Personnel

The following personnel are responsible for municipal parks and open space management. Employees performing the procedures in this SOP shall attend annual stormwater pollution prevention training.

Name	Responsibility
Mike Sasso	Parks and Forestry Foreman
Carmen Sorrentino	Parks and Forestry Foreman

Lawn Mowing

Occurs at the following parks: All locations.

On the following schedule:

Responsible Personnel: Parks and Forestry Division

Standard Operating Procedures:

→ Lawns shall be mowed to a height of 2 ½"

→ Mowing pattern shall vary to prevent ruts and promote even growth.

Pesticide, Herbicide, and Fertilizer Use

All pesticide, herbicide, and fertilizers are applied by an outside contractor in accordance with all state regulations.

No chemicals are stored on City property.

Other Landscaping

Involves the following *:*

- Weeding
- Planting/reseeding
- Pruning
- Leaf litter removal

Occurs at the following parks: All locations.

On the following schedule: Varies as needed.

Responsible Personnel: Parks and Forestry Division.

Standard Operating Procedures:

→ Landscaping waste shall be disposed of at the DPW City Yard so as to avoid entering the storm drain system.

→ Weeding shall be done manually where possible to reduce herbicide use.

→ Leaf litter shall be disposed of at the DPW City Yard so as to avoid entering the storm drain system.

Trash Management

Trash cans and/or dumpsters are located at the following parks: All locations.

Emptying and replacing bags/inspecting for leaks shall take place on the following schedule: Daily

Responsible Personnel: Sanitation Department

Additional trash cans or other necessary equipment shall be ordered by the Sanitation Department based on the results of park inspections.

Parks shall be inspected and cleaned for litter on the following schedule: Daily

Responsible personnel: Sanitation Department

Pet waste receptacles and/or bags are located at the following parks: All locations.

Additional pet waste receptacles, signage, bags, etc. shall be ordered by the Sanitation Department based on the results of park inspections.

Other Park Management

Procedures for addressing waterfowl congregation and waste at specific parks:
Choose and explain one or several options: (signage related to feeding geese) (decoys) (tall grasses near waterbodies or other structural changes) (dogs) (audio repellant) (other)

Specific Parks:

Responsible personnel: Parks and Forestry Division

Procedures for washing or cleaning park impervious surfaces:

- Sweep monthly

Specific Parks: All impervious surfaces

Responsible personnel: Highway department

Procedures for correcting areas experiencing erosion:

- Temporary stabilization measures
- Sediment and erosion control measures
- Re-establish grass or native plants

Parks and Open Space - Melrose, MA

		LOCATIONS	DESCRIPTION	
	Beebe Estate	West Foster Street	municipal building grounds	
	Bellevue Island	Bellevue Ave. and Lynn Fells Parkway	large traffic island w/ memorial	
	Belmont Island	Belmont St. and Melrose St.	municipal open space	
	Belmont Lot	Belmont St. and Franklin St.	parkling lot, unpaved	
	Berwick Street Islands	Berwick Street along RR Tracks	passive traffic islands	
	Bishop Park	Trenton St. and Washington St.	large traffic island w/ memorial	
	Bowden Park	West Emerson St. and Vinton St.	passive park w/ benches, small traffic island	
	Boylen Island	Green St. and Howard St.	small traffic island	
	Cedar Park Island	South Cedar Park	smal traffic island	
	Cedar Park Lot	South Cedar Park along Rail Road Tracks	parking lot	
	Central Fire Stration	Main Street	municipal building grounds	
	City Hall Building & Parking Lot	Main St.	municipal building grounds	
	Colby Park	Lynn Fells Parkway and Larchmont Rd.	large passive park	
	Common	East Foster, Sixth, Laurel, & Larrabee St.	2 softball fields, tot lot, b-ball ct., rec area	
	Conant Field	Baxter St. and Conant Rd.	2 baseball fields, batting cage, tot lot, b-ball ct.	
	Crystal St Tennis Cts	Crystal St. and Lynn Fells Parkway	Tennis Courts/ Grass	
	DesForges Park	Crystal St. adjacent Tennis Cts.	passive park w/ benches	
	Dills Court Lot	West Foster St behind Shaws, CVS & Elks	parking lot	
	Drinkwater Tot Lot	East End of Porter St	small tot lot	
	Dunton Park	Franklin St. and Pratt St.	small park w/ tot lot	
	Eastman Place Lot	Eastman Place to , rear of Starbucks	parking lot	
	Ell Pond Park	Main St. opposite Livermore Lot	passive park with gazebo, benches, memorial	
	Engine 1	Main St	municipal building grounds	
	Engine 2	Tremont Street	municipal building grounds	
	Engine 3	East Foster Street	municipal building grounds	
	Foss Park	Lynde St. and Malvern Street	t-ball field, tot lot, b-ball ct.	
	Franklin Field	Greenleaf Place behind Franklin School	2 soccer fields, tot lot	
	Franklin School	Main Street and Franklin Street	school grounds, parking lot & playground	
	Fred Green Football Field Grounds	Tremont St. west of M.H.S.	exterior grounds around field	
	Fred Green Multi-Purpose Turf Field	west of Middle School	turf field sweeing, grooming & marking	
	Friends Parking Lot	E. Foster & Grove behind Papa Ginos	parking lot, traffic islands	
	Gooch Park	Maple St. and Florence St.	tot lot, b-ball ct., open space	
	Greenleaf Place Lot	Greenleaf Place behind Franklin Field	parking lot	
	Hesseltine Park	Ruggles St. and Hesseltine Aven	baseball field, tot lot, b-ball ct., school grounds	
	High School	Lynn Fells Parkway and Melrose St.	school grounds, parking lot	
	Highlands Business District	Franklin Street	weeds around utility poles & curbing	
	Highlands Lot	Franklin St. along RR to Steele Ho.	parking lot	
	Hoover School	Glendower Rd	school grounds, parking lot	
	Hoover Tot Lot	Glendower Rd.	tot lot, school grounds	
	Horace Mann School	Damon Ave and Ruggles St	school grounds, parking lot, playground	
	Knoll East/West Soccer	Lynn Fells Parkway between Soccer fields	wooded knoll, memorial	
	Korean Monument	Knoll Parking Lot	Grass, Brush & Monument	
	Larrabee Lot	Grove St. behind Hugos to Melrose Drug	parking lot	
	Lebanon Park	Lebanon St. opposite Wyoming Cemetery	softball field, tot lot, b-ball ct.	
	Lewis Monk Field	Tremont St. opposite Operations Facility	baseball field, batting cage, b-ball ct.	
	Lewis Monk Field	Tremont St. opposite Operations Facility	baseball field, batting cage, b-ball ct.	
	Library	West Emerson St.	municipal building grounds	
	Lincoln Park	Pleasant Street	baseball field, 2 tot lots, b-ball ct., school grounds	

Lincoln School	W. Wyoming Avenue	school grounds, parking lot	
Livermore Lot	Top/Bot Main St & Lebanon St	parking lot, landscape islands	
Livermore Park	Upham St and Felton P1.	tot lot, b-ball ct.	
Lloyd Park	Swains Pond Ave. and Cumner Ave.	small traffic island, memorial	
Lynde Park	Grove St. and Lebanon St.	passive park, memorial	
Lyons (Tremont Street) Tennis Courts	Tremont Street @ Lynn Fells Parkway	Tennis Courts	
Main Street Business District	Main Street	Tree planters, weeds in gutters; weeds around poles	
Marvin Rd. Lot	Marvin Rd. along Rail Road Tracks	parking lot	
Mary Foley Park	Grove St. and Myrtle St.	passive park w/ benches, memorial(s)	
Meehan Park	Washington and Pleasant St.	large traffic island	
Memorial Hall	Main St. next to fire station	municipal building grounds	
Messengers Field	Brunswick Park	softball/t-ball field, tot lot, b-ball ct., school grounds	
Middle School	Lynn Fells Parkway	school grounds, parking lot	
Middle School Field: Cabbage Patch	Lynn Fells Parkway	300' x 180' multi purpose field	
Milano Park	Main St. and Grove St.	passive park w/ benches, flag pole	
Milano Senior Center	201 West Foster Street	municipal building grounds	
Morelli Basebal Field	Tremont Street @ Lynn Fells Parkway	baseball field	
Myrtle St. Lot	Myrtle St. adjacent Larrabee Lot	parking lot	
Police Station	56 West Foster Street	municipal building grounds	
Poplar Island	Poplar St. and Prospect St.	small traffic island	
Ripley Tot Lot	Lebanon St. behind Ripley School	tot lot, school grounds	
Roosevelt School	Brunswick Park and Vinton Street	school grounds, parking lot	
Thompson Park	Main St. and Lynde St.	small park, memorial	
Tremont Skateboard Park	Tremont St. opposite Operations Facility	skateboard park	
Vaughn Square	Lynn Fells Parkway and Melrose St.	small park, memorial	
Vinton Street Sidewalks	Vinton Street	overgrown brush along sidewalks	
Warren Park	Warren St. and Melrose St.	tot lot, open space	
Welcome to Melrose	Lynn Fells Parkway and West Emerson St.	small traffic island	
Winthrop School	First Street	school grounds, parking lot	
Winthrop Tot Lot	Winthrop School First St.	tot lot	
World War One	Knoll Parking Lot	Grass, Brush & Monument	
Wyoming Business District	West Wyoming	Tree planters, weeds in gutters; weeds around poles	
Wyoming Station Lot	Wyoming Ave, RR Tracks to Pleasant St	Parking Lot	

Appendix G
Street Design and Parking Lots Report (Draft)

Weston & Sampson℠

westonandsampson.com

WESTON & SAMPSON ENGINEERS, INC.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
tel: 978.532.1900

REPORT

June 2022

CITY OF
Melrose
MASSACHUSETTS

Year 4 MS4 Permit Compliance
Street Design and Parking Lots Report
DRAFT for Review

TABLE OF CONTENTS

ATTACHMENTS

Attachment A – Regulatory Review Matrix

Attachment B – Pioneer Valley Planning Commission Resources and Reference Table

Attachment C – Model Green Streets Policy

1.0 INTRODUCTION

1.1 Regulatory Requirement

The 2016 Massachusetts Municipal Separate Storm Sewer Systems (MS4) General Permit, which came into effect on July 1, 2018, regulates discharges from small MS4s to waters of the United States. The Permit requires MS4 operators to develop, implement, and enforce a stormwater management program (SWMP). The purpose of the SWMP is to reduce the discharge of pollutants from the MS4 to the maximum extent practicable, to protect water quality, and to satisfy the applicable water quality requirements of the Clean Water Act. MS4 operators must implement various Best Management Practices (BMPs) for each of the following six minimum control measures:

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Stormwater Runoff Control
- Stormwater Management in New Development and Redevelopment (Post-Construction Stormwater Management)
- Good Housekeeping and Pollution Prevention for Municipal Operations

As part of the minimum control measure for Post-Construction Stormwater Management, Section 2.3.6 of the 2016 MS4 Permit requires regulated communities to assess current street design and parking lot guidelines and other local requirements that affect the creation of impervious cover, and to summarize those findings in a report. The purpose of this exercise is to determine if changes to existing design standards can be made to support low impact design options and, where appropriate, propose recommendations and proposed schedules to incorporate policies and standards into the relevant regulatory mechanisms to minimize impervious cover in parking areas and street designs.

The City of Melrose shall implement the recommendations included in this report in the specified timeframe where feasible. The status of this assessment and any planned or completed changes to the relevant regulatory mechanisms shall be reported in each MS4 annual report.

1.2 Applicable Regulatory Mechanisms and Assessment Procedure

The following bylaws, rules & regulations, policies, and/or design standards address the creation of impervious cover in Melrose:

- Rules and Regulations Governing the Subdivision of Land in Melrose, Massachusetts (Subdivision Rules and Regulations)
- Zoning Bylaw, City Code Chapter 235
- Streets and Sidewalks Bylaw, City Code Chapter 202

In addition, the Waters, Sewers, and Drains Bylaw (City Code Chapter 228), the City of Melrose Complete Streets Policy (2016), the 2015 Open Space and Recreation Plan, and the Construction Site Inspection and Enforcement of Erosion and Sedimentation Control (2021) documents were reviewed but found to not include any relevant regulatory language relating to the creation of

impervious cover in Melrose. Each regulatory mechanism listed above was reviewed using the matrix included in Attachment A. The mechanisms were reviewed using a list of key questions in five categories, and the degree to which each mechanism addresses a key question was rated as Conventional, Better, or Best using a system based on the Local Bylaw and Regulation Assessment Tool developed by MassAudubon[1] and EPA's Assessing Street and Parking Design Standards to Reduce Excess Impervious Cover in New Hampshire and Massachusetts[2]. The definition for each rating is as follows:

- Conventional: The key question is not addressed, or no flexibility is allowed in design requirements. Dimensional standards include required minimum but no maximum (i.e., minimum driveway width but no maximum).
- Better: The key question is addressed, and some flexibility is allowed in design requirements, usually by special permit. LID design practices, including minimizing created impervious area, are encouraged but not required.
- Best: The key question is addressed, and flexibility in design is allowed by-right. LID practices, including minimizing created impervious area, are required or incentivized.

The results of this analysis are summarized in Section 2.0. Recommended updates to the assessed regulatory mechanisms are included in Section 3.0, and a proposed timeline for implementing those updates is presented in Section 4.0. Since completion of this analysis, the Lower Pioneer Valley Planning Commission (PVPC) produced a regulatory review toolkit similar to the MassAudubon tool: Assessment of Street Design and Parking Lot Guidelines and Feasibility of Allowing Green Infrastructure[3]. The PVPC tool includes useful resources and reference tables, and has been included herein as Attachment B.

[1] Supporting LID in Your Community, Local Bylaw and Regulation Assessment Tool, MassAudubon, 2017. https://www.epa.gov/npdes-permits/stormwater-tools-new-england#pcsm

[2] Assessing Street and Parking Design Standards to Reduce Excess Impervious Cover in New Hampshire and Massachusetts, US Environmental Protection Agency, April 2011. https://www3.epa.gov/region1/npdes/stormwater/assets/pdfs/ImperviousAssessment.pdf

[3] Assessment of Street Design and Parking Lot Guidelines and Feasibility of Allowing Green Infrastructure, Pioneer Valley Planning Commission, February 2022. https://www.mass.gov/doc/street-design-and-code-infrastructure-checklist/download

2.0 REVIEW OF REGULATORY MECHANISMS

The matrix included in Attachment A was used to review how Melrose's regulatory mechanisms and design standards address the creation of impervious cover in the City in the following categories:

- Impervious Area Management – Streets
- Impervious Area Management – Driveways
- Impervious Area Management – Sidewalks
- Impervious Area Management – Parking Lots

This section summarizes the results of the analysis for each category.

2.1 Category 1: Impervious Area Management – Streets

Category 1 includes key questions such as the minimum roadway widths in Melrose, required right-of-way widths, and design standards relating to dead-end streets. Street and right-of-way widths are defined in the Subdivision Rules and Regulations, and the Streets and Sidewalks Bylaw. Regulations for dead end streets are also included in the Rules and Regulations. Both the Subdivision Rules and Regulations, and the Zoning Bylaw include curbing requirements.

Minimum Roadway Width & Determinant

This section was rated "conventional" due to the strict 32-foot pavement width for all streets.

Road Right-of-Way Widths

This section was rated "conventional" due to the 50-foot right-of-way width required for all streets and no language outlining allowable usage within the right-of-way.

Allowable Dead End Street Design

This section was rated "conventional" because permanent dead-end streets are required to have a minimum outside diameter of pavement area of 100 feet, and design alternatives are not mentioned.

Curb Cuts/Flush Curbs

This section was rated "conventional" because curb cuts are not specifically allowed or prohibited in any current regulatory mechanism.

2.2 Category 2: Impervious Area Management – Driveways

Category 2 includes key questions related to minimum and/or maximum driveway widths, required front yard setbacks, and whether shared driveways are allowed in Melrose. Driveway specifications are included in the Zoning Bylaw. The Zoning Bylaw includes a table of front, side, and rear yard setback requirements for all zoning districts. Shared driveways or common service drives are not mentioned in any current regulatory mechanism.

Minimum Driveway Width

This section was rated "better" because minimum and maximum driveway widths are specified for all uses and there is no language related to reducing required driveway widths.

Required Front Yard Setback

This section was rated "conventional" as the Zoning Bylaw includes a Table of Dimensional requirements, which sets minimum required front yard setbacks for each district with no flexibility.

Allowable Driveway Design/Materials

This section was rated "better" as there is no language explicitly allowing or prohibiting different driveway designs (i.e., two-track design) but the use of pervious materials is required for driveways and parking areas in residential districts.

Shared Driveways

This section was rated "conventional" as common driveways are not explicitly allowed or prohibited.

2.3 Category 3: Impervious Area Management – Sidewalks

Category 3 includes key questions such as sidewalk placement requirements, minimum sidewalk widths, and allowable sidewalk materials. The Streets and Sidewalks Bylaw requires concrete sidewalks on both sides of all streets. The Planning Board can waive sidewalk requirements in certain cases.

Sidewalk Placement Requirements

This section was rated "better" because sidewalks are required on both sides of all streets, but sidewalk placement may vary by street type and may be waived based on expected pedestrian use.

Sidewalk Width

This section was rated "conventional" as sidewalks width is not specified. A sidewalk, grass plot and edge stone must be provided within nine feet from the inside line of the street.

Sidewalk Material

This section was rated "better" because although the Street and Sidewalks Bylaw requires sidewalks to be "granolithic" material, the Zoning Bylaws encourage the use of permeable materials.

2.4 Category 4: Impervious Area Management – Parking Lots

Category 4 includes key questions such as required parking ratios, required parking space dimensions, and whether landscaping is required in parking lot designs. The Zoning Bylaw establishes off-street parking space minimums for different uses, parking space dimensions for angle and parallel parking, and required aisle widths for different parking angles. There are various provisions for the reduction of parking requirements, including substitution of spaces within nearby municipal parking lots, different peak times of parking demands, proximity to public transportation, shared parking agreements, and other factors that must be produced in a report from a traffic engineer. Legal documentation is required for shared parking for uses on separate lots. Pervious parking materials are recommended in the Zoning Bylaws as an LID method but are only required for residential driveways and parking areas.

Required Parking Ratios

This section was rated "conventional" because parking minimums are established for different uses with little flexibility. Off-street parking is required for all proposed land uses.

Allowable Off-Street Parking for Commercial and Mixed Uses

This section was rated "conventional" as minimum parking requirements are set for different commercial uses.

Off-Site Parking Distance Limit

This section was rated "conventional" as parking must be on the same lot as the principal use. The Zoning Board of Appeals may grant a special permit to allow parking to be established no further than 300 feet from the premises when practical difficulties prevent establishment on the same lot, or within 1,000 feet of the building intended to be served in the case of substitution of parking space requirements within municipal parking lots.

Ability to Reduce Parking Requirements

This section was rated "better" as a special permit may be issued for shared or reduced parking requirements.

Shared Parking Agreements

This section was rated "better" as shared parking is allowed with a special permit.

Model Shared Parking Agreement

This section was rated "conventional" as an agreement is required for shared parking, but a model agreement is not provided in the Zoning Bylaw.

Parking Space Dimensions

This section was rated "best." Parking space sizes are defined for angled, parallel, and compact car parking. Up to 20% of spaces with five to 19 parking spaces may be compact and with 20 or more spaces, up to 30% may be compact.

Drive Aisle Width

This section was rated "conventional" because minimum drive aisle widths are defined by angle of parking.

Ability to Reduce Drive Aisle Width

This section was rated "conventional" as there are no provisions for reducing the minimum drive aisle widths.

Allowable Parking Lot Materials

This section was rated "better" as pervious parking materials are required for driveways and parking areas in residential districts are recommended as an LID method in the Zoning Bylaw but are not allowed in parking lots by-right.

Required Landscaping in Parking Lots

This section was rated "conventional" as screening with "suitable planting" is required for parking and loading areas. Low-impact development practices are not explicitly allowed or barred in parking lot landscape areas.

3.0 RECOMMENDED REGULATORY UPDATES

This section includes recommended regulatory updates identified as a result of the analysis summarized in Section 2.0. The recommended language would update Melrose's regulatory mechanisms to meet the following goals:

- Promote efficient, compact development patterns and infill;
- Promote smart designs for streets and parking lots that reduce overall impervious area and directly connected impervious area[4]; and
- Support low impact design[5] options.

The updates recommended in this section will be implemented in the timeframes included in Section 4.0, where feasible.

3.1 Updates to Zoning Bylaw

The following updates to the Zoning Bylaw should be considered to meet the goals outlined above:

- Update Section § 235-32, Off-street parking requirements, to include parking maximums as well as or instead of parking minimums for different uses.

- Update Section § 235-33, Off-street loading requirements, to establish maximum dimensions for loading spaces.

- Update Section § 235-40, Parking reduction provisions, to include a model shared parking agreement. Consider allowing shared parking and parking reductions by-right instead of by special permit.

- Update Section § 235-41, Parking and loading space standards, to explicitly allow the use of pervious or permeable materials for driveways and to allow shared driveways for all uses and Zoning districts. Update to explicitly allow curb cuts or flush curb near low impact development practices or stormwater treatment structures in parking and loading areas. Update to explicitly allow green infrastructure practices such as bioretention areas, bioswales, and tree trenches to count towards required screening or planting areas in parking lots. Do not allow green infrastructure practices that are considered hardscape, such as permeable pavers, to count toward vegetation requirements. Consider setting a maximum drive aisle width.

[4] Directly connected impervious area (DCIA), or effective impervious area, is the portion of impervious cover that creates a direct conveyance of stormwater to a storm drain or waterway.
[5] Low impact development (LID) is defined by EPA as a management approach and set of practices that can reduce runoff and pollutant loadings by managing stormwater runoff as close to its source(s) as possible and promoting the use of natural systems to manage stormwater by infiltration, evapotranspiration, and rainwater harvesting/reuse.

3.2 Updates to Subdivision Rules & Regulations

The following updates to the Subdivisions Rules & Regulations should be considered to meet the goals outlined in Section 3.0:

- Update Sections 5 and 6 to set categories for road width and right-of-way requirements based on state standards for road type, speed limits and expected traffic volume. Update to explicitly allow the use of curb cuts or flush curb near low impact development practices or stormwater treatment structures.

- Update Section 5.A.4, Dead End Streets, to recommend or require center landscaping with bioretention on dead end streets. Consider reducing the minimum diameter of dead-end streets or allowing alternative dead-end street designs, such as hammerhead turnarounds.

3.3 Updates to Streets and Sidewalks Bylaw

- Update Section § 202-16, Sidewalk area; street pavement, to explicitly allow green infrastructure and LID practices to be installed in curb buffer strips. Consider allowing for more flexible sidewalk siting (with contours or for best utility).

- Update Section § 202-27, Construction material, to explicitly allow or require permeable or porous pavement for all possible implementations such as sidewalks, alleyways, on-street parking, bikeways, trails and walkways on both private and public property. Consider requiring sidewalks to be permeable or requiring a certain percentage of surfaces in front yards be permeable (for example, 50%) by using porous asphalt, porous concrete, interlocking pavers, bricks, or landscaping.

3.4 Other Recommendations

The following recommendations do not pertain to an existing regulatory mechanism:

- The City should consider developing a Green Streets Policy to accompany its existing Complete Streets Program. This policy would promote the incorporation of green streets practices and green infrastructure into public and private development, including road reconstruction, bicycle/pedestrian projects, stormwater improvements, new development, and redevelopment projects. A model Green Streets Policy, developed by the Pioneer Valley Planning Commission, is included in Attachment C for reference.

4.0 IMPLEMENTATION TIMEFRAMES FOR REGULATORY UPDATES

Under Section 2.3.6.b. of the 2016 Massachusetts MS4 Permit, the City of Melrose shall implement the recommended updates to their regulatory mechanisms included in this report in the timeframes outlined in this section. The timeframes reflect the regular meeting schedule of the relevant City departments and boards and consider any other planned updates to the regulatory mechanisms. Implementation timeframes for the recommended updates to each document are summarized in Table 4.1.

Table 4.1: Implementation Timeframes for Regulatory Updates

Regulatory Mechanism	Appropriate Review Board	Complete First Draft of Updates	Complete Internal Review	Present Updates to Appropriate Review Board	Adopt Proposed Changes
Zoning Bylaw	Zoning Board of Appeals	November 2023	January 2024	April 2024	June 30, 2024
Streets and Sidewalks Bylaw	Planning Board	November 2023	January 2024	April 2024	June 30, 2024
Subdivision of Land Regulations	Planning Board	November 2023	January 2024	April 2024	June 30, 2024

5.0 REFERENCES

This section includes references that were utilized in the development of this Street Design and Parking Lots Report as well as additional resources for the City to consult when implementing the recommendations listed in Section 3.0.

5.1 References

Assessing Street and Parking Design Standards to Reduce Excess Impervious Cover in New Hampshire and Massachusetts, US Environmental Protection Agency, April 2011. https://www3.epa.gov/region1/npdes/stormwater/assets/pdfs/ImperviousAssessment.pdf

Assessment of Street Design and Parking Lot Guidelines and Feasibility of Allowing Green Infrastructure, Pioneer Valley Planning Commission, February 2022. https://www.mass.gov/doc/street-design-and-code-infrastructure-checklist/download

US Congress, Water Infrastructure Improvement Act. 2019. https://www.congress.gov/115/plaws/publ436/PLAW-115publ436.pdf

Supporting LID in Your Community, Local Bylaw and Regulation Assessment Tool, MassAudubon, 2017. https://www.epa.gov/npdes-permits/stormwater-tools-new-england#pcsm

5.2 Additional Resources

The following resources may provide additional guidance to the Town as they undertake the effort to implement the recommendations included in Section 3.0 within the timeframes outlined in Section 4.0:

- Streets:
  - Sustainable Neighborhood Road Design: A Guidebook for Massachusetts Cities and Towns
- Parking Lots:
  - Mass.gov Smart Parking Model Bylaw
  - Metropolitan Area Planning Council Shared Parking Example
  - Northwest Connecticut Parking Study Phase 2

Attachment A

Regulatory Review Matrix

2016 MS4 Permit Compliance - Melrose, MA

Street Design and Parking Lots Report Attachment A - Regulatory Review Matrix

Key Question	Zoning Bylaw		Subdivision Rules and Regulations		Streets and Sidewalks Bylaw		Score	Comments
	Section Reference	Language	Section Reference	Language	Section Reference	Language		
Category 1: Impervious Area Management - Streets								
Minimum residential roadway width & determinant			VI. Required Improvements for an Approved Subdivision, B. Streets and Roadways	Roadways shall be constructed for the full length of all streets in the subdivision. The center line of such roadways shall coincide with the street rights-of-way unless a variance is specifically authorized by the Public Works Department. The minimum width of roadways between curb lines shall be thirty-two (32) feet unless a greater width is required by the Board in the case of principal streets.			Conventional	Consider setting wide, medium and narrow categories.
Minimum non-residential and mixed-use roadway pavement widths & determinants			VI. Required Improvements for an Approved Subdivision, B. Streets and Roadways	The minimum width of roadways between curb lines shall be thirty-two (32) feet unless a greater width is required by the Board in the case of principal streets.			Conventional	Consider reducing max allowable road width depending on state standards for road type.
Road right-of way widths			V. Design Standards, A. Streets, 2. Width	The minimum width of street right-of-way shall be fifty (50) feet. Greater width may be required by the Board when deemed necessary. Alleys with a minimum width of twenty (20) feet may be required by the Board at the rear of any lots zoned or designated for business use. (commercial) In extending an existing street which is not fifty (50) feet in width, the adjustment of alignment shall be subject to approval of the Public Works department.	§202-15, Width and grade	No street or way shall be accepted by the City as a public street or way unless the street is at least 50 feet in width, except such streets or ways that were in public use or which appear on any plan recorded in the Registry of Deeds or approved by the Board of Survey in the manner provided by MGL c. 41, §§ 74, 75 and 76, prior to October 20, 1941, and that are not less than 40 feet in width and do not have a grade exceeding 15% or unless the street leads from some accepted street or way, provided that a street or way which was in public use prior to the year 1900 and is less than 40 feet in width may be so accepted.	Conventional	Consider lowering allowable ROW to 20-50' depending on road type.
Road right-of-way allowable usage							Conventional	There is no language outlining specific allowable usage within the right-of-way.
Turnarounds for dead end streets - are various designs allowed?			V. Design Standards, A. Streets, 4. Dead End Streets	Dead end streets shall not be longer than five hundred (500) feet unless, in the opinion of the Board, a greater length is necessitated by topography or other local conditions. Dead end streets shall be provided at the closed and with a turn-around having an outside roadway diameter of at least one hundred (100) feet and a property line diameter of at least one-hundred eighteen (118) feet.			Conventional	Consider allowing alternative design or hammerhead turnaround.
Minimum/maximum cul-de-sac diameter - are islands allowed?			V. Design Standards, A. Streets, 4. Dead End Streets	Dead end streets shall not be longer than five hundred (500) feet unless, in the opinion of the Board, a greater length is necessitated by topography or other local conditions. Dead end streets shall be provided at the closed and with a turn-around having an outside roadway diameter of at least one hundred (100) feet and a property line diameter of at least one-hundred eighteen (118) feet.			Conventional	Encourage or require center landscaping with bioretention.

2016 MS4 Permit Compliance - Melrose, MA								
Street Design and Parking Lots Report Attachment A - Regulatory Review Matrix								
Key Question	**Zoning Bylaw**		**Subdivision Rules and Regulations**		**Streets and Sidewalks Bylaw**		**Score**	**Comments**
	Section Reference	**Language**	**Section Reference**	**Language**	**Section Reference**	**Language**		
Use of curb cuts/flush curbs allowed	§ 235-71.1 Smart Growth District, § 235-71.2 Rail Corridor Overlay District	Off-street parking and loading spaces, internal ways, and maneuvering areas shall be designed to provide for adequate drainage, snow storage and removal, maneuverability and curb cuts.	VI. Required Improvements for an Approved Subdivision, B. Streets and Roadways	Curbs shall be provided in accordance with the then current standards of the Public Works Department and the Ordinances of the City to protect the adjacent land from erosion, facilitate cleaning and prevent encroachment by vehicles. Under certain conditions, this requirement may be waived by agreement between the Board and Public Works Department.			Conventional	Consider implementing language to allow flexibility for curb cuts to allow water to flow to LID features.
Category 2: Impervious Area Management - Driveways								
Required minimum driveway width	§ 235-41 Parking and loading space standards	Minimum and maximum driveway widths identified for one and two-families, multifamily residential or mixed use, and all other uses.					Better	
Ability to reduce minimum driveway width							Conventional	There is no language giving an applicant the ability to reduce minimum driveway widths.
Required front yard setback	§ 235 Attachment 2	Front, rear and side yard setbacks are specified in the Table of Dimensional and Density Regulations.					Conventional	
Two-track design allowed?	§ 235-41 Parking and loading space standards	Driveways and contiguous parking areas in residential districts shall be surfaced with pervious material systems that utilize porous pavement, pavers, brick or other materials in accordance with acceptable engineering practices or bituminous or cement concrete.					Better	There is no language explicitly allowing or prohibiting two-track driveway designs.
Shared driveways allowed?							Conventional	There is no language explicitly allowing or prohibiting shared driveways.
Category 3: Impervious Area Management - Sidewalks								
Requirements for sidewalk placement (i.e., are sidewalks required on both sides of the street?)					§202-16 Sidewalk area; street pavement	Any street or way ordered by the City Council to be constructed as a public way shall have a space reserved on each side thereof, extending not more than nine feet from the inside line of the street as ordered to be laid out by such Council, for a sidewalk, grass plot and edgestone. The portion of the street or way between the outside lines of the space so reserved shall be constructed with macadam or other pavement of similarly lasting character.	Better	Consider allowing for more flexible siting (with contours or for best utility), not necessarily parallel to road
Minimum width (probably 4-feet for ADA compliance)							Conventional	
Are permeable/pervious sidewalks allowed?	§ 235-16.1 Site plan review	Stormwater systems shall be designed to use low-impact design (LID) methodologies to mitigate drainage impact. Low-impact design (LID) methodologies may include porous pavements, bioretention cells, infiltration trenches, rainwater collection cisterns and other design methods that maximize the use of landscaped areas for stormwater control and promote the reuse of runoff.			§ 202-27 Construction material	All sidewalks shall be constructed of artificial stone known as "granolithic" or such other material as shall be recommended by the City Engineer and shall have a granite edgestone set along the gutter or outside edge, with sodding between the edgestone and outside edge of the granolithic, unless the City Council shall specify that either the sidewalk, edgestone or sodding be omitted in certain cases.	Better	Consider allowing or preferring permeable pavement or permeable pavers
Category 4: Impervious Area Management - Parking Lots								

2016 MS4 Permit Compliance - Melrose, MA								
Street Design and Parking Lots Report Attachment A - Regulatory Review Matrix								
Key Question	**Zoning Bylaw**		**Subdivision Rules and Regulations**		**Streets and Sidewalks Bylaw**		**Score**	**Comments**
	Section Reference	**Language**	**Section Reference**	**Language**	**Section Reference**	**Language**		
Current required parking ratios	§ 235-32 Off-street parking requirements	Off-street parking spaces shall be provided for every new structure, the enlargement of an existing structure, the enlargement of an existing structure, the development of a new land use or any change in an existing use in its entirety. The Table of Off-Street Parking Regulations identifies the number of off-street parking spaces required for each use.					Conventional	Consider setting maximum allowable parking spaces and not requiring more than 2 spaces/residence.
Allowable off-street parking for commercial/mixed uses?	§ 235-32 Off-street parking requirements	Off-street parking spaces must be provided for all uses in accordance with the Table of Off-Street Parking Regulations.					Conventional	
Off-site parking distance limit	§ 235-38 Location of parking spaces	Required off-street parking spaces shall be provided on the same lot as the principal use they are required to serve or, when practical difficulties prevent their establishment upon the same lot, the Board of Appeals may grant a special permit to allow the spaces to be established no further than 300 feet from the premises to which they are appurtenant.					Conventional	
Potential to reduce parking requirements where public transportation is available?	§235-40, Parking reduction provisions	The Board of Appeals by special permit may allow the substitution of spaces within municipal parking lots in lieu of the parking requirements of this article, provided they are located within 1,000 feet of the building which is intended to be served. In conjunction with a proposal that requires site plan review by the Planning Board, the Planning Board may by special permit allow shared or reduced parking requirements for uses having different peak times of parking demand requirements or if a use needs a lesser number of parking spaces than is required. Evidence which supports these shared or reduced parking requirements shall be produced in a report from a traffic engineer engaged by the applicant and approved by the Planning Board as part of site plan review. Where shared parking is to serve uses on separate lots, documentation shall be provided establishing the permanent legal right for such shared use. Factors that the Planning Board may consider include but are not limited to: (1) Proximity to public transportation. (2) Proximity to available public parking with demonstrated availability to support the project. (3) Characteristics of the residential or commercial units that create less parking demand. (4) Provision of a mix of uses on site with offset peak parking demand times. (5) A shared parking agreement with proximate properties with offset parking demand times. (6) Dedication of spaces for car-sharing services (e.g., Zipcar). (7) Employers who provide transit incentives for their employees. (8) Provisions for bicycle parking.					Better	Consider allowing parking reductions by-right instead of by special permit.
Other ability to reduce parking ratios?	§235-40, Parking reduction provisions	For any application or project for which site plan review is not otherwise required, the Board of Appeals may grant a special permit to reduce the parking space requirements to 80% of that required in the Table of Off-Street Parking Regulations where conditions unique to the use will reasonably justify such a reduction.					Better	Again consider allowing parking reductions by-right and not by special permit.

2016 MS4 Permit Compliance - Melrose, MA								
Street Design and Parking Lots Report Attachment A - Regulatory Review Matrix								
Key Question	Zoning Bylaw		Subdivision Rules and Regulations		Streets and Sidewalks Bylaw		Score	Comments
	Section Reference	Language	Section Reference	Language	Section Reference	Language		
Current required parking space dimensions	§ 235-41 Parking and loading space standards	Each off-street parking space shall not be less than nine feet in width and 18 feet in length for angle parking or 22 feet in length for parallel parking, exclusive of drives, walks and maneuvering space. For sites with five to 19 parking spaces, up to 20% of the spaces may be compact in size, and with 20 or more spaces, up to 30% may be compact. In conjunction with a proposal that requires site plan review by the Planning Board, the Planning Board may by special permit allow for up to 50% of the parking spaces to be compact in size. Compact spaces are a minimum of eight feet in width and 16 feet in length or 20 feet in length for parallel parking, exclusive of drives, walks and maneuvering space. Such compact car spaces shall be located in one or more continuous areas and shall be clearly designated by signs or pavement marking.					Best	
Allow for shared parking agreements	§235-40, Parking reduction provisions	Shared parking agreements are allowed with a special permit from the Planning Board.					Better	Consider allowing shared parking by-right.
Provide a model shared parking agreement							Conventional	Consider including a model shared parking agreement
Current required drive aisle dimensions	§ 235-41 Parking and loading space standards	Minimum aisle widths specified for different angles of parking in this section.					Conventional	Consider setting a maximum drive aisle width
Ability to reduce minimum drive aisle width							Conventional	Consider setting a maximum drive aisle width
Is the use of structural permeable pavement allowed?	§ 235-41 Parking and loading space standards, § 235-16.1 Site plan review	The area and access driveways thereto shall be surfaced with bituminous or cement concrete material and shall be graded and drained so as to dispose of all surface water accumulation in accordance with acceptable engineering practices. Driveways and contiguous parking areas in residential districts shall be surfaced with pervious material systems that utilize porous pavement, pavers, brick or other materials in accordance with acceptable engineering practices or bituminous or cement concrete. Stormwater systems shall be designed to use low-impact design (LID) methodologies to mitigate drainage impact. Low-impact design (LID) methodologies may include porous pavements, bioretention cells, infiltration trenches, rainwater collection cisterns and other design methods that maximize the use of landscaped areas for stormwater control and promote the reuse of runoff.					Better	Consider allowing permeable pavement by-right in parking lots.
Is spillover parking allowed to be impervious?							Conventional	Consider explicitly prohibiting spillover parking areas from being impervious.
Required landscaping in parking lots?	§ 235-41 Parking and loading space standards	The area shall be effectively screened with suitable planting or fencing on each side which adjoins or faces the side or rear lot line of a lot situated in any "R" district.					Conventional	Consider requiring a percentage of landscaping or explicitly requiring LID in parking areas
Are commercial parking lots or structures allowed?	§ 235-32 Off-street parking requirements	Off-street parking spaces must be provided for all uses in accordance with the Table of Off-Street Parking Regulations.					Conventional	

Attachment B

Pioneer Valley Planning Commission Resources and Reference Table

INTRODUCTION

STREET DESIGN AND PARKING LOT GUIDELINES AND INFRASTRUCTURE

ASSESSMENT OF FEASIBILITY OF ALLOWING GREEN

NPDES MS4 Community: _____

Pioneer Valley Planning Commission, February 2022

Introduction

The United States Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts (MS4) (with modifications effective on January 6, 2021) requires the development of two local assessments within four (4) years of the effective date of the permit as follows:

2016 Massachusetts Small MS4 General Permit, Section 2.3.6.b: Assessment of Street Design and Parking Lot Guidelines

Within four (4) years of the effective date of this permit, the permittee shall develop a report assessing current street design and parking lot guidelines and other local requirements that affect the creation of impervious cover. This assessment shall be used to provide information to allow the permittee to determine if changes to design standards for streets and parking lots can be made to support low impact design options. If the assessment indicates that changes can be made, the assessment shall include recommendations and proposed schedules to incorporate policies and standards into relevant documents and procedures to minimize impervious cover attributable to parking areas and street designs. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The local planning board and local transportation board should be involved in this assessment. This assessment shall be part of the SWMP. The permittee shall report in each annual report on the status of this assessment including any planned or completed changes to local regulations and guidelines.

2016 Massachusetts Small MS4 General Permit, Section 2.3.6.c: Assessment of Feasibility of Allowing Green Infrastructure

Within four (4) years from the effective date of the permit, the permittee shall develop a report assessing existing local regulations to determine the feasibility of making, at a minimum, the following practices allowable when appropriate site conditions exist: i. Green roofs; ii. Infiltration practices such as rain gardens, curb extensions, planter gardens, porous and pervious pavements, and other designs to manage stormwater using landscaping and structured or augmented soils; and iii. Water harvesting devices such as rain barrels and cisterns, and the use of stormwater for non-potable uses. The assessment should indicate if the practices are allowed in the MS4 jurisdiction and under what circumstances are they allowed. If the practices are not allowed, the permittee shall determine what hinders the use of these practices, what changes in local regulations may be made to make them allowable, and provide a schedule for implementation of recommendations. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The permittee shall report in each annual report on its findings and progress towards making the practices allowable.

Compliance Recommendation: Pre-Application Meeting with Developers

Requiring project applicants to participate in a pre-application meeting with local officials can be one of the most important and cost-effective strategies to limiting impervious cover and ensuring best stormwater management approaches. For this pre-application meeting, an applicant can be asked to take some first steps in thinking about the site through a Low Impact Development lens that involves analysis of site resources, soils, and a sketch plan informed by those considerations. (See link below to PVPC checklist for developer use in preparing for this meeting). The pre-application meeting then enables a preliminary conversation about the site, stormwater management and erosion control considerations, and concept plan prior to investing in extensive professional design efforts. This pre-application meeting can be included as part of stormwater management permitting and site plan review in zoning if there are smaller projects (under 1 acre) that a municipality wishes to include.

https://thinkblueconnecticutriver.org/wp-content/uploads/2020/12/10.-LID-Checklist-for-Preapplication-Meeting-PVPC-Model.docx

Benefits of Impervious Cover Reduction and Use of Green Infrastructure

While the MS4 permit requirements are aimed at water quality improvements, impervious cover and encouraging green infrastructure stormwater management can also reduce localized flooding, improve groundwater recharge, enhance neighborhood aesthetics, and reduce summer heat. Please refer to the resources provided below for additional information.

A Word About Stormwater Management in Drinking Water Supply Protection Areas

For drinking water supply protection areas--particularly recharge areas for public water supplies, but also where there is reliance on private wells for supply--it is important to carefully consider the impervious surfaces from which stormwater flows will be managed. For example, flows from non-metal rooftops could be managed to infiltrate directly into soils. The likelihood of contamination in such flows is typically low and thus the likelihood of eventual harm to groundwater sources for drinking is also low. A parking or loading area, however, is very different. In such circumstances, best practice would be to ensure that the perimeter area is curbed so that flows go through a pretreatment device prior to infiltration. The pretreatment facility should also include an emergency shutoff valve that can be activated in case of a spill to keep contaminated flows contained within the parking area and from reaching the infiltration facility. Note that the current 2008 MassDEP Stormwater Handbook does not allow for the location of any stormwater bmps in Zone 1 areas, unless necessary to manage stormwater from essential drinking water facilities.

How to Use This Checklist

This checklist can be used as a method of documenting review of existing local code for requirements that affect the creation of impervious cover and feasibility of allowing green infrastructure and it contains some notes and recommendations for potential policy and language changes. This checklist could also serve as the submission to EPA once code review assessment has been completed with additions in the column headings, "changes recommended" and "proposed schedule to incorporate changes." Best practice for review of code and potential revisions occurs through conversations with relevant boards and departments, such as the Planning Board, Public Works, Conservation Commission, Board of Health, and Fire Department.

Relevant Local Documents / Code to Review

Assuming that local stormwater bylaw/ordinance and regulations have been updated to comply with new pre and post construction MS4 permit standards, including promoting a Low Impact Development approach and advancing green infrastructure stormwater management, other key places within municipal code for review are as follows:

Subdivision Rules & Regulations	Wetland Protection Bylaws / Rules & Regulations	Local Building Codes
Zoning Bylaws	Board of Health Bylaws / Rules & Regulations	Local Plumbing Codes
General Bylaws		

Citations / Resources

Author	Title	Web Link
American Planning Association - Massachusetts Chapter and Homebuilders Association of Massachusetts	Sustainable Neighborhood Road Design: A Guidebook for Massachusetts Cities and Towns	https://www.apa-ma.org/wp-content/uploads/2018/12/NRB_Guidebook_2011.pdf
Casey Trees and Davey Tree Expert Co.	National Tree Benefit Calculator	http://www.treebenefits.com/calculator/
Center for Watershed Protection	The Code & Ordinance Work sheet: A Tool for Evaluating the Development Rules in Your Community	https://owl.cwp.org/mdocs-posts/better-site-design-code-and-ordinance-cow-worksheet-2017-update/
Commonwealth of Massachusetts, Executive Office of Energy and Environmental Affairs	Smart Growth / Smart Energy Toolkit: Smart Parking Model Bylaw	https://www.mass.gov/files/documents/2017/11/03/Smart%20Parking.pdf
Massachusetts Association of Conservation Commissions	MACC Wetlands Buffer Zone Guide Book	https://www.readingma.gov/conservation-division/files/macc-wetlands-buffer-zone-guidebook
Metropolitan Area Planning Council	Massachusetts Low Impact Development Toolkit: Low Impact Development - Do Your Local Codes Allow It? A Checklist for Regulatory Review	https://www.mapc.org/resource-library/do-your-local-codes-allow-lid/
Metropolitan Area Planning Council	Low Impact Development Toolkit	https://www.mapc.org/resource-library/low-impact-development-toolkit/
Metropolitan Area Planning Council	Once is Not Enough: Guide to Water Reuse in Massachusetts	http://www.mapc.org/wp-content/uploads/2017/11/3-1-Once-is-Not-Enough-Guide-to-Water-Reuse-10-05.pdf
Minnesota Pollution Control Agency	Overview for Stormwater and Rainwater Harvest and Use/Reuse	https://stormwater.pca.state.mn.us/index.php/Overview_for_stormwater_and_rainwater_harvest_and_use/reuse
Pioneer Valley Planning Commission	Low Impact Development Checklist	https://thinkblueconnecticutriver.org/wp-content/uploads/2020/12/10.-LID-Checklist-for-Preapplication-Meeting-PVPC-Model.docx
Pioneer Valley Planning Commission	Green Infrastructure Fact Sheets	http://www.pvpc.org/content/green-infrastructure-toolkit
Pioneer Valley Planning Commission	Pioneer Valley Sustainability Toolkit	http://www.pvpc.org/plans/pioneer-valley-sustainability-toolkit
U.S. Environmental Protection Agency	Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scales	https://www.epa.gov/sites/default/files/2014-04/documents/water-quality-scorecard.pdf
U.S. Environmental Protection Agency	Assessing Street and Parking Design Standards to Reduce Excess Impervious Cover in New Hampshire and Massachusetts	https://www3.epa.gov/region1/npdes/stormwater/assets/pdfs/ImperviousAssessment.pdf
U.S. Environmental Protection Agency	General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts Authorization to Discharge under the National Polluntant Discharge Elimination System (with modifications effective January 6, 2021)	https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/final-2016-ma-sms4-gp-mod.pdf
U.S. Environmental Protection Agency	Overcoming Barriers to Green Infrastructure	https://www.epa.gov/green-infrastructure/overcoming-barriers-green-infrastructure
U.S. Environmental Protection Agency	Incorporating Low Impact Development into Municipal Stormwater Programs	https://www3.epa.gov/region1/npdes/stormwater/assets/pdfs/IncorporatingLID.pdf
U.S. Environmental Protection Agency	Encouraging Low Impact Development: Incentives Can Encourage Adoption of LID Practices in Your Community	https://www.epa.gov/sites/default/files/2015-09/documents/bbfs7encouraging.pdf
U.S. Environmental Protection Agency	Soak Up the Rain Outreach Tools	https://www.epa.gov/soakuptherain/soak-rain-outreach-tools
U.S. Forest Service	The Sustainable Urban Forest Guide: A Step-by-Step Approach	https://urbanforestrysouth.org/resources/library/ttresources/the-sustainable-urban-forest-guide-a-step-by-step-approach/at_download/file

Acronyms/Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Trips
BMP	Best Management Practice
EPA	Environmental Protection Agency
LID	Low Impact Development
LUHPPL	Land Uses with Higher Potential Pollutant Loading
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
ROW	Right of Way

ASSESSMENT OF STREET DESIGN AND PARKING LOT GUIDELINES AND FEASIBILITY OF ALLOWING GREEN INFRASTRUCTURE

Pioneer Valley Planning Commission, February 2022

Example of Parking Requirements per 1,000 sq ft of Gross Floor Space from *Assessing Street and Parking Design Standards to Reduce Excess Impervious Cover in New Hampshire and Massachusetts*

Land Use	Maximum	Minimum
Bank	3	2
Large Scale Retail	4	2
General Office Building	4	2
Medical Building	8	2
Nursing Home	3	2
Restaurants	10	6
Shopping Centers	4	3
Bed and Breakfast	1.2 spaces per guest room or suite	1 space per guest room or suite
Personal Services	3	2
Churches and Places of Worship	1 space per 3 seats in the service portion of the building	1 space per 5 seats in the service portion of the building
Museums and Libraries	2	1
Public and Private Educational Institutions	1 space per 3 seats in the classroom	1 space per 5 seats in the classroom

General Parameters for Residential Road Design from *Sustainable Neighborhood Road Design: A Guidebook for Massachusetts Cities and Towns*

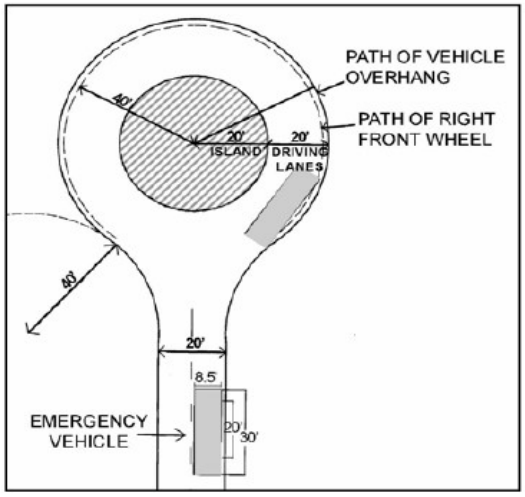
Parameter	Single Use Residential Wide	Single Use Residential Medium	Single Use Residential Narrow	Single Use Residential Alley
Traveled Way				
Typical ADT	4,999 < 1,500	1,499 < 400	399 < 0	100 < 0
Design Speed	25 - 30 mph	20 mph	20 mph	15 mph
Operating Speed	20 - 25 mph	20 mph	15 - 20 mph	15 - 20 mph
Number of Through Lanes	2	2	2	1
Lane Width	10 - 12 feet	10 - 12 feet	10 feet	9 - 10 feet
Shoulder	2 feet	2 feet	2 feet	2 feet
Bike Lanes	Shared road or 6 feet wide	Shared road	Shared road	Shared road
Utility Easement Width	--	--	10 feet	10 feet
Range of ROW Width	40 - 50 feet	36 - 40 feet	33 - 36 feet	20 feet

ASSESSMENT OF STREET DESIGN AND PARKING LOT GUIDELINES AND FEASIBILITY OF ALLOWING GREEN INFRASTRUCTURE

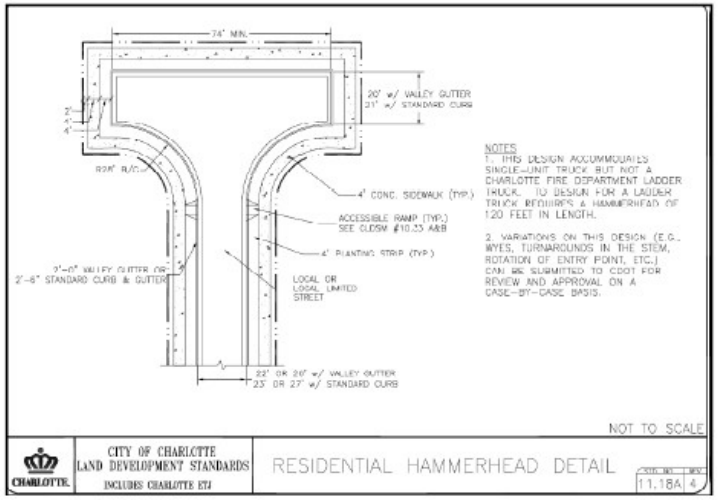
Pioneer Valley Planning Commission, February 2022

Parameter	Single Use Residential Wide	Single Use Residential Medium	Single Use Residential Narrow	Single Use Residential Alley
Roadside				
Desirable Roadside Width (pedestrian, swale, and planting strip)	5.5 - 12 feet	5.5 - 10 feet	5.5 feet	None
Grass Plot / Planting Strip	0 - 6 feet	0 - 6 feet	0 - 6 feet	None
Minimum Sidewalk Width	4 feet; one side OK	4 feet / shared road	Shared road	Shared road
Street Lighting	At intersections and pedestrian-scale lighting at residential driveways	At intersections and pedestrian-scale lighting at residential driveways	At intersections and pedestrian-scale lighting at residential driveways	At intersection with road
Intersections				
Traffic Control	Stop signs, 4-way yield	4-way yield	4-way yield	Yield exiting alley
Curb Radii	15 - 25 feet	15 - 25 feet	15 - 20 feet	15 feet

Example of Cul-de-Sac Designs and Dimensions, from *Sustainable Neighborhood Road Design: A Guidebook for Massachusetts Cities and Towns*



a. Cul-de-sac with vegetated island



b. Hammerhead turnaround design

Attachment C

Model Green Streets Policy

green infrastructure

TOOLKIT FOR

Green Infrastructure

Catalyst for Regional Progress

PVPC

PIONEER VALLEY SUSTAINABILITY TOOLKIT

TABLE OF CONTENTS

green infrastructure

Catalyst for Regional Progress

PVPC

PIONEER VALLEY SUSTAINABILITY TOOLKIT

UNDERSTANDING

Bioretention Areas

WHAT IT IS

Bioretention facilities (also known as rain gardens) are landscaped depressions designed with soils and a variety of plants to receive and treat stormwater through the use of natural processes. These natural processes include the uptake of water by plants and transfer of water to the atmosphere, and infiltration (or soaking up) of water into the soils where microbial action helps to breakdown pollutants and gravity pulls water further down through the soil layers to recharge groundwater. (See Figure 1)

Bioretention facilities can be used in a variety of settings: along a street edge or as an island in a parking lot to capture storm flow from asphalt or concrete surfaces; and near residential or commercial buildings to capture storm flow from roofs. Bioretention facilities are often designed with an underdrain or an overflow that directs flow to the municipal storm drain system.

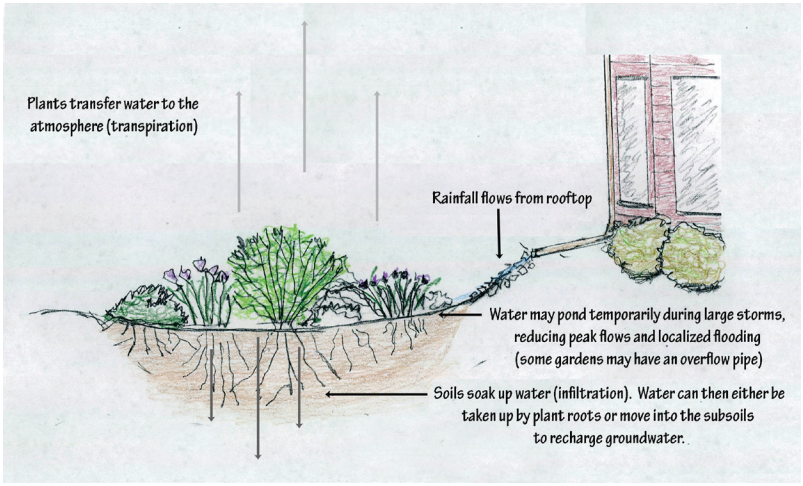


Figure 1: How a Bioretention Facility Functions

WATER QUALITY TREATMENT

When a bioretention facility is designed with an underdrain that ultimately delivers flow to surface waters, the capacity of a facility to treat stormwater is critical. Bioretention systems have proven effective at removing many pollutants associated with stormwater: suspended solids, including particulate phosphorous, petroleum hydrocarbons, and heavy metals. The table below shows water quality treatment in the four bioretention facilities tested to date by the University of New Hampshire Stormwater Center.

A rain garden along Route 9 in Hadley, captures storm flow from a drive and parking lot. This photo is taken just after installation and before plants are really established.

Photo courtesy of Berkshire Design Group, Inc.

Pollutant Removal in Four Bioretention Facilities at the University of New Hampshire Stormwater Center

System	Pollutant					
	Total Suspended Solids (TSS)	Total Petroleum Hydrocarbons in the Diesel Range	Dissolved Inorganic Nitrogen (NO3)	Total Zinc	Total Phosphorous	Average Annual Peak Flow
					% Removal	% Reduction
Bio 1-48" depth (42" filter depth)	97	99	44	99	-	75
Bio II-30" depth (24" filter depth)	87	99	NT	73	34	79
Bio III-30" depth (24" filter depth)	91	64	44	75	NT	84
Bio IV-37" depth (24" filter depth)	83	65	42	67	NT	95

NT = no treatment | Source: University of New Hampshire Stormwater Center 2012 Biennial Report

To boost the ability of bioretention facilities to manage for nitrogen and dissolved phosphorous, researchers have been experimenting with optimizing soil mixtures and design. See discussion under "Design considerations." Furthermore, Allen Davis of the University of Maryland has noted that bowl volume, media composition, media depth, underdrainage configuration, and vegetation type, all have roles in effectively helping to address objectives, depending on needs, be they hydrologic (peak flow mitigation, infiltration, annual hydrology, and stream stability) and/or water quality (total suspended solids and particulates, pathogen-indicator species, metals, hydrocarbons, phosphorus, nitrogen, and temperature). Information on how best to design systems according to these needs is evolving.

DESIGN CONSIDERATIONS

For the Pioneer Valley, major design objectives for bioretention involve flow reduction and nutrient reduction. Following is some brief guidance on design considerations relative to these objectives. As noted above, bioretention design objectives that aim to address specific target pollutants are emerging. Some of the listings below under "Links to more information" provide some resources that will be useful in this regard.

Flow reduction

Maximum volume reduction comes when bioretention facilities are located in soils that provide for good infiltration and the use of fines in the soil mix are kept to a minimum (the entry of fines into the facility should also be limited through a pretreatment element that allows for settling of particles).

Research is showing that infiltration in soils can be enhanced and preserved over time through the use of dense vegetative cover. The University of New Hampshire Stormwater Center (UNHSC) reports that of the four bioretention facilities it has studied, infiltration rates over time were optimal in the basin (Bio III) where they used a continuous dense vegetative cover. They report, "Previous studies have indicated that plant roots generally experience a 30% die back each year which aids in the development of macropores that keep soil surface infiltration capacity high over time. The data from this study suggests that the dense vegetative cover is more important than plant type for maintaining infiltration rates in vegetative systems."

Nutrients

In designing bioretention facilities for nutrient removal, fill media selection is critical. As it breaks down organic matter typically leaches nitrogen and phosphorous and can exacerbate water quality issues. It is important to have some organic matter to aid plant growth, but limiting its use is critical for successful bioretention facilities.

Nitrogen

Research out of the University of Maryland points to two major considerations for promoting nitrogen removal:

Creation of an anaerobic zone where microbes can use forms of nitrogen (NO2 and NO3) instead of oxygen for respiration – Use of a deeper media layer (3 feet minimum), media with a less permeable bottom soil layer, lower infiltration rates (1 to 2 inches per hour), and design for internal water storage, (a subsurface portion of the media that provides some storage volume) are all important design compoents. In a 2003 study, he found that adding a suitable carbon source, particularly newspaper, to the gravel layer provides a nutrition source for the microbes, enables anaerobic respiration, and can enhance the denitrification process. Davis et al noted that while organic matter should be kept to very modest amounts to avoid leaching of nitrogen as it breaks down, there should be about 5% of total weight or 10% of total volume of organic matter to provide carbon sources. Postconstruction carbon can be supplied from plant roots, leaf litter, and of course the mulch as it breaks down.

More dense planting of vegetation with sizeable root masses (but not so aggressive so as to pose a threat to clogging underdrains) – Deeply rooted grasses, notes Davis et al, are expected to provide good performance. Note that in research at the UNHSC, nitrogen removal was poorest in the bioretention system that had a 60% sand mixture and wooded vegetation as compared to the sister system that had an Eco-Lawn.

Phosphorous

Media selection is the major considerations for promoting phosphorous removal in bioretention facilities. While modest amounts of mulch can be used, Davis et al recommend selecting media with high P-sorption potential, including iron and aluminum rich soils and iron and aluminum based water treatment residuals (a byproduct of drinking water treatment), which could be used as amendments.

Inclusion of vegetation within a bioretention facility also helps to promote phosphorous removal.

RELATED CONSIDERATIONS

General design considerations noted by the U.S. EPA National Pollutant Discharge Elimination System (NPDES) Stormwater Menu of BMP's include:

Drainage Area – Bioretention facilities should usually be used on small sites (five acres or less). When used to treat larger areas, they tend to clog. In addition, it is difficult to convey flow from a large area to a bioretention facility.

Pretreatment – Incorporating pretreatment helps reduce the maintenance burden of bioretention and reduces the likelihood that the soil bed will clog over time. Several mechanisms can be used to provide pretreatment in bioretention facilities. Often, runoff is directed to a grass channel or filter strip to filter out coarse materials before the runoff flows into the filter bed of the bioretention facility. Other features include a pea gravel diaphragm, which acts to spread flow evenly and drop out larger particles.

Slope – Bioretention facilities are best applied to relatively shallow slopes usually at five percent. A sufficient slope is needed at the site to ensure that water that enters the bioretention area can be connected with the storm drain system. These particular stormwater management practices are most often applied to parking lots or residential landscaped areas, which generally have shallow slopes.

Landscaping – Landscaping is critical to the function and aesthetic value of a bioretention facility. Native vegetation is ideal for planting. Another important feature is to select species that can withstand the type of hydrologic system it will experience. At the bottom of the bioretention facility, it is important to have plants that can tolerate both wet and dry conditions. Along the edges, it will remain primarily dry, so upland species will be the most resilient to this type of condition.

MAINTENANCE CONSIDERATIONS

When properly designed, maintenance of these systems is minimal. UNHSC notes, "... the highest maintenance burden occurs during the first two years of operation as the vegetation grows and the system begins to stabilize." Once vegetation is established, maintenance is comparable to what is required for standard landscaping. (UNHSC, 2012 Biennial Report)

Systems with fine soils may need more cleaning due to obstruction from sediment. Long-term maintenance mainly requires inspection and scraping of surface pollutants.

PERMITTING CONSIDERATIONS

In the Massachusetts Stormwater Handbook, Volume 1 under Stormwater Management Standard #6, stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply. Discharges within Zone II require the use of a treatment train that provides 80% TSS removal prior to discharge. Bioretention facilities are a good fit for discharges within Zone IIs as they have a TSS removal rate of 90%. In addition, under the Massachusetts Stormwater Handbook, Volume 2, Chapter 2, bioretention facilities are a good option for discharges near cold-water fisheries. However, these should not be developed near bathing beaches and shellfish growing areas.

BARRIERS TO USE

Concern	Experience
Cost	The cost of installing a bioretention facility can vary greatly. A "do it yourself" bioretention facility that captures flow from the roof of a single family home and where soils are well draining can cost as little as a hundred dollars with a simple planting scheme. Engineered systems can cost $4 to $6 per square foot, including the grading, underdrain, stone, and plants. An estimate from the University of New Hampshire Stormwater Center (UNHSC) provides a cost based on per acre of impervious surface draining to the facility that ranges from $14,000 and $25,000 per acre, not including design, permitting, or construction oversight costs. UNHSC further notes that in 2007 they installed a bioretention system in a parking lot median strip as a retrofit. It cost a total of $14,000 per acre, including $8,500 per acre for labor and installation, and $5,500 per acre for materials and plantings. "These finding indicate that for municipalities with equipment and personnel, the retrofit costs are nearly $5,500 per acre of drainage." (University of New Hampshire Stormwater Center 2012 Biennial Report)
Accumulation of toxics	Stormwater flow from roadways and parking lots typically carries a mix of pollutants. Where bioretention facilities are used to receive, capture, and treat these flows, do facilities become toxic? Lisa Stiffler, a researcher with the Sightline Institute, a Seattle based think tank, has been investigating. She has found the following: Petroleum pollutants/PAHs: Studies from the field and laboratory find that rain gardens do a great job of capturing petroleum pollution, and that the chemicals are largely eliminated when they are destroyed by bacteria in the soil. Heavy metals: Soil and mulch in rain gardens contain particles that will adsorb and hold metals including copper, cadmium, lead, and zinc. A small fraction of the metals are sucked into plant roots and vegetation. When Northwest counties test for metals in the sediment that is scooped from the bottom of stormwater ponds or rain gardens that drain parking lots and other city surfaces — material that would likely have higher levels of metals than your average residential rain garden — they found that the contamination levels were still below soil and compost standards meant to protect human health. Bacteria and viruses: While some research has found bacteria and viruses in stormwater that can cause disease in humans, sunlight as well as other microorganisms in the runoff and soil of rain gardens can destroy the pathogens. Also, most of the microorganisms present come from animal waste and are less likely to cause illness in people. The bottom line is that the soil in rain gardens is safe for kids and pets. That said, people are advised to wash their hands after working or playing in any soil, which can contain naturally occurring metals, fecal waste from pets, or any number of compounds one would not want to ingest.

Snow management	If used in conjunction with parking lots or roadways, bioretention facilities should be designed to make for easy movement of plows. Planning a plow path and telling snow plow operators where to push the snow is important in keeping snow out of bioretention areas. According to the Massachusetts Stormwater Handbook (Vol. 2, Ch. 2), never store snow in bioretention facilities. The operation and maintenance plan must specify where on-site snow will be stored. A major reason for this is that infiltrating capabilities will become impaired due to fines that remain once snow melts.

EXAMPLES OF WHERE STRATEGY HAS BEEN IMPLEMENTED

Veterans Affairs Medical Center, Northampton, MA

Three rain gardens at the Northampton Veterans Affairs Medical Center enhance drainage through infiltration of rainfall and snowmelt, and improve aesthetics and habitat values with extensive native plantings. The three rain gardens are part of a campus rain garden master plan.

The rain garden below on the right captures flow from a 1,200 square foot area of roof. The rain garden shown below, includes a “level spreader” built of stone at the top of the system to ensure that storm flow distributes evenly across the basin and does not cause gullies or erosion. This garden below receives flow from a 1,600 square foot area of roof.

Photos courtesy Thomas Benjamin

UNDERSTANDING

Downspout Disconnection

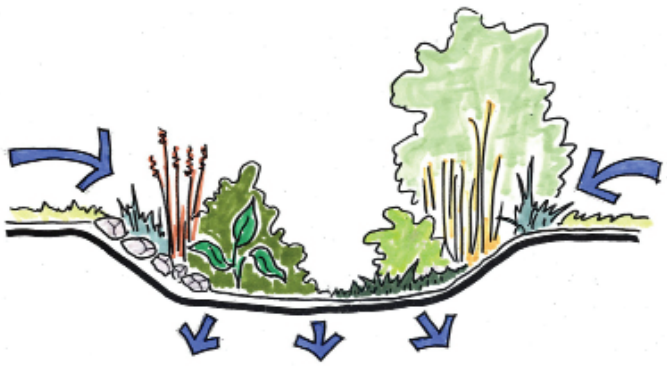
PURPOSE

Establishing a municipal downspout disconnection program provides support for a simple, low cost and low maintenance green infrastructure practice to reduce the amount of runoff entering the municipal storm or combined sewer system, thus reducing the occurrence of combined sewer overflows and associated water pollution.

The purpose of a municipal downspout disconnection program is to identify and disconnect those downspouts (also called roof leaders) that discharge into the sanitary sewer system, thereby reducing peak storm flows and associated combined sewer overflows (CSO). Sometimes, downspouts may not be directly plumbed into the sewer, but flow onto contiguously connected impervious areas such as driveways and parking lots, which drain to storm drains in the street. Under both circumstances (direct connection or overflow), redirecting downspouts to vegetated areas such as lawns or rain gardens is a recommended best practice.

In a 2011 study conducted by the Center for Watershed Protection, researchers evaluated runoff reduction at downspout disconnections to six urban residential lawns in the City of Baltimore, Maryland with C-type soils (less cohesive granular soils). On average, runoff reduction was high with an average reduction of 95% for the 1-inch rainfall event, and an average reduction of 90% for the 2-inch rainfall event. Numerous factors affect runoff reduction including soil type, age of lawn, slope, organic matter content, and management practices. The study noted that D-type (or compacted soils) would have resulted in less runoff reduction.

Rain gardens are an attractive alternative to lawn and allow 30% more water to soak into the ground than a conventional lawn (Wisconsin Department of Natural Resources, 2003). In addition to their ability to retain and infiltrate runoff, they provide important habitat for bees, butterflies and birds in urban and suburban areas.

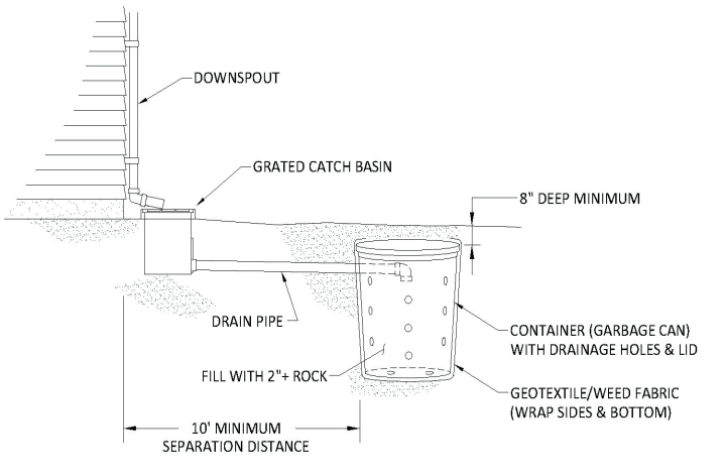


SOURCE: www.GroundworkAppliedDesign.com

DESIGN CONSIDERATIONS

The physical disconnection is relatively simple as illustrated below, however there are a number of design considerations that need to be factored into a project.

- Evaluate soil type at the site to determine the type of on-site infiltration that will be most effective. Small highly compacted sites, or sites underlain with clay may not be feasible for on-site infiltration.
- Direct downspout disconnections away from the basement foundation. Make sure downspout extensions end at least three feet away from basement foundations, and water is being directed on ground that slopes away from the building, however do not disconnect downspouts on slopes greater than 10%.
- Downspout disconnections can redirect flows to vegetated areas such as a lawn or rain garden where there is the capacity for water to infiltrate into the ground.
- Alternatively, a disconnected downspout can be plumbed into an underground drywell, gravel pit or trench where water is stored and slowly infiltrates into the ground.
- Do not allow water to splash or pond on adjacent property. Infiltrate all water on site.
- Do not redirect water to paved walkways and driveways as it will cause icing in the winter and unsafe conditions for pedestrians.



A subsurface infiltration chamber can be built from a variety of materials. Key components include pipe, a perforated storage chamber, stone, and filter fabric.

SOURCE: Fairbanks Green Infrastructure Group www.faribankssoilwater.org

HOW TO DISCONNECT A DOWNSPOUT

Step 1: Observe Your Site

It is important to understand where runoff from your downspouts go, including your house, garage, and other covered surfaces. Identify the location of downspouts and roof line, and estimate the square footage of your roof area. Map out areas in your yard for infiltration down slope of structures where you might disconnect downspouts.

Step 2: Design Your Disconnection

Make sure you have enough landscaped area for rain to soak safely into the ground. The ground area must be at least 10% of the roof area that drains to the disconnected downspout.

roof area	sizing factor	landscapes area size
500 sq. ft. X	10% =	50 sq. ft. (5'x10')

Step 3: Disconnect and Redirect

Cut off the downspout above the old connecting pipe. Cap or plug the top of the pipe. Fittings can be either approved adapters or blind plugs. These are available at most plumbing supply stores. Secure the cut downspout to the wall with a bracket. Next, install an elbow and extension to carry water away from the house. Add a concrete "splash pad" at the ground where the water spills from the downspout onto the lawn to prevent erosion, or landscape the area with stone, or install a rain garden to infiltrate the runoff water.

Step 4: Maintenance

Proper maintenance of your gutters, downspouts, and landscaping can reduce problems.

- **Clean gutters at least twice a year, and more often if you have overhanging trees.**
- **Make sure gutters are pitched to downspouts, and repair low spots.**
- **Check and clear elbows or bends in downspouts to prevent clogging.**
- **The ground should slope away from the structures. Don't build up soil, mulch, or other landscaping materials against the foundation and siding.**
- **Avoid draining water onto impermeable plastic weed block or cloth.**
- **Maintain healthy vegetation (lawn or rain garden plants) in the drainage area to minimize erosion and promote optimum infiltration.**

DEVELOPING A MUNICIPAL DOWNSPOUT DISCONNECTION PROGRAM

Some examples of successful municipal downspout disconnection programs are provided below. However, it is important to understand key program components so that a missing element does not become a barrier to program implementation.

Local Policies and Regulations

Municipalities should adopt a local policy or regulation prohibiting downspout connections and establishes a local program with standards and incentives for downspout disconnection and on-site infiltration. Such a program may not be appropriate in neighborhoods where soils are not suitable for infiltration. Neighborhoods with combined sewers are high priority areas for downspout disconnection programs. Soil suitability for infiltration should be assessed in these neighborhoods prior to implementing a program.

Stormwater plumbed into the sanitary sewer can not only cause combined sewer overflows, but it increases the volume of water to be treated at the waste water treatment plant at an expense to the municipality. Clean roof runoff does not need the level of treatment sewage receives at a treatment plant. By reducing the volume of water being treated at the plant, the municipality saves money that can be used to support other infrastructure needs.

See local examples below for more information on funding and operating a downspout disconnection program.

Education and Outreach

Public service announcements, community meetings, YouTube videos, brochures, and financial incentives have proven very important to successful programs. On-going education to residents about the benefits of disconnection and redirection, and alternative uses of stormwater such as rainwater harvesting for irrigation or greywater, cannot be overlooked. This means adequate funding is needed for dedicated staff, outreach materials, and possibly materials such as a downspout disconnection kit or a drywell for infiltration.

Technical Support

All successful downspout disconnection programs provide a licensed plumbing contractor to perform the work at no cost to the homeowner. Alternatively, the homeowner can do the work themselves or hire a licensed plumber at their own expense, sometimes from a pre-approved list of contractors provided by the City. If a homeowner chooses not to use a city contractor, or a pre-approved contractor, a site inspection is performed upon completion to ensure compliance with local sewer regulations and/or plumbing codes. In some cases, dye testing may be needed to determine if a downspout is connected to or has been properly disconnected from the sanitary sewer.

Funding Sources

Funding sources are typically derived from one of the following or a combination thereof: sewer rates, stormwater utility fees, and State Revolving Fund (SRF). Dedicating funding to downspout disconnection from any of these sources is identified in planning phases such as I/I studies and master plans, capital improvement plans, or through enforcement proceedings such as Administrative and Court Orders.

DISCONNECTION PROGRAMS – LESSONS LEARNED

City of Portland, Oregon

The City of Portland, Oregon's Department of Environmental Services operated a very successful downspout disconnection program from 1993 to 2011, disconnecting more than 58,000 downspouts at a total cost of $13 million, inclusive of disconnection construction, staffing, and outreach materials and media. The program was funded solely from their sewer and stormwater utility fee, established in 1977. Some key lessons learned include:

- Scale Matters – **The program targeted a large geographic area to reduce CSOs to the Columbia, Slough and Willamette Rivers. To do this successfully, they used a simple technique for disconnection that was conservatively applied to only downspouts that could be disconnected safely.**
- Downspout Disconnections Only Tool in the Toolbox - **They did not build rain gardens or other systems, seeking as much benefit as simply as possible. If a downspout disconnection could not be done safely, they didn't do it.**

- **Build Trust with Consistent Messaging – Consistent and persistent messaging through targeted and direct outreach to homeowners helped build trust in the community and grow the program. Homeowners were slow to sign up at first, but the programs reputation for working well with property owners and careful attention to site details encouraged others to participate.**
- **Financial Incentives are Important - Homeowners could earn $53 for each downspout disconnection toward the stormwater portion of their city utility bill. Homeowners could have their downspouts disconnected for free by a licensed and bonded plumber under contract with the City, do it themselves, or utilize one of the volunteer community groups trained by the City. All sites were inspected after disconnection by the City. Later, the City also established the Clean River Rewards program which offered on-going discounts on utility bills for other on-site stormwater management options.**
- **Keep Risk Low – High safety standards meant some downspouts could not be disconnected without risk of onsite flooding or harm to workers performing disconnection.**

Boston Water and Sewer Commission

The Boston Water and Sewer Commission's (BWSC) downspout disconnection program was established 25 years ago as a component of their combined sewer separation. Through numerous Infiltration and Inflow Studies, the Commission identified neighborhoods and individual properties with downspouts connected to the combined or sanitary sewer, and initiated direct outreach to property owners about disconnecting their downspouts. Homeowners may choose to allow a contractor hired by BWSC to disconnect the downspouts at no cost to the homeowner, or the homeowner may hire a licensed plumber to disconnect at the owner's expense. The program has disconnected downspouts on 39,000 buildings, and estimates to have disconnected over 75,000 downspouts.

Funding sources have varied over the course of the program. In general, funding has been provided by the Metropolitan Water Resources Authority (MWRA), which gets its funding for sewer separation projects from SRF. MWRA operates the regional Deer Island Waste Water Treatment Plant. The funding structure has varied from full coverage to a cost share depending on different factors over time including the phase of separation, funding levels, and whether the project was located in a combined or separated sewershed. BWSC's portion of the cost share structure has come from their sewer rates revenue.

To support the sewer separation program, the City adopted a Sewer Use Regulation in 1998 prohibiting downspout connection to the combined sewer and requiring disconnection. The program saves BWSC money by reducing the volume of water it sends to the Deer Island Wastewater Treatment Plant, and supports MWRA's mandates to eliminate CSOs. More about this program can be viewed here:

http://www.bwsc.org/SERVICES/Programs/downspout/downspout.asp

REFERENCES AND RESOURCES

CITY OF PORTLAND, OREGON ENVIRONMENTAL SERVICES. HOW TO MANAGE STORMWATER: DOWNSPOUT DISCONNECTION.
www.cleanriverspdx.org

LAW, NEELY AND DANA PUZEY. DOWNSPOUT DISCONNECTION STUDY SHOWS GREAT POTENTIAL FOR RUNOFF REDUCTION ON SMALL URBAN LAWNS. CENTER FOR WATERSHED PROTECTION WINTER NEWSLETTER, 2012.

UNIVERSITY OF CONNECTICUT. RAIN GARDENS: A DESIGN GUIDE FOR CONNECTICUT AND NEW ENGLAND HOMEOWNERS.
www.nemo.uconn.edu/raingardens/

UNIVERSITY OF WISCONSIN EXTENSION. RAIN GARDENS: A HOW-TO MANUAL FOR HOMEOWNERS. 2003
http://dnr.wi.gov/topic/shorelandzoning/documents/rgmanual.pdf

FOR MORE INFORMATION, PLEASE CONTACT

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UNDERSTANDING

Green Roofs

green infastructure

PURPOSE

Green roofs decrease greenhouse gas emissions caused by heating and cooling systems by making buildings more energy efficient through the installation of roofs with vegetation, soil, and membrane layers.

In recent years, green roofs have gone from a horticultural curiosity to a booming growth industry, primarily because the environmental benefits of extensively planted roofs are now beyond dispute. Whether for industrial or governmental complexes or private homes, in urban or suburban settings, green roofs provide many benefits to buildings, neighborhoods and municipalities including:

- Reduce stormwater infrastructure needs and costs by retaining 25 to 90% of precipitation (seasonally dependant).
- Insulate buildings by reducing heat loss (winter) and heat gain (summer) through the roof.
- Provide new opportunities for urban agriculture, or the creation of community gardens.
- Significantly reduce sound levels from sources such as traffic or airplanes.
- Protect roof membrane resulting in longer material lifespan and decreased maintenance and savings in replacement costs.
- Provide amenity space for day care, meetings, and recreation.
- Provide aesthetic appeal, increasing property value and the overall marketability of the building, particularly for accessible green roofs.
- Reduce 'urban heat island effect' in the summer

Catalyst for Regional Progress
PVPC
PIONEER VALLEY SUSTAINABILITY TOOLKIT

PROMOTING GREEN ROOFS IN THE PIONEER VALLEY

Communities can adopt local zoning incentives or provide financial incentives through municipal stormwater fee reductions, tax credits and grant programs to encourage the installation of green roofs on new and existing buildings. Examples of zoning incentives include density bonuses (typically in the form of floor area ratio (FAR) bonuses) or a reduction in parking requirements. Some cities in the United States have taken steps to mandate that all new privately-owned large buildings (typically over 50,000 sq/ft) meet LEED Certified standards, which require green roofs. Few municipalities actually require projects to achieve LEED certification.

The U.S. is far behind other countries in adopting strategies to support the installation of green roofs. Germany has emerged as the world leader not only in developing green roof technologies and systems, but in passing federal and state legislation to mandate green roofs under specific conditions and offering economic incentives to install them. The state of Nordrhein-Westfalen, for example, pays €15.00 per square meter ($19.40/10.8 square feet) to individuals who install them, while other states offer similar programs. (Snodgrass, 2006)

ENVIRONMENTAL BENEFITS

Improved air and water quality are two important environmental benefits to green roofs. The plants and growing medium of a green roof absorb water that would otherwise become runoff, thereby reducing peak storm flows and reducing associated water pollution. Research indicates that peak flow rates are reduced by 50% to 90% compared to conventional roofs. The characteristics of the soil substrate have a major influence on the effectiveness of a green roof. The soil layer traps sediments, leaves and other particles, thereby treating the runoff before reaching an outlet. The water retention capacity of the soil is dependent upon both the properties of the soil substrate and the vegetative cover. For example:

- **1-inch deep moss and sedum layer over a 2-inch gravel bed retains about 58% of the water**
- **2.5-inch deep sedum and grass layer retains about 67% of the water**
- **4-inch layer of grass and herbaceous vegetation retains about 71% of the water**

When incorporated into a combined sewer overflow abatement strategy, green roofs can reduce the need for sewer separation or storage projects required to reduce the volume and frequency of combined sewer overflows. (MA DEP and Low Impact Development Center)

The insulation provided by a green roof improves the cooling and heating efficiency of a building. By reducing energy demand for these functions, green roofs reduce air pollution and greenhouse gas emissions associated with energy production. Additionally, by reducing roof temperatures, green roofs slow the formation of ground-level ozone. Vegetation on a green roof can remove particulate matter and gaseous pollutants including nitrogen oxides, sulfur dioxide, and carbon monoxide from the air. They also remove carbon dioxide and produce oxygen. (MA DEP)

DESIGN CONSIDERATIONS

What is the purpose of the green roof?

Identifying a green roof's purpose and incorporating that into the early stages of planning and design is critical. All of the end uses may be compatible (stormwater retention, temperature management, community garden), but each requires different design and structural emphases and will significantly impact how the roof looks and functions, including what vegetation will cover it.

Load-bearing Considerations

Load bearing is the most critical consideration for any green roof. There are no regulatory barriers to building a green roof per se. Structural engineers assess loads from two general perspectives: dead and live loads. Local building codes usually specify a roof's required live load, which includes snow, water, wind, and safety factors required for the building's performance. Live load also includes human traffic, temporary installations such as furniture or maintenance equipment, and anything else transient in nature. Dead load includes the weight of the roof itself, along with permanent elements that make up the roof's structure, including roofing layers, any permanent installations for heating and cooling, and the projected wind or snow loads. Green roofs must be designed to withstand both live and dead loads. Additionally, because extensive green roof systems must be evaluated while fully saturated – which adds from 15 to 25 pounds per square foot – this must also be factored in. (Snodgrass, 2006)

Components of the Green Roof

The term green roof actually denotes a system of comprising several components, or layers, that work together to function as a single combined unit. While a green roof can be built on a variety of decking surfaces including concrete, steel, wood, and composite, the system is only possible when other components are added to ensure that the roof is protected against collapse and degradation and several other conditions are met. The basic components include: decking, waterproofing layer, and insulation layer, a root barrier, a drainage layer, a filter layer, and a substrate or medium layer.

Vegetation and Plant Selection

The act of growing plants under atypical conditions necessarily influences their selection and maintenance in ways that differ from considerations for ground-level plants. Selecting the right plants is one of the foremost challenges. For example, without irrigation and at least 8 inches of mostly organic medium, most green roofs in North America cannot sustain a wide variety of plant species that appear in traditional gardens. (Snodgrass, 2006) Solar orientation will affect plant growth, and may be particularly important on sites with extreme slopes that have the potential to shade a roof.

Jones Ferry River Access Center Green Roof, Holyoke, MA

This green roof includes is 13,000 square foot roof built to reduce and treat stormwater runoff, improve energy efficiency within the building lowering heating and cooling costs, reduces rooftop noise and improve air quality. The building was designed to accommodate the roofing system, including a sturdier roof framing, a thick EPDM membrane for waterproofing the roof.

The six inches of growth media is an engineered blend of carefully selected materials designed to be light weight while providing superior moisture retention. It's superior to regular soil because it is lighter, free from pathogens, undesirable insects and weeds. The roofing system will weigh between 20-25 pounds per square foot saturated with water. On an annual average, 50%-80% of all stormwater that falls on the roof is retained and not released to the storm sewer system.

In a completely dry state, the R-Value of the roof garden is approximately 6. However, the higher the moisture content of the assembly, the lower the R-Value, as thermal conductivity increases. Plants function as small water pumps operating at high pressure and low volume. When materials experience a phase change from liquid to vapor, they absorb a large of amount of heat energy from the surrounding environment. In the case of water, every gallon transpired by the plants absorbs roughly 8,000 BTU's of heat energy. As a result, during hot summer days, the roof membrane temperature is typically 5-10°F cooler than the ambient air temperature. The plants, mostly sedum acclimated to grow in this area, also stabilize the growth media and absorb stormwater.

MUNICIPAL INCENTIVE PROGRAMS FOR GREEN ROOFS

Portland, Oregon

The City of Portland offers a Floor Area Ratio (FAR) bonus to developers who build rooftop gardens or Ecoroofs in certain districts of the city. The ratio of the FAR bonus varies, depending on the percentage of the total building roof that the Ecoroof or rooftop garden covers. The City also funds up to $5 per square foot of an 'ecoroof' project through their Ecoroof Incentive Program, which runs to 2013.

Chicago, Illinois

The City of Chicago's "Green Permit Process" offers qualifying projects, such as green roof projects, an expedited permit process and possible reduction of the permit fees.

Minneapolis, Minnesota

The City of Minneapolis charges property owners for management of stormwater based on the degree to which their property is covered by impervious surfaces. Property owners could qualify for fee reductions of up to 100% by establishing onsite water-quality and/or quantity treatment systems, such as rain gardens, detention ponds and green roofs.

Toronto, Canada

The City of Toronto instituted a "green roof bylaw" that requires green roofs for all new development above 21,500 sq/ft. Coverage requirement range from 20-60% of the available roof space depending on the size of the development.

Acton, Massachusetts

The Town of Acton adopted a zoning by-law allowing for a density bonus for buildings achieving LEED certification in the East Acton Village District.

Portsmouth, New Hampshire

The City of Portsmouth adopted a density bonus for private projects that use LEED in the central business district by which a project benefits from a 0.5 increase in FAR if it meets appropriate open space requirements and build to LEED Certified standards.

Los Angeles, California

The City of Los Angeles requires all privately owned buildings in the city with more than 50 units or over 50,000 sq/ft to meet LEED Certified standards. Additionally, all City of Los Angeles building projects that are 7,500 sq/ft or larger are required to meet LEED standards.

REFERENCES AND RESOURCES

U.S. GREEN BUILDING COUNCIL, GREEN BUILDING INCENTIVE STRATEGIES:
www.usgbc.org/DisplayPage.aspx?CMSPageID=2078

TOWN OF ACTON ZONING BYLAW (SECTION 5.5B.2.2.D):
http://www.acton-ma.gov/

CITY OF PORTLAND ECOROOF PROGRAM:
http://www.portlandonline.com/bes/index.cfm?c=44422

CITY OF LOS ANGELES GREEN LA INITIATIVE:
www.ladwp.com/ladwp/areaHomeIndex.jsp?contentId=LADWP_GREENLA_SCID

CITY OF CHICAGO GREEN PERMIT PROCESS
www.cityofchicago.org/city/en/depts/bldgs/supp_info/overview_of_the_greenpermitprogram.html

CITY OF MINNEAPOLIS STORMWATER PROGRAM:
http://www.ci.minneapolis.mn.us/stormwater/green-initiatives/

CITY OF TORONTO GREEN ROOFS PROGRAM:
http://www.toronto.ca/greenroofs/

Snodgrass, Edmund C. and Lucie L. Snodgrass. *Green Roof Plants: A Resource and Planting Guide.* Timber Press, 2006.

FOR MORE INFORMATION, PLEASE CONTACT

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UNDERSTANDING

Green Streets

PURPOSE

Green streets are designed to treat and infiltrate stormwater close to its source while creating more vibrant and livable communities.

Stormwater runoff from streets, roads, parking lots, roofs and other impervious surfaces is a significant source of water pollution to our rivers, streams and ponds, as well as a major contributor to combined sewer overflows. Green streets can provide cost effective infrastructure solutions to reduce and manage stormwater runoff and flooding through the use of green infrastructure facilities – small, decentralized, natural or engineered systems that utilize soils and vegetation as a primary treatment mechanism. This approach integrates the built and natural environment, introducing park-like elements that enhance the pedestrian experience.

GREEN STREETS PRINCIPLES

Green streets are designed utilizing three guiding principles:

Green Infrastructure – Use naturalized systems to treat and manage stormwater close to its source.

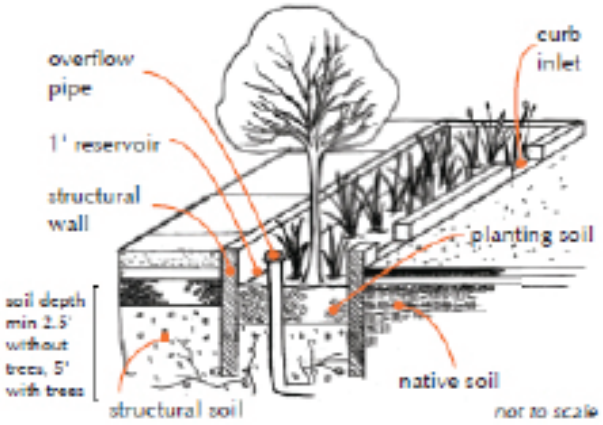
Green infrastructure (GI) uses naturalized systems to infiltrate, evapotranspire, and/or recycle stormwater runoff close to its source. Rain gardens, bioretention areas, tree box filters/trenches, green roofs, bioswales, permeable pavement, and street trees are some common GI practices. In addition to vegetation and engineered soils, GI uses permeable surfaces to intercept rain and snow melt close to the source, reducing the burden on traditional grey infrastructure systems. GI facilities seek to complement rather thanreplace existing grey infrastructure to achieve some of the additional benefits green streets have to offer a community.

Complete Streets – Create bicycle and pedestrian friendly streets.

Complete Streets are designed for all users regardless of age, ability, income, or mode of transportation, and prioritize the health, safety, and comfort of residents and visitors. Through the use of designated bike lanes, safe pedestrian crossings, traffic-calming elements, and accessible transit systems, Complete Streets create healthier, more pleasant streetscapes that offer opportunities to walk and bicycle safely every day.

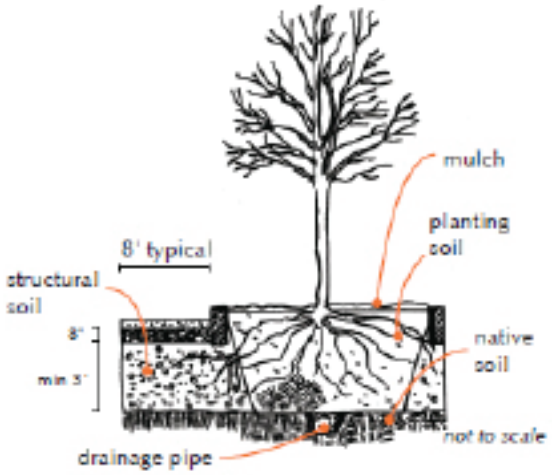
Placemaking – Generate a strong sense of place.

Placemaking is about strengthening the connection between people and the spaces they share. In this way, spaces are created that reflect the identity and history of residents, taking a number of forms from pocket parks to participatory art projects to human-scale built environments. Good public spaces can be both temporary and seasonal, as in a Saturday morning farmer's market on a local street closed to vehicular traffic, to permanent parks, plazas and boulevards. Placemaking can increase positive interactions between people, instill community pride, improve quality of, beautify a place, and support economic growth.



STORMWATER PLANTER

A stormwater planter is usually a rectangular, vegetated planter, sometimes planted with trees. Its four concrete sides double as a curb and structure for the planter and allow water to pool up to 1' before overflowing into another planter or the grey infrastructure system, storing and infiltrating water over time.



BREAKOUT

Break-outs are excavated areas filled with structural soil, often under sidewalks or roads. Used in combination with other green infrastructure tools such as tree trenches or stormwater planters, break-outs provide more room for tree roots to grow in tight spaces, increasing the longevity and survival rate of urban trees.

ADOPTING A GREEN STREETS POLICY

Adopting a municipal Green Streets Policy demonstrates a community's commitment to achieving the principles identified above in both private and public projects. The following are examples of Green Street Polices from cities around the country:

Northampton, Massachusetts – Green Streets Policy

Northampton has developed a Green Streets Policy statement which promotes the use of green streets facilities and green infrastructure in public and private development, including:

- **Road reconstruction, new road development and bicycle and pedestrian projects;**
- **Stormwater projects, and;**
- **New development and redevelopment projects**

through regulation, capital investment and management mechanisms as a cost effective and sustainable practice for stormwater management.

Prince George's County, Maryland – Complete and Green Streets Policy

The County requires road, sidewalk, trail, and transit related construction/reconstruction projects to include environmental site design where practicable.

District of Columbia – Green Streets Policy

The District of Columbia's stormwater rules and the Department of Transportation's Low Impact Development Action Plan inform the City's Green Streets Policy.

Cleveland, Ohio – Complete and Green Streets Ordinance

The purpose of the ordinance is to the creation of a network of Complete and Green Streets that will improve the economic, environmental, and social well-being of the city.

Tucson, Arizona – Green Streets Policy

Tucson's policy requires stormwater harvesting features to be integrated into all publicly funded roadway development and redevelopment projects.

Holyoke, Massachusetts – Green Streets Guidebook

The City's Guidebook is intended to introduce city planners and policy makers to Green Streets, advocate for Green Streets implementation in Holyoke, and serve as a preliminary set of design guidelines to transform Holyoke's streets into more ecologically, socially, and economically positive spaces. The Guidebook includes a Toolbox with design standards for Green streets strategies; nine design templates representative street characteristics in Holyoke that can be applied to future projects; a site-specific application of Green Street design principles in downtown Holyoke; an exploration of relative costs and benefits; and recommended next steps for the city to implement Green Streets.

Edina, Minnesota – Living Streets Policy

The policy enables the City to implement their Living Streets Plan for safe walking, bicycling and driving, reduced stormwater runoff, reduced energy consumption, and promoting health.

REFERENCES AND RESOURCES

CITY OF SEATTLE, RIGHT OF WAY IMPROVEMENTS MANUAL: GREEN STREETS
http://www.seattle.gov/transportation/rowmanual/manual/6_2.asp

CITY OF PORTLAND, GREEN STREETS CONSTRUCTION GUIDE
http://www.portlandoregon.gov/bes/45379?

CITY OF PHILADELPHIA'S GREEN CITY CLEAN WATERS,
GREEN STREETS DESIGN MANUAL
http://www.phillywatersheds.org/what_were_doing/gsdm

U.S. ENVIRONMENTAL PROTECTION AGENCY, EFFECTIVE GUIDE TO GREEN STREETS
http://water.epa.gov/aboutow/eparecovery/upload/2009_09_10_eparecovery_EPA_ARRA_Green_Streets_FINAL.pdf

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UNDERSTANDING

Porous Asphalt

WHAT IT IS

With roads and parking lots accounting for a high percentage of impervious surface, porous asphalt can be an ideal Best Management Practice in the right location. It essentially eliminates the impervious surface that would otherwise be created. Porous asphalt uses a standard asphalt mix with no sand or fines and a polymer binder to provide strength and stability. The void spaces of this mixture allows rain and snowmelt to pass through to a subbase of stone aggregate that both supports the asphalt layer and provides storage for and treatment of rainfall or snowmelt.

Unlike many other stormwater management facilities, porous asphalt requires no additional land or space, functioning within the footprint of the roadway, parking lot, alley, or sidewalk. By promoting infiltration, filtration, and recharge of groundwater, porous asphalt significantly reduces runoff volume and peak flows, decreases runoff temperature, and improves water quality. The University of New Hampshire Stormwater Center (UNHSC) reports that it also speeds snow and ice melt, reducing the salt required for winter maintenance. While porous asphalt is most recommended for low volume and low speed applications, U.S. Environmental Protection Agency has noted that porous asphalt has performed well in all highway pilot projects in the United States. Maine DOT has recently used porous asphalt on a high volume road in South Portland (see more information about this project under Examples).

WATER QUALITY TREATMENT

The porous asphalt design tested at UNHSC, being widely promoted now in New England, uses coarse sand as a subbase filter course that enhances effectiveness in pollutant removal rates. The facility at UNHSC has demonstrated the following:

Pollutant	% Removal
Total Suspended Solids (TSS)	99
Total Petroleum Hydrocarbons in the Diesel Range	99
Dissolved Inorganic Nitrogen (NO3)	No treatment
Total Zinc	75
Total Phosphorous	60
Average Annual Peak Flow Reduction	82

Source: University of New Hampshire Stormwater Center 2009 Annual Report

DESIGN CONSIDERATIONS

Stormwater design parameters – Three to five feet of vertical separation is needed from seasonal high groundwater. U.S. EPA also notes, "The load bearing and infiltration capacities of the subgrade soil, the infiltration capacity of the porous asphalt, and the storage capacity of the stone base/subbase are the key stormwater design parameters. To compensate for the lower structural support capacity of clay soils, additional subbase depth is often required. The increased depth also provides additional storage volume."

Quality control – Careful assessment of site conditions, and quality control for material production and installation methods are essential to success.

Protect porous surface from sediment and fines – To minimize clogging and promote continued good infiltration rates over time it is critical to protect the surface and base from sediment and fines during and after construction. Pretreatment BMPs, such as filter strips and swales, may be important considerations where water is flowing from upland areas onto the surface. Devices such as chatter strips at parking lot entries can also help reduce clogging. Sanding during the winter months should be discouraged.

Specifications - For guidance on design, see specification provided by UNHSC at: http://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/UNHSC%20PA%20Spec%20update-%20FEB-2014.pdf.

The specification shown in Figure 1 (at right) is intended for:

1. porous asphalt pavement in parking lot applications;

2. a cold climate application based upon the field experience at the UNHSC porous asphalt parking lot located in Durham, New Hampshire. They note that the can be adapted to projects in other climates provided that selection of materials and system design reflects local conditions, constraints, and objectives.

The mix for porous asphalt requires a polymer binder, which may be difficult to acquire for small scale projects. For

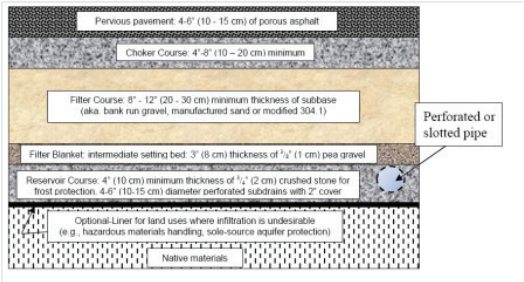

Figure 1: Typical Parking Area Cross Section for Porous Asphalt
Courtesy: University of New Hampshire Stormwater Center

example, when New England Environmental, Inc. in Amherst, MA constructed its porous asphalt parking lot in 2009 it found that the binder specified by UNH for the asphalt mix is only appropriate for larger-scale jobs, because it is only sold by the trailer truckload. New England Envrionmental, Inc. found a substitute binder that includes polymer fibers, much like what is used for asphalt curbing, that could be acquired by the barrel.

PERMITTING CONSIDERATIONS

The Massachusetts Stormwater Handbook currently does not allow for porous asphalt in Zone IIs, or near any other critical areas, including Outstanding Resource Waters and Special Resource Waters (see Stormwater Management Standard #6). While the stormwater management standards relate to jurisdictional areas under the Wetlands Protection Act, these standards have been applied by reference through local bylaws and ordinances to upland locations as well. MassDEP is currently proposing a revision to its guidance about porous asphalt, and porous pavements generally, as new information has become available on its treatment capabilities. Until this recommendation from MassDEP is accepted, however, any legal actions will be based on the current guidance within the Stormwater Handbook.

BARRIERS TO USE

Concern	Experience
Cost	$10 to $12 per square foot based on costs for MassDOT Park and Ride facility in Whately, MA, including 16 inches of stone for subbase and 5 inches of surface mix. Note that the scale and size of a project can also affect price, with lower per square foot costs on larger projects. The UNH Stormwater Center notes that material costs alone are about 20 to 25 percent more than traditional asphalt, but total project cost for porous asphalt is comparable to those for conventional asphalt projects if one accounts for the stormwater infrastructure costs that are required to manage runoff from conventional asphalt. The University of Rhode Island in building their porous asphalt parking lots in 2002 and 2003 found that the construction costs were comparable to equivalent sized conventional parking lots. While initial costs of a porous asphalt facility may be slightly higher than a facility that uses conventional asphalt, the lifespan of a porous asphalt parking lot can be more than 30 years compared to 15 years for a conventional parking lot. (See: "Pervious Pavements: New findings about their Functionality and Performance in Cold Climates "by J. Gunderson, Stormwater, September 2008.)
Winter performance	Given the well draining stone bed and structural support of porous asphalt, the freeze thaw cycle tends to produce fewer cracks and potholes than on conventional asphalt pavement. (University of New Hampshire Stormwater Center) "Because of the well-drained nature of the porous pavement and reservoir base, issues related to frozen media were minimized. Significant frost penetration was observed up to depths of 71 cm without declines in hydrologic performance or observable frost heave." (Results of a study published in Journal of Environmental Engineering in January 2012 notes) Low to no black ice development, allowing for reduced salt application rates of up to 50 to 75 percent. Best not to use sand at all to avoid clogging of pours. (University of New Hampshire Stormwater Center)
Maintenance	Requires vacuuming twice each year (spring and fall), and perhaps more frequently depending on use, to prevent clogging of pores with sediment and fines. Several contractors in the region offer vacuuming services. Typically, per square foot costs will be lower with larger jobs. A municipality for example may see better value in hiring to have several lots vacuumed at once rather than each vacuumed on separate occasions. Repairs can be made with standard asphalt, not to exceed 10 percent of surface area. (University of New Hampshire Stormwater Center) For winter maintenance tips, see UNHSC recommendations related to plowing and use of salt for general maintenance, during a storm event, and between storm events. See: http://unh.edu/unhsc/sites/unh.edu.unhsc/files/docs/UNHSC%20porous%20winter%20maintenance%20fact%20sheet_1_11.pdf
Clogging	Studies of the long-term surface permeability of porous asphalt and other permeable pavements have found high infiltration rates initially, followed by a decrease that then levels off with time. With initial infiltration rates of hundreds of inches per hour, the long-term infiltration capacity remains high even with clogging. See: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=135&minmeasure=5
Durability	The University of New Hampshire Stormwater Center acknowledges that while porous asphalt is weaker than conventional asphalt pavements, durability can be greatly improved with the proper admixtures and design. It has been effective for both commercial and roadway applications. (UNHSC 2012 Annual Report)

EXAMPLES OF WHERE STRATEGY HAS BEEN IMPLEMENTED

New England Environmental, Inc. headquarters, Amherst, MA

As part of developing their new LEED platinum rated office building, New England Environmental, Inc. included porous asphalt in a suite of stormwater management strategies that also includes rain gardens and grass pavers. They used porous asphalt for all travel lanes (about a 10,000 square foot area), while grass pavers were used in all parking stalls. The porous asphalt has been in place since 2008 and is performing beyond expectations with vacuuming occurring twice each year to remove sediment and fines. Owner Mickey Marcus reports that the cost for the parking lot as a whole was equivalent to the cost of a conventional parking lot with attendant stormwater management facilities. For the future, Marcus discourages the use of grass pavers in combination with porous asphalt as the pavers become too easily damaged with winter plowing. See figure 2.

Figure 2: New England Environmental, Inc. with porous asphalt drive in foreground and grass paver parking stalls in middle ground | Courtesy: Mickey Marcus, NEE

MassDOT Park and Ride facility, Routes 5 and 10, Whately, MA

At the request of the local conservation commission, which was concerned about the parking facility's proximity to a wetlands area, MassDOT used porous asphalt in the 40 parking stalls at this new Park and Ride facility in Whately, MA. The porous area has 16 inches of stone in the subgrade and 5 inches of surface mix. Construction costs ran $10 to $12 per square foot for the porous asphalt area. MassDOT used traditional asphalt in the travel lanes for this facility.

Maine Mall Road, South Portland, ME

Maine DOT used porous asphalt on this four lane (75-foot wide) high-volume road (16,750 AADT) as part of a larger effort to restore a local creek to its water quality classification. They installed porous asphalt on 850 linear feet and used a specification that included a 3-inch open graded friction course, followed by 6 inches of asphalt treated permeable base, 15 inches of stone reservoir, and 6 to 12 inches of porous filter material (see project location in Figure 3 and cross section in Figure 3 below.) Total project costs were $90 per square yard and the project was funded entirely through the American Recovery and Reinvestment Act monies.1

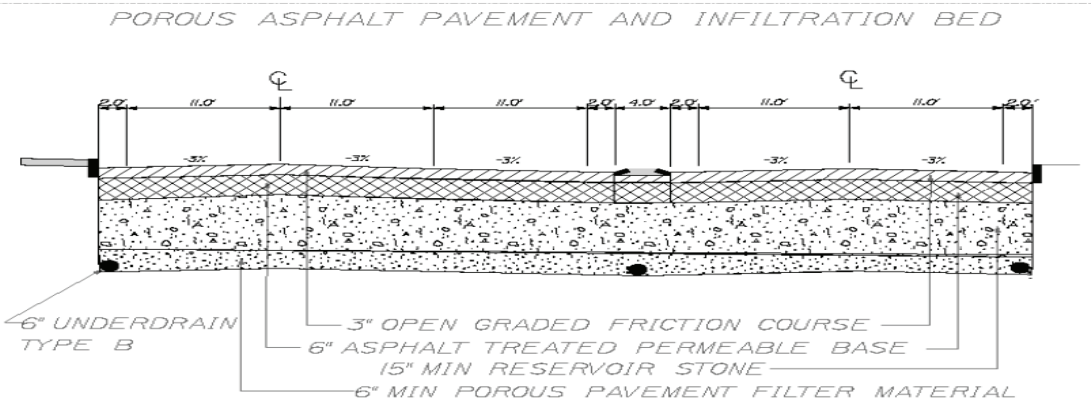

Figure 4: Cross section of porous asphalt system on Maine Mall Road | Source: Maine DOT

University of Rhode Island, Kingston, RI

In 2002 and 2003, the University of Rhode Island built two porous asphalt parking lots over a sole source aquifer. One lot is 5.5 acres and accommodates 800 vehicles while a smaller 1.47 acre lot accommodates 200 vehicles. Due to concerns of potential groundwater contamination and compaction of the asphalt, commercial and industrial vehicles are not permitted to park on these lots. In addition the recharge bed was designed to be 6 to 6.5 feet above seasonal high groundwater. Design of the facility includes a 2.5 thick porous asphalt surface layer, a 1-inch layer of choker course, and 3 to 3.5 feet of crushed rock to temporarily store and infiltrate rainfall and snowmelt. The crushed rock storage reservoir is separated from underlying soils and adjacent subsurface materials by a layer of geotextile filter fabric. Intended to prevent movement of fine soil particles up into the overlying reservoir, the fabric instead captured fines moving down from the overlying layers and became clogged so that water cannot infiltrate and moves laterally across the barrier.

Entrance areas of the parking lots are paved with conventional asphalt to accommodate heavier use and to better receive sediment deposition from tires as vehicles enter the lot. Landscaped parking lot islands act as bioinfiltration areas throughout the parking areas to provide a secondary route of infiltration during intense rainfall and in case the pavement surface gets clogged up. The outer areas of the lot are landscaped with trees and grass to keep windblown dust from nearby agricultural activities from accumulating on the porous asphalt.

During the summer of 2005, a new porous asphalt parking area was constructed expanding the existing lot and increasing the capacity from 814 to 1582 spaces. The new lot covers 5.8 acres. Several changes were made to the new lot to allow for simpler maintenance. They are:

1. Fewer, wider infiltration islands
2. Curb cuts for water entry to island bioinfiltration areas
3. Mowed grass, not meadow grass for islands
4. Fewer wheel stops, where possible, due to wheel stops being moved by cars and plowing

LINKS TO MORE INFORMATION

HEIN, DAVID K., STRECKER, ERIC, PORESKY, AARON, ROSEEN, ROBERT, AND VENNER , MARIE FOR AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) STANDING COMMITTEE ON THE ENVIRONMENT. OCTOBER 2013. "PERMEABLE SHOULDERS WITH STONE RESERVOIRS." SEE:
onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25(82)_FR.pdf

ROSEEN, ROBERT M., BALLESTRO, THOMAS P., HOULE, JAMES J., BRIGGS, JOSHUA F., AND HOULE, KRISTOPHER F. JANUARY 2012. "WATER QUALITY AND HYDROLOGIC PERFORMANCE OF A POROUS ASPHALT PAVEMENT AS A STORM-WATER TREATMENT STRATEGY IN A COLD CLIMATE." JOURNAL OF ENVIRONMENTAL ENGINEERING, 81-89.

UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER. OCTOBER 2009. "UNHSC DESIGN SPECIFICATIONS FOR POROUS ASPHALT PAVEMENT AND INFILTRATION BEDS." SEE:
http://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/pubs_specs_info/unhsc_pa_spec_10_09.pdf

UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER. JANUARY 2011. "WINTER MAINTENANCE GUIDELINES FOR POROUS ASPHALT." SEE:
http://unh.edu/unhsc/sites/unh.edu.unhsc/files/docs/UNHSC%20porous%20winter%20maintenance%20fact%20sheet_1_11.pdf

UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER. "POROUS ASPHALT PAVEMENT FOR STORMWATER MANAGEMENT."
http://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/pubs_specs_info/porous_ashpalt_fact_sheet.pdf

U.S. ENVIRONMENTAL PROTECTION AGENCY. MENU OF BMPS: POROUS ASPHALT PAVEMENT. SEE:
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index
cfm?action=browse&Rbutton=detail&bmp=135&minmeasure=5

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UNDERSTANDING

Rain Water Harvesting

PURPOSE

Rainwater harvesting is a means to capture runoff from rooftops and store it for non-potable uses such as irrigation and greywater plumbing. In addition to reducing the demand on public water supplies by replacing potable water with rainwater, rainwater harvesting can reduce peak stormwater flows, potentially reducing combined sewer overflows and other pollution associated with stormwater runoff.

Rainwater harvesting – collecting rainwater from impervious surfaces and storing it for later use – is gaining in popularity as communities, businesses, and homeowners seek ways to affordably manage stormwater, and address the potential for increasingly limited water resources caused by climate change. The many benefits of rainwater harvesting and reuse include:

- **Provides inexpensive supply of water for outdoor water use and non-potable indoor uses**
- **Reduces stormwater runoff and associated pollution by reducing peak flows**
- **Helps reduce peak summer water use demand by creating alternative water supplies**

RAINWATER HARVESTING SYSTEMS

Rainwater harvesting systems typically divert and store runoff from residential and commercial roofs. Often referred to as 'clean' runoff, roof runoff does contain pollutants (metals or hydrocarbons from roofing materials, nutrients from atmospheric deposition, bacteria from bird droppings), but they are generally in lower concentrations and absent from many of the pollutants present in runoff from other impervious surfaces. Installing a rainwater collection system requires diverting roof downspouts to cisterns or rain barrels to capture and store the runoff. Collection containers are constructed of dark materials or buried to prevent light penetration and the growth of algae.

From the storage container, a dual plumbing system is needed for indoor uses and/or connection to an outdoor irrigation system.

DESIGN CONSIDERATIONS

Every rainwater harvesting system, from a single 60-gallon rain barrel to a 1,400-gallon underground cistern, is custom tailored to site features, intended water use, budget, whether it is new construction or a retrofit, and how much space is available for storage capacity. Points toward LEED project certification are also available for a properly designed rainwater harvesting system.

Some general design considerations for every project include:

- The earlier rainwater harvesting is incorporated into a new building design process, the more efficient and cost effective-it will be.
- The largest and often most expensive system feature will be the storage tank, also called a cistern.
- Storage tanks can be installed above or below ground.
- Storage located high on the building or the site saves energy and costs (no pumps = zero energy use).
- Elevated storage requires structural and seismic engineering.
- Above ground storage structures can serve additional beneficial purposes as shade or privacy structures, and as heat sinks.
- If space permits, size the cistern to capture the occasional really large storm, and have water available for extended dry periods.
- Cisterns designed for full time domestic water use should be sized based upon a minimum of 30 gallons per day per person. http://www.saveourh2o.org/water-use-calculator
- Underground storage tanks must be anchored to keep from floating when empty.
- Use gravity as much as possible for the movement of water in the system.
- Plumbing, backflow, overflow, and air gaps are important design features, and may require a licensed plumber depending on local code requirements.
- Above ground tanks must be drained completely before freezing temperatures, and thus are seasonal applications.
- Maintenance depends on intended reuse of water. Typical maintenance includes keeping gutters and cistern screens clean as well as periodic inspection and replacement of any water treatment components and equipment, including pumps and backflow prevention devices. The tank will require cleaning annually for potable water sources.
- Rain barrel costs, including installation, range from $60-$150.
- Underground storage systems range in cost depending on the size of the cistern and the water reuse application. For example, a buried 1,800 gallon storage tank with overflow directed to a drywell recharge area, including submersible pump for supply to an irrigation system, costs $5,000-$6,000, including installation.

How to Size a Rain Barrel

Rain barrel volume can be determined by calculating the roof top water yield for any given rainfall, using the following general equation:

V = A2 x R x 0.90 x 7.5 gals./ft.3

V = volume of rain barrel (gallons)

A2 = surface area of roof (square feet)

R = rainfall (feet)

0.90 = losses to system (no units)

7.5 = conversion factor (gallons per cubic foot)

Example: One 60-gallon barrel would provide runoff storage from a rooftop area of approximately 215 square feet for 0.5 inch (0.042 ft.) of rainfall.

REGULATIONS

Massachusetts has no statutes or regulations concerning rainwater harvesting. Consequently, greywater requirements are often used to govern rainwater harvesting systems, resulting in requirements that are more stringent than necessary for outdoor water use. In 2010, the International Association of Plumbing and Mechanical Officials (IAPMO) published the first of its kind Green Plumbing and Mechanical Code Supplement (GPMCS). The supplement is a separate document from the Uniform Plumbing and Mechanical Codes and establishes requirements for green building and water efficiency applicable to plumbing and mechanical systems. In addressing "Non-potable Rainwater Catchment Systems", the GPMCS specifically identifies provisions for collection surfaces, storage structures, drainage, pipe labeling, use of potable water as a back-up supply (provided by air-gap only), and a wide array of other design and construction criteria. It also refers to and incorporates information from the ARCSA/ASPE Rainwater Catchment Design and Installation Standard, a document published in 2008 under a joint effort by the American Rainwater Catchment Systems Association (ARCSA) and the American Association of Plumbing Engineers (ASPE). (EPA, 2013)

CROSS-CONNECTIONS WITH MUNICIPAL WATER SUPPLY AS BACKUP SOURCE

State code allows the direct plumbing of municipal water supply to a RWH system as a back-up water supply provided an approved reduced pressure backflow preventer (RPBP) is installed and included under a required maintenance plan. These fixtures have a physical air gap internal to the device that separates "unregulated" harvested water from the municipal supply. A standards model of an RPBP is approved by MA DEP for use in cross-connections.

WATER RATES

Water rates are perceived as irresponsibly low by many water sustainability professionals and researchers, and seldom reflect the true costs of its use. Many communities also have a decreasing block rate structure wherein water becomes cheaper on a unit basis the more one uses. Low rates are perhaps the largest impediment to rainwater harvesting systems, since under current rate structures one would never build a harvesting system to save money on water usage, except in a rare case where a site is particularly water constrained.

TREATMENT REQUIREMENTS

Since no standards exist for secondary exposure to contaminants or bacteria from use of harvesting systems (e.g spray irrigation, toilet use, etc.), municipalities often use primary exposure thresholds (e.g drinking the water) to set water quality requirements for harvesting systems since no scientific basis for assessing risk exposure exists today. Or, greywater reuse code provisions are applied which are not necessarily appropriate and are typically considered over treatment which results in increased costs to a project limiting implementation of these systems.

CONSIDERATIONS FOR ESTABLISHING A MUNICIPAL RAINWATER HARVESTING PROGRAM

- **Establish specific codes or regulations for rainwater harvesting** – Local codes should define rainwater harvesting and establish its position as an acceptable stormwater management and water conservation practice.
- **Identify acceptable end uses and treatment standards** – Consider and identify acceptable uses for harvested rainwater and the required treatment for specific uses. Rainwater is most commonly used for non-potable uses and segregated by indoor and outdoor use.
- **Detail required system components** – Delineate between rain barrels and cisterns. Needed system requirements include: pre-filtration (screens, etc.), storage containers, back-flow prevention, dual piping system, cross-connection prevention, and signage for locations of potable and non-potable water within the system. Refer to the UPC's Green Plumbing and Building Code Supplement for guidance.
- **Permitting** – Rain barrels should not require local permitting. A building permit may be required for cistern systems used for non-potable water uses. If harvested rainwater is used for potable water, the collection and treatment system should be inspected and approved by the local Board of Health.
- **Maintenance** – Adequate design and maintenance of the cistern and piping system is the responsibility of the cistern owner.

» **Rates of use** – To be used efficiently for maximum stormwater retention, rainwater needs to be used in a timely manner to ensure adequate storage capacity for subsequent rain events. Municipalities should engage in outreach and education about best practices. Harvesting programs targeting combined sewer areas should promote post-storm slow draw down of rain barrels and cisterns to delay stormwater release to the sewer system and ensure maximum storage for the next storm.

LOCAL RAINWATER HARVESTING PROJECTS

Center-Pepin School, Easthampton, MA

A 305-gallon storage tank collects rainwater from a 670 square foot roof and serves as a source of irrigation water for the school yard garden. The cistern does not fully capture the first one inch storm, and overflow is directed to an existing ground level concrete channel along the building which drains to the municipal storm sewer. The system cost $308 plus $125 for delivery, and was installed by volunteers at the school.

MassMutual Financial Group, Springfield, MA

Roof water reclamation serves as a reservoir for on-site irrigation. 60-inch diameter HDPE piping provides 200,000 gallons of storage. An independent pumping system pressures water for irrigation system. There is automated conversion to domestic water during dry periods, and a smaller infiltration system for winter.

A similar system to the one in the photo was installed at MassMutual.

REFERENCES AND RESOURCES

GEOSYNTEC CONSULTANTS. CODE BARRIERS TO GREEN INFRASTRUCTURE/LOW IMPACT DEVELOPMENT. EMAIL COMMUNICATION, 2012.

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS. GREEN PLUMBING AND MECHANICAL CODE SUPPLEMENT. 2010.
http://www.iapmo.org/pages/iapmo_green.aspx

KLOSS, CHRISTOPHER, LOW IMPACT DEVELOPMENT CENTER. MANAGING WET WEATHER WITH GREEN INFRASTRUCTURE, MUNICIPAL HANDBOOK, RAINWATER HARVESTING POLICIES. DECEMBER, 2008.

NATIONAL CONFERENCE OF STATE LEGISLATORS. STATE RAINWATER/GREYWATER HARVESTING LAWS AND LEGISLATION. SEPTEMBER 1, 2013.
http://www.ncsl.org/research/environment-and-natural-resources/rainwater-harvesting.aspx

U. S. ENVIRONMENTAL PROTECTION AGENCY. RAINWATER HARVESTING: CONSERVATION, CREDITS, CODES AND COSTS LITERATURE REVIEW AND CASE STUDIES. EPA-841-R-13-002, JANUARY, 2013.

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UNDERSTANDING

Tree Box Filters

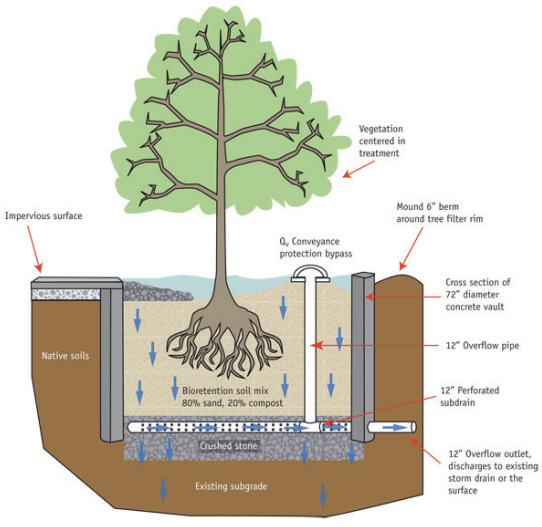
WHAT IT IS

Tree box filters are typically installed along roadways to act as mini bioretention systems. They are particularly useful in urban settings where space is limited and where traditional street tree plantings can be converted to provide stormwater management functions. A tree box filter involves a prefabricated concrete box that can be bottomless to promote infiltration or closed bottomed where soils are not conducive to infiltration. The box typically contains a metal grate at the surface to protect the integrity of the tree's roots and soils, a soils mix designed to both promote tree growth and stormwater function, a tree species (tolerant of road salt and the varying cycles of inundation and drought), and a perforated subdrain located within a bed of crushed stone at the very bottom.

Storm runoff from adjacent roadways and sidewalks enters the box through an inlet along the curbing and then soaks into and gets filtered by the soil mix. Stormwater is then taken up by tree roots, or soaks deeper into the subgrade to recharge groundwater, or collects in a perforated subdrain to discharge to the storm sewer system or to the surface.

WATER QUALITY TREATMENT

Like other bioretention systems, the tree filter box retains, degrades, and absorbs pollutants as stormwater filters through layers of mulch, soil, and plant roots. The University of New Hampshire Stormwater Center (UNHSC) installed its first tree box filter



Source: University of New Hampshire Stormwater | Center, 2009 Biannual Report

Tree box filter boxes are prefabricated bioretention cells that can be integrated into existing curb and catch basins drainage systems along streets to receive runoff from adjacent impervious surfaces.

green infrastructure

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in 2004 and reports, "Their water quality treatment performance is high, often equivalent to other bioretention systems, particularly when well distributed through a site." UNHSC's 4-foot deep, 6-foot diameter facility demonstrated the following:

Pollutant	% Removal
Total Suspended Solids (TSS)	93
Total Petroleum Hydrocarbons in the Diesel Range	99
Dissolved Inorganic Nitrogen (NO3)	3
Total Zinc	78
Total Phosphorous	NT
Average Annual Peak Flow Reduction	NT

Source: University of New Hampshire Stormwater Center 2009 Biannual Report

During a two-year study at the University of Virginia using a manufactured tree box filter called Filterra made by Americast, Inc. researchers found "...pollutant removal rates vary as a function of the filter surface area to drainage area." At the minimum of .33% filter surface area to drainage area ratio filtering 90% of the annual runoff (calculations that involved the rainfall distribution and frequency data from the mid Atlantic region) the expected pollutant removal rates are as shown below. They note that higher pollutant removal rates are made possible by increasing the ratio of filter surface area to drainage area.

Total suspended solids: 85%

Total phosphorous: 74%

Total nitrogen: 68%

Metails: 82%

Peak Flow Reduction

UNHSC notes in its 2009 Biannual Report that, "Without additional engineering, the tree box filters can do little to reduce peak flows unless sited in appropriate soils, such as those in groups "A" (sand, loamy sand, or sandy loam with high infiltration rates) and "B" (silt loams or loams with moderate infiltration rates)."

A technical bulletin from the Virginia Stormwater Manual notes that while tree box filters are not used generally for the attenuation of runoff for stream channel erosion control and flood control purposes, "...some degree of volume/flow reduction can be achieved

by combining this filter system with an adjacent [downstream] underground storage / detention system (gravel trench or pipes). Such a combined system may be useful for urban retrofit projects to address problems associated with combined sewer overflows or for stream protection."

DESIGN CONSIDERATIONS

There are numerous prefabricated tree box filter structures that are commercially available. They are generally sized and spaced much like catch basin inlets. Design variations are abundant and as mentioned above, the functionality of the tree box filter can be augmented for volumetric control with adjacent underground storage or given naturally well draining soils (Groups A and B). Design (sizing, spacing, installation, and location) are done in accordance with manufacturer's specifications.

While drainage areas may range in size from one-quarter to a half acre, there is an optimum ratio between filter surface area to drainage area that brings together cost effectiveness

Source: Neponset River Watershed Association

The Neponset River Watershed Association worked with the Town of Milton to retrofit an existing "curb and catch basin" drainage system in the Central Crossing neighborhood with tree filter boxes. The project reduced bacterial loading to Pine Tree Brook and the Neponset River while raising awareness of these facilities as a cost effective approach to stormwater management.

with pollutant removal effectiveness. The two-year study at the University of Virginia, which used the tree box filter manufactured by Filterra and rainfall distribution / frequency for the Mid Atlantic region, found that the optimum ratio between filter surface area to contributing impervious surface drainage area is 0.33% (36 ft2) of filter surface for every ¼ acre of drainage area. This would require a 6 by 6-foot filter box.

For locating tree box filters, the State of Virginia Stormwater Management Program offers the following guidelines. Tree box filters are,

> ...best incorporated into the overall site, or streescape or parking lot landscaping plan. The individual box locations represent a combination of drainage considerations (based on final grades and water quality requirements), desired aesthetics, and minimum landscaping requirements, and must be coordinated with the design of the drainage infrastructure.

Because proper functioning of the soil media is so critical (as with other bioretention facilities), there are several additional consideration worth noting:

- **Tree box filters are installed after site work is complete and stabilization measures have been implemented. It is important to protect the filter media from premature clogging and failure.**
- **Exposing the soil, microbes, and plants to prolonged and frequent flooding and wet conditions will significantly change the hydrologic regime reducing the effectiveness of the media to capture pollutant and the microbe's/plant's abilities to cycle nutrients, break down organics and uptake heavy metals. If the filter media remains water logged for 3 or 4 days anaerobic conditions will develop, dropping both oxygen and pH levels which may kill desirable soil microbes and plants. As such, runoff should not be detained and stored in a holding tank to be metered out to the filter media over a long period of time and frequent flows (such as from basement sump pumps) must be excluded.**

BARRIERS TO USE

Following are possible concerns that may serve as barriers to use of tree box filters.

Concern	Experience
Cost	There are a variety of costs described in the available literature on tree box filters, ranging from $1,500 to $10,000. Recent quotes from manufacturers of these systems provide perhaps a more realistic range: $7,000 to $12,000, depending on size and not including installation. For public projects, installations can be done by municipal public works department or they might be bid out as part of a larger construction project. Annual maintenance cost for an owner has been reported at approximately $100 per unit. Annual maintenance by the manufacturer is $500 per unit.
Winter performance	University of New Hampshire Stormwater Center found, "The tree box filter's ability to treat water quality remained relatively stable in all seasons... While some seasonal variation in infiltration capacity and nitrogen removal does occur, cold conditions do not seem to warrant significant design alterations."
Maintenance	Once the tree is established, annual maintenance is typically minimal. In UNHSC's five-year experience with the tree filter box (installed in 2004), they note that maintenance entailed only routine trash removal and periodic inspections to ensure that the bypass and soils are adequately conveying water. In 2008, they also removed the top two inches of surface fines accumulation to restore infiltration capacity (due to an accumulation of sealcoat fines and flakes which caused a noticeable reduction in infiltration). Periodic removal of surface fines (similar to that of deep sump catch basins) may be useful over the long term to support infiltration. Manufacturers may provide services for inspection, care, and maintenance of the tree box filter for the first year or two after installation. Charles River Watershed Association notes that maintenance entails the following: periodic inspection of plants and structural components, periodic cleaning of inflow and outflow mechanisms (the system comes with an observation well that can be used as a clean out), periodic testing of mulch and soil for buildup of pollutants that may be harmful to the vegetation. Biannual replacement of mulch.

LINKS TO MORE INFORMATION

UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER. MARCH 2010. "UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER 2009 BIANNUAL REPORT." SEE:
http://www.unh.edu/unhsc/

CHARLES RIVER WATERSHED ASSOCIATION. APRIL 2008. "EVALUATION OF GREEN STREET DESIGN ELEMENTS AND BEST MANAGEMENT PRACTICES: COMPARISON OF CONVENTIONAL AND STORMWATER TREE PITS." SEE:
http://www.crwa.org/hs-fs/hub/311892/file-642201447-pdf/Our_Work_/Blue_Cities_Initiative/Resources/CRWA_Stormwater_Trees_Urban_Environment.pdf

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UNDERSTANDING

Code Review Checklist

PURPOSE

The Code Review Checklist is a tool for assessing the capacity of local regulations to support green infrastructure options in new development and redevelopment within a community.

There are many reasons why a community should support the development of green infrastructure in both new development and redevelopment. In addition to the effectiveness of the many structural practices designed to manage and treat storm water close to its source through natural or engineered systems, green infrastructure facilities can be beautiful, compatible with the pedestrian environment, and support place making design elements at almost any site. The pending reissuance of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit will also require regulated communities to assess their local regulations and policies for compatibility with green infrastructure practices.

HOW IT WORKS

The Code Review Checklist is divided into several easy to follow sections that allow a community to determine:

- **if their local regulations are compliant with the draft 2010 NPDES MS4 Permit;**
- **the degree to which their street design, parking lot and other local requirements affect the creation of impervious cover;**
- **and the extent to which a Low Impact Design (LID) approach is integral to site planning and development.**

The checklist does not offer a ranking or final score but rather identifies specific areas of local regulations that can be improved upon to better support green infrastructure and LID site planning.

NPDES MS4 Permit Compliance – Based on the draft 2010 permit, the Code Review Checklist asks a series of questions that allow the municipality to determine if their local bylaws or ordinances meet permit requirements for stormwater management program funding, illicit connections, erosion and sediment control at construction sites, and post construction stormwater management in new development and redevelopment.

Street and Parking Lot Standards in Subdivision Regulations and Zoning – Once completed, these sections of the Code Review Checklist offer a comparison between existing code requirements and LID standards for road width and length, rights of ways, sidewalks, cul de sacs, stormwater management facilities, and landscaping requirements.

Feasibility of Green Infrastructure in Other Local Regulations, Policies, and Programs This section of the Checklist seeks information about other zoning tools such as open space or cluster development, Board of Health and wetland regulations, street tree policies and programs, and local building/plumbing codes relative to programs such as rain water harvesting.

RESOURCES

The Pioneer Valley Green Infrastructure Code Review Checklist is a compilation of guidance drawn from several resources including The Center for Watershed Protection's Code and Ordinance Worksheet, the U.S. Environmental Protection Agency's Water Quality Scorecard, and the Metropolitan Area Planning Council's Low Impact Development Toolkit Checklist for Regulatory Review.

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UNDERSTANDING

Green Infrastructure In Zoning

PURPOSE

Measurable standards can be adopted within municipal zoning codes, and subdivision and stormwater regulations, to promote a comprehensive approach to Low Impact Development and the integration of green infrastructure in community development.

There are many opportunities within local zoning codes and subdivision and stormwater regulations to promote Low Impact Development (LID) standards and green infrastructure including the use of incentives, code requirements with standards, and a well-defined planning process that promotes coordination between preliminary plans, site plans, and stormwater management plans. Examples include incentives such as density bonuses, infiltration requirements with design standards, and planning for multipurpose functionality of design elements such as buffers and screening for landscaping and stormwater management. Rather than adopting a separate bylaw that may conflict with other sections of the zoning code, integrate green infrastructure throughout such that it becomes the norm not an exception.

Many green infrastructure strategies have multiple benefits and offer a more comprehensive approach for addressing a range of issues and challenges. For example, a green roof takes up no extra space at all, manages storm water by reducing peak flows, improves the heating and cooling efficiency of a building, and has the potential to be a source of food production. Techniques such as bioretention areas, grass filter strips, and swales can also meet landscaping and open space requirements while addressing stormwater treatment and infiltration.

Green Infrastructure

Communities are exploring strategies that promote capture and control of rain water near where it falls. This includes the use of natural or engineered systems – such as green roofs, rain gardens, or cisterns. In these facilities, stormwater can be cleansed as it moves through soils and plant roots (treatment), returned to groundwater (infiltration), returned to the air (evapotranspiration), and/or captured to irrigate plants or flush toilets (reuse). This approach is called "green infrastructure" because of the use of plants to enhance and/or mimic natural processes. Green infrastructure contrasts with traditional "gray infrastructure" which is typically built to capture and retain large volumes of stormwater collected over a large area, and convey it to the nearest waterway.

Source: Pioneer Valley Green Infrastructure Plan, February, 2014

AN EFFECTIVE PERMITTING PROCESS IS CRITICAL

Critical to effective implementation of green infrastructure facilities is the site inventory and analysis process which should occur before any design work. Existing site conditions may offer opportunities to minimize impacts as well as the costs of stormwater management and can be identified through careful site analysis. Local zoning and permitting can promote a thoughtful process by defining the planning process, and providing standards for green infrastructure.

Town of Franklin, Massachusetts – Best Development Practices Guidebook

Franklin, Massachusetts' commitment to expedited permitting resulted in creation of their Best Development Practices Guidebook to take the guess work out of permitting requirements for developers. Critical to smooth and successful permitting is their four step process for site plan and subdivision applications that begins with an existing site conditions map and an initial pre-development meeting, held every Wednesday at 3 PM, with representatives from all town boards, the police and fire departments, and Town Counsel. Developers are offered guidance on how to meet multiple permit requirements and community planning objectives with the least amount of time and expense. Through this process, LID and green infrastructure strategies are coordinated with other project requirements early in the planning process.

http://www.town.franklin.ma.us/Pages/FranklinMA_planning/initiatives/bestdevelopment.pdf

INTEGRATING GREEN INFRASTRUCTURE STANDARDS

Drainage

A best practice for eliminating conflicting standards is to reference the local stormwater bylaw or regulation within needed sections of the zoning code for appropriate drainage standards, thereby keeping all drainage standards and specifications in one section of the local code. All zoning standards for drainage should be consistent with the purpose and standards identified in any local stormwater management bylaw, regulation or policy to provide a seamless process for promoting LID site planning. Conserving the natural hydrologic function of a site, reducing impervious surfaces and preventing runoff are key principles in ensuring post development peak flows do not exceed predevelopment peak flows. Green infrastructure facilities should be explicitly encouraged for treatment, attenuation, and infiltration of stormwater at decentralized locations around a site to capture stormwater at its source.

Dimensional and Density Regulations

Explicitly allow bioretention areas, rain gardens, filter strips, swales, and constructed wetlands within required setback areas.

Allow reduction in frontage (and corresponding road length/paved area) where appropriate, such as in Open Space Residential Developments, at the outside sideline of curved streets, and around cul-de-sacs. Removal of all frontage requirements for open space developments allows greater flexibility for such projects.

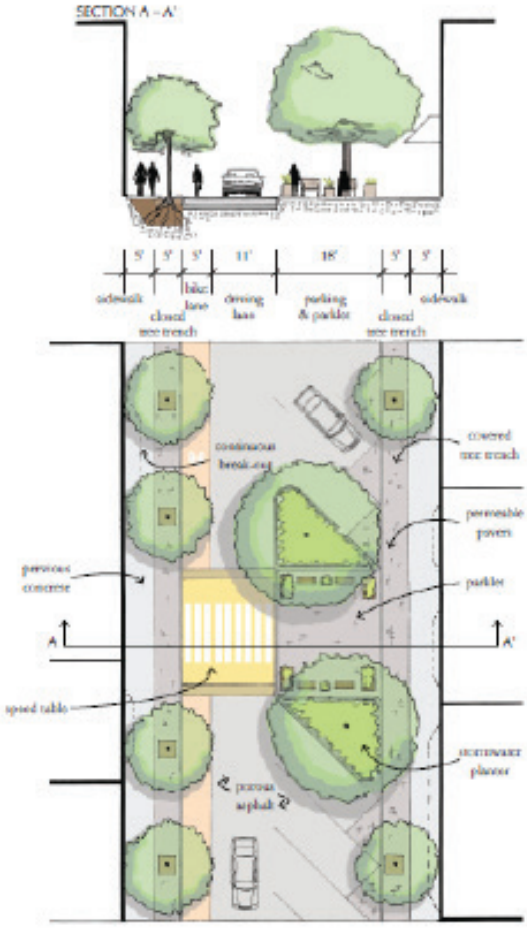
Setbacks for front, rear, and side yards should promote a walkable streetscape and support community character which means they will likely vary based on land use. In a mixed use district, setbacks should include enough space to comfortably design a pedestrian sidewalk against the building, a single lane automobile access lane or driveway, and a substantial vegetated buffer adjacent to the residential use as a screening buffer that can also serve as stormwater green infrastructure. A rear setback of 30-50 feet maybe required to ensure that loading, trash removal and other similar activities have adequate room. Flexibility in these standards due to lot configuration is important.

Site Preparation, Landscaping, Screening and Buffers

Landscaping requirements and objectives vary as a function of land use and activity. Emphasize native vegetation preservation on-site, and note that screening and buffer areas can be used for stormwater management provided that screening functions are not compromised. Consider including design standards for landscaping and screening that encourage the use of green infrastructure facilities. In the same way that architectural design standards serve a town, design standards for landscaping can support place-making within neighborhoods and across a community.

Roads

Roadways should be designed to be as narrow as possible while still wide enough to accommodate travel lanes, regular on-street parking (where required), and the passage of emergency vehicles, school buses, and the occasional delivery truck. Many local standards will specify that local urban roads be paved to a width of between 28 and 32 feet, while local rural roads might have a standard of only 22 feet in width. These guidelines are appropriate for high density development or higher vehicle volumes but are generally excessive for most suburban and rural developments. At a minimum, local codes and regulations should not discourage or prohibit impervious cover reductions. Curbs should be eliminated wherever possible to allow road drainage into open channel systems or other green infrastructure facilities. Requirements for curb and gutter infrastructure (i.e. requirements for new subdivisions to connect to storm sewer infrastructure) can be replaced with requirements for" perforated curb and swale" infrastructure, or simply roads without curbs where appropriate.



In thriving commercial areas, shaded pedestrian seating areas and calmed vehicular traffic invite people out in the neighborhood. Covered tree trenches manage stormwater and landscape pedestrian paths between the sidewalk and road, guiding circulation in the commercial district.
SOURCE: Holyoke Green Streets Guidebook, 2014

Landscaping and street standards can work well together to support community development objectives such as an improved pedestrian experience with a downtown commercial shopping district as illustrated in the City of Holyoke's Green Streets Guidebook (2014) image herein.

Example Road Travel Widths for Local Streets

Minimum Road	Parking	Average Daily Trips (ADT)	Number of Dwelling Units Served
20	Parking on both sides*	<200	20
22	Parking on one side*	200-400	20-40
26	Parking on both sides	400-2,000	40-200
28	Parking on one side	>2,000	>200
32	Parking on both sides	>2,000	>200

*Parking is restricted to one side during a snow emergency. No parking is designated of road is a designated fire lane. Source: Rhode Island Low Impact Development Site Planning and Design Guidance Manual. Horsley Witten Group and RI DEP, March 2011.

The standard ROW width of between 50-60 feet can also be excessive in many situations. Wide ROWs require more clearing and grading, potentially changing the ecological function of a site and creating more expense. The ROW need only be wide enough to contain all of the cross sectional elements including sidewalks, utility easements, parking lanes, drainage features, and travel lanes which depend on the size, density and location of the development. More moderate standards for ROW construction may include a 44- to 50-foot ROW width for 26- to 30-foot wide local urban and suburban streets. In a rural setting, a 40-foot ROW for 22-foot wide local roads might be more appropriate.

Also in subdivisions, there are opportunities to reduce the required radius of a cul-de-sac (down to an outer road radius of 30 to 40 feet), and to allow hammerhead turnarounds. On dead end streets, hammerhead turnarounds can provide a feasible way to reduce paved area while providing sufficient turnaround space for larger fire vehicles.

REDUCING IMPERVIOUS SURFACES IN PARKING REQUIREMENTS

Communities should establish both minimum and maximum parking ratios to provide adequate parking while reducing excess impervious coverage. Parking reductions could be allowed for factors such as: mixed land uses, access to alternative transportation, demographics, and utilization of Transportation Demand Management (TDM) Programs including subsidized mass transit and parking cash out programs. Flexibility is a key component to providing adequate but not excessive parking.

Off Street On-site Parking Requirements - Identify maximum parking spaces. Consider requiring a Special Permit for an increase in maximum parking allowance. Some on-site parking requirements could be met off-site particularly in redevelopment sites and compact mixed use centers.

Shared Parking and Other Opportunities to Reduce Parking Requirements – Establish formulas for the utilization of shared parking for uses with different peak demand periods (e.g. work day peak demand period 9am-5pm; housing peak demand period 6pm-8am). Provide a model shared parking agreement and facilitate implementation. An alternative to shared parking is increasing the number of zoning districts that have minimal parking requirements.

Parking and Loading Space Standards - Allow for smaller stalls for compact cars, up to 30% of total parking spaces. Allow pervious pavement driveways and parking stalls, soils permitting, in all zoning districts. Encourage pervious pavement in overflow parking areas and shoulders. Snow storage should not coincide with these areas as it may include sand which will clog pervious pavement and prevent infiltration. This is especially important if porous pavement is being utilized for stormwater management. Edging and curbing can be eliminated or perforated to allow stormwater flows into infiltration and bioretention areas. For larger parking lots, require separating parking rows with planting strips that may function to manage stormwater and shade the lot reducing the heat island effect. Shade tree requirements in planting strips should also take into consideration stormwater treatment.

On-Street Parking Demand - Wider residential streets are often justified by the need to provide on-street parking. However, providing a continuous parking lane on both sides of the street is usually an inefficient and expensive way to satisfy the required parking for residential areas, since most of the required parking per unit can be met in driveways or through shared parking. Consider using one or both of the on-street parking lanes as a traffic lane (i.e. a queuing street), both traffic movement and parking needs could be met with a narrower street.

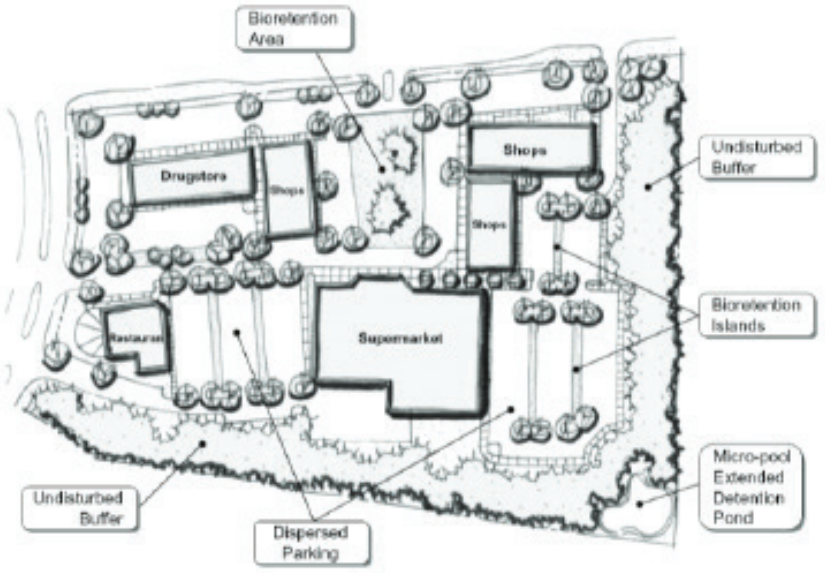
SIDEWALKS

Flexible design standards should be adopted that are based on safe pedestrian movement and limiting impervious cover. Constructing five-foot wide sidewalks on both sides of the street is not always appropriate, even in medium to high density developments. A three- or four-foot sidewalk on one side of the street is appropriate for many situations. Where practicable, sidewalks should be graded to drain into front lawns, reducing the total amount of runoff generated by the roadway. Consider permeable surfaces such as permeable asphalt or compacted aggregate where appropriate. Walkways may be removed from the roadway entirely and used to provide access to natural features or connect other destinations such as a playground, park or adjacent development.

The Town of South Hadley, Massachusetts allows subdivision developers to pay a fee in lieu of sidewalks in small developments where a sidewalk network may not serve a purpose. The fee contributes to bicycle and pedestrian projects in other areas of town.

OPEN SPACE PROTECTION IN ZONING

Open Space Residential Development (OSRD), Open Space Design (OSD), Conservation Development and Natural Resource Protection Zoning (NRPZ) are the current zoning models for what was previously called cluster or flexible development. This approach utilizes LID site design strategies for conserving natural hydrologic functions and reducing impervious surfaces for preventing runoff, integrating green infrastructure as a fundamental design element. These plans retain native vegetation and natural areas, and structure site layout to greatly reduce street infrastructure. The open space set aside should be based on resource values, not by formula such as X% of the development. The four step planning process reverses the typical subdivision planning process by first, designating open space based on an environmental analysis, siting houses next, layout of roads and trails, and last, lot lines are drawn.



This commercial shopping plaza set aside an undisturbed buffer and integrated green infrastructure facilities to reduce impervious coverage and provide a natural vegetated corridor around the site. Source: Rhode Island Low Impact Development Site Planning and Design Guidance Manual. Horsley Witten Group and RI DEP, March 2011.

REFERENCES AND RESOURCES

THE CONWAY SCHOOL. CITY OF HOLYOKE GREEN STREETS GUIDEBOOK. MARCH, 2014.

Mass Audubon's Shaping the Future of Your Community Outreach and Assistance Program

http://www.massaudubon.org/our-conservation-work/community-outreach/sustainable-planning-development/shaping-the-future-of-your-community-program/workshops/protecting-land-habitat

Massachusetts Smart Growth/Smart Energy Toolkit

http://www.mass.gov/envir/smart_growth_toolkit/pages/how-to-SG.html

RHODE ISLAND LOW IMPACT DEVELOPMENT SITE PLANNING AND DESIGN GUIDANCE MANUAL. HORSLEY WITTEN GROUP AND RI DEP, MARCH 2011.

www.dem.ri.gov/programs/bpoladm/suswshed/pdfs/lidplan.pdf

PIONEER VALLEY GREEN INFRASTRUCTURE PLAN, "TABLE 4.3 GREEN INFRASTRUCTURE DESIGN RESOURCES". PIONEER VALLEY PLANNING COMMISSION, FEBRUARY 2014.

www.pvpc.org/file/pvpc-green-infrastructure-plan-final-02-18-14pdf

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UNDERSTANDING

Subdivion Regulations

What it is

Subdivision regulations guide the private development of new roads. They control layout and construction, specifying municipal requirements for location, width, and grades of proposed ways. They also specify requirements for public utilities. As streets typically account for 50 to 75 percent of impervious cover in the developed environment, it is critical that these regulations encourage and even require best practices for stormwater management. These regulations should also be consistent with requirements within a municipality's stormwater management bylaw/ordinance.

Cost Savings in a Subdivision Project

Photo: Nashua Telegraph

In Pelham, New Hampshire, a subdivision that took a low impact approach to site development and used green infrastructure stormwater management practices **realized a 6% savings on the total cost of stormwater infrastructure**[1] The road shown here makes use of porous asphalt, allowing rainfall to soak into the surface and filter through underlying soils.
For more on porous asphalt, see related fact sheet.

Within subdivision regulations, best practices can be addressed in the early stages of the planning process itself, and within requirements for the following:

- location and length of roadways
- right of ways
- paved roadway width
- curbs
- drainage
- sidewalks
- utilities
- landscaping
- cul de sacs

Planning process

Approval for a subdivision project typically begins with submission of a preliminary plan, which helps initiate a conversation about the project between the developer, planning board, and board of health. This early stage in the project provides communities with an opportunity to promote an integrated site design process and use of distributed stormwater management practices to best match the predevelopment hydrologic condition. This could include advancing provisions within stormwater management regulations and also within zoning regulations for: 1. Open Space Residential Development, which allows for a more compact development pattern to preserve open space and reduce the amount of paved surfaces through clustering of development to the least environmentally sensitive areas; or 2. where appropriate Traditional Neighborhood Development (TND), which involves the more traditional neighborhood pattern used prior to the automobile, and includes small lots and homes with porches oriented toward the street. TNDs typically have narrow roads and on-street parking coupled with reductions in required off-street parking.

For preliminary plan submission, municipalities could provide to developers a standard site analysis checklist to maximize design and functionality of best stormwater management practices. This could include many of the same steps within the conservation development process, beginning with a good site analysis to designate natural drainage areas, important conservation areas, and locating development areas. Applicants could bring the results of this analysis to a pre-application conference. As part of this analysis and reporting, the applicant could identify proposed best stormwater management practices. Soil testing for this site analysis could be for the site overall and not as rigorous as the more detailed soil work necessary to design a stormwater management facility.

It may be useful to include credits for improved stormwater management practices. The Massachusetts Department of Environmental Protection (DEP) stormwater standards as incorporated into the state's Wetlands Protection Act Regulations has established a "LID Site Design Credit" whereby in exchange for directing runoff from roads and driveways to vegetated open areas, preserving open space with a conservation restriction, or

directing rooftop runoff to landscaped or undisturbed areas, developers can reduce or eliminate the traditional BMPs used to treat and infiltrate stormwater.2

Location and length of roadways

Protecting important natural features and minimizing disturbance and amount of paved area is a first line approach to protecting hydrology on a previously undeveloped site. This can be achieved by identifying opportunities to reduce:

- **cut and fill, thereby minimizing disturbance of native soils**
- **unnecessary contouring of the site, and**
- **removal of native vegetation.**

In addition, streets ought to be located in order to protect important natural features, avoiding low areas and steep slopes.

Developers should be encouraged to limit clearing within the right-of-way to the minimum necessary for constructing roadway, drainage, sidewalk, and utilities, and to maintaining site lines. During site development, permeability of soils for infiltration should be preserved. Where soils are compacted by construction vehicles, contractors should be required to reestablish permeability.

Alternative street layouts should be explored for options to increase the number of homes per unit length and minimize the length of the roadway. This might be achieved through clustering of the development or through Traditional Neighborhood Design as described above.

Right of ways

A right of way is the strip of land that contains all the elements of a roadway. At a minimum, this typically includes vehicle travel lanes, grading and drainage, and utilities. It also can include bike lanes, shoulders, on-street parking, curbs, sidewalks, and vegetated areas. Right of ways between 50 and 60 feet wide are standard, but this it has often led to overdesign with excessive clearing, grading and extensive use of the width for paving.

Good design has not so much to do with the width of the right of way itself, but considerations of context and what makes for efficient and effective use of the right of way. What makes sense for the elements of a right of way on a busy suburban road will likely not make sense for a low volume rural road.

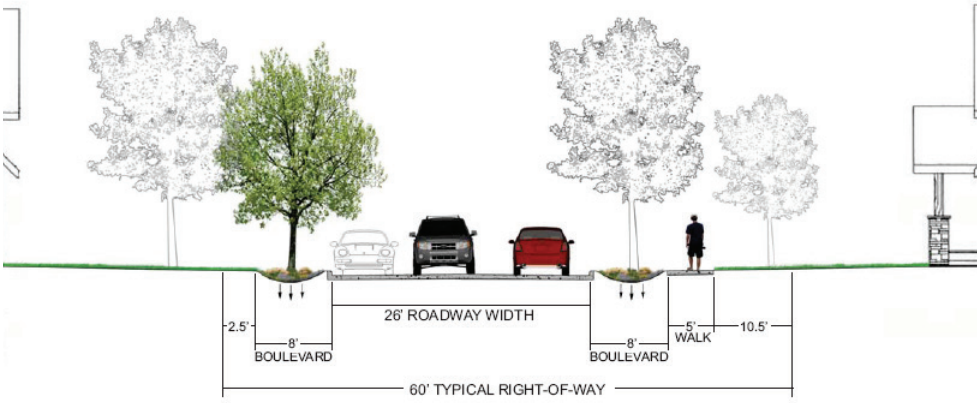
Several communities in Minnesota have developed “Living Streets” policies that take context into consideration. This policy brings together “complete streets” objectives of providing for multiple modes of transportation (vehicular, pedestrian, and bicycle) and “green streets” objectives of reducing environmental impacts (through reduced impervious surface and improved stormwater management). In thinking about how to accommodate these various objectives within the right of way, these communities have developed design options that can be deployed depending on what specific objectives there may be for a project. In Maplewood, Minnesota, there are three design options for

a local street with a 60-foot right of way (note that not all 60 feet in the right of way is used):

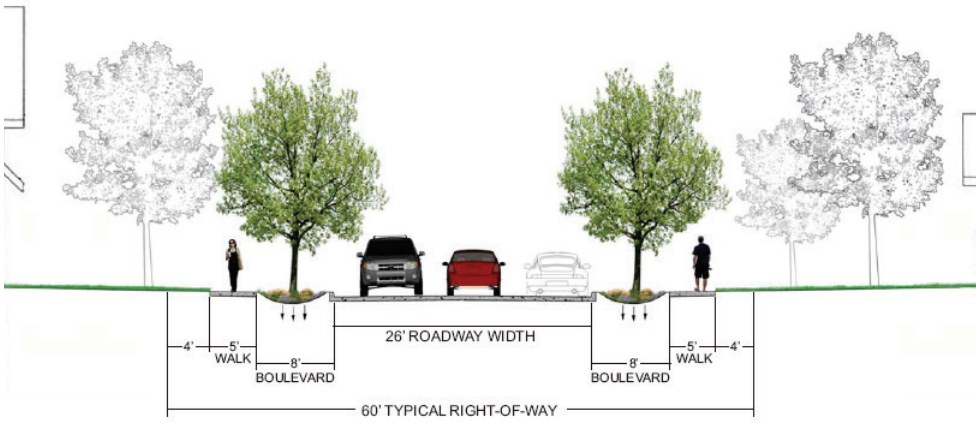
Guidelines from Edina, Minnesota's Living Street Policy are useful in thinking about right of way use:

- **Provide bicycle accommodation on all primary bike routes.**
- **Allocate right-of-way for boulevards (stormwater infiltration facility)**
- **Allocate right-of-way for parking only when necessary and not in conflict with Living Streets**
- **principles**
- **Consider streets as part of our natural ecosystem and incorporate landscaping, trees, rain**
- **gardens and other features to improve air and water quality**

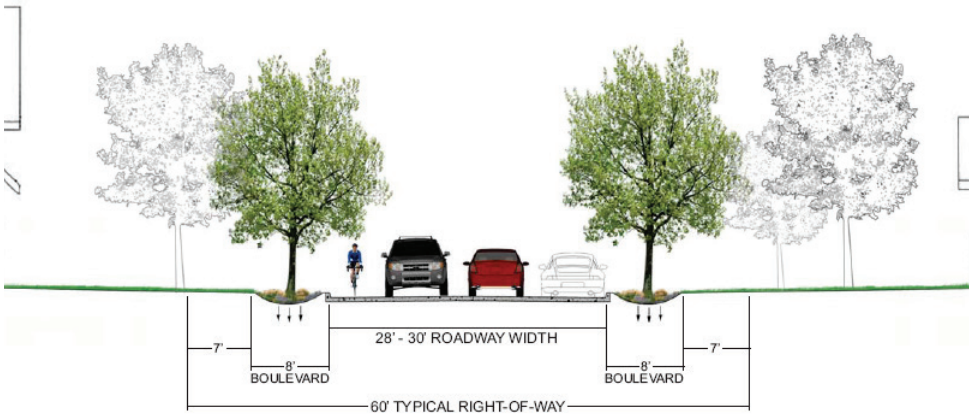
Municipalities ought to consider the use of drawings that show how the elements of a right of way cross section might vary given different contexts. Such drawings provide a clear understanding about objectives and efficient and effective use of the right of way area.



24 to 26-foot roadway width with parking on one side; 8-foot boulevard/ stormwater infiltration facility on each side; and 5-foot sidewalk on only one side



24 to 26-foot roadway width with parking on one side; 8-foot boulevard/ stormwater infiltration facility on each side; and 5-foot sidewalk on each side



28' to 30' roadway width with parking on one side; and 8-foot boulevard/stormwater infiltration facility on each side

Source: City of Maplewood, Minnesota, Living Streets Policy, Adopted January 28, 2013

Paved roadway width

Narrower road widths produce advantages not only in terms of reduced stormwater impacts, but also lower development costs, improved community character, and enhanced pedestrian safety. As a result, it is important for municipalities to revisit and update roadway width standards within subdivision regulations. Many existing standards are based on universal application of guidelines for highways or very large scale subdivisions planned more than 50 years ago. Revised standards should involve the minimum required pavement width and derive from careful considerations with public works and emergency response officials of traffic volume, on-street parking (where required), and passage of emergency vehicles and school buses. Typical road width reduction standards are shown on the following page.

Communities might also explore the use of permeable shoulders to reduce overall imperviousness of a roadway. This would involve combining a traditional asphalt surface for the travel lanes and an adjacent porous surface for the shoulder or bike lane area. Snow and ice management for the roadway must avoid sand so as to avoid clogging of the porous shoulder area. For more information, see a recent publication entitled, "Permeable Shoulders with Stone Reservoirs," referenced more fully in the Links to More Information Section below.

Emergency Vehicle Access

Emergency access considerations can have direct bearing on street width. Under the Massachusetts' fire marshal code, the minimum fire access lane width is 18 feet. Generally speaking, this can be met by two 9-foot travel lanes. The purpose of a fire access lane is to allow one fire truck to operate while allowing enough space for a second truck to pass by during the event of an emergency. Fire access lanes can be located on roads, but they must not be obstructed (i.e. by parked cars or snow).

While the state fire marshal code provides a minimum width, fire access lanes cannot be standardized across the state. Each community has different needs and fire apparatus that range in size. Communities may increase minimum fire access lane widths if required for their particular equipment. Alternatively, municipalities may select fire access equipment that allows for narrower lanes consistent with community design goals.

Table 5: General Parameters for Residential Road Design

Parameter	Single Use Residential Wide	Single Use Residential Medium	Single Use Residential Narrow	Single Use Residential Alley
Traveled Way				
Typical ADT	4,999 < 1,500	1,499 < 400	399 < 0	100 < 0
Design speed	25-30 mph	20 mph	20 mph	15 mph
Operating speed	20-25 mph	20 mph	15-20 mph	15-20 mph
Number of Through Lanes	2	2	2	1
Lane Width	10-12 feet	10-12 feet	10 feet	9-10 feet
Shoulder	2 feet	2 feet	2 feet	2 feet
Bike Lanes	Shared road Or 6 feed wide	Shared road	Shared road	Shared road
Utility Easement Width	----	----	10 feet	10 feet
Range of ROW Width	40-50 feet	36-40 feet	33-36 feet	20 feet
Roadside				
Desirable Roadside Width (pedestrian, swale, and planting strip)	5.5-12 feet	5.5-10 feet	5.5 feet	None
Grass Plot/Planting Strip	0-6 feet	0-6 feet	0-6 feet	None
Minimum Sidewalk Width	4 feet one side ok	4 feet/Shared road	Shared road	Shared road
Street Lighting	At intersections and pedestrian scale lighting at residential driveways.	At intersections and pedestrian scale lighting at residential driveways.	At intersections and pedestrian scale lighting at residential driveways.	At intersection with road
Intersections				
Traffic control	Stop signs, 4-way yield	4-way yield	4-way yield	Yield exiting alley
Curb Radii	15-25 feet	15-25 feet	15-20 feet	15 feet

Source: Sustainable Neighborhood Road Design: A Guidebook for Massachusetts Cities and Towns, May 2011, American Planning Association, Massachusetts Chapter and Home Builders Association of Massachusetts (page 27).

Cul de sacs

The required radius for a cul-de-sac also impacts the amount of impervious area. In the Pioneer Valley, minimum cul-de-sac radius requirements (at outer road edge) are typically set between 60 and 120 feet, and hammerhead turnarounds, which would greatly reduce impervious cover, are not typically allowed. Better stormwater management recommendations often call for cul-de-sacs to be designed with an outer road radius of 30 to 40 feet, as well as allowing for hammerhead turnarounds in lieu of cul-de-sacs.

Also in subdivision regulations, there are opportunities to reduce the required radius of a cul-de-sac (down to an outer road radius of 30 to 40 feet), and to allow hammerhead turnarounds. On dead-end streets, hammerhead turnarounds can provide a feasible way to reduce paved area while providing sufficient turnaround space for larger fire vehicles.

» **E. Cul de sac or dead end street -- Revise cul de sac requirements for granite curbing to allow bioretention area on landscaped island (soils permitting). This could entail curbing that is perforated to allow for the flow of runoff to the bioretention area;**

- **Minimize the required radii for cul-de-sacs - radius of 35 feet is optimal, depending on emergency vehicles;**
- **Minimize the number of residential street cul-de-sacs and incorporate landscaped areas to reduce their impervious cover. The radius of cul-de-sacs should be the minimum required to accommodate emergency and maintenance vehicles. Alternative turnarounds should be considered.**

Cul-de-sac infiltration island accepts stormwater from surrounding pavement. Note flat curb.

The cross section drawing to left shows how a cul de sac can be designed to serve as a bioretention area for stormwate runoff. The photo to the right shows a bioretention cul de sac in Waterford, Connecticut, that is designed to collect and filter roadway runoff from a residential development.

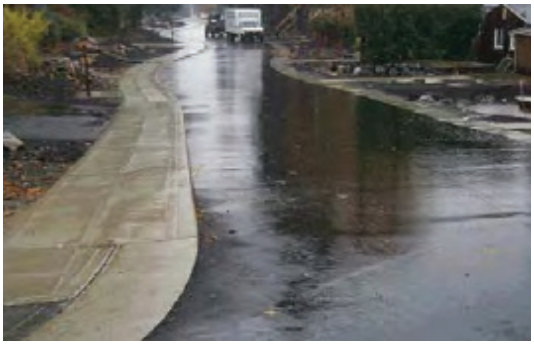
Curbs

Currently subdivision regulations typically call for the use of curb and gutter infrastructure connected to storm sewer infrastructure. This traditional approach produces stormwater flows that have greater impacts on local rivers and streams. As an alternative, regulations can promote roads without curbs where appropriate or the use of "perforated curbs." Perforated curbs are curbs with gaps that allow stormwater to move from the street through to a stormwater management facility that could include swales or planters, such as tree box filters. (See image on the following page.)

Another alternative involves the use of "invisible curbs." Invisible curbs are granite curbs that are buried along the street edge so as to allow stormwater to flow over into a stormwater management facility. Invisible curbs provide the structural support needed to plow from curb to curb, thereby retaining the desired roadway width even in snowy conditions. (See images on the following page.)

Perforated Curbs

Perforated curbing allows stormwater to enter planters that are designed to soak up rainfall.



Invisible Curbs

"Invisible" curbs along the street edge allow runoff to move into bioretention swales.

Drainage

Standards for drainage within the subdivision regulations should encourage and even require better site design with a low impact development approach that includes:

- **conservation of open space, natural drainage systems, native vegetation and other resources on site;**
- **minimizing and disconnecting impervious surfaces;**
- **clustering, and eliminating impervious surfaces that are connected to the municipal stormwater system; effective BMP selection and placement**

This section should also refer to and be consistent with the stormwater management bylaw/ordinance. It should identify which size projects require a stormwater management permit, and what are the design parameters for drainage (i.e., water quality volume treatment, which targets pollutant transport; channel protection volume, which targets erosion; and overbank and extreme flood protection). For communities that have adopted for upland areas the *Massachusetts Stormwater Handbook*, the design parameters with Standard 2 address downstream and off-site flooding. It requires that the post-development peak discharge rate is equal to or less than the pre-development rate from the 2-year and the 10 year 24 hours storms. The Model LID Bylaw prepared

by the Massachusetts Executive Office of Energy and Environmental Affairs suggests performance standards that go further, including treatment of discharges and protection for channels, overbank flooding, and extreme flooding.

The drainage section should also address requirements for bridge openings and major culverts. There are now important habitat preservation and climate change adaption considerations that ought to be considered in the design of these facilities. *The Massachusetts River and Stream Crossing Standards* should be referenced as an important resource for design of these facilities.

Sidewalks

In addition to roadways, sidewalks provide another important opportunity to reduce impervious area or provide better management of stormwater runoff. Regulations can promote a variety of strategies for achieving this, including:

Use of porous surfacing material for sidewalks and bus waiting areas. A recent publication on complete streets by the City of Boston that promotes the use of porous materials in certain sidewalk zones describes the advantages of this choice in paving:

> Permeable pavements provide increased traction when wet because water does not pool, and the need for salt, sand, and plowing is reduced during winter due to low/no black ice development. Compared to traditional paving methods, long-term maintenance costs may be lower in cold climates since permeable pavements resist cracking and buckling in freeze-thaw conditions. Nevertheless, permeable paving requires regular maintenance including: annual inspection of paver blocks for deterioration; periodic replacement of sand, gravel and vegetation; and annual industrial vacuuming of pavements to unclog sand and debris (Note: The use of sand in ice prevention should be avoided because it will clog pavement pores.)[3]

Flexibility in sidewalk standards to accommodate best management practices. This might include allowing alternatives to the minimum sidewalk standards or alternatives to sidewalk layout where pedestrian circulation makes use of common areas rather than street rights of way.

Grading of impervious sidewalk surfaces to direct stormwater runoff to bioretention areas or other such facility to eliminate or keep flow out of the municipal storm drain system

Utilities

Rather than require all electric, telephone, cable TV, fiber optic, and other conduits to be installed away from the road and its edge, allow placement of utilities under the paved section of the right of way. This creates essential space along the roadway edge for stormwater management facilities.

Often there is concern that such placement of utilities under the road will result in traffic delays and additional costs to utility companies. In the *Rhode Island LID Site Planning and Design Guidance for Communities*, however, authors from the Horsley Witten Group

note that the reality is, "The amount of pavement needed to be removed during such operations can be decreased through better diagnostic tests and trenchless technologies for utility construction and repair."

If the idea of putting utilities under the road edge is too great a concern for Departments of Public Works, then the next best strategy is to place utilities directly abutting roadway pavement, within 1 to 2 feet.

Landscaping and trees

Trees, shrubs, and ground covers are essential to good stormwater management. Leaves, needles, branches, and bark intercept rainfall so that it can then evaporate to the atmosphere. Leaf litter and mulch on the ground creates a spongy surface for retention of stormwater. Rainfall that reaches the roots is taken up into plants and then transpired to the atmosphere. Roots also help to stabilize soils and prevent erosion.

Subdivision regulations can recognize these important benefits through the following:

- **Encourage both preservation of existing stands of trees and mature trees on site as well as plans that incorporate trees into stormwater management practices. This can be done through specific requirements and through a system of credits. Calculating stormwater benefits of certain species based on size can be done through the National Tree Benefit Calculator at: www.treebenefits.com/calculator/**
- **Allow for bioretention areas or other vegetated stormwater facilities within treebelt areas and to count toward other required landscaping features, including site, parking or perimeter screening. This creates areas that function on several levels, including aesthetics and stormwater management.**

LINKS TO MORE INFORMATION

AHBL FOR PUGET SOUND PARTNERSHIP. NOVEMBER 2011. INTEGRATING LID INTO LOCAL CODES: A GUIDEBOOK FOR LOCAL GOVERNMENTS. SEE:
http://www.psp.wa.gov/LID_GLG.php

AMERICAN PLANNING ASSOCIATION, MASSACHUSETTS CHAPTER, AND HOME BUILDERS ASSOCIATION OF MASSACHUSETTS. MAY 2011. "SUSTAINABLE NEIGHBORHOOD DESIGN: A GUIDEBOOK FOR MASSACHUSETTS CITIES AND TOWNS." SEE:
www.apa-ma.org/apa-ma_documents/.../NRB_Guidebook_2011.pdf

CENTER FOR WATERSHED PROTECTION AND USDA FOREST SERVICE. "USING TREES TO REDUCE STORMWATER RUNOFF." FOR THIS POWERPOINT PRESENTATION, SEE:
http://www.slideshare.net/watershedprotection/using-trees-to-reduce-stormwater-runoff-formatted-presentation?type=powerpoint

ALSO SEE WEB PAGE RELATED TO THIS COLLABORATION:
http://www.forestsforwatersheds.org/reduce-stormwater/

LAWRENCE, TIMOTHY AND MYERS, MONIQUE. 2009. "EMERGENCY SERVICES AND STORM WATER MANAGEMENT." CALIFORNIA SEA GRANT PROGRAM. SEE:
www-csgc.ucsd.edu/BOOKSTORE/Resources/LID_FACTSHEET.pdf

RHODE ISLAND DEPARMENT OF ENVIRONMENTAL MANAGEMENT AND COASTAL RESOURCES MANAGEMENT COUNCIL. MARCH 2011. "RHODE ISLAND LOW IMPACT DEVELOPMENT SITE PLANNING AND DESIGN GUIDANCE MANUAL." SEE:
www.dem.ri.gov/programs/bpoladm/suswshed/pdfs/lidplan.pdf

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1 In his presentation, "Right Practice, Right Place: Green Infrastructure Technologies that Work in New England" at EPA's Growing Your Green Infrastructure Program, December 2012, Robert Roseen noted that in addition to reducing the number of acres to be cleared, the developer was able to avoid the use of 1,616 feet of curbing, 785 feet of pipe, 8 catch basins, 2 detention basins, and 2 outlet control structures.

2 Information on the LID Site Design Credit is found in Volume 3 of the Massachusetts Stormwater Handbook.

3 For more information, see the document from which this quote is drawn:
http://www.bostoncompletestreets.org/pdf/2/chap2_5_sidewalk_materials.pdf

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UNDERSTANDING

Paying for Green Infastructure

WHAT IT IS

Paying for green infrastructure projects can happen in a variety of ways. Green infrastructure facilities can be integrated into projects where stormwater management is already a component. This often presents important savings in avoided costs. Green infrastructure can also be paid for through a variety of mechanisms, including: stormwater utilities, fees tied to permitting, connection fees, establishment of betterments and management districts, bonds and loans, and sponsorships. While stormwater utilities are covered in a separate fact sheet within this series, the other financing mechanisms are described in more detail below.

AN INTEGRATED APPROACH

Wherever there are considerations of stormwater management, as there are in most public development or redevelopment projects, there is a role for green infrastructure. Funding for green infrastructure work can come from a variety of sources already used to cover the costs of such projects, including roads, combined sewers, railways, sidewalks, and schools. See diagram below.

Opportunities for Integrating Green Infrastructure with Other Projects

Recognizing the full value of green infrastructure can be an important impetus for integration of such facilities in existing projects. These are often referred to as secondary benefits. These are not typically part of stormwater projects that rely solely on traditional "gray"/underground infrastructure. Secondary benefits include: social, such as avoided flooding and healthier neighborhoods; economic, such as job creation and increased property values; and environmental such as cleaner waters and improved air quality. This more comprehensive accounting method is known as the "Triple Bottom Line" of green infrastructure used most notably by Philadelphia in their planning for green infrastructure. (For more information on the Triple Bottom Line approach, see Philadelphia's Long Term Control Plan Update (2009).) By integrating green infrastructure across the range of municipal projects while also accounting for all of the benefits to be derived, proponents can think more broadly and call on a far wider range of sources for project funding. (See Pioneer Valley Green Infrastructure Plan, page 82-84 for matrix showing Potential Sources for Enhanced Project Funding at: http://www.pvpc.org/plans/pioneer-valley-green-infrastructure-plan .

The City of Lancaster, Pennsylvania, accounted for these benefits in terms of "avoided costs or savings." With a goal of reducing annual average stormwater runoff by 1.053 billion gallons within the next 25 years, the city developed a study—drawing from their green infrastructure plan and a national valuation guide. The study involved placing a value on practices, such as bioretention and other infiltration practices by monetizing the benefits of services, such as: improved water quality, increased groundwater recharge, reduced flooding, reduced energy use, and reduced atmospheric CO2. The result is projections showing significant annual avoided costs/savings at the end of the 25-year implementation period. See table below.

Projected annual avoided costs/savings in Lancaster, PA, case study (benefits accrued at end of 25-year implementation period)	
$122.4 billion per year	Water - Avoided costs for wastewater treatment and the use of traditional "gray infrastructure" through green roofs, tree planting, permeable pavement, bioretention and infiltration practices, and water harvesting
$2,368,000	Energy - Reduced electricity and natural gas usage due to green roofs, tre planting, water harvesting, providing insulation shading, wind blocking, and evaporation

$1,023,000	Air quality - Reduced emissions of nitrogen dioxide, ozone, sulfur dioxide, and particulate matter due to uptake and absorption, reduced energy emissions, reduced ozone with trees, green roofs, permeable pavement, and bioretention and infiltration practices
$786,000	Climate change-related benefits in reduced CO2 through direct carbon sequestration, reduced water and wastewater treatment, reduced energy production due to vegetation and permeability.

Source: Webinar presented by Hal Sprague of Center for Neighborhood Technology, Valuing Green Infrastructure: Economic, Environmental, and Social Benefits, September 26, 2013, for the Vermont Agency of Natural Resources.

Portland Takes Direct Approach

A national leader in green infrastructure, the City of Portland, Oregon, took a direct approach to integrating green infrastructure into projects as a way to abate stormwater flows into the combined sewer system. One strategy entailed adopting a green streets policy whereby all City of Portland funded development, redevelopment or enhancement projects meeting the threshold in their stormwater management manual (of developing or redeveloping 500 square feet of impervious surface) must incorporate green street facilities.1 This policy led to what EPA has described as, "...a formal process to overlay multi-bureau project plans and scheduled capital improvement projects to identify how public and private projects can achieve multiple community and environmental benefits through green infrastructure."2 To cover the costs of green streets projects, Portland supplemented funds from general budget and capital improvement funds with innovation grants from EPA, revenue from a stormwater utility fee and from a one percent tax on construction projects that cannot meet the City's stormwater management regulations. What they learned, as did other case study communities examined by EPA, is that the increased investment necessary to include green infrastructure in large undertakings is typically a very small percentage of the total project costs. In addition, the use of green infrastructure elements can also decrease overall project costs, particularly with reductions in use of concrete or asphalt.

Portland's story underscores how integrating or overlapping green infrastructure with street development, redevelopment, or enhancement can yield tremendous value. For Pioneer Valley cities and towns where might there be other possibilities of overlap that may be worth exploring?

STORMWATER PERMIT FEES

Stormwater permit fees address potential stormwater impacts related to new construction. The fees are typically site specific and can be an unreliable source of funding when development slows.

Currently, three communities in the region assess stormwater permit fees to review and permit new development projects (Agawam, Northampton, and Wilbraham). While there is no direct connection between these permit fees and funds to maintain the stormwater system, stormwater permit fees are paid into general funds, and most communities pay for stormwater system maintenance from the general funds. In a sense, then, some part of these permit fees may help to cover some stormwater system maintenance costs.

CONNECTION FEES

Northampton is one community that currently charges a fee for a property's initial connection to the stormwater system. Connection fees for stormwater might be augmented based on a practice in Westfield relative to wastewater. The City of Westfield established a connection fee associated with new sewer hook ups aimed at helping to increase capacity at the wastewater treatment plant (where the City was reaching capacity). For every new gallon of sewage to be generated, the customer pays a fee equivalent to the cost of fixing 5 gallons worth of infiltration and inflow. It may be worth exploring whether this same strategy could be applied to stormwater whereby new connections to the system help to mitigate other flows into the system, thereby preserving capacity and avoiding the need for costly expansion projects.

BETTERMENTS AND MANAGEMENT DISTRICTS

MGL Chapter 80 allows for the assessment of cost of public improvements by municipalities. Whenever a certain location or district receives exclusive benefit or advantage from a public improvement, betterments can be assessed in that area for the improvement. This could be the case where several neighborhoods in a town require improved stormwater infrastructure. The cost of improvements can be offset by charges to those properties located within that jurisdiction.

To implement the Long Creek Watershed Management Plan in Maine (the result of a citizen's lawsuit over impaired waters), landowners in four municipalities joined forces to create the Long Creek Watershed Management Plan District. The District collects fees from property owners and uses the money to restore Long Creek and install stormwater retrofits. The fee is $3,000 per acre of impervious surface per year.

BONDS AND LOANS

Bonds are useful to initiate large capital projects, but they involve borrowing money and accruing debt. MassDEP's Clean Water State Revolving Loan Fund (SRF) has been an important source for low interest loans for many water infrastructure projects in the Pioneer Valley.

A 2014 letter from MassDEP Division Municipal Services Director Steve McCurdy, notes that MassDEP will receive a $47.6 million federal grant to subsidize the CWSRF program and that at least 10 % of these monies must be dedicated in 2014 to Green Infrastructure projects or components as defined by EPA. The 2014 Intended Use Plan lists 12 new Green Infrastructure construction projects in Massachusetts and 3additional Green Infrastructure construction projects are on the 2014 Carry-Over list. "The exact monetary value of the Green components of these projects will be determined when project applications are submitted, but are expected to be well in excess of the $4.76 million requirement," he concludes.

In addition, the SRF program has offered principal forgiveness for Environmental Justice projects, those projects occurring in areas defined to be a neighborhood with annual median household income (MHI) less than 65 percent of the state MHI.

SPONSORSHIPS

Several communities have been able to tap into local businesses to provide donations and sponsorships for green infrastructure projects.

In Portland, Maine, businesses helped to cover $20,000 of the $64,000 cost for a demonstration rain garden along the tidal Back Cove. The garden covers 2.5 acres of land adjacent to a popular recreational trail that is heavily used by walkers, joggers, and cyclists. The project's popularity led to the installation of a second rain garden adjacent to the trail's parking area, which was designed and funded by Stantec, a national engineering firm with local offices. Signage at the rain gardens highlights corporate sponsors.8 This idea builds on the successful Adopt a Trail corporate sponsorship program run by Portland's local land trust.

In Lynchburg, Virginia, a new corporate sponsorship program is drawing funding for the installation of demonstration rain gardens in prominent public places throughout the City. Each garden is sponsored by a local business, which is then credited with an attractive sign onsite. To date, this program has raised over $1.6 million and established 50 gardens.

Virginia also has a related statewide program called Streetscape Appearance Green Enhancement (SAGE), a comprehensive roadside management program that has been in existence since 2006. Funded entirely by donations, but managed by municipalities, the program aims to beautify local streetscapes, boost civic and community pride, and facilitate future economic development. Municipalities manage the donations through a 501 (c)3 non-profit and contributions are organized so as to cover construction, maintenance, and renewal, typically after 5 years.

OTHER POTENTIAL AND FUTURE SOURCES

Hazard Mitigation Funding

Though green infrastructure implemented area wide could help to mitigate natural hazards and build community resiliency, grant programs out of the Massachusetts and Federal Emergency Management Agencies do not as of yet provide opportunities for funding of green infrastructure stormwater management projects. The Massachusetts Emergency Management Grant Program's State Hazard Mitigation Officer Richard Zingarelli notes:

Standard hazard mitigation projects require a benefit-cost analysis that shows that the cost of the project is exceeded by the benefit as measured by direct reduction of damages from natural hazards. The difficulty is that it is difficult, if not impossible, to quantify a direct reduction in damage that results from measures like green roofs and porous pavement. As a result, any limited eligibility for funding in these programs would fall under the "5% Initiative" of the Hazard Mitigation Grant Program (HMGP), which allows for setting aside up to 5% of the total available HMGP funding for activities that are difficult to evaluate using traditional cost-effectiveness criteria.

It is important to know that the use of the word "mitigation" in emergency preparedness means avoidance and preparation (resiliency) and is more closely linked to the concept of "adaptation" in climate change.

WATER QUALITY CREDITS TRADING

Water quality trading is a market-based approach—an idea that has emerged from the energy market—that enables jurisdictions to achieve needed pollution controls through the purchase of credits for a particular pollutant. Landowners can produce water quality credits by implementing green infrastructure practices that reduce volume and pollutants, and typically at a much lower cost than a municipal treatment facility. EPA notes, "Through water quality trading, facilities that face higher pollutant control costs to meet their regulatory obligations can purchase pollutant reduction credits from other sources that can generate these reductions at lower cost, thus achieving the same or better overall water quality improvement. In most cases, trading takes place on a watershed level under a pollutant cap (the total pollutant load that can be assimilated by a waterbody without exceeding water quality standards) developed through the TMDL

process or a similar type of water quality analysis that produces information on pollutant loadings and resulting water quality conditions."

For the Long Island Sound TMDL, the state of Connecticut adopted trading legislation. Public Act No. 01-180, which establishes the trading framework for a Long Island Sound Nitrogen Credit Exchange Program to be directed by a Nitrogen Credit Advisory Board appointed by the General Assembly and the governor. EPA notes, "The Nitrogen Credit Exchange Program establishes a well-defined trading structure supported and regulated by limits mandated in state law. The state legislation specifies trading ratios (e.g., delivery and location ratios) and accounting methodologies to formalize all calculations used in trading."

LINKS TO MORE INFORMATION

ENVIRONMENTAL FINANCE CENTER UNIVERSITY OF MARYLAND. 2014. LOCAL GOVERNMENT STORMWATERFINANCING MANUAL: A PROCESS FOR PROGRAM REFORM. SEE:
http://efc.umd.edu/assets/efc_stormwater_financing_manual_final_(1).pdf

NATURAL RESOURCES DEFENSE COUNCIL. FEBRUARY 2012. FINANCING STORMWATER RETROFITS IN PHILADELPHIA AND BEYOND. SEE:
http://www.nrdc.org/water/files/stormwaterfinancing-report.pdf

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY. 2013. COMMUNITY BASED PUBLIC PRIVATE PARTNERSHIPS FOR GREEN INFRASTRUCTURE-DRIVEN STORMWATER RETROFITS: A WEBINAR.

ENVIRONMENTAL FINANCE CENTER, UNIVERSITY OF NORTH CAROLINA. 2014. A CATALOG OF FINANCE PUBLICATIONS ON GREEN INFRASTRUCTURE APPROACHES TO STORMWATER MANAGEMENT. SEE:
http://www.efc.sog.unc.edu/reslib/item/catalog-green-infrastructure-and-stormwater-finance-publications

USEPA. 2009. FUNDING STORMWATER PROGRAMS FACTSHEET. SEE:
www.epa.gov/region1/npdes/stormwater/assets/pdfs/FundingStormwater.pdf

CHARLES RIVER WATERSHED ASSOCIATION FOR MA COASTAL ZONE MANAGEMENT. 2007. ASSESSMENT OF STORMWATER FINANCING MECHANISMS IN NEW ENGLAND. SEE:
www.crwa.org/projects/stormwater/Municipal%20SFM%20Case%20Studies%20Repo.pdf

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UNDERSTANDING

Stormwater Utilities

WHAT IT IS

For many cities and towns there are significant costs associated with operating, maintaining, and upgrading stormwater infrastructure. The municipal system for capturing and conveying stormwater from rooftops, driveways, and roadways can include the hundreds of catchbasins along street edges and miles of underground pipes.

Establishing a stormwater utility is one important strategy to creating a reliable funding source for this work. Currently there are between 1,500 and 2,000 stormwater utilities in the United States, 5 of which are located in Massachusetts (Fall River, Newton, Northampton, Reading, and Westfield).

Most municipalities in the Pioneer Valley rely on allocations from the general fund to service stormwater infrastructure. These allocations, however, are not keeping pace with actual needs for upgrading aging systems, reducing localized problems—such as flooding and erosion—and meeting regulatory requirements for environmental protection.

A stormwater utility operates much like an electric or drinking water utility. Fees collected from property owners go into a dedicated fund to pay specifically for the work of operating, maintaining, and improving stormwater infrastructure. This reinforces the idea that like other utilities, stormwater management is a public service. Monies can be used to pay for operation and maintenance expenses, project or capital-related expenditures, staffing, engineering, permitting, inspection, and program management costs.

In 1998, the City of Chicopee was the first municipality in Massachusetts to collect a fee for maintenance and upgrade of stormwater infrastructure, but the program is technically not a "stormwater utility" as funds go into a water pollution control account that also receives funding for projects that include the sanitary sewer system. So the program is referred to simply as a "stormwater fee."

HOW IT WORKS

Since impervious surfaces (roofs, driveways, and roadways) are what produce the runoff from rainfall and snowmelt that must be managed, stormwater utility rates are most commonly based on the amount of impervious surface on a property. For residential customers, many municipalities set rates according to a method called Equivalent Residential Unit (ERU). This unit is derived from the impervious area footprint of a typical single-family home. The City of Newton, Massachusetts, for example, currently has an ERU of 3,119 square feet. Each residential property is thus billed $25 per year based on this average of 1 ERU. Non residential

properties, including industrial and commercial properties are billed based on 6 ERUs or $150 per year. The City has been exploring a different rate structure for residences of more than three households and commercial and industrial properties since the current flat rate of 6 ERUs has properties with small impervious areas (small downtown shops, etc.) paying the same as properties with large impervious areas (shopping malls). The new rate would assign a certain number of ERUs to a commercial and industrial property based on actual impervious area. Rates for larger properties in some municipalties are sometimes not based on ERUs, but rather a dollar per unit cost based directly on the area of impervious surface on a property.

A guidance document prepared by the National Association of Flood and Stormwater Management Agencies notes, "The fundamental objective of a stormwater utility/service fee is attainment of equity. Service fee rate methodologies are designed to attain a fair and reasonable apportionment of cost of providing services and facilities."

Enabling Legislation

In Massachusetts there are two companion pieces of legislation that allow municipalities to set up stormwater utilities: MGL Chapter 83 Section 16 and MGL Chapter 40 Section 1A. The first, MGL Chapter 83 Section 16, is relatively new enabling legislation that allows municipalities to set up a stormwater management utility and charge utility fees for managing stormwater. The second, MGL Chapter 40 Section 1A, provides a definition of a district for the purpose of water pollution abatement, water, sewer, and/or other purposes. Together, these two pieces of legislation allow a municipality to set up an authority to manage stormwater and to charge utility fees for managing stormwater.

WHERE THEY ARE USED CURRENTLY IN MASSACHUSETTS

Two of Massachusetts' five stormwater utilities are located in the Pioneer Valley. (See table below.) The cities of Northampton and Westfield are currently the only municipalities in the region with programs that collect fees specifically dedicated to maintenance and upgrade of stormwater infrastructure. Westfield instituted a stormwater utility in 2010 for the purpose of financing a stormwater management division, responsible for meeting federal requirements for stormwater monitoring and maintaining the City collection system. Northampton adopted a stormwater utility in 2014 to generate funding for meeting federal permit requirements and attending to aged stormwater and flood control infrastructure.

There are roughly 6,600 smaller residential properties (1-3 family) in Northampton. Under the billing formula these properties are divided into four groups based on the impervious surface area on each property. All properties within each group pay the same fee. This standard fee is calculated based on the average impervious and pervious areas for all properties within each group. Based on the annual budget of $1,980,056, the annual residential fees are estimated to be:

Stormwater Utilities/Fees in Massachusetts

Community	Date Created	Equivalent Residential Unit (ERU)*	Fee	Annual Revenue
Chicopee	1998	2,000 s.f.	Single family residential at $100 per year Multi family, industrial, commercial properties at $1.80 per 1,000 square feet, with a minimum charge of $100 per year and a maximum charge of $640 per year	$1,500,000 (2012)

Fall River	2008	2,800 s.f.	Residential: 1 to 8-family at $140 per year Commercial, industrial and residential properties greater than 8 family at $140 per year for 2,800 square feet of impervious surface	$4,660,000 (2012)
Newton	2006	3,119 s.f. Proposed change: 2,600 s.f.	Residential at $25 per year, with those receiving elderly discount, $17.52 per year Non residential at $150 per year (Proposed change involves replacing the flat fee with a fee based on area of imperviousness. This would include residences with 3 or more units.)	$725,000 (2012)
Northampton	2014		1 to 3 family homes annual residential fee estimated to be: $63.94 for impervious area <2,250 sq. ft. $91.05 for impervious area 2,250 to 3,056 sq. ft. $125.61 for impervious area 3,056 to 4,276 sq. ft. $259.07 for impervious area >4,276 sq. ft.	$2,000,000 (estimated)
Reading	2006	2,552 s.f.	Single and two-family residences at $40 per year Multi-family, commercial, and industrial properties at $40 per 3,210 square feet annually	$357,000 (2012)

Westfield	2010	NA	Residential at $20 per year Commercial properties at $.045 per 1,000 square feet up to a maximum of $600 per year	$560,000 (2012)

*Residential customers are typically billed for stormwater runoff based on the Equivalent Residential Unit (ERU). An ERU is based on the amount of impervious surface area or percent impervious area found at the typical single-family home within the municipality.

DISCOUNTS AND CREDITS

Local governments with stormwater utilities can encourage better practices on private property by reducing fees in exchange for facilities that reduce the need for service by the municipal stormwater system. Discounts and credits can be geared to promote impervious surface reductions, onsite management or volume reduction, or the use of specific practices, such as raingardens/bioretention facilities, drywells, cisterns, or green roofs.

The City of Chicopee has just begun to implement a "Rain Smart Rewards" ordinance that offers a stormwater fee reduction of up to 50 percent in exchange for implementation of improved stormwater management practices by property owners.

In Minneapolis, Minnesota, 50 percent of the stormwater fee can be waived if the property owner can demonstrate that the runoff from a 10-year, 24-hour storm event can be managed on site. If a property owner can demonstate that the runoff from a 100-year, 24-hour storm event can be managed on site, the entire stormwater fee is waived.

Portland, Oregon's Clean River Rewards program provides stormwater utility fee discounts to encourage residential and commercial property owners to manage stormwater on site (35 percent discounts) and/or on the public right of way that serves their property (65 percent discounts). Partial credits are also given for ecoroofs, four or more trees over 15 feet tall, and for properties with less than 1,000 square feet of imperviousness. There is a Residential Discount Calculator and a Commercial Discount Calculator on the program's website so that property owners can calculate what changes they might make to obtain certain savings.

Starting July 1, 2014, credits in Northampton will be available for small residential stormwater improvements (rain gardens and porous driveways), construction and maintenance of larger stormwater best management practices, protected open land, commonly owned undeveloped properties and educational programs. Senior (needs-based), low income, and protected land credits are automatically applied based on documentation by the Northampton Assessor's Office. All other credits will require submission of an application and other documentation.

BENEFITS

Establishing a stormwater utility is no easy task. It requires tremendous effort in terms of education and politics. The process, however, helps everyone to understand the service provided by the municipal stormwater system and the significant costs of operating, maintaining, and improving this infrastructure. In the end, the utility provides a dedicated and stable source of funding to maintain and upgrade an aging system, reduce localized problems—such as flooding and erosion, and meet regulatory requirements for environmental protection.

A stormwater utility has other benefits as well:

- **Creates an equitable way to pay for stormwater services, especially if the fee structure is based on the amount of impervious surface. Discounts or offsets can be provided to low-income residents or elderly, further ensuring the fee's equitability.**
- **Tax-exempt properties like universities, hospitals, and places of worship are required to pay the fee, so that they help cover the cost of services they receive**
- **Typically easier for the municipality to institute than other forms of funding. "In many communities, new taxes require a vote of approval by the public, while a fee is a charge that municipalities have the authority to leverage for the services they provide."6**
- **May enable municipalities to consolidate or coordinate responsibilities previously dispersed among several departments and develop programs that are comprehensive, cohesive, and consistent year to year**
- **Creates funding that can be leveraged to meet grant and bond requirements**
- **If a credit or reduction is offered, the fee can become an incentive for improved stormwater management on private property thereby reducing the service demand on the municipal system**

IMPORTANT CONSIDERATIONS

To achieve desired objectives, several considerations should be taken into account when proposing and establishing a stormwater utility:

Start with a thoughtful outreach campaign that generates enthusiasm for the community's stormwater vision. If property owners understand the benefits they will receive, they are more likely to support the fee. As part of this, it is important to work in advance with religious institutions, private schools, hospitals, and non profits to be clear that the utility is like other utilities that they must pay. And education should be ongoing.

As part of setting rates and calculating bills, develop a sound methodology with rigorous quality assurance. GIS mapping should be integral to this method if area of impervious cover is a factor in setting rates.

Set rates so that the fee provides adequate revenue to achieve stormwater goals. If the fee is unreasonably high, it will not be supported. If it is too low, promised benefits will not materialize and public support is likely to erode.

Give some advance thought to determining how stormwater utility fees can be collected. Typically, they have been collected either on a separate bill, added to a water collection bill, or added to the property tax bill.

Be sure that the greatest costs are directed toward those who create the most runoff, particularly commercial and industrial facilities with large areas of impervious cover, rather than residential and other properties with low impervious cover.7 At the same time, municipalities should be sensitive to where residents may already be paying stormwater management fees through homeowner associations.

Ensure that fees do not harm low-income residents, as in Detroit, where an increase in stormwater fees caused some low-income residents to be unable to pay their water bill and have their water turned off. Sliding fee scales, bill discounts, crisis vouchers, and zero interest loans for qualified customers are options for offsetting the burden on lower income residents.

LINKS TO MORE INFORMATION

METROPOLITAN AREA PLANNING COUNCIL. 2013. STORMWATER UTILITY FUNDING STARTER KIT. SEE:
http://www.mapc.org/stormwater-utility-funding-starter-kit
(Note: A well done update of PVPC's 1998 kit called, "How to Create a Stormwater Utility.")

ROSS STRATEGIC AND INDUSTRIAL ECONOMICS, INC. FOR US EPA, REGION 1. 2013. EVALUATION OF THE ROLE OF PUBLIC OUTREACH AND STAKEHOLDER ENGAGEMENT IN STORMWATER FUNDING DECISIONS IN NEW ENGLAND: LESSONS FROM COMMUNITIES. SEE:
http://www.epa.gov/evaluate/pdf/water/eval-sw-funding-new-england.pdf

WESTERN KENTUCKY UNIVERSITY. 2012. STORMWATER UTILITY SURVEY. SEE:
http://www.wku.edu/engineering/civil/fpm/swusurvey/

ENVIRONMENTAL FINANCE CENTER, UNIVERSITY OF NORTH CAROLINA. 2012. STORMWATER UTILITY DASHBOARD. SEE:
http://efc.unc.edu/tools/NCStormwaterDashboard_2012.html

DELANY, JOE, K. HONETSCHLAGER, AND T. MCINTIRE. 2009. STRUCTURING A STORMWATER UTILITY. TOWN OF READING, MA. SEE:
http://www.salemsound.org/PDF/ReadingStormwaterUtility.pdf

USEPA. 2009. FUNDING STORMWATER PROGRAMS FACTSHEET. SEE:
www.epa.gov/region1/npdes/stormwater/assets/pdfs/FundingStormwater.pdf

CHARLES RIVER WATERSHED ASSOCIATION FOR MA COASTAL ZONE MANAGEMENT. 2007. ASSESSMENT OF STORMWATER FINANCING MECHANISMS IN NEW ENGLAND. SEE:
www.crwa.org/projects/stormwater/Municipal%20SFM%20Case%20Studies%20Repo.pdf

NEW ENGLAND ENVIRONMENTAL FINANCE CENTER. 2005. STORMWATER UTILITY FEES: CONSIDERATIONS AND OPTIONS. SEE:
http://efc.muskie.usm.maine.edu/docs/StormwaterUtilityFeeReport.pdf

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Green Roof Model Incentives

The following green roof model incentives are excerpted from municipal bylaws, regulations and policies from around the United States, and offer example language for customizing incentives to meet the needs of your municipality.

FLOOR AREA RATIO BONUS

City of Portland Zoning Code Title 33, Chapter 33.510 Central City Plan District

Rooftop Gardens OptionIn CX, EX, and RX zones outside of the South Waterfront Subdistrict, developments with rooftop gardens receive bonus floor area. For each square foot of rooftop garden area, a bonus of one square foot of additional floor area is earned. To qualify for this bonus option, rooftop gardens must meet all of the following requirements.

a. The rooftop garden must cover at least 50 percent of the roof area of the building and at least 30 percent of the garden area must contain plants.

b. The property owner must execute a covenant with the City ensuring continuation and maintenance of the rooftop garden by the property owner. The covenant must comply with the requirements of 33.700.060.

GREEN ROOF POLICY

City of Portland, Green Building Policy

NOW THEREFORE, BE IT RESOLVED that the Portland City Council amends the City of Portland's Green Building Policy to direct all City Bureaus and the Portland Development Commission to:

» **Require design and construction of all new City-owned facilities to include an ecoroof with at least 70% coverage AND high reflectance, Energy Star-rated roof material on any remaining non-ecoroof roof surface area; OR, Energy Star-rated roof material when an integrated ecoroof/Energy Star-rated roof is impractical;**

GREEN ROOF BYLAW

Toronto, Canada Green Roof Bylaw

http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=83520621f3161410VgnVCM10000071d60f89RCRD&vgnextchannel=3a7a036318061410VgnVCM10000071d60f89RCRD

Toronto Municipal Code Chapter 492, Green Roofs

The Bylaw applies to new building permit applications for residential, commercial and institutional development made after January 31, 2010 and will apply to new industrial development as of April 30, 2012. The full bylaw is available at the web link above.

§ 492-2. Green roofs required.

A. Every building or building addition constructed after January 30, 2010, with a gross floor area of 2,000 square meters or greater shall include a green roof with a coverage of available roof space in accordance with the following chart:

Gross Floor Area (Size of Building)	Coverage of Available Roof Space (Size of Green Roof)
2,000 — 4,999 m^2	20%
5,000 — 9,999 m^2	30%
10,000 — 14,999 m^2	40%
15,000 — 19,999 m^2	50%
20,000 m^2 or greater	60%

GREEN PERMIT PROCESS

City of Chicago Green Permit Process

http://www.cityofchicago.org/city/en/depts/bldgs/supp_info/overview_of_the_greenpermitprogram.html

Projects meeting the following criteria are eligible for the Green Permit Process:

- **Permit applications that include green technologies such as green roofs, rainwater harvesting, solar panels, solar thermal panels, wind turbine and geothermal systems are REQUIRED to be submitted through a Green Permit Program Project Administrator.**
- **Commercial project participant must earn certification within the LEED rating system**
- **Smaller Residential Project participant must earn certification under the Chicago**

Green Homes Program checklist based rating system or LEED for Homes.

» Green Menu Items – All Green Permit Program participants must utilize certain green strategies or green technologies to receive incentives offered by the Green Permit Program.

  » Green roofs improve the urban environment by combating the urban heat island, reducing stormwater runoff, and reducing the energy use of the building beneath.

  » For projects with no other green roof requirement, provide 50% green roof. For projects with a green roof required by Department of Planning and Development, add 25% to the DPD green roof requirement.

GREEN ROOF FEE CREDIT

City of Chicago Green Roof Fee Credit

http://www.cityofchicago.org/content/dam/city/depts/bldgs/general/GreenPermit/Green_Roof_Checklistada.pdf

FEE STRUCTURE	
☐ **Building Permit Fee**	Building permit fee calculation is based on building occupancy and area of work. Please visit our website for additional information and to use the permit fee calculator. www.cityofchicago.org/buildings
☐ **Green Roof Fee Credit**	A credit of $0.05 per square foot of green roof provided will be applied to your total permit fee.
☐ **Building Permit Deposit**	50% of total building permit fee due at permit submittal meeting. Please make checks payable to **The City of Chicago Department of Revenue**

Minneapolis Fee Reductions

http://www.minneapolismn.gov/publicworks/stormwater/fee/stormwater_fee_stormwater_mngmnt_feecredits

The Stormwater Credit system provides:

» Up to 50 percent credit (reduction) in your stormwater utility fee for management tools/practices that address stormwater quality

» 50 percent or 100 percent credit (reduction) in your stormwater utility fee for management tools/practices that address stormwater quantity

Below is a partial list of stormwater BMPs approved for use in the Quality Credits program:

» Rain Gardens

» Pervious Pavers

» Wet Ponds

» Dry Wells

» Sand Filters

- Filter Strips
- Infiltration trenches
- Green Roofs

Only those properties that can demonstrate the capacity to handle a 10-year or 100-year rain event can receive a stormwater quantity credit. To apply for a stormwater quantity credit, property owners must have their applications certified by a state licensed engineer or landscape architect.

Property owners can apply for either the "Standard Quantity Reduction Credit" or the "Additional Quantity Reduction Credit."

Standard Quantity Reduction Credit. The Standard Quantity Reduction Credit is a 50 percent credit on a property's stormwater fee. The "Standard Quantity" credit is based on a property's stormwater quantity management tools/practices being able to retain the 10-year, 24-hour type II SCS storm event. To qualify for this credit, the property owner must demonstrate that stormwater from the property is controlled with an on-site constructed stormwater quantity management tool/practice (BMP).

Additional Quantity Reduction Credit. The Additional Quantity Reduction Credit is a 100 percent credit on a property's stormwater fee. To be eligible for the "Additional Quantity" credit, a property's stormwater quantity management tools/practices must be able to retain the 100-year, 24-hour type II SCS storm event. To qualify for this credit, the property owner must demonstrate that stormwater from the property is controlled with an on-site constructed stormwater quantity management tool/practice (BMP).

You can learn more about stormwater quantity management tools/practices from the Minnesota Stormwater Manual.

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UNDERSTANDING

Model Green Streets Policy Statement

A Green Streets policy can be adopted by a municipality to encourage the transformation of impervious city street surfaces into landscaped green-spaces that capture stormwater and recharge it on sight.

Model Policy from Northampton Massachusetts

In City Council, October____, 2014

Ordered, that the City adopt a Green Streets and Infrastructure Policy

WHEREAS, Stormwater runoff from streets, roads, parking lots, roofs and other impervious urban surfaces is a significant source of water pollution to our rivers, streams and water bodies, and also is a key contributor to inflow into sanitary sewers; and

WHEREAS, Green Streets may provide cost-effective infrastructure solutions to reduce and manage stormwater runoff and flooding, including from more intense storm and flooding events and reduce localized flooding from surcharging, adapt to climate change, and manage stormwater runoff; and

WHEREAS, Green Streets improve water quality by filtering stormwater, removing contaminants and cooling the stormwater before it encounters groundwater or surface water bodies, such as rivers, all of which ultimately benefit watershed health. Facilities that filter stormwater through vegetation and soil can reduce total suspended solids (TSS), organic pollutants /oils, and heavy metals by at least 90%; and

WHEREAS, Green Streets foster unique and attractive streetscapes that protect and enhance neighborhood livability, integrate the built and natural environments, enhance the pedestrian environment, and introduce park-like elements into neighborhoods; and

WHEREAS, Green Streets can serve as urban greenways or pathways and provide a preferred means of connecting neighborhoods and parks/recreation areas in ways that are attractive to pedestrians and bikers and complement complete streets; and

WHEREAS, Green Streets encourage the planting of landscapes and trees which contribute environmental benefits such as reduced summer air temperatures, reductions in global warming through carbon sequestration and air pollution screening.

WHEREAS, green infrastructure may help to reduce the long-term costs of gray infrastructure maintenance, and complement gray infrastructure with hybrid systems of gray, piped infrastructure combined with green, vegetated infrastructure; and

WHEREAS, a Green Streets and Infrastructure policy demonstrates the City's commitment to achieving comparable infrastructure required for private developments and complements the City's complete streets policy by providing pedestrian and bicycle access; and

WHEREAS, forthcoming U.S. Environmental Protection Agency Municipal Separate Storm Sewer System (MS4) stormwater permits will require that the city control the amount and quality of stormwater discharged from the MS4s to rivers, streams, lakes, ponds, and wetlands; and

WHEREAS, recharge of groundwater sources is a key mitigation activity under the soon to be amended Massachusetts Water Management Act regulations 310 CMR 36.00; and

DEFINITIONS:

- **Green Infrastructure: Infrastructure which keeps rain close to where it falls, using structures to improve on-site infiltration, such as rain gardens, green roofs and permeable pavements, to promote cleaner, slower, and smaller storm flows to nearby rivers and streams;**
- **Green Street: A subset of Green Infrastructure in which the street handles significant amounts of stormwater on site through use of vegetated and/or soil-infiltration facilities. Green Streets can include landscaped street-side planters or swales or tree box filters or porous pavement that capture stormwater runoff and allow it to soak into the ground as soil and vegetation filter pollutants.**

RESOLUTION

Now, **THEREFORE, IT IS HEREBY RESOLVED** that the City of Northampton adopts a policy to promote the use of green street facilities and green infrastructure in public and private development through regulation, capital investment, and management mechanisms as a cost-effective and sustainable practice for stormwater management in current and future projects wherever technically and economically feasible. This includes:

- Road reconstruction, new road development and bicycle or pedestrian projects;
- Stormwater projects; and
- New development and redevelopment projects

Further, it is city policy to:

- Incorporate and maintain green street facilities and green infrastructure into all City-funded development, redevelopment, and enhancement projects, to the extent technically and economically feasible, and utilizing the best technology available at the time to meet water quality goals with the lowest lifecycle costs; and
- Ensure that regulations require and incentivize all development to incorporate some Green Streets and green infrastructure features; and
- Ensure coordination and communication between City departments, in particular, Public Works and Planning and Sustainability, to ensure implementation of this policy, as well as fully addressing competing priorities.

FOR MORE INFORMATION, PLEASE CONTACT

Pioneer Valley Planning Commission
413-781-6045

60 Congress Street, Floor 1
Springfield, MA 01104-3419

www.pvpc.org

UNDERSTANDING

Model Sewer Regulations For Downspout Disconnection

REGULATIONS GOVERNING THE USE OF SANITARY AND COMBINED SEWERS AND STORM DRAINS OF THE BOSTON WATER AND SEWER COMMISSION

Adopted February 27, 1998

Section 4 - Wastewater-Stormwater Separation.

(a) The plumbing of any existing or new building shall be so constructed as to keep all stormwater, surface water, groundwater, roof and surface runoff, subsurface drainage, uncontaminated cooling water, and uncontaminated industrial process water, non-contact cooling water, and non-contact industrial process water separate from sanitary sewage and industrial wastes, and from the building sewer.

(b) The building drain conveying wastewater from plumbing fixtures within the building shall discharge to a building sewer, while the building drain conveying stormwater and other drainage shall discharge to a building storm drain.

(c) Where separate storm drains and sanitary sewers are provided, and the Commission has determined that on-site retainage of stormwater is not possible, building storm drains shall be connected to a storm drain. Connection of a building storm drain to a sanitary sewer is prohibited.

(d) Where separate storm drains and sanitary sewers are provided, building sewers shall be connected to a sanitary sewer. Connection of a building sewer to a storm drain is prohibited.

(e) Where only a combined sewer has been provided, and the Commission has determined that on-site retainage of stormwater is not possible, the separate building storm drain shall be connected to the building sewer in a manner prescribed by the Commission's

Requirements for Site Plans and the building sewer connection shall be made to such combined sewer.

(f) The Commission shall require an owner to eliminate a source of infiltration or inflow whenever the Commission determines that the source is resulting in excessive infiltration or inflow to be discharged directly or indirectly to the sanitary sewer system.

Section 5 - Connections to Combined Sewers.

In order to prevent the direct discharge of wastewater to receiving waters under dry weather conditions, a building sewer shall not be connected to a combined sewer overflow.

Section 6 - Connections to Manholes.

Building sewer connections for new or substantially rehabilitated buildings shall not be made directly to Commission-owned manholes unless expressly authorized in writing by the Commission.

Section 7 - Connections to Catch Basins.

Private drains, including but not limited to, building storm drains for new or existing buildings and drains from irrigation systems, shall not be connected directly to catch basins.

Section 8 - Connections from Individual Wastewater Disposal Systems.

Connection of an individual wastewater disposal system, whether directly or indirectly, to a Commission sewer or drain is prohibited.

Section 7 - Connections to Catch Basins.

Private drains, including but not limited to, building storm drains for new or existing buildings and drains from irrigation systems, shall not be connected directly to catch basins.

Section 8 - Connections from Individual Wastewater Disposal Systems.

Connection of an individual wastewater disposal system, whether directly or indirectly, to a Commission sewer or drain is prohibited.

Section 9 - Dye Testing of Connections.

Prior to activating water service, every new building sewer shall be dye tested by the Commission, or by the owner or his designee in the presence of a Commission inspector, to establish that the building sewer is properly connected to the Commission's wastewater system. The Commission may conduct dye testing of an existing building sewer to establish that it is properly connected to the Commission's wastewater system. The

Commission may require the owner forthwith to eliminate a connection from a building sewer to a storm drain (also referred to as an illegal connection) at the owner's expense. Where separate sanitary sewers and storm drains exist, the Commission may also dye test, or require the owner to dye test in the presence of a Commission inspector, a new or existing building storm drain to establish that the building storm drain is properly connected to the Commission's storm drainage system. The Commission may also require the owner forthwith to eliminate a connection from a building storm drain to a sanitary sewer at the owner's expense.

FOR MORE INFORMATION, PLEASE CONTACT

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Appendix H
Green Infrastructure Report (Draft)

Weston & Sampson℠

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REPORT

June 2022

CITY OF
Melrose
MASSACHUSETTS

Year 4 MS4 Permit Compliance
Green Infrastructure Report
DRAFT for Review

TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

1.1 Regulatory Requirement

The 2016 Massachusetts Municipal Separate Storm Sewer Systems (MS4) General Permit, which came into effect on July 1, 2018, regulates discharges from small MS4s to waters of the United States. The Permit requires MS4 operators to develop, implement, and enforce a stormwater management program (SWMP). The purpose of the SWMP is to reduce the discharge of pollutants from the MS4 to the maximum extent practicable, to protect water quality, and to satisfy the applicable water quality requirements of the Clean Water Act. MS4 operators must implement various Best Management Practices (BMPs) for each of the following six minimum control measures:

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Stormwater Runoff Control
- Stormwater Management in New Development and Redevelopment (Post-Construction Stormwater Management)
- Good Housekeeping and Pollution Prevention for Municipal Operations

As part of the minimum control measure for Post-Construction Stormwater Management, Section 2.3.6 of the 2016 MS4 Permit, regulated communities are required to assess existing local regulatory mechanisms to determine the feasibility of making the following practices allowable when appropriate site conditions exist:

- Green roofs
- Infiltration practices such as rain gardens, curb extensions, planter gardens, porous and pervious pavements, and nature-based stormwater management practices
- Water harvesting devices such as rain barrels and cisterns, and the use of stormwater for non-potable uses
- Open space preservation or cluster development practices

The purpose of this exercise is to determine if these practices are allowed or, if not, what regulatory mechanisms hinder the use of these practices. This report will recommend any changes to local regulations necessary to make these practices allowable and will include a schedule for implementing those recommendations.

The City of Melrose shall implement recommendations included in this report in the specified timeframe to the extent feasible. The status of this assessment and any planned or completed changes to the relevant regulatory mechanisms shall be reported in each MS4 annual report.

1.2 Applicable Regulatory Mechanisms and Assessment Procedure

The following bylaws, rules & regulations, policies, and/or design standards were reviewed to identify existing language that encourages the use of green infrastructure practices for stormwater

management in Melrose, and also identify opportunities to incorporate new language as it pertains to the use of green infrastructure in development:

- Rules and Regulations Governing the Subdivision of Land in Melrose, Massachusetts (Subdivision Rules and Regulations)
- Zoning Bylaw, City Code Chapter 235
- Wetlands Protection Bylaw, City Code Chapter 231
- Waters, Sewers, and Drains Bylaw, City Code Chapter 228

In addition, the City of Melrose Complete Streets Policy (2016), the 2015 Open Space and Recreation Plan, and the Construction Site Inspection and Enforcement of Erosion and Sedimentation Control (2021) documents were reviewed but found not to include relevant regulatory language regarding green infrastructure and open space. Each regulatory mechanism listed above was reviewed using the matrix included in Attachment A. The mechanisms were reviewed using a list of key questions in four categories, and the degree to which each mechanism addresses a key question was rated as Conventional, Better, or Best using a system based on the Local Bylaw and Regulation Assessment Tool developed by MassAudubon[1], the Assessment of Street Design and Parking Lot Guidelines and Feasibility of Allowing Green Infrastructure Checklist and Guide developed by the Pioneer Valley Planning Commission[2], and references provided by EPA on their WaterSense website[3]. The definition for each rating is as follows:

- Conventional: The key question is not addressed, or no flexibility is allowed in design requirements.
- Better: The key question is addressed, and some flexibility is allowed in design requirements, usually by special permit. LID design practices and green infrastructure are encouraged but not required.
- Best: The key question is addressed, and flexibility in design is allowed by-right. LID practices and green infrastructure are required or incentivized.

The results of this analysis are summarized in Section 2.0. Recommended updates to the assessed regulatory mechanisms are included in Section 3.0, and a proposed timeline for implementing those updates is presented in Section 4.0.

[1] Supporting LID in Your Community, Local Bylaw and Regulation Assessment Tool, MassAudubon, 2017. https://www.epa.gov/npdes-permits/stormwater-tools-new-england#pcsm
[2] https://www.mass.gov/doc/street-design-and-code-infrastructure-checklist/download
[3] https://www.epa.gov/watersense

2.0 REVIEW OF REGULATORY MECHANISMS

The matrix included in Attachment A was used to review how the City's regulatory mechanisms and design standards address the use of green infrastructure and low impact development (LID) practices in Melrose in the following categories:

- Provisions for Use of Green Infrastructure Stormwater Management Practices
- Rainwater Harvesting
- Green Roofs
- Preservation of Natural Areas and Limits of Disturbance

This section summarizes the results of the analysis for each category.

2.1 Category 1: Provisions for Use of Green Infrastructure

Category 1 includes key questions such as if bioretention areas are allowed to count toward landscaping requirements, if vegetated open channels are allowed for stormwater conveyance, or if any incentives are provided for incorporating green infrastructure into development or redevelopment designs. Most language relating to the use of green infrastructure is included in the Zoning Bylaw, the Wetlands Protection Bylaw, and the Waters, Sewers, and Drains Bylaw. The Site Plan Review section of the Zoning Bylaw requires that stormwater systems be designed using LID methodologies, and all projects requiring a Stormwater Permit must consider LID site planning and design strategies.

Curb Bump-Outs – Use and Allowable Materials

This section was rated "conventional" as curb bump-outs and curb cuts are not mentioned in any current regulatory mechanism.

Stormwater Design Standards Promote LID

This section was rated "best". LID strategies must be utilized in stormwater systems.

Curb Buffer Strip – Use and Allowable Materials

This section was rated "conventional" due to the requirement to loam and seed the area between the curb and the sidewalk. The use of green infrastructure techniques in this strip is not explicitly allowed or prohibited.

LID Features Allowable By-Right

This section was rated "better" due to the requirement to use LID techniques in the design of stormwater management systems.

Allowable Uses of Permeable Pavement

This section was rated "better" since permeable pavement is recommended as an LID method for stormwater systems, but not allowable by-right.

Use of LID to Meet Landscaping Requirements

This section was rated "conventional" since there is no language explicitly allowing or prohibiting LID or green infrastructure practices from counting toward the required landscaping on a development site.

Use of LID Practices Toward Tree Planting Requirements

This section was rated "conventional" since there is no language allowing or prohibiting stormwater BMPs from counting toward a site's tree planting requirements.

Incentives to Adopt Green Infrastructure

This section was rated "better" because an applicant proposing an increase of impervious area greater than 500 square feet within a buffer zone or land subject to flooding can either submit engineering drainage calculations in compliance with the DEP Stormwater Policy or can apply LID best management practices to all new impervious surfaces.

Incentives for Filtering Runoff Using Vegetation

This section was rated "conventional" because there is no language in place that offers incentives for filtering stormwater runoff using vegetation.

Vegetated Open Channel Conveyances

This section was rated "better" because vegetated open channel systems are encouraged as LID best management practices, but no specific design criteria are in place for those systems.

Requirement to Use Native, Less-Water Intensive Vegetation

This section was rated "better" since the requirement to use native planting species is only explicitly in place in the sections of the Zoning Bylaw outlining design standards for Smart Growth District and the Rail Corridor Overlay District.

2.2 Category 2: Rainwater Harvesting

Category 2 includes key questions such as whether rainwater harvesting is allowed, where rainwater capture systems can be located, and if stormwater is allowed to be repurposed for non-potable uses. The Zoning Bylaw states that stormwater systems must be designed to use LID methodologies such as rainwater collection cisterns, but rainwater harvesting is not mentioned in any other current regulatory mechanisms.

Roof Downspout Discharge Location

This section was rated "conventional" because there is no language explicitly allowing or prohibiting downspouts from being directed to a rain barrel or treatment structure.

Rain Barrel Use, Placement, and Maintenance

This section was rated "conventional" since there is no language in any of the reviewed regulatory mechanisms discussing the use or placement of rain barrels or cisterns.

Rainwater Harvesting for Non-Potable Use

This section was rated "better" since there is no language discussing design standards for the harvesting of rainwater, but "rainwater collection cisterns and other design methods that maximize the use of landscaped areas for stormwater control and promote the reuse of runoff are recommended as LID methodologies in the Zoning Bylaw.

2.3 Category 3: Green Roofs

Category 3 includes key questions such as if green roofs are explicitly allowed or prohibited and, if allowed, what design standards are in place for green roofs. The only language relating to green roofs in the reviewed regulatory mechanisms is in the Wetlands Protection Bylaw and the Density Incentives Section of the Zoning Bylaw.

Use of Green Roofs

This section was rated "better" since green roof systems are a recommended LID technique to manage stormwater in the Wetlands Protection Bylaw.

Design Standards for Green Roofs

This section was rated "conventional" since there are no design standards in place for green roofs, nor is there a reference to a state-issued design standard for green roofs.

Incentives for Green Roof Installation

This section was rated "better" since a special permit may be authorized by the Planning Board for certain business districts to allow an increase in dimensional and density requirements with incentives such as satisfying open space requirements by providing roof decks, plazas, or green roofs. There is no other language explicitly permitting or prohibiting the use of green roofs in Melrose.

2.4 Category 4: Preservation of Natural Areas/Limits of Disturbance

Category 4 includes key questions such as if the community has an open space residential development bylaw, if there is a natural resource protection zoning district, and what restrictions are placed on development within or close to riparian or wetland buffer areas. Language relating to overlay districts and additional design standards are included in the Zoning Bylaw. Language relating to limits of disturbance and buffer requirements is included in the Wetlands Protection Bylaw and the Subdivision Rules and Regulations.

Presence of Open Space Residential Development or Natural Resource Protection Zoning District

This section was rated "best" since Melrose has a Floodplain Overlay District and has minimum open space requirements for all Zoning districts.

Allowances/Incentives for Flexible Site Design

This section was rated "best" since there are allowances for reduced dimensional and density regulations—as well as specific site design requirements related to open space—for single-family cluster residential developments, planned unit and business developments.

Minimum and Maximum Yard Sizing

This section was rated "conventional" since the zoning bylaw establishes minimum yard sizes for different uses, and only sets maximum front yard sizes for certain business districts.

Vegetated Areas on Site Plans

This section was rated "conventional" since site plans are not required to show the extents of existing vegetated areas.

Stream Buffer or Floodplain Requirements

This section was rated "best" due to the existing limitations on activities within 100' of water and wetland resources. These restrictions are consistent with state regulatory requirements.

Conservation Easements for Buffer Areas

This section was rated "better" since the Planning Board may require the establishment of conservation easements where a subdivision is traversed by a water course, drainage way, channel or stream.

Maintenance Activities in Buffer Areas

This section was rated "conventional" since there is no language explicitly restricting maintenance activities in buffer areas.

Minimum Required Wetland Buffer

This section was rated "best" due to the existing 100' minimum wetland buffer, which is consistent with state requirements.

Environmentally Critical Areas on Site Plans

This section was rated "better" since existing and proposed topography and natural features must be shown on Site Plan applications, but environmentally critical areas are not specifically mentioned.

Limits on Disturbance of Existing Vegetation and Requirements for Phased Disturbance

This section was rated "conventional" since there is no language requiring developers to minimize disturbance of existing vegetation.

Reestablishing Vegetation in Disturbed Open Space

This section was rated "conventional" since there is only language requiring vegetation to be reestablished for Wireless Communication Service Facilities (WCSF). There is no language specific to reestablishing disturbed open space.

Limiting Site Design to Areas of Lesser Slope and Farther from Watercourses

This section was rated "better" since there is language prohibiting disturbances of land within 100 feet of resource areas, and on land with greater than 25% slopes over a horizontal distance of 30 feet on a parcel of land intended or proposed for subdivision or development.

Limiting Topsoil Removal to Maintain Infiltration Characteristics

This section was rated "better" since there is some language in the zoning ordinance requiring the provision of topsoil, seeding, and/or reseeding after development activities.

Restricting New Soils to Maintain Infiltration Characteristics

This section was rated "conventional" since there is no language discussing the impacts of bringing in new soils on a site's infiltration characteristics.

Restricting Soil Compaction or Requiring Soil Restoration

This section was rated "better" since there is language requiring that proper drainage be restored in filled areas, however there are no requirements to avoid soil compaction by construction equipment.

3.0 RECOMMENDED REGULATORY UPDATES

This section includes recommended regulatory updates identified as a result of the analysis summarized in Section 2.0. The recommended language will update Melrose's regulatory mechanisms to meet the following goals:

- Allow and encourage green roofs,
- Allow and encourage infiltration practices and green infrastructure techniques to manage stormwater using landscaping and augmented soils,
- Allow and encourage rain barrels and cisterns to promote the use of stormwater for non-potable uses, and
- Allow for flexible site design in line with open space/cluster development practices[4].

The updates recommended in this section will be implemented in the timeframes included in Section 4.0.

3.1 Updates to Zoning Bylaw

The following updates to the Zoning Bylaw should be considered to meet the goals outlined above:

- Update Article VI, Section § 235, Dimensional and Density Regulations, to explicitly allow vegetated stormwater treatment structures, bioretention areas and other green infrastructure practices to be sited in setback areas and in buffer strips within the public right-of-way. Also explicitly allow treatment practices and structures to count towards landscaping and planting requirements. Acceptable green infrastructure and LID practices include bioretention areas, tree trenches/tree box filters, bioswales, and vegetated filter strips. All stormwater treatment structures and low-impact development practices must be designed consistent with the requirements of the most recent Massachusetts Stormwater Handbook. Require the use of non-invasive, drought-tolerant plantings in all zoning districts.

- Update Section § 235-16.1, Site plan review, to require showing the extents of existing vegetation and environmentally critical/ constrained areas on the Site Plan. Set a maximum amount of open space disturbance or require projects requiring larger disturbances to phase disturbances during construction. Also update this section to explicitly require disturbed open space to be reestablished as part of the proposed development.

[4] Development in which the buildings and associated roadways or parking are clustered together in one or more groups separated from adjacent property and/ or other groups within the development by intervening Dedicated Open Space usable for passive or active recreational activities (760 CMR 59.00). Massachusetts provides a model open space design/natural resource protection zoning bylaw, which emphasizes designing around the natural landscape and preserving common open space within subdivisions. This model bylaw is part of the Commonwealth's Smart Growth/Smart Energy Toolkit: https://www.mass.gov/files/documents/2017/11/03/Open%20Space%20Design%20(OSD)-Natural%20Resource%20Protection%20Zoning%20(NRPZ)_0.pdf

- Update Section § 235-74, Removal of Sand, Gravel, Quarry, or Other Earth Materials, and/or § 235-76, Filling of Any Lot, to require applicants to describe how the proposed project will minimize and limit the removal of topsoil from the development site. Also require applicants to maintain the natural infiltration characteristics of the site to the maximum extent practicable.

- Update Section § 235-76, Filling of Any Lot, to require applicants to minimize compaction of topsoil and subsoils to the maximum extent practicable. Where soils must be compacted by heavy construction equipment, require subsurface restoration prior to final landscaping activities.

- Update the Table of Dimensional and Density Regulations (§ 235, Attachment 2), to specify maximum front, side and rear yard sizes for each zoning district.

3.2 Updates to Subdivision Rules and Regulations

The following updates to the Subdivision Rules and Regulations should be considered to meet the goals outlined above:

- Update Section 6.B, Streets and Roadways, to recommend or explicitly allow the installation of green infrastructure and LID practices in traffic calming structures like bump-outs, medians, and traffic islands. Explicitly allow buffer strips and other stormwater treatment structures to be installed between the curb and sidewalk. Allow vegetated stormwater channels along roadways.

- Update Section 6.C, Storm Drainage, to recommend or require the use of green infrastructure and LID practices.

- Update Section 6, Required Improvements for an Approved Subdivision, to allow pervious materials for all possible implementations such as sidewalks, alleyways, on-street parking, bikeways, trails and walkways.

3.3 Updates to Wetlands Protection Bylaw

The following updates to the Wetlands Protection Bylaw shall be considered:

- Replace all references to the Massachusetts Stormwater Policy in §231-6, Standards, with references to the most recent version of the Massachusetts Stormwater Handbook.

3.4 Updates to Waters, Sewers, and Drains Bylaw

- Update Article V (§228), Stormwater, to include design criteria for bioretention areas, swales, vegetated channels, stormwater wetlands, infiltration trenches, green roofs, and other LID/ green infrastructure practices specific to Melrose. Explicitly allow rainwater harvesting systems (downspouts to LID features, rain barrels, cisterns on rooftops, etc.) that meet all Massachusetts State Plumbing or State Building Codes with a required maintenance plan. Consider working with the state to identify how rainwater can be used for non-potable interior uses and provide a list of

examples of encouraged uses. Explicitly allow and/or encourage the installation of green roofs and set design standards for green roofs.

3.5 Other Recommendations

The City should consider developing a Green Infrastructure Best Practices document to distribute to developers.

4.0 IMPLEMENTATION TIMEFRAMES FOR REGULATORY UPDATES

Under Section 2.3.6.b. of the 2016 Massachusetts MS4 Permit, the City of Melrose shall implement recommended updates to their regulatory mechanisms included in this report in the timeframes outlined in this section. The timeframes reflect the regular meeting schedule of the relevant City departments and boards and consider any other planned updates to the regulatory mechanisms. Implementation timeframes for the recommended updates to each document are summarized in Table 4.1.

Table 4.1: Implementation Timeframes for Regulatory Updates

Regulatory Mechanism	Appropriate Review Board	Complete First Draft of Updates	Complete Internal Review	Present Updates to Appropriate Review Board	Adopt Proposed Changes
Zoning Bylaw	Zoning Board of Appeals	November 2023	January 2024	April 2024	June 30, 2024
Waters, Sewers, and Drains Bylaw	Planning Board	November 2023	January 2024	April 2024	June 30, 2024
Subdivision Rules & Regulations	Planning Board	November 2023	January 2024	April 2024	June 30, 2024

5.0 REFERENCES AND ADDITIONAL RESOURCES

This section includes references that were utilized in the development of this Green Infrastructure Report as well as additional resources for the Town to consult when implementing the recommendations listed in Section 3.0.

5.1 References

The following references were consulted in the development of this report:

- Supporting LID in Your Community, Local Bylaw and Regulation Assessment Tool, MassAudubon, 2017.
- Assessment of Street Design and Parking Lot Guidelines and Feasibility of Allowing Green Infrastructure Checklist and Guide, Pioneer Valley Planning Commission, 2022.
- EPA WaterSense

5.2 Additional Resources

The following resources may provide additional guidance to the Town as they undertake the effort to implement the recommendations included in Section 3.0 within the timeframes outlined in Section 4.0:

- Preservation of Natural Areas:
  - EPA Water Sense Research Report on Turfgrass Allowance
  - EPA Non-Point Source Pollution
- Landscaping Island and Screening Ordinance:
  - Mass.gov Smart Growth/Smart Energy Toolkit Module Bylaws
- Riparian Buffers:
  - Mass.gov Floodplain Management
- Rainwater Harvesting:
  - City of Berkley, CA Guide to Conserving Water through Rainwater Harvesting & Graywater Reuse for Outdoor Use
  - National Conference of State Legislation – State Rainwater Harvesting Laws and Legislation
  - Virginia Construction Code – Uniform Statewide Building Code

MS4 Permit Compliance - City of Melrose, MA								
Green Infrastructure Report Appendix A - Regulatory Review Matrix								
Key Question	**Zoning Bylaw**		**Subdivision Rules & Regulations**		**Wetlands Protection Bylaw, Waters, Sewers and Drains Bylaw**		**Score**	**Comments**
	Section Reference	**Language**	**Section Reference**	**Language**	**Section Reference**	**Language**		
Category 1: Adopt Green Infrastructure Stormwater Management Provisions								
Are curb bump-outs allowed? Can bioretention be installed in bump-outs?							Conventional	Curb bump outs are not mentioned in any current regulatory mechanism.
Do stormwater design standards promote piping and surficial retention or LID?	§ 235-16.1 Site plan review	Stormwater systems shall be designed to use low-impact design (LID) methodologies to mitigate drainage impact. Low-impact design (LID) methodologies may include porous pavements, bioretention cells, infiltration trenches, rainwater collection cisterns and other design methods that maximize the use of landscaped areas for stormwater control and promote the reuse of runoff. Stormwater flood mitigation shall be provided through the use of best management practices (BMPs) to further reduce the frequency and intensity of flooding otherwise generated at the proposed site. To the extent practicable, BMPs shall be sized to capture, retain, and percolate to ground all runoff from impermeable surfaces generated by the five-year, twenty-four-hour storm event. Preferred BMPs shall include, but not be limited to, constructed wetlands, pocket wetlands, rain gardens, vegetated swales, retention/detention ponds, and subsurface leaching systems.	Section VI. Required Improvements for an Approved Subdivision, A.C. Storm Drainage	Storm drains, culverts and related installations, including catch basins, gutters and manholes, shall be installed as necessary to provide adequate disposal of surface water from all streets within the subdivision and adjacent land, by and at the expense of the applicant or subdivider.	§ 228-89 Stormwater permits, Wetlands Protection Bylaw, § 231-6 Standards	Low-impact development (LID) site planning and design strategies must be considered for all projects requiring a Stormwater Permit. Any applicant proposing an increase of impervious area greater than 500 square feet within a buffer zone or land subject to flooding may demonstrate that there will be no net increase in runoff peak discharge rate and no net loss of recharge to groundwater by submitting engineering drainage calculations in compliance with the DEP Stormwater Policy or by applying LID best management practices to all new impervious surfaces. Suggested techniques include: [a] Removal of preexisting impervious area of the same or greater size in the same drainage area; [b] Use of permeable pavers in place of impervious materials; [c] Design of surfaces so that runoff will be in the form of sheet flow directed towards a naturally vegetated buffer area. The width of the naturally vegetated area must be at least equal to the width of the impervious area; [d] Direction of runoff flow to rain gardens or bioretention areas. These areas should be large enough to accommodate the volume of one inch of runoff over the area of contributing impervious surface; [e] Use of green roof systems; [f] Connection of runoff from new impervious areas to dry wells or other infiltration devices. Said devices should be large enough to accommodate the volume one inch of runoff over the area of contributing impervious surface; or [g] Other similar stormwater management practices as may be approved by the Commission on a case-by-case basis.	Best	LID is promoted for stormwater systems. LID site planning and design must be considered for all projects requiring a Stormwater Permit.
Can GI techniques replace grass strips between the sidewalk and curb?							Conventional	There is no language explicitly allowing or prohibiting GI techniques in grass strips.
Can LID features be easily sited or do they require a waiver?	§ 235-16.1 Site plan review	Stormwater systems shall be designed to use low-impact design (LID) methodologies to mitigate drainage impact.			§ 228-89 Stormwater permits	Stormwater management easements are required for all areas used for off-site stormwater control unless a waiver is granted by the DPW.	Better	A waiver is only required for off-site stormwater management systems.
Are vegetated stormwater BMPs allowed in setbacks?							Conventional	There is no language explicitly allowing or prohibiting the use of vegetated BMPs in setbacks.

MS4 Permit Compliance - City of Melrose, MA								
Green Infrastructure Report Appendix A - Regulatory Review Matrix								
Key Question	**Zoning Bylaw**		**Subdivision Rules & Regulations**		**Wetlands Protection Bylaw, Waters, Sewers and Drains Bylaw**		**Score**	**Comments**
	Section Reference	**Language**	**Section Reference**	**Language**	**Section Reference**	**Language**		
Is permeable pavement allowed? For what uses?	§ 235-16.1 Site plan review	Stormwater systems shall be designed to use low-impact design (LID) methodologies to mitigate drainage impact. Low-impact design (LID) methodologies may include porous pavements, bioretention cells, infiltration trenches, rainwater collection cisterns and other design methods that maximize the use of landscaped areas for stormwater control and promote the reuse of runoff.					Better	Permeable pavement is recommended as an LID method for stormwater systems.
Can bioretention areas and other stormwater practices count as landscaping areas?	§ 235-16.1 Site plan review	Stormwater systems shall be designed to use low-impact design (LID) methodologies to mitigate drainage impact. Low-impact design (LID) methodologies may include porous pavements, bioretention cells, infiltration trenches, rainwater collection cisterns and other design methods that maximize the use of landscaped areas for stormwater control and promote the reuse of runoff.					Conventional	There is no language explicitly allowing or prohibiting the use of BMPs to meet landscaping requirements.
Can bioretention areas, tree boxes, and other BMPs count toward tree planting requirements?							Conventional	There is no language explicitly allowing or prohibiting the use of BMPs to meet planting requirements.
Are any incentives in place to adopt green infrastructure?					Wetlands Protection Bylaw, § 231-6 Standards	Any applicant proposing an increase of impervious area greater than 500 square feet within a buffer zone or land subject to flooding must demonstrate that there will be no net increase in runoff peak discharge rate and no net loss of recharge to groundwater. The requirement can be met by submitting engineering drainage calculations in compliance with the DEP Stormwater Policy or by applying LID best management practices to all new impervious surfaces.	Better	LID may be implemented for impervious area requirements in buffer zones in lieu of DEP Stormwater Policy drainage calculations.
Are any incentives provided for using vegetation to filter stormwater runoff?							Conventional	There is no language providing incentives for using vegetation to filter stormwater runoff.
Is vegetated open channel conveyance of stormwater allowed? Are there established design criteria for vegetated channels?	§ 235-16.1 Site plan review	Preferred BMPs shall include, but not be limited to, constructed wetlands, pocket wetlands, rain gardens, vegetated swales, retention/detention ponds, and subsurface leaching systems.					Better	LID practices such as vegetated swales are recommended for stormwater systems.
Are landscaping plans required to use less-water intensive, native vegetation?	§ 235-71.1. Smart Growth District, § 235-71.2 Rail Corridor Overlay District	The Smart Growth District and Rail Corridor Overlay District require native planting species for landscape materials.					Better	
Category 2: Rainwater Harvesting								

MS4 Permit Compliance - City of Melrose, MA								
Green Infrastructure Report Appendix A - Regulatory Review Matrix								
Key Question	**Zoning Bylaw**		**Subdivision Rules & Regulations**		**Wetlands Protection Bylaw, Waters, Sewers and Drains Bylaw**		**Score**	**Comments**
	Section Reference	**Language**	**Section Reference**	**Language**	**Section Reference**	**Language**		
Are downspouts allowed to be disconnected into a rain barrel or yard?							Conventional	Downspouts cannot be connected to the sanitary sewer. There is no other language related to downspout use.
Can rain barrels be placed within standard zoning setback areas?							Conventional	There is no language related to allowable rain barrel placement.
Can cisterns be placed on rooftops for rainwater harvesting?							Conventional	There is no language related to allowable cistern placement.
Are maintenance plans required for rainwater harvesting systems?							Conventional	There is no language requiring maintenance plans for rainwater harvesting systems.
Are site designs allowed to include systems that use stormwater for non-potable uses?	§ 235-16.1 Site plan review	Stormwater systems shall be designed to use low-impact design (LID) methodologies to mitigate drainage impact. Low-impact design (LID) methodologies may include porous pavements, bioretention cells, infiltration trenches, rainwater collection cisterns and other design methods that maximize the use of landscaped areas for stormwater control and promote the reuse of runoff.					Better	Rainwater collection systems are recommended as LID practices for stormwater systems.
Category 3: Green Roofs								
Do any regulations explicitly allow or prohibit green roofs?					Wetlands Protection Bylaw, § 231-6 Standards	Low-impact development (LID) site planning and design strategies must be considered for all projects requiring a Stormwater Permit. Green roof systems are a recommended LID technique to manage stormwater.	Better	
Are there design standards for green roofs? Do they defer to the MA State Building Code per MA Stormwater Handbook guidance?							Conventional	There is no language that includes design standards for green roofs.
Are there any incentives in place for installing green roofs?	§ 235-66 Density incentives allowed in BA-1 and BA-2 Districts	A special permit may be authorized by the Planning Board for certain business districts to allow an increase in dimensional and density requirements with incentives such as satisfying open space requirements by providing roof decks, plazas, or green roofs.					Better	A special permit may be granted for the reduction of density requirements by using green roofs to satisfy open space requirements.
Category 4: Preservation of Natural Areas/Limits of Disturbance								

MS4 Permit Compliance - City of Melrose, MA								
Green Infrastructure Report Appendix A - Regulatory Review Matrix								
Key Question	**Zoning Bylaw**		**Subdivision Rules & Regulations**		**Wetlands Protection Bylaw, Waters, Sewers and Drains Bylaw**		**Score**	**Comments**
	Section Reference	**Language**	**Section Reference**	**Language**	**Section Reference**	**Language**		
Does the community have a bylaw or zoning district specifically for open space residential development or natural resource protection?	§ 235 Attachment 2: Table of Dimensional and Density Regulations, Article XV, § 235 Floodplain District	Every district has minimum open space requirements which are included in the Table of Dimensional and Density Regulations. The Floodplain District is an overlay district requiring all structural and nonstructural activities to be in compliance with MGL c. 131, § 40, and with the following: Section of the Massachusetts State Building Code which addresses floodplain and coastal high-hazard areas (currently 780 CMR 120.G, Flood Resistant Construction and Construction in Coastal Dunes); Wetlands Protection Regulations, Department of Environmental Protection (DEP) (currently 310 CMR 10.00); Inland Wetlands Restriction, DEP (currently 310 CMR 13.00); and Minimum Requirements for the Subsurface Disposal of Sanitary Sewage, DEP (currently 310 CMR 15, Title 5).					Best	The Zoning Bylaw includes open space requirements for all districts. There Floodplain Overlay District protects natural resources.
Are there allowances for flexible site design or incentives for open space or cluster design?	§ 235-67 Cluster residential development, § 235-71.1. Smart Growth District, § 235-71.2 Rail Corridor Overlay District	Single-family residential development in a cluster pattern is allowed in the SR, SR-A and SR-B Districts provided the tract of land is in a single or consolidated ownership at least 15 acres in size. The minimum open space requirement shall be 50% of the total tract area. A portion of the open space land, amounting to at least 10% of the total tract area, shall be set aside as common land covenanted to be maintained as permanent open space in private or cooperative ownership. Such common land shall be restricted to open space recreational uses, such as tot-lot, park, playground, play field, golf course or conservation area. Planned unit and business developments in certain zoning districts also require open space land percentages. The Smart Growth District and Rail Corridor Overlay District are overlay districts with additional site design requirements, permitted uses, and open space requirements.					Better	Cluster residential development with reduced dimensional and density regulations is permitted with open space and other requirements. Planned unit and business developments with reduced density and dimensional requirements are permitted in certain districts with open space and other requirements.
Presence of maximum as well as minimum yard sizing?	§ 235 Attachment 2: Table of Dimensional and Density Regulations	Each zoning district has minimum front, side and rear yard sizes specified in the Table of Dimensional and Density Regulations. Only some business districts have maximum front yard setbacks.					Conventional	Only certain business districts have maximum front yard setbacks.

MS4 Permit Compliance - City of Melrose, MA								
Green Infrastructure Report Appendix A - Regulatory Review Matrix								
Key Question	**Zoning Bylaw**		**Subdivision Rules & Regulations**		**Wetlands Protection Bylaw, Waters, Sewers and Drains Bylaw**		**Score**	**Comments**
	Section Reference	**Language**	**Section Reference**	**Language**	**Section Reference**	**Language**		
Are site plans required to show the extents of existing vegetated areas?	§ 235-16.1 Site plan review	At a minimum, the submittal materials shall include the following items as applicable: Existing and proposed topography and the location of all natural features such as wetlands, streams, water bodies, and exposed bedrock to be removed, if any.			§ 228-89 Stormwater permits	The application package shall include: A set of plans depicting existing and proposed site conditions.	Conventional	The extents of existing vegetated areas are not explicitly required as part of Site Plan or Stormwater Management Permit submittals.
Are there stream buffer or floodplain requirements? Are they consistent with state regulatory requirements?	Article XV, § 235 Floodplain District	The Floodplain District is an overlay district requiring all structural and nonstructural activities to be in compliance with MGL c. 131, § 40, and with the following: Section of the Massachusetts State Building Code which addresses floodplain and coastal high-hazard areas (currently 780 CMR 120.G, Flood Resistant Construction and Construction in Coastal Dunes); Wetlands Protection Regulations, Department of Environmental Protection (DEP) (currently 310 CMR 10.00); Inland Wetlands Restriction, DEP (currently 310 CMR 13.00); and Minimum Requirements for the Subsurface Disposal of Sanitary Sewage, DEP (currently 310 CMR 15, Title 5).			Wetlands Protection Bylaw, § 231-6 Standards	The Wetlands Protection Bylaw protects all resource areas and lands within 100 feet of resource areas, which include any freshwater wetlands; marshes; wet meadows; bogs; swamps; vernal pools; banks; lakes; ponds of any size; rivers; streams (including intermittent streams); creeks; lands under water bodies; and lands subject to flooding or inundation by groundwater or surface water. The bylaw includes additional standards and procedures stricter than those of the Wetlands Protection Act, MGL c. 131, § 40. Floodplain requirements: There shall be no net loss of flood storage volume at any elevation. There shall be no increase in the rate of runoff as a result of any project.	Best	Activities in the Floodplain District are subject to all state water resource related regulatory requirements. The Wetlands Protection Bylaw protects all resource areas and lands within 100 feet of resource areas.
Are buffer areas protected by a conservation easement or other permanent restrictions?			Section V. Design Standards, C. Easements	Where a subdivision is traversed by a water course, drainage way, channel or stream, the Board may require that there be provided a storm water easement or drainage right-of-way of adequate width to conform substantially to the lines of such water course, drainage way, channel or stream, and to provide for construction or other necessary purposes, as required by the Board.			Better	The establishment of conservation easements may be required by the Planning Board in buffer areas.
Is there language restricting maintenance activities in buffer zones?							Conventional	There is no language relating to maintenance activities in buffer zones.
What is the minimum required wetland buffer?	Article XV, § 235 Floodplain District	The Floodplain District is an overlay district requiring all structural and nonstructural activities to be in compliance with MGL c. 131, § 40, and with the following: Section of the Massachusetts State Building Code which addresses floodplain and coastal high-hazard areas (currently 780 CMR 120.G, Flood Resistant Construction and Construction in Coastal Dunes); Wetlands Protection Regulations, Department of Environmental Protection (DEP) (currently 310 CMR 10.00); Inland Wetlands Restriction, DEP (currently 310 CMR 13.00); and Minimum Requirements for the Subsurface Disposal of Sanitary Sewage, DEP (currently 310 CMR 15, Title 5).			Wetlands Protection Bylaw, § 231-6 Standards	The Wetlands Protection Bylaw protects all resource areas and lands within 100 feet of resource areas. A no disturbance zone shall be provided and maintained in the area of land situated between a wetland and a parallel line located 15 feet away, measured outward horizontally from the edge of the wetland. The no disturbance zone shall be naturally vegetated and free from oil, hazardous materials, and chemicals (including, without limitation, fertilizers, herbicides and pesticides). A no construction zone shall be provided and maintained in the area of land situated between a wetland and a parallel line located 20 feet away, measured outward horizontally from the edge of the wetland. Lawns and landscaping are permitted but structures and appurtenances thereto are prohibited in the no construction zone.	Best	The Wetlands Protection Bylaw protects all resource areas and lands within 100 feet of resource areas.

MS4 Permit Compliance - City of Melrose, MA								
Green Infrastructure Report Appendix A - Regulatory Review Matrix								
Key Question	**Zoning Bylaw**		**Subdivision Rules & Regulations**		**Wetlands Protection Bylaw, Waters, Sewers and Drains Bylaw**		**Score**	**Comments**
	Section Reference	**Language**	**Section Reference**	**Language**	**Section Reference**	**Language**		
Are environmentally critical/constrained areas required to be identified as part of the existing conditions plan?	§ 235-16.1 Site plan review	At a minimum, the submittal materials shall include the following items as applicable: An executive summary generally describing the nature and location of the project, including parking and loading, traffic flow and circulation, projected traffic volumes and impact, external lighting, landscaping and screening, utilities and protection and/or enhancement of existing natural areas. Existing and proposed topography and the location of all natural features such as wetlands, streams, water bodies, and exposed bedrock to be removed, if any.			§ 228-89 Stormwater permits	The application package shall include: A set of plans depicting existing and proposed site conditions. The site plan showing all proposed stormwater infrastructure shall be stamped by a Massachusetts registered professional engineer.	Better	Existing and proposed topography and natural features must be shown on Site Plan applications.
Are there limits on allowable disturbance of existing vegetation? Is disturbance of vegetated areas required to be phased?							Conventional	No language specifically relating to disturbing existing vegetation.
Is there a requirement to reestablish vegetated areas in disturbed open space?	§ 235-73 Wireless communications service facilities	For wireless communication service facilities (WCSF), in cases where vegetation already exists efforts will be made to preserve such vegetation or replace with similar vegetation.					Conventional	Vegetation only required to be replaced in WCSF zoning district.
Is there any language requiring limiting site designs to areas of lesser slope and/or farther from watercourses?	§ 235-73.2 Slope protection	All areas with natural slopes exceeding 25% over a horizontal distance of 30 feet on a tract or parcel of land intended or proposed for subdivision or development, or on a lot intended for building purposes, shall be excluded from the calculation of the minimum lot area required for the applicable zoning district. All natural slopes exceeding 25% over a horizontal distance of 30 feet are protected and shall remain in their natural state.	Section V. Design Standards, A.3. Grade	Grades of all streets shall be the reasonable minimum but shall not be less than one-half (0.5) percent nor more than six (6) percent for principal streets and ten (10) percent for other streets. Where the grade of a street exceeds six (6) percent at an intersection, especially with a principal street, the subdivider shall reduce the grade for a reasonable distance from such intersection or in accordance with the City Ordinances or Standards of the Public Works Department in effect at the time.			Better	
Is there any language discussing the impacts of topsoil removal from a site on the infiltration characterics of the site?	§235-76.E	"At the conclusion of operation, the filled area or fill materials shall be left in a manner approved by the Building Commissioner to assure soil surface stabilization and proper drainage of the site, including provision of topsoil and seeding or reseeding so as to support a perennial cover crop"					Better	This language does not specifically require minimizing topsoil removal to the maximum extent practicable to maintain a site's infiltration characteristics.
Is there any language discussing the impacts of bringing in new soils on the infiltration characteristics of a site?							Conventional	There is no language pertaining to maintaining infiltration characteristics on development sites in any reviewed regulatory mechanism.

MS4 Permit Compliance - City of Melrose, MA								
Green Infrastructure Report Appendix A - Regulatory Review Matrix								
Key Question	**Zoning Bylaw**		**Subdivision Rules & Regulations**		**Wetlands Protection Bylaw, Waters, Sewers and Drains Bylaw**		**Score**	**Comments**
	Section Reference	**Language**	**Section Reference**	**Language**	**Section Reference**	**Language**		
Are there any requirements to avoid soil compaction by construction equipment and/or for soil permeability to be restored if compaction occurs?	§235-76.E	"At the conclusion of operation, the filled area or fill materials shall be left in a manner approved by the Building Commissioner to assure soil surface stabilization and proper drainage of the site, including provision of topsoil and seeding or reseeding so as to support a perennial cover crop"					Better	No mention of avoiding soil compaction but some provisions for restoration.

Appendix I
Phosphorus Source Identification Report (PSIR) (Draft)

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1.0 REGULATORY SUMMARY AND PURPOSE

The 2016 MS4 Permit includes specific requirements for MS4 operators that discharge to impaired waterbodies where pollutants typically found in stormwater—specifically nutrients, solids, bacteria/pathogens, chloride, metals, and oil and grease—are the cause of the impairment and there is not a Total Maximum Daily Load (TMDL) approved by the United States Environmental Protection Agency (USEPA). Additional requirements for phosphorus impairments include supplementary public education efforts, specific BMP design standards, increased street sweeping, and the development of a Phosphorus Source Identification Report (PSIR) for each waterbody with a phosphorus impairment.

Melrose is required to develop a PSIR for the portion of the City located within the Mystic River Watershed. Ell Pond, which is located in Melrose and receives direct discharges from seven City-owned outfalls, is also impaired for phosphorus and is the primary focus of this report. In accordance with permit requirements, the report includes the following elements:

1. A calculation of the total MS4 area draining to the water quality limited receiving water, incorporating updating mapping of the MS4 and catchment delineations;
2. All screening and monitoring results targeting the receiving water;
3. Impervious area and Directly Connected Impervious Area (DCIA) for the target catchment area(s);
4. Identification, delineation, and prioritization of potential catchments with high phosphorus loadings; and
5. Identification of potential retrofit opportunities or opportunities for the installation of structural BMPs during redevelopment, including the removal of impervious area.

This PSIR was completed on or before the end of Permit Year 4 or June 30, 2022 in accordance with permit requirements.

2.0 WATERBODY DESCRIPTION AND LITERATURE REVIEW

2.1 Waterbody Description

Approximately 60% of the City of Melrose's land area is located within the Mystic River Watershed. Runoff from the western portion of the City drains to Ell Pond or Ell Pond Brook, which flows into the Malden River and eventually reaches the Mystic River just upstream of the Amelia Earhart dam. The eastern portion of the City is within the North Coastal watershed, which does not have a nutrient impairment. Figure 1 shows the watershed boundary within Melrose. Ell Pond, which is located in the center of the City, is impaired for phosphorus and requires the development of a TMDL in addition to the Final Report issued for Alternative TMDL Development for the Mystic River Watershed, which was published in January 2020[1]. A description of Ell Pond and the Mystic River are included below.

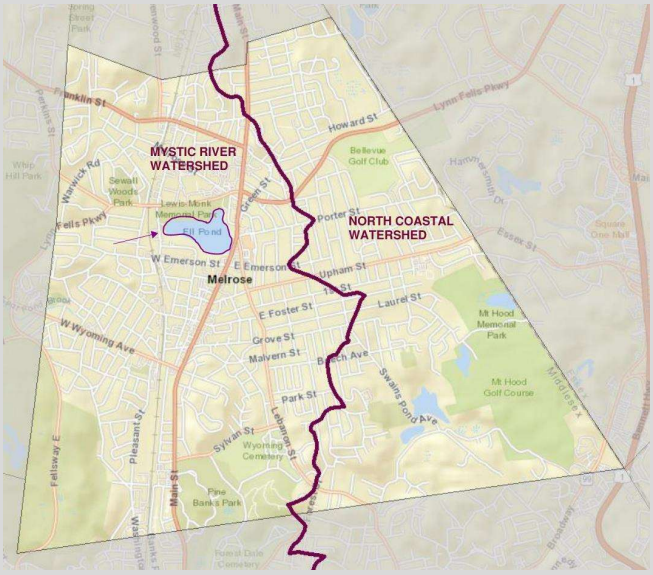


Figure 1: Watershed Boundaries in Melrose & Ell Pond Locus Map

Ell Pond

Ell Pond is a 23-acre kettle pond located in the center of Melrose, Massachusetts. The pond is bordered by residential homes, parks, and playing fields. The land immediately surrounding the pond's shoreline is managed by the City of Melrose and includes open space for recreational activities. The Melrose High School and Middle School border the recreation areas to the north, separated by the Lynn Fells Parkway which is managed by the Massachusetts Department of Conservation and Recreation (DCR). Ell Pond is within the Mystic River Watershed and its contributing drainage area is located mostly in Melrose with small portions in Wakefield and Stoneham. The pond has been flagged for poor water quality since 1951, when swimming was banned due to coliform levels above the state's swimming water standards. It is currently listed on the 2018/2020 Massachusetts Integrated List of Waters, or 303(d) list, for chlorophyll-a, fecal coliform, harmful algal blooms, total phosphorus, total suspended solids, and transparency/clarity.

[1] Mystic River Watershed Alternative TMDL Development for Phosphorus Management – Final Report; Prepared for the U.S. Environmental Protection Agency, January 2020. https://www.mass.gov/doc/mystic-river-watershed-alternative-tmdl-development-for-phosphorus-management-final-report/download

Mystic River

Originating at the outlet of the Lower Mystic Lake, the Mystic River flows through Arlington, Somerville, Medford, Everett, Chelsea, Charlestown, and East Boston before emptying into Boston Harbor. The watershed covers 76 square miles—approximately 1% of the land area in Massachusetts. Melrose does not have any direct discharges to the Mystic River. As the river runs through urban communities, the watershed is highly developed and faces multiple water quality impairments. Cultural eutrophication–the degradation of aquatic environments by nutrient pollution caused by human activity and urban development–is a major cause of impairments in the watershed. Severe algal blooms occur regularly in receiving waters throughout the watershed during the summer months, reducing water clarity and contributing to anoxic bottom waters that do not support aquatic life. Algal blooms and macrophyte growth in the Mystic Lakes subsequently degrade the aesthetic quality of the river, and jeopardize designated uses such as fishing and boating.

2.2 Literature Review

Given that water quality in Ell Pond has been an ongoing point of concern, many studies, reports, and remediation plans for the pond have previously been developed. The following studies and reports were reviewed as part of the Phosphorus Source Identification Report:

- A Restoration & Management Program for Ell Pond, Prepared for the City of Melrose by the Metropolitan Area Planning Council. December, 1981.
- Restoration Study for Ell Pond Melrose, Massachusetts; Prepared for the City of Melrose by Lycott Environmental Research, Inc. May, 1985.
- Ell Pond, Melrose Stormwater Mitigation Project 604(b) Water Quality Management Planning Grant (2014-03/604); Prepared by the City of Melrose with funding received from the Massachusetts Department of Environmental Protection Bureau of Water Resources and the U.S. Environmental Protection Agency Region 1, June, 2016.
- Melrose Ell Pond Watershed Green Infrastructure Project; Prepared by the City of Melrose with funding received from the Metropolitan Area Planning Council, February, 2021.
- Ell Pond Park Feasibility Study; Prepared by Weston & Sampson for the City of Melrose, 2022.
- Mystic River Watershed Alternative TMDL Development for Phosphorus Management – Final Report; Prepared for the U.S. Environmental Protection Agency, January 2020.

The 1981 Restoration & Management Program for Ell Pond consists of a summary of past studies on Ell Pond, a description of the pond and its watershed including water quality data, and an action plan for determining pollution sources, funding pond restoration, and implementing general watershed protection measures. From the 1960s to the 1970s, various studies identified water quality concerns for the pond including high bacterial counts, excessive plant growth, low oxygen levels, and mud depth due to sedimentation. The action plan identified the major pollution problems in the pond, one of which was algae and weed growth due to high nitrogen and phosphorus levels.

The 1985 Restoration Study for Ell Pond consisted of a diagnostic study of the pond, a feasibility study, and a recommended restoration program. The study also included water quality, stormwater

runoff and in-pond sampling, and a nutrient budget analysis for a year-long period between 1984 and 1985. The complete phosphorus loading for the Ell Pond watershed was calculated based on the storm and base flow loadings developed from wet and dry weather sampling events for sub-watershed areas with storm sewer systems, loadings for sub watershed areas without storm sewer systems based on land use classifications, outflow loadings based on outlet sampling concentrations, precipitation loading on the pond surface, and internal loading based on sediments and biomass. In 1985, most of the Ell Pond watershed without storm sewer systems was densely-developed residential land.

The 1985 study concluded that due to the high concentrations of phosphorus entering Ell Pond, the pond was in an accelerated rate of eutrophication. The pond had a high potential for severe algal blooms, which may have been partially suppressed due to the low transmission of light measured in the pond. The nutrient budget analysis revealed high nitrogen to phosphorus ratios indicating that phosphorus was the limiting nutrient; the report therefore recommended reducing phosphorus inputs into Ell Pond to attempt to control plant life. The report proposed various programs to address the high levels of bacteria at the pond inlets, nutrient loadings, oil and grease contamination, sediment loadings, and other factors. Lycott Environmental Research eventually recommended a watershed management program including a detailed storm sewer evaluation survey, sewer cross connection/exfiltration elimination, a water quality monitoring program, increased street sweeping, improved outlet maintenance and cleaning, deep sump catch basins, development of watershed construction erosion and sediment control guidelines, and hydro-raking.

The 2016 Stormwater Mitigation Project Report, financed partially by funding from the MassDEP 604(b) Water Quality Management Planning Grant Program, consisted of the delineation of subdrainage areas, development of conceptual BMP designs to address pollution from stormwater runoff, field work to prioritize mitigation locations, and preliminary design plans and construction cost estimates for seven selected sites. The report focuses on the area of the Ell Pond drainage basin representing 38% of the watershed in Melrose, discharging at outfall OF-30. Stormwater sampling was conducted at eleven locations for fecal coliform, enterococci, and total suspended solids and analyzed by multiplying concentrations by the “first flush” volume of runoff, which was determined to equal the product of 1” of runoff times roadway length times roadway width plus 10% for driveways and sidewalks in each subdrainage area. The mass pollutant loadings were used to select subdrainage areas with the highest concentrations for BMP design based on the Massachusetts Stormwater Handbook. Seven sites were further analyzed with soil borings and permeability testing, and two rain gardens, three small subsurface systems and two large subsurface systems were selected as surrogate BMP systems to remove up to 90% of pathogens, 70 to 90% of total suspended solids, 90% of total nitrogen, 90% of total phosphorus, and 90% of metals. Preliminary designs and cost estimates for these sites are provided in the report.

The 604b Stormwater Mitigation Project Report, the Ell Pond Park Feasibility Study and the City’s website provide insight into the types of treatment and remediation initiatives that have been undertaken at Ell Pond. Since the 1985 Restoration Study, significant drainage improvements have been completed around Ell Pond and various illicit connections to the sanitary sewer system, which were contributing to high bacteria levels, have been removed. In 2002, the construction of the new Roosevelt Elementary School near Ell Pond included a subsurface piping system below the new

playing field for infiltration. In 2009, the City completed drainage improvements on Tremont Street and the Lynn Fells Parkway, replacing a headwall on Ell Pond. The Department of Conservation and Recreation (DCR) has since cleaned and/or replaced the entire drainage system on the Lynn Fells Parkway between Tremont Street and Melrose Street. With funding assistance from the Federal Emergency Management Agency (FEMA's) Pre-Disaster Mitigation (PDM) grant program; the City completed construction of a control gate at the outlet of the pond to prevent flooding and constructed 3,500 feet of culvert from the control gate to an existing outlet at Lower Spot Pond Brook in 2010. In 2011, a new athletic complex was constructed across the Lynn Fells Parkway, including deep sump hooded catch basins and a stormwater management basin for storage and treatment prior to discharge to Ell Pond.

In 2021, the City submitted an application for an Ell Pond Watershed Green Infrastructure Project to the MAPC's Accelerating Climate Resilience Municipal Grant Program. The proposed project included seven tree box filters within the Ell Pond watershed to address water quality and climate change heat effects, but was ultimately not funded. The Massachusetts Office of Coastal Zone Management (CSM) awarded a grant to Melrose to help fund the installation of three rain gardens and one subsurface structure on Orient Avenue, which built upon the design project funded by the 604(b) program. Construction of the rain gardens was completed in June of 2021. Weston & Sampson began work with the West Knoll Feasibility Study Committee in 2019, and in 2022, completed the Ell Pond Park Feasibility Study which established a preferred master plan for the park including site improvements such as upgrades to playing fields, recreational opportunities, parking, stormwater management, and landscaping.

Mystic River Watershed Alternative TMDL

The 2020 Alternative TMDL Report includes results from multiple conducted on the Mystic River Watershed dating from 2000 to 2017. The study considered data from the Mystic River Watershed Association (MyRWA)'s baseline water quality monitoring program, which has been in place since 2000, from MyRWA's phosphorus loading monitoring program, which has been in effect since 2015, and from the Massachusetts Water Resources Authority (MWRA)'s ongoing Boston Harbor and combined sewer overflow event monitoring. The Alternative TMDL focuses on data for eutrophication-related parameters in the watershed, such as total phosphorus and dissolved oxygen concentrations. The existing data was used to develop comprehensive watershed and in-stream models to estimate annual phosphorus loadings, link phosphorus loads to response parameters in receiving waters, and estimate the load reductions needed to meet water quality targets in the watershed. The TMDL established a surrogate water quality target since there is no numeric water quality standard for phosphorus, choosing to use chlorophyll-a as the surrogate because it is a direct indication of algal biomass cause by elevated phosphorus concentrations. A seasonal average chlorophyll-a concentration of <10 μg/L was determined to be the water quality goal for surface waters in the Mystic River Watershed. The alternative TMDL analysis found that, in order to meet the target chlorophyll-a concentration, phosphorus loads from stormwater in the watershed will need to be reduced by 59-62%. The siting and sizing of stormwater BMPs, particularly green infrastructure BMPs, will be critical to meeting this water quality goal, and the report includes guidance for communities to start making improvements in the most cost-effective way possible.

2.2 Historic Sampling Data

Historic sampling data for Ell Pond is available from the 1981 Restoration & Management Program and the 1985 Restoration Study. Historical sampling locations and current corresponding outfall locations are included in Table 1 and depicted in Figure 2. Sampling data from July 27, 1981, is presented in Table 2 and sampling data from 1984-1985 is presented in Table 3.

Table 1: Ell Pond Historical Sampling Locations		
Number	Location	Current Outfall ID
1	In-Pond, deepest area of pond	-
2	West inlet, off Tremont Street, next to swimming pool	OF-28
3	Northwest inlet, near old municipal tennis courts	OF-29
4	North inlet, east end of school property	OF-30
5	Southeast outlet off Main Street	-

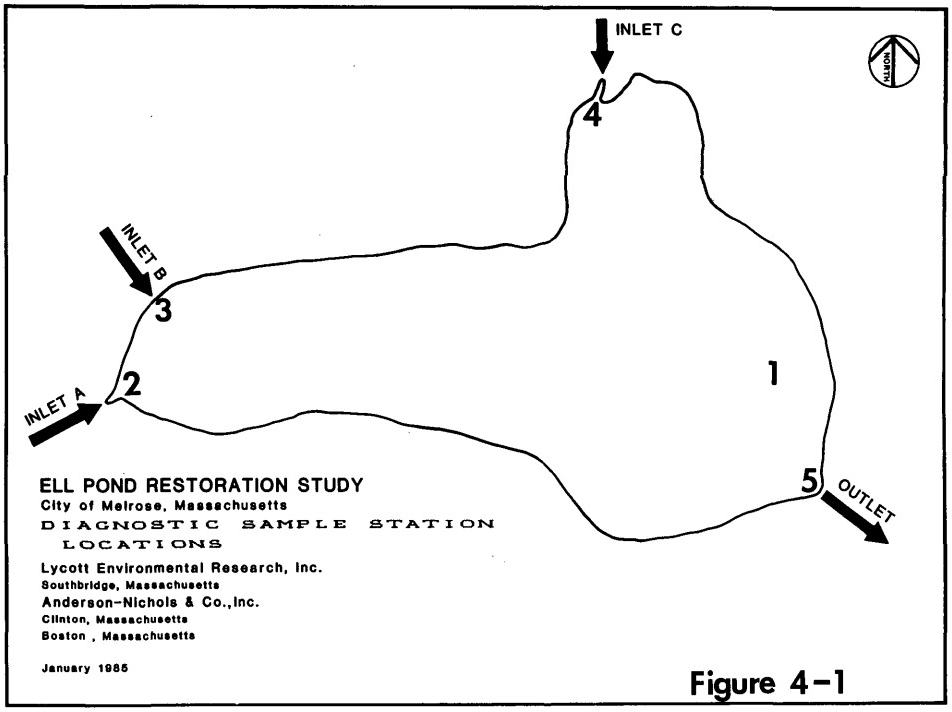


Figure 2: Historical Sampling Locations (Source: Lycott Environmental Research, Inc.)

Table 2: Ell Pond Total Phosphorous Sampling Data, July 1981 (Source: Metropolitan Area Planning Council)		
1985 Report Location #	Sample Location	Total P (mg/L)
1	Center of Pond, 0.5m	0.15
1	Center of Pond, 2.5m	0.16
5	Southeast Storm Drain Outlet	0.11

2	Northwest Storm Drain Inlet	0.16

Table 3: Ell Pond Total Phosphorous Sampling Data, 1984-1985 (Source: Lycott Environmental Research, Inc.)							
	Location #, Total Phosphorus Concentration (mg/L)						
Sampling Date	1 (surface)	1 (deep)	2 (OF-28)	3 (OF-29)	4 (OF-30)	5	1 (metalimnion)
1/17	.0125	<.01	.0125	-	.0225	<.01	-
2/23	.057	.05	.044	-	.025	.019	-
3/30	.04	.04	.72	-	.42	.61	-
4/11	.028	.039	.029	.04	.085	.02	-
4/25	.04	.04	.011	.084	.027	.022	-
5/9	.059	.056	.02	.185	.044	.05	-
5/23	.58	.056	.121	.40	.074	.079	.55
6/6	.11	.11	.11	.038	.11	.13	.47
6/20	.06	.22	.01	.27	.07	.07	-
7/6	.118	.174	.570	.108	.076	.108	.145
7/18	.077	.094	.340	.236	.209	.086	-
8/1	.091	.14	.274	.053	.073	.084	-
8/13	.092	.121	.196	.087	.072	.087	-
8/28	.103	.070	.274	.083	.043	.052	-
9/13	.081	.143	.020	-	-	.320	-
9/26	-	-	.169	.076	.065	.065	-
10/11	.036	.114	.193	.087	.045	.777	-
10/25	.069	.101	.476	.351	.326	.112	-
11/26	.104	.013	.277	.100	.050	-	-
12/12	.076	.072	.297	.053	.091	.075	-
1/3	.037	.037	.106	.041	.021	.049	-

From the 1985 Study, the mean in-pond concentration of phosphorus was 0.073 mg/L, with a range of <0.01 to 0.174 mg/L. The tributaries to the pond had concentrations of phosphorus ranging from 0.04 to 0.507 mg/L, the west inlet having consistently high concentrations. The west inlet is now known as OF-28, discharging off of Tremont Street. Land use in the catchment area tributary to this outfall today is mostly single-family residential with 41% impervious coverage. The average in-pond total phosphorous level of 0.073 mg/L from 1984-1985 was just above the current EPA gold book standard for streams entering a lake/reservoir of 0.05 mg/L[2].

[2] United States Environmental Protection Agency; "Quality Criteria for Water 1986". May 1986. https://www.epa.gov/sites/default/files/2018-10/documents/quality-criteria-water-1986.pdf

3.0 CATCHMENT AREA CHARACTERISTICS

Appendix H of the MA MS4 Permit requires permittees developing a phosphorus source identification report to calculate impervious and directly connected impervious area (DCIA) for all catchments tributary to the waterbodies of concern. Impervious area and DCIA were calculated for each delineated catchment area tributary to Ell Pond in Melrose. This section discusses the procedure for and results of these calculations.

3.1 Available GIS Mapping

Melrose's GIS includes extensive mapping of the drainage system in the Mystic River watershed and tributary to Ell Pond, including catchment delineations which have been recently updated. There are currently nineteen outfalls owned by the City of Melrose within the Mystic River Watershed, seven of which discharge to Ell Pond. The total drainage area in Melrose within the Mystic River Watershed 1,745 acres; 1,556 acres are within a delineated MS4 catchment area and 684 acres are directly tributary to Ell Pond. Most drainage infrastructure in Melrose is more than forty years old. The City has installed multiple BMPs to date, which are inspected annually and maintained as needed. A map showing the drainage infrastructure in the catchment areas within the Mystic River Watershed is included in Appendix A.

Land use data for the MS4 catchment areas within the Mystic River Watershed, as well as impervious area delineations for parcels, roads and other rights-of-way, was collected from MassGIS' most recent (2016) land use data layer. Table 4 presents a summary of land use in the tributary area:

Table 4: Land Use in Mystic River Catchment Areas in Melrose

Land Use	Acres	Percent of Overall Catchment Area
Commercial	39.25	2.52%
Industrial	7.99	0.51%
Mixed use, other	5.14	0.33%
Mixed use, primarily residential	7.21	0.46%
Open land	110.76	7.12%
Residential - multi-family	230.26	14.80%
Residential - other	0.62	0.04%
Residential - single family	715.05	45.96%
Right-of-way	297.48	19.12%
Tax exempt*	139.25	8.95%
Unknown	2.77	0.19%
Grand Total	**1,555.78**	**100.00%**

*The tax exempt land use includes all publicly-owned land including schools, parks, and government buildings, as well as property that is exempt from taxation such as property owned by religious groups, housing/utility authorities, hospitals, museums, etc.

3.2 Directly Connected Impervious Area

The land use data and impervious area delineation were used to calculate the percent of Directly Connected Impervious Area (DCIA) for each MS4 catchment area. Percent DCIA is calculated by applying the Sutherland Equation developed in the 1995 publication *Methodology for Estimating the Effective Impervious Area of Urban Watersheds*[3] and updated in the 2014 memorandum titled *Overview of Methodology to Calculate Baseline Stormwater Phosphorus Loads and Phosphorus Load Reduction Requirements for the Charles River*[4]. In order to properly use the Sutherland Equations, the MassGIS land use codes were converted to the EPA-defied land uses and phosphorus load export rates shown in Table 1-2 of Attachment 1 to Appendix F of the 2016 Massachusetts Small MS4 General Permit. The EPA land use codes chosen based on this guidance for each MassGIS land use are included in Table 5. Properties with an "Unknown" land use were considered as Commercial or Medium-density residential, which have the same Sutherland Equation. Weston & Sampson determined the amount and percent of impervious area in each MS4 catchment area for each land use, then used the appropriate Sutherland Equation to determine the percent DCIA for each land use in each catchment. These percentages were used to determine the total DCIA for each catchment. Table 6 lists the Sutherland Equation that was used for each land use type. Table 7 presents impervious area and DCIA statistics for each catchment.

Table 5: Conversion of MassGIS 2016 Land Use Codes to EPA Land Use Codes

MassGIS 2016 Code	MassGIS 2016 Use	EPA Land Use Code	EPA Use
3	Commercial	1	Commercial
4	Industrial	2	Industrial
20	Mixed Use, other	1	Commercial
10	Mixed use, primarily residential	5	High Density Residential
2	Open Land	9	Open Land
12	Residential- Multi-Family	5	High-Density Residential
13	Residential - Other	4	Medium-Density Residential*
11	Residential- Single Family	4	Medium-Density Residential*
55	Right-of-Way (Roads)	2	Industrial**
9	Tax-Exempt	6	Urban Public/ Institutional
0	Unknown	1	Medium Density Residential*

*EPA designates Medium-Density Residential as residential areas with parcel sizes between ¼ and ½ acre, which most closely matches these areas[5]
**EPA considers all transportation uses, including roads, to be Industrial uses

[3] Sutherland, R.C., "Methodology for Estimating the Effective Impervious Area of Urban Watersheds", Watershed Protection Techniques, Vol. 2, No. 1, Fall 1995.
[4] Voorhees, Mark. Overview of Methodology to Calculate Baseline Stormwater Phosphorus Loads and Phosphorus Load Reduction Requirements for the Charles River. January 14, 2014.
[5] United States Environmental Protection Agency., "Methodology to Calculate Baseline Estimates of Impervious Area and Directly Connected Impervious Area for Massachusetts Communities". March 2010. https://www3.epa.gov/region1/npdes/stormwater/ma/IA-DCIA-Calculation-Methodology.pdf

Table 6: EPA Land Use Classes and Corresponding Sutherland Equations (Source: EPA)			
EPA Code	Land Use	Watershed Selection Criteria	Sutherland Equation (where IA(%) > 1)
1	Commercial	Average: Mostly storm sewered with curb and gutter, no dry wells or infiltration, rooftops are directly connected	DCIA%=0.4(IA%) ^ 1.2
2	Industrial	Average: Mostly storm sewered with curb and gutter, no dry wells or infiltration, rooftops are directly connected	DCIA%=0.4(IA%) ^ 1.2
3	Low Density Residential	Somewhat connected: 50% not storm sewered, but open section roads, grassy swales, residential rooftops not connected, some infiltration	DCIA%=0.1(IA%) ^ 1.5
4	Medium Density Residential	Average: Mostly storm sewered with curb and gutter, no dry wells or infiltration, residential rooftops not directly connected	DCIA%=0.1(IA%) ^ 1.5
5	High Density Residential	Highly Connected: Same as above, but residential rooftops are connected	DCIA% = 0.4(IA%) ^ 1.2
6	Urban Public/ Institutional	Average: Mostly storm sewered with curb and gutter, no dry wells or infiltration, rooftops are directly connected	DCIA%=0.1(IA%) ^ 1.5
7	Agriculture	Mostly Disconnected: Small Percentage of urban area is storm sewered, or 70% or more infiltrated/disconnected	DCIA%=0.01(IA%) ^ 2
8	Forest	Mostly Disconnected: Small Percentage of urban area is storm sewered, or 70% or more infiltrated/disconnected	DCIA%=0.01(IA%) ^ 2
9	Open Land	Average: Mostly storm sewered with curb and gutter, no dry wells or infiltration, residential rooftops not directly connected	DCIA%=0.1(IA%) ^ 1.5
10	Water	n/a	n/a

Table 7: Impervious Area and DCIA Statistics for Mystic River Catchments in Melrose						
Catchment Area	Impervious Area (Acres)	DCIA (Acres)	Catchment Area (Acres)	Percent IA	Percent DCIA	Percent Connectivity
AOF-106	353.80	72.45	614.45	57.58%	11.79%	20.48%
OF-30	143.96	33.83	260.90	55.18%	12.96%	23.50%
OF-29	107.50	23.17	247.85	43.37%	9.35%	21.55%
OF-28	54.59	11.64	131.80	41.42%	8.83%	21.32%
OF-34	32.73	7.78	91.14	35.91%	8.53%	23.76%
OF-42	15.49	6.13	23.63	65.53%	25.93%	39.57%
OF-9	28.22	5.91	124.47	22.67%	4.75%	20.95%
OF-47B	9.47	4.80	16.30	58.12%	29.46%	50.69%
AOF-23	3.52	2.11	6.08	57.89%	34.74%	60.00%
OF-31	4.83	1.83	8.93	54.12%	20.47%	37.82%

Table 7: Impervious Area and DCIA Statistics for Mystic River Catchments in Melrose						
Catchment Area	Impervious Area (Acres)	DCIA (Acres)	Catchment Area (Acres)	Percent IA	Percent DCIA	Percent Connectivity
OF-33	5.52	1.79	10.14	54.44%	17.62%	32.37%
OF-6	2.03	1.54	2.06	98.21%	74.55%	75.90%
OF-37	2.39	1.28	3.19	75.07%	40.19%	53.54%
AOF-21	1.95	1.02	6.54	29.85%	15.60%	52.26%
OF-44	2.52	0.68	6.92	36.44%	9.79%	26.86%
OF-50	0.44	0.40	0.53	82.48%	74.90%	90.82%
AOF-42	0.22	0.15	0.35	62.64%	43.86%	70.02%
AOF-24	0.13	0.06	0.32	39.90%	19.60%	49.13%
AOF-22	0.08	0.03	0.18	46.68%	18.28%	39.16%
Total	**769.39**	**176.60**	**1555.78**	**49.45%**	**11.35%**	**22.95%**

Note: Percent Connectivity is the percent of total impervious area which is connected.

Many studies have been published in the past 15 years discussing the relationship between urban, impervious land cover and waterbody hydrology, habitat, biology, and ecosystem function. These studies have more recently included correlations between DCIA and biological indicators such as fish assemblages and algal blooms. Watersheds with as low as 4-6% IA and 1-5% DCIA typically begin to show water quality impacts. While the DCIA in the Ell Pond drainage area exceeds this threshold, the calculated range of percent DCIA is expected for municipalities similar to Melrose[6].

[6] Obropta, C.C. & Del Monaco, N. "Reducing Directly Connected Impervious Areas with Green Stormwater Infrastructure". *Journal of Sustainable Water in the Built Environment.* 2018. https://ascelibrary.org/doi/pdf/10.1061/JSWBAY.0000833

4.0 POLLUTANT LOADING ANLAYSIS AND PRIORITIZATION OF CATCHMENTS WITH HIGHER POTENTIAL PHOSPHORUS LOADS

The 2016 MS4 Permit requires all Phosphorus Source Identification Reports to include the identification, delineation, and prioritization of potential catchments with high phosphorus loadings. The potential for a particular site or area to contribute phosphorus to stormwater varies based on land use, impervious coverage, directly connected impervious area, and soil type. Hydrologic soil group (HSG), or the soil's ability to infiltrate stormwater, is the most important soil characteristic for the purposes of this analysis. HSG is ranked from A to D, with Group A soils more suited for infiltration, and Group D soils more likely to contribute runoff.

To identify catchment areas with higher potential phosphorus loads, a model for each catchment area was developed using land use data and impervious area data from MassGIS (2016), and soil HSG data from the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS). A land use/land cover grid was developed for the catchment areas within the Mystic River Watershed. That grid, which calculated the areas of each combination of land use, land cover, and soil type in each catchment, is included as Appendix B.

4.1 Phosphorus Load Export Rates

Land use, impervious coverage, directly connected impervious area, and HSG have been utilized by EPA as part of the MS4 Permit to develop Phosphorus Load Export Rates (PLERs) for different combinations of those attributes in close geographical areas where there is no considerable difference in average annual rainfall. Table 8 presents the PLERs that are included in Attachment 1 of Appendix F of the 2016 Massachusetts MS4 Permit. Single family residential land is the most prevalent land use in the catchment areas, followed by right-of-way land. Tax-exempt land was assigned the same PLER as commercial and industrial land in accordance with permit guidance.

Table 8: Phosphorus Load Export Rates (PLERs) by Land Use

Land Use Category	Land Surface Cover	PLER (lb/acre/year)
Commercial and Industrial	Directly Connected Impervious	1.78
	Pervious	*See Developed Pervious
Multi-Family and High Density Residential	Directly Connected Impervious	2.32
	Pervious	*See Developed Pervious
Medium Density Residential	Directly Connected Impervious	1.96
	Pervious	*See Developed Pervious
Low Density Residential	Directly Connected Impervious	1.52
	Pervious	*See Developed Pervious
Highway	Directly Connected Impervious	1.34
	Pervious	*See Developed Pervious
Forest	Directly Connected Impervious	1.52
	Pervious	0.13
Open Land	Directly Connected Impervious	1.52
	Pervious	*See Developed Pervious
Agriculture	Directly Connected Impervious	1.52
	Pervious	0.45
*Developed Pervious – HSG A	Pervious	0.03

Table 8: Phosphorus Load Export Rates (PLERs) by Land Use		
Land Use Category	Land Surface Cover	PLER (lb/acre/year)
*Developed Pervious – HSG B	Pervious	0.12
*Developed Pervious – HSG C	Pervious	0.21
*Developed Pervious – HSG C/D	Pervious	0.29
*Developed Pervious – HSG D	Pervious	0.37

4.2 Results

The land use/land cover grid shown in Appendix B, the directly connected impervious area (DCIA) determined for each catchment, and the PLERs included in Table 8 were used to calculate an estimated phosphorus load for each outfall. Disconnected impervious area, or the difference between impervious area and DCIA, was considered pervious coverage in HSG D to account for the fact that some runoff from disconnected impervious surfaces will be infiltrated before it reaches the MS4. Each distinct area of the land use/land cover grid was multiplied by the appropriate PLER to determine its yearly phosphorus load, and the results were summed by catchment area. The results of the pollutant loading analysis are presented in Table 9.

Table 9: Pollutant Loading Analysis Results					
Catchment Area	Catchment Area (Ac.)	DCIA (Ac.)	Disconnected IA (Ac.)	Relative Phosphorus Loading (lbs/yr/ac)	Phosphorus Loading (lbs/yr)
AOF-106	614.45	72.45	281.35	0.43	263.58
OF-30	260.90	33.83	110.13	0.45	117.00
OF-29	247.85	23.17	84.33	0.34	83.26
OF-28	131.80	11.64	42.95	0.32	41.91
OF-34	91.14	7.78	24.95	0.37	33.34
OF-9	124.47	5.91	22.31	0.24	29.49
OF-42	23.63	6.13	9.36	0.68	16.03
OF-47B	16.29	4.80	4.67	0.71	11.55
OF-33	10.14	1.79	3.73	0.59	5.96
AOF-23	6.08	2.11	1.41	0.87	5.27
OF-31	8.93	1.83	3.01	0.55	4.88
AOF-21	6.54	1.02	0.93	0.50	3.25
OF-6	2.06	1.54	0.49	1.54	3.18
OF-37	3.18	1.28	1.11	0.97	3.09
OF-44	6.92	0.68	1.84	0.30	2.06
OF-50	0.53	0.40	0.04	1.40	0.75
AOF-42	0.35	0.15	0.07	0.88	0.31
AOF-24	0.32	0.06	0.06	0.55	0.18

Table 9: Pollutant Loading Analysis Results					
Catchment Area	Catchment Area (Ac.)	DCIA (Ac.)	Disconnected IA (Ac.)	Relative Phosphorus Loading (lbs/yr/ac)	Phosphorus Loading (lbs/yr)
AOF-22	0.17	0.03	0.05	0.54	0.09
Total	**1555.77**	**176.58**	**592.79**	**0.40**	**625.16**

Table 9 confirms that catchments with more DCIA have a higher potential to contribute phosphorus to stormwater runoff. Smaller catchments with fewer acres of DCIA and disconnected impervious area have lower potential phosphorus loads, even when a higher percent of the catchment area is covered with impervious surfaces.

Non-point source runoff is also a significant source of potential phosphorus loading to Ell Pond. Since there are so many residential properties abutting the shores of the pond, runoff is generated from impervious area on those properties and discharges overland to the pond. Some of that runoff is likely infiltrated by lawns on the property, but what does reach the pond has a relatively high potential phosphorus load based on the amount of organic matter, such as leaf litter, grass clippings, soils, and dog waste that the runoff encounters.

4.2.1 Catchment Descriptions

The characteristics of the ten catchments with the highest phosphorus loading are summarized below:

Catchment AOF-106

The catchment area tributary to AOF-106 covers 614 acres south of Ell Pond, bordered to the west by the Melrose-Stoneham line and to the easy by Whitman Ave and Melrose Common. The catchment includes portions of Main Street, Tremont Street, Wyoming Ave, and many smaller neighborhood streets. The most predominant land uses in this catchment area are single-family residential and right-of-way land. The catchment is comprised of 58% impervious coverage, of which 12% is directly connected impervious area; soils are mostly hydrologic soil group (HSG) A. Potential sources of phosphorus in this catchment include leaf litter, grass clippings, pet waste, roadway debris, fertilizers, pesticides, or other chemicals used in lawn maintenance and landscaping that may contain phosphorus. The subsurface infrastructure in this catchment includes two covered brooks—Ell Pond Brook and Spot Pond Brook, which meet just upstream of the outfall/daylight location behind 355 Pleasant Street. The large and interconnected nature of the drainage system in this catchment puts the catchment at higher risk for illicit connections and/or discharges, which may contribute to phosphorus loading.

Catchment OF-30

OF-30 covers 261 acres north and east of Ell Pond. It includes Orient Avenue, Batchelder Street, Bellevue Avenue, Linden Road, Elm Street, Ashland Street, Albion Street, West Highland Avenue, Sargent Street, Nowell Road, Chapman Avenue, Marvin Road, Howell Street, and parts of Melrose Street, Green Street, Porter Street, First Street, East Emerson Street, Lincoln Street, and Stratford

Road. It also includes parts of Franklin Street, Main Street, Upham Street, and the Lynn Fells Parkway, which are all heavily trafficked. The most predominant land uses in this catchment area are single-family residential and right-of-way land. The catchment is comprised of 55% impervious coverage, of which 5% is directly connected impervious area; soils are mostly hydrologic soil group (HSG) A or unknown. Potential sources of phosphorus in this catchment include leaf litter, grass clippings, roadway debris, fertilizers, pesticides, or other chemicals used in lawn maintenance and landscaping that may contain phosphorus.

Catchment OF-29

OF-29 covers 248 acres northwest of Ell Pond. It includes North Avenue, South Avenue, Randolph Street, York Terrace, Ferdinand Street, Orris Street, Belmont Place, Brunswick Park, Volpe Way, Seawall Woods Road, Upland Road, Glen Road, Walton Park, and parts of Woodland Avenue, Tremont Street, Melrose Street, Belmont Street. It also includes parts of Warwick Road, Vinton Street, Franklin Street, and the Lynn Fells Parkway, which are all heavily trafficked. The most predominant land use in this catchment area is single-family residential, followed by right-of-way land. The catchment is comprised of 43% impervious area, of which 6% is directly connected impervious area; soils are mostly HSG A or unknown. Potential sources of phosphorus in this catchment include leaf litter, grass clippings, roadway debris, fertilizers, pesticides, or other chemicals used in lawn maintenance and landscaping that may contain phosphorus.

Catchment OF-28

OF-28 covers 132 acres west of Ell Pond. It includes Stevens Road, Maple Road, Whipple Hill Road, Oakland Street, Otis Street, Youle Street, Charles Street, Holland Road, and parts of Perkins Street, West Emerson Street, Tremont Street and the Lynn Fells Parkway, which is heavily trafficked. The most predominant land uses in this catchment area are single-family residential and right-of-way land. The catchment is comprised of 41% impervious area, of which 7% is directly connected impervious area; soils are mostly HSG A or unknown. Potential sources of phosphorus in this catchment include leaf litter, grass clippings, roadway debris, fertilizers, pesticides, or other chemicals used in lawn maintenance and landscaping that may contain phosphorus.

OF-34

The catchment tributary to OF-34 covers 91 acres west of the daylighted portion of Ell Pond Brook. It includes Washington Street, Pleasant Street, and many smaller neighborhood streets. The most predominant land uses in this catchment are single and multi-family residential land. The catchment is comprised of 36% impervious area, of which 9% is directly connected impervious area; soils are mostly HSG A. Potential sources of phosphorus in this catchment include leaf litter, grass clippings, roadway debris, fertilizers, pesticides, or other chemicals used in lawn maintenance and landscaping that may contain phosphorus.

OF-9

The catchment tributary to OF-9 covers 124 acres near Wyoming Cemetery. It includes all of the cemetery, parts of Sylvan and Lebanon Streets, and smaller neighborhood streets. The most predominant land uses in this catchment area are urban public/institutional land, single-family

residential, and open land. The catchment is comprised of 23% impervious area, of which 5% is directly connected impervious area; soils are mostly HSG A. Potential sources of phosphorus in this catchment include leaf litter, grass clippings, roadway debris, fertilizers, pesticides, runoff from stockpiles at the cemetery, and or other chemicals used for maintenance and landscaping that may contain phosphorus.

Catchment OF-42

OF-42 covers 24 acres east of Ell Pond. It includes parts of Lebanon Street, Rowe Street, Beverly Street, Green Street, Porter Street, and the Melrose-Wakefield Hospital. It also includes part of Main Street, which is heavily trafficked. The most predominant land uses in this catchment area are single family residential and right-of-way land. The catchment is comprised of 66% impervious area, of which 23% is directly connected impervious area; soils are mostly HSG C or unknown. Potential sources of phosphorus in this catchment include leaf litter, grass clippings, roadway debris, fertilizers, pesticides, or other chemicals used in lawn maintenance and landscaping that may contain phosphorus.

Catchment OF-47B

OF-47B covers 16 acres north of Ell Pond and includes part of the Lynn Fells Parkway, the Melrose Middle/High Schools and athletic fields. The most predominant land uses in this catchment area are open land and tax-exempt land. The catchment is comprised of 58% impervious area, of which 19% is directly connected impervious area; soils are mostly unknown HSG. Potential sources of phosphorus in this catchment include leaf litter, grass clippings, roadway debris, fertilizers, pesticides, or other chemicals used in lawn maintenance and landscaping that may contain phosphorus.

Catchment OF-33

The catchment tributary to OF-33 covers 10 acres south of West Wyoming Ave between Main Street and the daylighted portion of Ell Pond Brook. The most predominant land uses in the catchment are single and multi-family residential land. The catchment is 54% impervious area, of which 18% is directly connected impervious area; soils are mostly unknown HSG. Potential sources of phosphorus in this catchment include roadway debris, leaf litter, grass clippings, pet waste, or other chemicals used in residential landscaping that may contain phosphorus.

Catchment AOF-23

Catchment AOF-23 covers 6 acres near Melrose's southern border with Malden, including parts of Washington Street and Brazil Street. The catchment is predominantly multi-family residential and single-family residential land. 58% of the catchment is impervious area, of which 35% is directly connected impervious area; soils are mostly unknown HSG. Potential sources of phosphorus in this catchment include roadway debris, leaf litter, grass clippings, pet waste, or other chemicals used in residential landscaping that may contain phosphorus.

4.3 Dry and Wet Weather Outfall Screening and Sampling

Melrose has a total of 44 outfalls that are under the City's jurisdiction and regulated under the 2016 MS4 permit. Dry weather screening and sampling of these outfalls was conducted between May 21, 2020 and June 3, 2020. A total of eight outfalls and interconnections had dry weather flow and were sampled, four of which discharge to Ell Pond or are in the greater Mystic watershed. The results of these sampling events were recorded in the City's GIS and summarized in a separate report, 2020 Dry Weather Outfall and Interconnection Screening and Sampling. Wet weather screening and sampling is scheduled to begin in 2022 and will be complete by the end of Permit Year 10, or June 30, 2028. Where flow was observed during dry weather screening, field kits were used to analyze samples for ammonia, chlorine, surfactants, temperature, salinity, and conductivity, and samples were sent to a laboratory for Escherichia coliform (E. coli) analysis. Samples collected at outfalls discharging directly to Ell Pond were also analyzed for phosphorus, and total suspended solids. The dry-weather sampling results for phosphorus are presented in Table 10.

Table 10: Dry-Weather Phosphorus Sampling Results

Outfall ID	Sampling Date	Total Phosphorus (mg/L)
OF-28	5/21/2020	<0.05
OF-29	5/21/2020	0.052
OF-42	5/21/2020	<0.05
OF-44	5/26/2020	-*

*Flow observed at OF-44 was not analyzed for phosphorus since OF-44 does not directly discharge to a phosphorus-impaired waterbody.

There is no regulatory standard for phosphorus concentrations in the Massachusetts Surface Water Quality Standards, so the benchmark criteria was based on available literature. The EPA gold book standard identifies an average of at least three samples exceeding 0.1 mg/L as the upper threshold for flowing waters and 0.05 mg/L for streams entering a lake or reservoir[7]. The standard of 0.1 mg/L was used as a benchmark concentration to assess samples in the 2020 Dry Weather Report. This concentration was used as the benchmark in this report assuming that a similar concentration may be established for Ell Pond when a TMDL is developed. Of the outfalls sampled, none exceeded this standard. The Alternative TMDL for Phosphorus for the Mystic River Watershed does not include a benchmark phosphorus concentration for stormwater discharges. EPA has indicated that they will be providing additional guidance regarding benchmark criteria for parameters included in Appendix G of the 2016 MS4 permit.

4.4 Catchment Ranking Matrix

The purpose of performing the pollutant loading analysis was to develop a priority ranking of the catchments tributary to the Mystic River. Catchments with the highest potential phosphorus load

[7] United States Environmental Protection Agency; "Quality Criteria for Water 1986". May 1986. https://www.epa.gov/sites/default/files/2018-10/documents/quality-criteria-water-1986.pdf

were considered highest priority. Since phosphorus concentrations did not exceed benchmark criteria at any of the outfalls sampled during dry-weather, and because observed phosphorus concentrations in stormwater discharge can vary depending on the time of year the sampling is conducted, and other factors, the sample phosphorus concentrations were not considered when ranking the catchment areas. Other data collected during outfall inspections, such as distance from the outfall to the receiving water, were considered. Outfalls discharging directly to Ell Pond were considered higher priority than those discharging to receiving waters in the greater Mystic Watershed, since those outfalls discharge directly to a waterbody requiring the development of a TMDL for phosphorus. The area that contributes overland flow to Ell Pond was not ranked, as it is not considered a delineated catchment area under the MS4 Permit as there is no point source discharge. The catchment ranking is presented in Table 11.

Table 11: Mystic River Watershed Catchment Ranking

Rank	Catchment ID	Catchment Area (Ac.)	Relative Phosphorus Loading (lb/yr/ac)	Phosphorus Loading (lb/yr)	Total Phosphorus Dry Weather Sampling Result (mg/L)	Direct Discharge to Ell Pond?
1	OF-30	260.90	0.45	117.00		Yes
2	OF-29	247.85	0.34	83.26	0.052	Yes
3	OF-28	131.80	0.32	41.91	<0.05	Yes
4	OF-42	23.63	0.68	16.03	<0.05	Yes
5	OF-47B	16.29	0.71	11.55		Yes
6	OF-50	0.53	1.40	0.75		Yes
7	AOF-106	614.45	0.43	263.58		No
8	OF-9	124.47	0.24	29.49		No
9	OF-34	91.14	0.37	33.34		No
10	OF-33	10.14	0.59	5.96		No
11	OF-31	8.93	0.55	4.88		No
12	OF-44	6.92	0.30	2.06	-	No
13	AOF-21	6.54	0.50	3.25		No
14	AOF-23	6.08	0.87	5.27		No
15	OF-37	3.18	0.97	3.09		No
16	OF-6	2.06	1.54	3.18		No
17	AOF-42	0.35	0.88	0.31		No
18	AOF-24	0.32	0.55	0.18		No
19	AOF-22	0.17	0.54	0.09		No

5.0 BEST MANAGEMENT PRACTICE (BMP) RETROFIT OPPORTUNITIES

In addition to a community-wide BMP retrofit inventory, the 2016 MS4 Permit requires permittees with discharges to a phosphorus-impaired waterbody to identify potential retrofit opportunities in the sub-catchments tributary to those receiving waters as part of the PSIR. Retrofit opportunities may include the installation of structural BMPs during redevelopment or the removal of impervious area. As catchment areas tributary to Ell Pond were considered highest priority in the catchment ranking matrix included in Section 4.4, the location of potential retrofit projects discussed in this section is limited to the Ell Pond drainage area.

5.1 Potential Retrofit Sites

The following factors were considered when identifying potential retrofit sites in the high priority sub-catchments tributary to Ell Pond: parcel size, existing use, soil type, and available open space. Areas within the right-of-way were also considered for impervious area disconnection and/or reduction. Municipal ownership was considered the most important factor, as it is unlikely that the City will be able to install a structural BMP on land that is privately owned unless the City plans to acquire the property in question. Soils and available open space were also weighed heavily as site suitability characteristics. Given the limited amount of City-owned property in the Ell Pond watershed, areas in both high priority and low priority catchments were considered for retrofit. Those projects within the right-of-way are intended to be considered in conjunction with the City's existing schedule for roadway and sidewalk improvements in the area. The identified locations for potential BMP retrofit are included in Table 12 and discussed in more detail below.

Table 12: Potential BMP Retrofit Sites

Site Address	Property Owner	Site Area (Ac.)	Percent Impervious Coverage	Soil Type	Existing Parcel Use	Catchment ID	Catchment Rank
Franklin Field (2 Greenleaf Place)	City of Melrose	3.54	12.44%	Unknown	Field	OF-30	1
Winthrop Elementary School (162 First Street)	City of Melrose	2.80	42.88%	B/D	School	OF-30	1
Dunton Park (143 Franklin Street)	City of Melrose	0.35	4.21%	Unknown	Park	OF-30	1
Linden Road at Lynn Fells Parkway	Right-of-Way	N/A	N/A	A	-	OF-30	1
Elm Street at Lynn Fells Parkway	Right-of-Way	N/A	N/A	A	-	OF-30	1
Linden Road at Porter Street	Right-of-Way	N/A	N/A	C	-	OF-30	1
Morelli Field/ Fred Green Field (129 Tremont Street)	City of Melrose	7.77	42.64%	A/ Unknown	Fields	OF-29	2
Roosevelt Elementary School/ Messenger	City of Melrose	4.80	36.25%	A/ Unknown	School	OF-29	2

Table 12: Potential BMP Retrofit Sites							
Site Address	Property Owner	Site Area (Ac.)	Percent Impervious Coverage	Soil Type	Existing Parcel Use	Catchment ID	Catchment Rank
Playground (253 Vinton Street)							
Warren Street Park (31 Warren St)	City of Melrose	0.43	20.72%	A	Park	OF-29	2
Sewall Woods Park (Sewall Woods Road)	City of Melrose	8.89	<1%	A/ Unknown	Park	OF-28 (west), OF-29 (east)	2, 3
City Works Yard (72 Tremont Street)	City of Melrose	2.21	92.98%	Unknown	Public Works	OF-28	3
Franklin Street from Vinton Street to City Limit	Right-of-Way	N/A	N/A	A	-	OF-28	3
Ell Pond Park (Lynn Fells Parkway)	City of Melrose	16.40	15.72%	Unknown	Park	OF-47B	5
Melrose Middle/ High School (350 Lynn Fells Parkway)	City of Melrose	12.82	76.02%	A/ Unknown	School	OF-47B, OF-50	5, 7
Crystal Street	Right-of-Way	N/A	N/A	Unknown	-	OF-37	6
Melrose Street & Lynn Fells Parkway	Right-of-Way	N/A	N/A	Unknown	-	OF-30	1

5.1.1 Franklin Field

Franklin Field is a 3.5-acre City-owned parcel off Franklin Street at 2 Greenleaf Place. The parcel is surrounded by residential and commercial properties and is located adjacent to the Franklin School or Early Childhood Center. This site was included in the Ell Pond Stormwater Mitigation Study as part of MassDEP's 604b grant, which included a preliminary BMP design and construction cost estimate for the site. The proposed BMP includes a subsurface leach system with subdrainage back to the existing drain system on Franklin Street. Expected phosphorus removal would depend on the amount of impervious area diverted to BMPs or disconnected from the MS4.

5.1.2 Winthrop Elementary School

Winthrop Elementary School is a 2.8-acre City-owned parcel located on the corner of First Street and Ashcroft Road. Due to the amount of traffic during the school year, this site would provide excellent public education opportunities. Winthrop School is next in line for complete reconstruction when Massachusetts School Building Authority funding becomes available. If the site is reconstructed, stormwater improvements that provide public education co-benefits, like rain gardens or other small surface bioretention BMPs, should be considered in addition to infiltration trenches or other subsurface systems.

5.1.3 Dunton Park

Dunton Park is a 0.35-acre City-owned parcel located off Franklin Street at Pratt Street. The park is adjacent to residential properties. This site was also included in the Ell Pond Stormwater Mitigation Study. The preliminary BMP design includes a subsurface leach system fronted by settling tanks and a flow splitter. A construction cost estimate is included in the 604b grant report. Expected phosphorus removal would depend on the amount of impervious area diverted to BMPs or disconnected from the MS4.

5.1.4 Linden Road at Lynn Fells Parkway

The Linder Road at Fells Parkway intersection was also included in the Ell Pond Stormwater Mitigation Study. The preliminary BMP design includes a subsurface leach system fronted by a splitting tank with underdrainage back to the existing drain system. A construction cost estimate is included in the 604b grant report. Expected phosphorus removal would depend on the amount of impervious area diverted to BMPs or disconnected from the MS4. Any improvements abutting Lynn Fells Parkway must be coordinated with the Department of Conservation and Recreation (DCR) to ensure all impacted drainage infrastructure is owned and maintained by the City of Melrose.

5.1.5 Elm Street at Lynn Fells Parkway

The Elm Street at Lynn Fells Parkway intersection was also included in the Ell Pond Stormwater Mitigation Study. The preliminary BMP design includes a subsurface leach system with underdrainage back to the existing drain system. A construction cost estimate is included in the 604b grant report. Expected phosphorus removal would depend on the amount of impervious area diverted to BMPs or disconnected from the MS4. Any improvements abutting Lynn Fells Parkway must be coordinated with the Department of Conservation and Recreation (DCR) to ensure all impacted drainage infrastructure is owned and maintained by the City of Melrose.

5.1.6 Linden Road at Porter Street

The Linder Road at Porter Street intersection was also included in the Ell Pond Stormwater Mitigation Study. The preliminary BMP design proposed includes a subsurface leach system with underdrainage back to the existing drain system. A construction cost estimate is included in the 604b grant report. Expected phosphorus removal would depend on the amount of impervious area diverted to BMPs or disconnected from the MS4.

5.1.7 Morelli Field/ Fred Green Field

The Morelli and Fred Green Fields are recreational fields that are part of a 7.8-acre City-owned parcel located on the corner of Tremont Street and the Lynn Fells Parkway. To disconnect a portion of the drainage system on Tremont Street, the City should consider installing leaching catch basins, tree filter pits, or other subsurface systems within the parcel or the right-of-way. The City is currently planning to replace the turf carpet at Morelli Field in the next year but is not planning any subsurface improvements at this time.

5.1.8 Roosevelt Elementary School/ Messenger Playground

The Roosevelt Elementary School and Messenger Playground are part of a 4.8-acre City-owned parcel located between Brunswick Park and Vinton Street. Due to the heavy traffic during school

hours, this site would provide excellent public education opportunities. The school is surrounded by residential properties and the MBTA orange line. Portions of the drainage infrastructure within and surrounding the site could be rerouted to rain gardens or other small green infrastructure practices within the parcel or adjacent right-of-ways. This site is known to have localized flooding issues and high groundwater, however a record plan dated 6/15/2001 shows a "proposed infiltration area" under the playground. The City should confirm if that system was constructed and if any maintenance is required.

5.1.9 Warren Street Park

Warren Street Park is a 0.43-acre City-owned parcel located on the corner of Melrose Street and Warren Street. Potential retrofits include re-routing a portion of the existing drainage system on Warren Street or Melrose Street to rain gardens or other small surface bioretention BMPs, infiltration trenches or other subsurface systems, or other green infrastructure within the parcel or adjacent right-of-ways. The park is scheduled for reconstruction in the next year (FY2023) however the City will consider incorporating green infrastructure into the sidewalk improvements that will be constructed following work at the park.

5.1.10 Sewall Woods Park

Sewall Woods Park is an 8.9-acre forested City-owned parcel located off of Seawall Woods Road and the Lynn Fells Parkway. Potential retrofits may include conversion of City-owned catch basins on Seawall Woods Road to leaching catch basins or small infiltration trenches within the parcel or the right-of-way, or small surface BMPs (bioretention or similar). Green infrastructure improvements may be incorporated into upcoming water main work on Sewall Woods Road, scheduled for the next year (FY2023).

5.1.11 City Yard

The Melrose City Yard is a 2.2-acre City-owned parcel located on Tremont Street across from Ell Pond Park. A portion of the drainage system along Tremont Street could be diverted to a surface BMP (bioretention or similar) or infiltration trenches along the front of the property to disconnect impervious area within catchment OF-28. The City will be replacing the salt shed at the City Yard in the next year (FY2023), and will consider adding green infrastructure improvements to that work at the site.

5.1.12 Franklin Street from Vinton Street to City Limit

Franklin Street from Vinton Street to the City Limit is included in the City's MassDOT Complete Streets Funding Program Project Prioritization Plan. The project is ranked twenty-third and the proposed work includes the installation of pedestrian bump-outs and re-striping for traffic control on Franklin Street from Vinton Street westerly to the City Limit. The City should look for specific locations to implement green infrastructure when planning future roadway and sidewalk improvements in this area. Potential retrofits may include small surface BMPs (bioretention or similar) within curb bump-outs within the right-of-way, or conversion of City-owned catch basins to leaching catch basins or small infiltration trenches.

5.1.15 Ell Pond Park

Ell Pond Park is a 16.4-acre City-owned parcel located along Lynn Fells Parkway and Ell Pond. The parcel includes the Knoll parking lot, the Memorial Knoll, West Knoll field, East Knoll field, Lewis Monk Little League field, Crystal Street tennis courts, Lyons tennis courts, and a dog park. The Ell Pond Park Feasibility Study being conducted by the City and Weston & Sampson aims to identify necessary improvements to existing park facilities and features and proposes the use of this parcel and Cabbage Patch Field across Lynn Fields Parkway which is part of the municipally owned Middle and High School parcel. The study currently proposes stormwater management improvements such as subsurface stormwater chambers, sediment forebays, deep sump catch basins, rain gardens, invasive species removal/treatment, porous pavement materials, and native tree and shrub plantings. A constructed stormwater wetland system is being designed to treat discharges from OF-50 and OF-30. Potential retrofits such as conversion of City-owned catch basins to leaching catch basins or small infiltration trenches and surface BMPs (bioretention or similar) within the park would provide excellent public education opportunities. The City will be implementing improvements to Ell Pond Park in phases as funding becomes available from different sources. Expected phosphorus removal would depend on the number of BMPs installed and the amount of impervious area diverted to BMPs or disconnected from the MS4. Cut sheets for bioretention areas and tree filter pits as well as examples of these BMPs in the right-of-way are included in Appendix C.

5.1.16 Melrose Middle/ High School

The Melrose Middle/High School is a 12.8-acre City-owned parcel located on the Lynn Fells Parkway across from Ell Pond Park. Portions of the drainage infrastructure within and surrounding the site could be rerouted to rain gardens or other small surface bioretention BMPs. This site is known to have localized flooding and high groundwater, making subsurface infiltration likely infeasible.

5.1.17 Crystal Street

This one-way street directly northeast of Ell Pond serves residential properties and the Crystal Street tennis court. There are various existing catch basins on both sides of the street to consider for conversion to leaching catch basins, tree filter pits, or infiltration trenches.

5.1.18 Melrose Street & Lynn Fells Parkway

The Department of Conservation and Recreation is planning infrastructure improvements on Lynn Fells Parkway near the intersection with Melrose Street. The City is working with DCR to incorporate more infiltration practices and green infrastructure, such as tree filter pits or bioretention areas, into the proposed design.

5.1.19 Infiltration Trenches – Various Locations

The City received a grant through a partnership with the Mystic River Watershed Association to site and install up to 30 infiltration trenches at existing catch basin locations. These trenches will be sited in high priority catchment areas within the Ell Pond watershed, and will generally follow the design included in Appendix C. Construction of these trenches will begin in September 2023.

5.2 Completed Retrofit Projects

The City has completed or is actively working on some retrofit projects in the Ell Pond watershed. These projects are summarized in Table 13 and discussed in more detail below. This section should be updated as the City completes stormwater retrofit projects in the watershed.

Table 12: Potential BMP Retrofit Sites							
Site Address	Property Owner	Site Area (Ac.)	Percent Impervious Coverage	Soil Type	Existing Parcel Use	Catchment ID	Catchment Rank
Orient Avenue	Right-of-Way	N/A	N/A	C	-	OF-30	1
Poplar Street and Prospect Street Intersection	Right-of-Way	N/A	N/A	A	-	OF-28	3

5.2.1 Orient Avenue

Three rain gardens were installed in vegetated strips between the sidewalk and the curb along Orient Avenue in June 2021. The work built upon the stormwater assessment and preliminary design project funded by MassDEP's 604(b) grant, and construction and final design were funded by CZM. The rain gardens were designed to capture and treat the first flush of stormwater runoff from each drainage area, and included native plantings, amended sands and underdrainage return to existing drainage structures.

5.2.2 Poplar Street and Prospect Street Intersection

The City recently redesigned the intersection of Poplar Street and Prospect Street, installing a planted bump-out between the southwest corner of the intersection and an existing vegetated island, reducing impervious area and providing traffic calming and pedestrian safety co-benefits.

5.3 Implementation

The City of Melrose will begin addressing the findings of this Phosphorus Source Identification Report in Permit Year 5 (FY2023). The City must first evaluate each potential retrofit opportunity identified in the previous section through the following actions:

- Determine a planned retrofit date for each potential retrofit site identified in Section 5.1 based on the next planned infrastructure, resurfacing, or redevelopment activity planned for the site.
- Determine an estimated cost for each potential retrofit project discussed in Section 5.1.
- Determine the engineering and regulatory feasibility of implementing each potential retrofit project.
-

A list of planned BMP retrofit projects and schedule for their implementation will be included in the City's Year 5 MS4 Annual Report.

By the end of Permit Year 6 (FY2024), the City will plan and install one of the retrofit projects identified in Section 5.1 as a demonstration project. The remainder of the retrofit projects, where implementation is feasible from an engineering and permitting perspective, will be installed according to the schedule included in the Year 5 annual report. Future availability of funding will also be considered in developing the schedule. Melrose will track any structural BMPs installed in the

watershed and calculate the estimate phosphorus removal attributable to those BMPs consistent with Attachment 3 to Appendix F of the MS4 Permit. The BMP type, area treated, design storage volume, and estimated phosphorus removed in pounds per year by each BMP will be included in the City's future MS4 annual reports.

6.0 REFERENCES

- City of Melrose, "Ell Pond, Melrose Stormwater Mitigation Project 604(b) Water Quality Management Planning Grant (2014-03/604)", Massachusetts Department of Environmental Protection Bureau of Water Resources and the U.S. Environmental Protection Agency Region 1. June 2016.
- City of Melrose, "Melrose Ell Pond Watershed Green Infrastructure Project", February 2021.
- Ellis, E.P., "MassDOT Complete Streets Funding Program Project Prioritization Plan". August 2017.https://www.cityofmelrose.org/sites/g/files/vyhlif3451/f/uploads/melrose_cs_prioritization_plan_2017-08-31_final.pdf
- Lycott Environmental Research, Inc., "Restoration Study for Ell Pond Melrose, Massachusetts". May 1985.
- Metropolitan Area Planning Council, "A Restoration & Management Program for Ell Pond". December 1981.
- Sutherland, R.C., "Methodology for Estimating the Effective Impervious Area of Urban Watersheds", Watershed Protection Techniques, Vol. 2, No. 1, Fall 1995.
- United States Environmental Protection Agency., "Methodology to Calculate Baseline Estimates of Impervious Area and Directly Connected Impervious Area for Massachusetts Communities". March 2010. https://www3.epa.gov/region1/npdes/stormwater/ma/IA-DCIA-Calculation-Methodology.pdf
- United States Environmental Protection Agency; "Quality Criteria for Water 1986". May 1986. https://www.epa.gov/sites/default/files/2018-10/documents/quality-criteria-water-1986.pdf
- Weston & Sampson, "Ell Pond Park Feasibility Study", May 2022.

APPENDIX A

Ell Pond MS4 Map

N

Wakefield

Stoneham

Melrose

Saugus

Malden

OF-29

OF-30

OF-47B

OF-50

OF-28

OF-37

Ell Pond

OF-42

AOF-106

AOF-42

OF-33

OF-31

OF-34

OF-44

OF-9

OF-6

AOF-21

AOF-24

AOF-23

AOF-22

Legend

- Mystic River Watershed Boundary
- Drain Manhole
- Catch Basins
- Gravity Main Drain Pipe
- Covered Brook

Outfalls

- Not Regulated
- Regulated

Mystic Watershed Catchments

Receiving Water

- Ell Pond
- Ell Pond Brook
- Unnamed Wetland
- Rivers, Streams, and Brooks
- Lakes, Ponds, Reservoirs
- Parcels

0 0.075 0.15 0.3 0.45 0.6 Miles

APPENDIX A

CITY OF MELROSE, MASSACHUSETTS

PHOSPHORUS SOURCE IDENTIFICATION REPORT

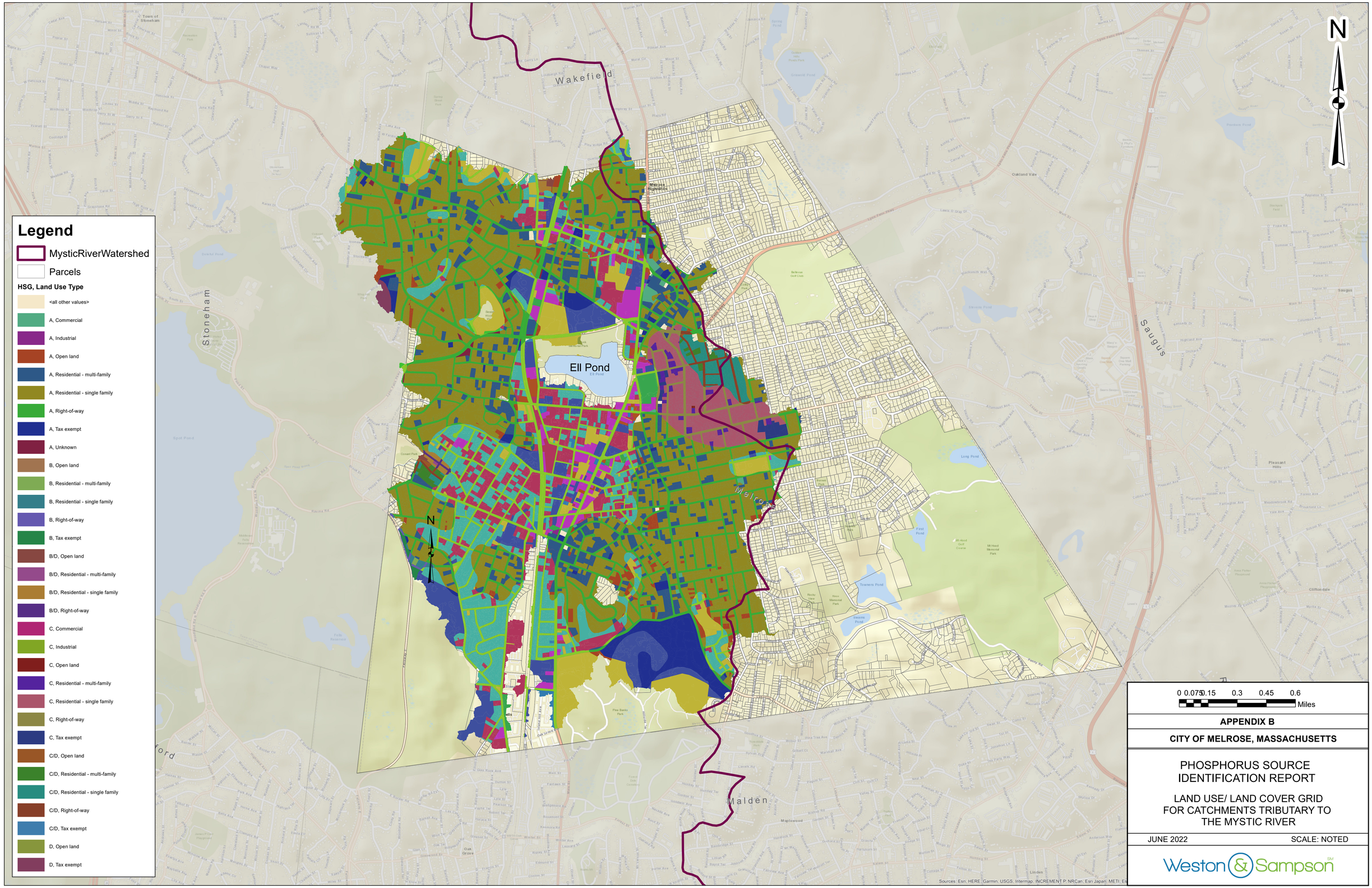
MYSTIC RIVER WATERSHED MS4 MAP

JUNE 2022 SCALE: NOTED

Weston & Sampson SM

APPENDIX B

Land Use/Land Cover Grid



APPENDIX B

CITY OF MELROSE, MASSACHUSETTS

PHOSPHORUS SOURCE IDENTIFICATION REPORT

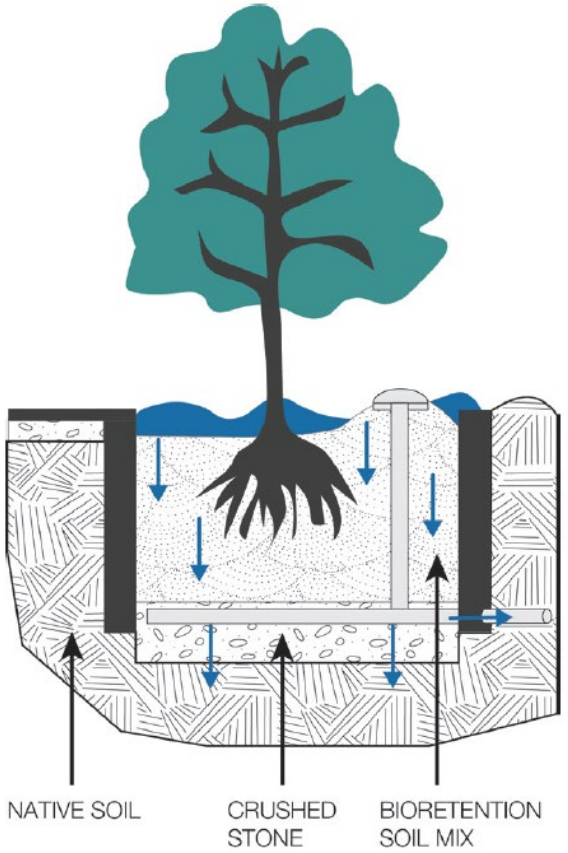
LAND USE/ LAND COVER GRID FOR CATCHMENTS TRIBUTARY TO THE MYSTIC RIVER

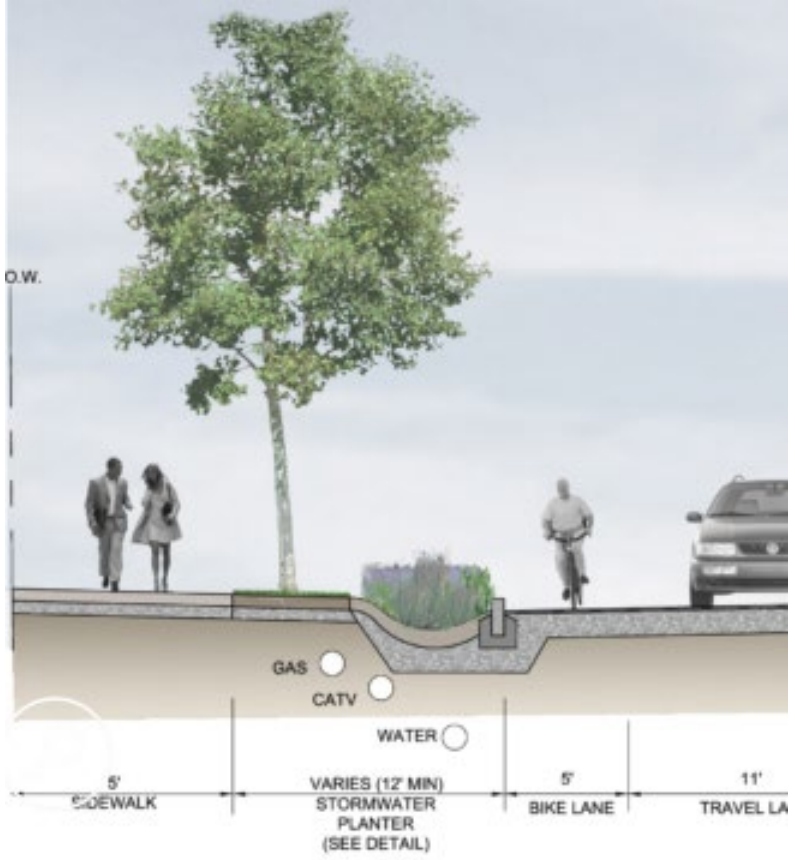
JUNE 2022 SCALE: NOTED

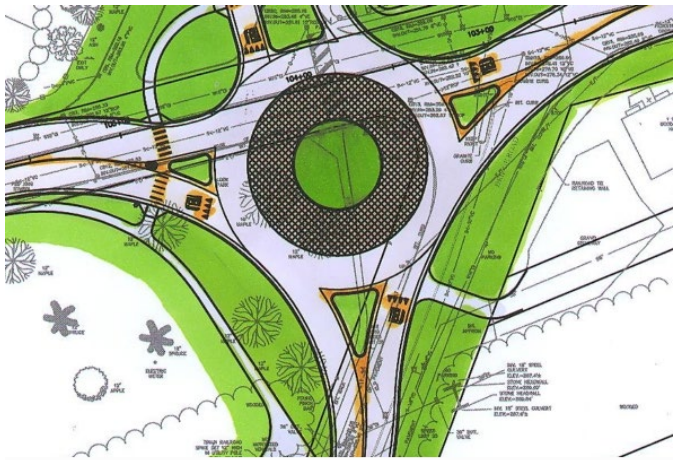
Weston & Sampson℠

APPENDIX C

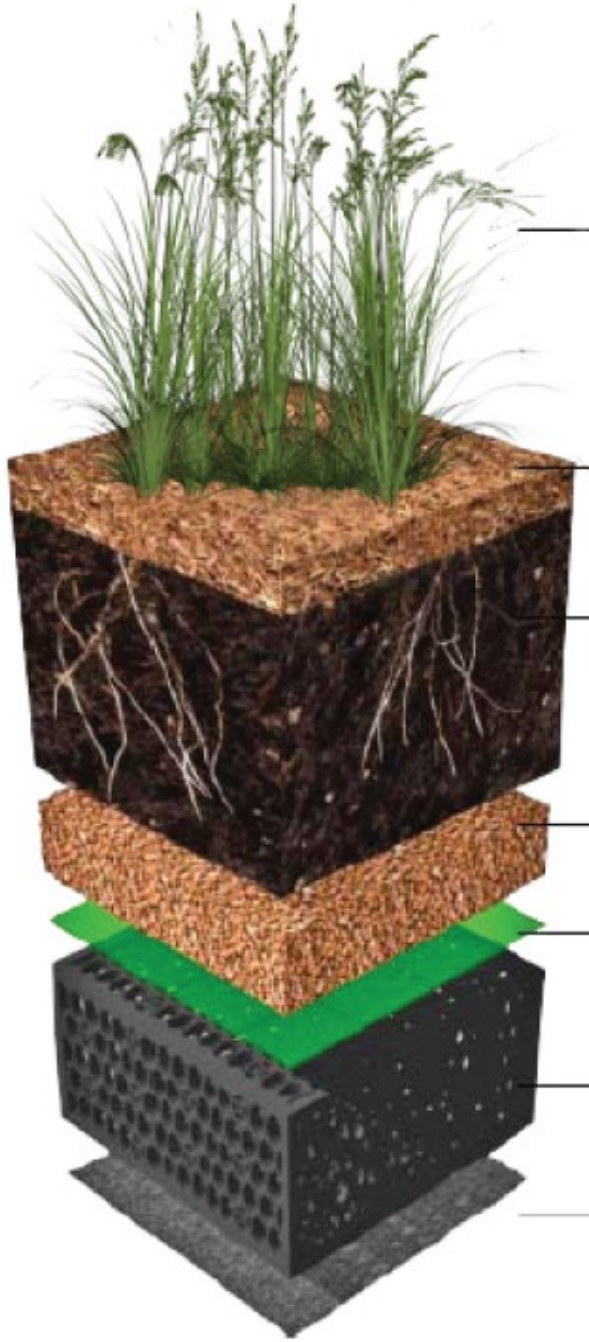
BMP Retrofit Cut Sheets, Example, and Working Designs







Weston & Sampson



PLANTING

CLEAN, SHREDDED HARDWOOD MULCH

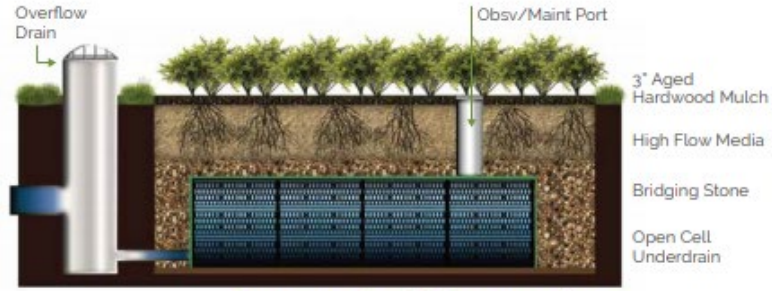
HIGH PERFORMANCE BIOFILTRATION MEDIA

CLEAN, BRIDGING STONE

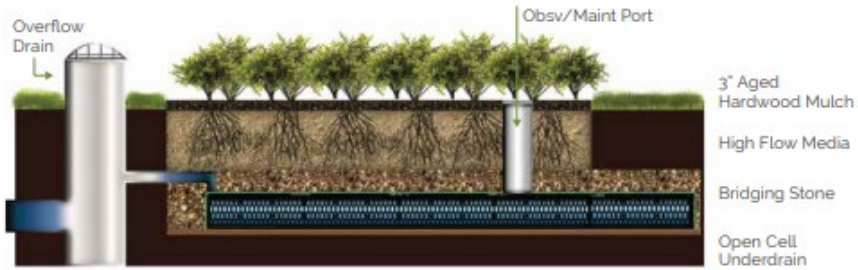
OPEN MESH SEPARATION FABRIC

MODULAR HIGH PERFORMANCE UNDERDRAIN

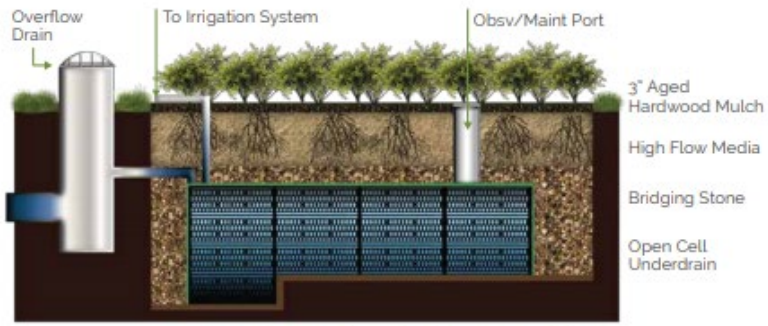
GEOTEXTILE OR LINER ENVELOPE



Expanded Detention



Expanded Infiltration



Rainwater Harvesting

ACF Environmental

ACF Environmental

Bioretention Areas & Rain Gardens

Description: Bioretention is a technique that uses soils, plants, and microbes to treat stormwater before it is infiltrated and/or discharged. Bioretention cells (also called rain gardens in residential applications) are shallow depressions filled with sandy soil topped with a thick layer of mulch and planted with dense native vegetation. Stormwater runoff is directed into the cell via piped or sheet flow. The runoff percolates through the soil media that acts as a filter.

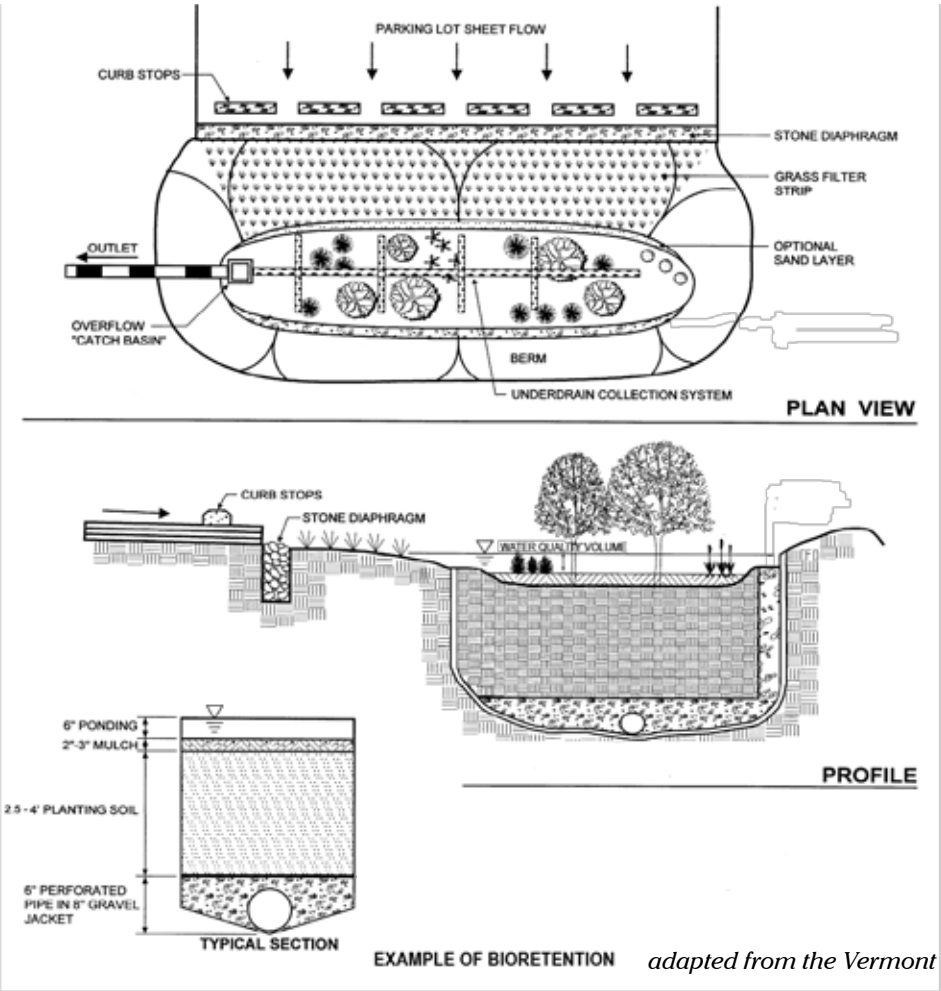
There are two types of bioretention cells: those that are designed solely as an organic filter filtering bioretention areas and those configured to recharge groundwater in addition to acting as a filter exfiltrating bioretention areas. A filtering bioretention area includes an impermeable liner and underdrain that intercepts the runoff before it reaches the water table so that it may be conveyed to a discharge outlet, other best management practices, or the municipal storm drain system. An exfiltrating bioretention area has an underdrain that is designed to enhance exfiltration of runoff into the groundwater.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	N/A
3 - Recharge	An exfiltrating bioretention area provides groundwater recharge.
4 - TSS Removal	90% TSS removal credit with adequate pretreatment
5 - Higher Pollutant Loading	Can be used for certain land uses with higher potential pollutant loads if lined and sealed until adequate pretreatment is provided. Adequate pretreatment must include 44% TSS removal prior to infiltration. For land uses that have the potential to generate runoff with high concentrations of oil and grease such as high intensity use parking lots and gas stations, adequate pretreatment may also include an oil grit separator, sand filter or equivalent. In lieu of an oil grit separator or sand filter, a filtering bioretention area also may be used as a pretreatment device for infiltration practices exfiltrating runoff from land uses with a potential to generate runoff with high concentrations of oil and grease.
6 - Discharges near or to Critical Areas	Good option for discharges near cold-water fisheries. Should not be used near bathing beaches and shellfish growing areas.
7 - Redevelopment	Suitable with appropriate pretreatment

Pollutant Removal Efficiencies

- Total Suspended Solids (TSS) — 90% with vegetated filter strip or equivalent
- Total Nitrogen — 30% to 50% if soil media at least 30 inches
- Total Phosphorus — 30% to 90%
- Metals (copper, lead, zinc, cadmium) — 40% to 90%
- Pathogens (coliform, e coli) — Insufficient data



EXAMPLE OF BIORETENTION *adapted from the Vermont Stormwater Manual*

Special Features:

- Can be lined and sealed to prevent recharge where appropriate
- Adequate pretreatment is essential
- Not recommended in areas with steep slope
- Depth of soil media depends on type of vegetation that is proposed
- Soil media must be 30 inches deep to achieve removal of nitrogen

Advantages/Benefits:

- Can be designed to provide groundwater recharge and preserves the natural water balance of the site
- Can be designed to prevent recharge where appropriate
- Supplies shade, absorbs noise, and provides windbreaks
- Can remove other pollutants besides TSS including phosphorus, nitrogen and metals
- Can be used as a stormwater retrofit by modifying existing landscape or if a parking lot is being resurfaced
- Can be used on small lots with space constraints
- Small rain gardens are mosquito death traps
- Little or no hazard for amphibians or other small animals

Disadvantages/Limitations:

- Requires careful landscaping and maintenance
- Not suitable for large drainage areas

Maintenance

Activity	Frequency
Inspect and remove trash	Monthly
Mow	2 to 12 times per year
Mulch	Annually
Fertilize	Annually
Remove dead vegetation	Annually
Prune	Annually

sediment, trash and debris. Eventually a layer of sediment will accumulate on the top of the sand, which can be easily scraped off using rakes or other devices. Finer sediments will penetrate deeper into the sand over time, necessitating replacement of some (several inches) or all of the sand. Discolored sand indicates the presence of fine sediments. Dewater and properly dispose of sand removed from the filter.

References

Erickson, Andrew J., et al., Enhanced Sand Filtration for Storm Water Phosphorus Removal, Journal of Environmental Engineering. Volume 133, Issue 5, pp. 485-497, May 2007.

Tree Box Filter

Description: The Tree Box Filter consists of an open bottom concrete barrel filled with a porous soil media, an underdrain in crushed gravel, and a tree. Stormwater is directed from surrounding impervious surfaces through the top of the soil media. Stormwater percolates through the media to the underlying ground. Treated stormwater beyond the design capacity is directed to the underdrain where it may be directed to a storm drain, other device, or surface water discharge.

Advantages/Benefits:

- May be used as a pretreatment device
- Provides decentralized stormwater treatment
- Ideal for redevelopment or in the ultra-urban setting

Disadvantages/Limitations:

- Treats small volumes

Special Features

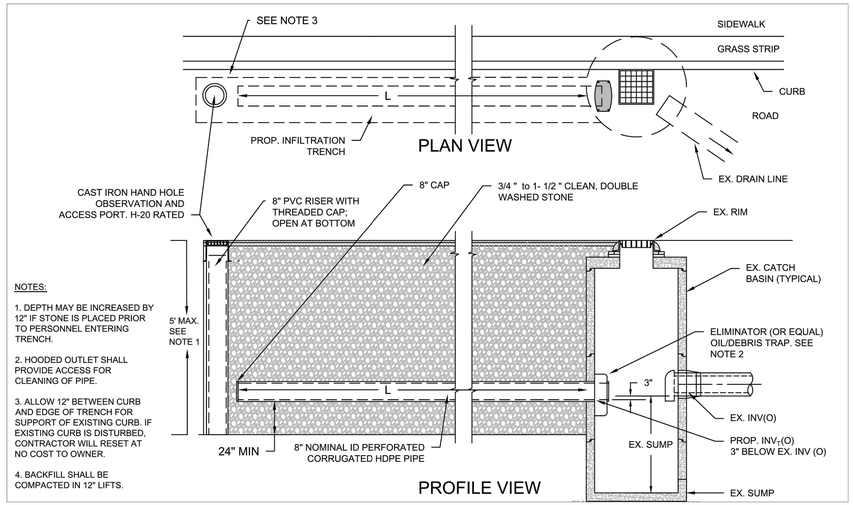
Reduces volume and rate of runoff.

Ability to meet specific standards

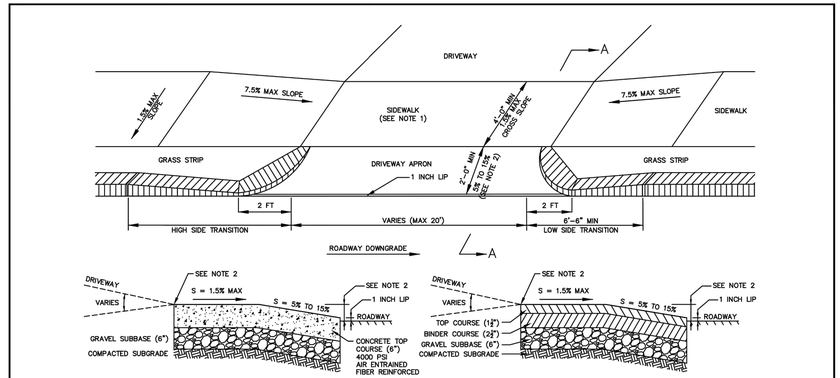
Standard	Description
2 - Peak Flow	N/A
3 - Recharge	No infiltration credit
4 - TSS Removal	Presumed to remove 80% TSS
5 - Higher Pollutant Loading	May be used as pretreatment device if lined
6 - Discharges to near or to Critical Areas	Not suitable for vernal pools or swimming areas. At other critical areas, may be used as a pretreatment device.
7 - Redevelopment	May be used for retrofit.

Pollutant Removal Efficiencies

- Total Suspended Solids (TSS)- 80% presumed for regulatory purposes
- Total phosphorus (TP)- Not Reported
- Dissolved Inorganic Nitrogen- Not Reported
- Zinc- Not Reported
- Pathogens (coliform, e. coli)- Not Reported



Town of ARLINGTON ENGINEERING DIVISION	STANDARD PIPE TRENCH INFILTRATION SYSTEM	DEC. 2020 NOT TO SCALE REVISION ②	D-1



SECTION A–A
CONCRETE SIDEWALK & APRON
(SEE NOTE 1)

SECTION A–A
ASPHALT SIDEWALK & APRON
(SEE NOTE 1)

NOTES:

1. MATCH DRIVEWAY APRON MATERIALS WITH EXISTING SIDEWALK MATERIAL
2. DOWNWARD SLOPING DRIVEWAYS REQUIRE A SIDEWALK HEIGHT AT LEAST 3" ABOVE THE ROADWAY

Town of ARLINGTON ENGINEERING DIVISION	TYPICAL DRIVEWAY APRON WITH GRASS STRIP	SEPT. 2016 NOT TO SCALE REVISION ②	D-3

NOTES

1. PLANS WERE DEVELOPED USING AVAILABLE AERIAL IMAGERY, EXISTING PLANS, AND ON-SITE OBSERVATIONS. A FORMAL SURVEY OF THE PROJECT AREAS WAS NOT CONDUCTED. UTILITY LOCATIONS AND INVERT MEASUREMENTS ARE APPROXIMATE.
2. CONTRACTOR IS RESPONSIBLE FOR NOTIFYING DIG-SAFE AND ALL APPLICABLE UTILITIES OF THE PROPOSED WORK PRIOR TO ANY EXCAVATION. THE TOWN OF ARLINGTON IS NOT A MEMBER OF DIG-SAFE AND MUST BE NOTIFIED DIRECTLY AT LEAST 72 HOURS PRIOR TO EXCAVATION BY CALLING 781-316-3310.
3. TRENCHES HAVE BEEN PROPOSED IN LOCATIONS WHERE NO UTILITY CONFLICTS WERE APPARENT. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING ALL APPLICABLE UTILITIES FOR APPROPRIATE MARK-OUTS AND CONFIRMING NO CONFLICTS ARE PRESENT. THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING THE ENGINEER SHOULD ANY EXISTING UTILITY CONFLICTS BE IDENTIFIED WITHIN PROPOSED TRENCH LIMITS.
4. CONTRACTOR IS RESPONSIBLE FOR NOTIFYING RESIDENTS AND ABUTTERS OF ANY WORK THAT MAY INTERFERE WITH DRIVEWAY AND WALKWAY ACCESS.
5. A RELATIVE LOCAL DATUM HAS BEEN SET FOR EACH TRENCH LOCATION. THE CATCHBASIN RIM ELEVATION HAS BEEN SET TO ZERO FEET (0.0') AT EACH LOCATION.
6. EXISTING ASPHALT SHOULD BE SAWCUT PRIOR TO EXCAVATION.
7. TRENCHES SHOULD BE BACKFILLED AND COMPACTED IN 12 INCH LIFTS.
8. CONTRACTOR IS RESPONSIBLE FOR APPROPRIATE CONSTRUCTION SIGNAGE AND BARRIERS AS NEEDED AND SHALL BE INCIDENTAL TO THE CONTRACT.
9. CONTRACTOR TO MAINTAIN CLEAN WORK ZONE AND SWEEP WORK SITE DAILY.
10. PAVING TO BE COMPLETED WEEKLY.
11. EROSION CONTROL SHALL BE USED WHEN NECESSARY AND CONSIDERED INCIDENTAL TO THE CONTRACT. ANY SEDIMENT THAT ENTERS THE TOWN'S STORMWATER SYSTEM AS A RESULT OF CONSTRUCTION SHALL BE REMOVED AT THE EXPENSE OF THE CONTRACTOR.
12. CONTRACTOR SHOULD TAKE CARE TO NOT IMPACT NEARBY TREES DURING CONSTRUCTION.
13. ANY AREA DISTURBED BY THE CONTRACTOR OUTSIDE OF THE LIMITS OF WORK SHALL BE RESTORED TO ORIGINAL CONDITION AT NO COST TO THE OWNER.

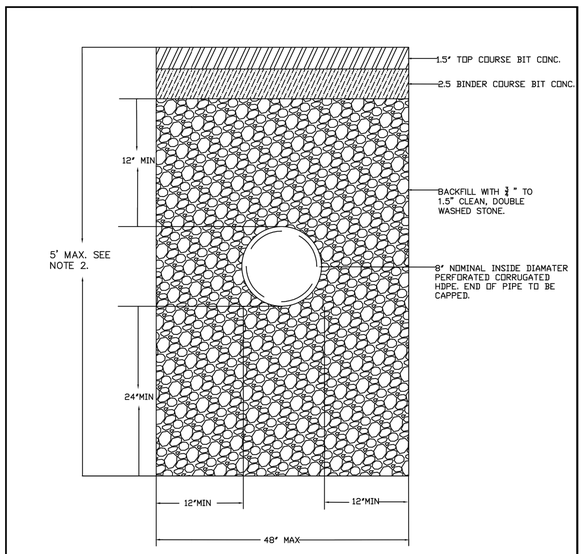
No.	Revision/Issue	Date

Town of
ARLINGTON
Engineering Division
51 Grove Street
Arlington, MA 02476

2021 GREEN INFRASTRUCTURE IMPROVEMENTS PROJECT

ARLINGTON CONSTRUCTION DETAILS

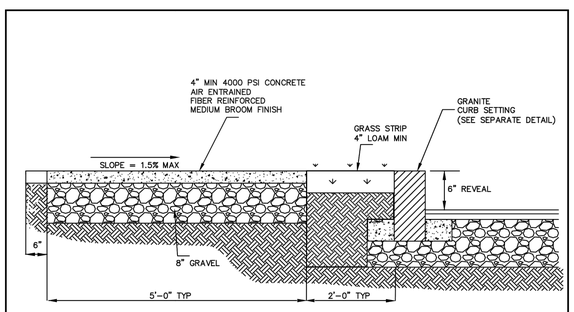
Dr□n B□: □C	Sheet: 13
□ver□ed B□: WCC	
S□□le: NTS	
D□te: FEBR□□R□ 2021	



NOTES:

1. ALL BACKFILL SHALL BE COMPACTED IN 12 INCH LIFTS.
2. DEPTH MAY BE INCREASED BY 1 FOOT IF STONE IS PLACED PRIOR TO PERSONNEL ENTERING THE TRENCH.
3. MEASURES SHALL BE TAKEN TO PREVENT MIGRATION OF FINES INTO BACKFILL.
4. PIPE SPECS BASED OFF HD100EC PIPE MANUFACTURED BY LANE ENTERPRISES.

Town of ARLINGTON ENGINEERING DIVISION	STREET INFILTRATION TRENCH CROSS SECTION VIEW	DEC. 2020 NOT TO SCALE REVISION ⓪	D-2

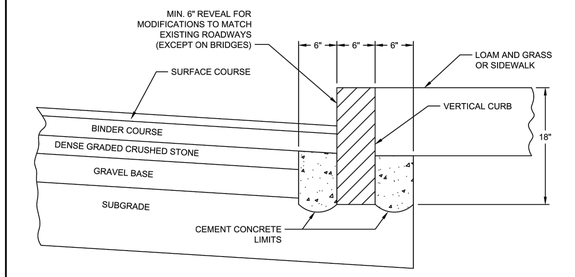


CONCRETE SIDEWALK

NOTES:

1. EXPANSION JOINTS SHALL BE INSTALLED EVERY 20 FEET MINIMUM. CONTROL JOINTS TO BE APPROXIMATELY 5 FEET.
2. ½" PREFORMED POLYMER FOAM JOINT FILLER INSTALLED TO FULL DEPTH OF CONCRETE.
3. GRASS STRIP CAN BE REDUCED TO 18 INCHES IF EXISTING WALKWAY CANNOT MAINTAIN A 5 FOOT SIDEWALK WITH 2 FOOT GRASS STRIP.
4. SIDEWALK SURFACE SHALL SLOPE TOWARD STREET TO AVOID STANDING WATER OR PUDDLING.
5. SIDEWALK TO BE BROOM FINISHED.

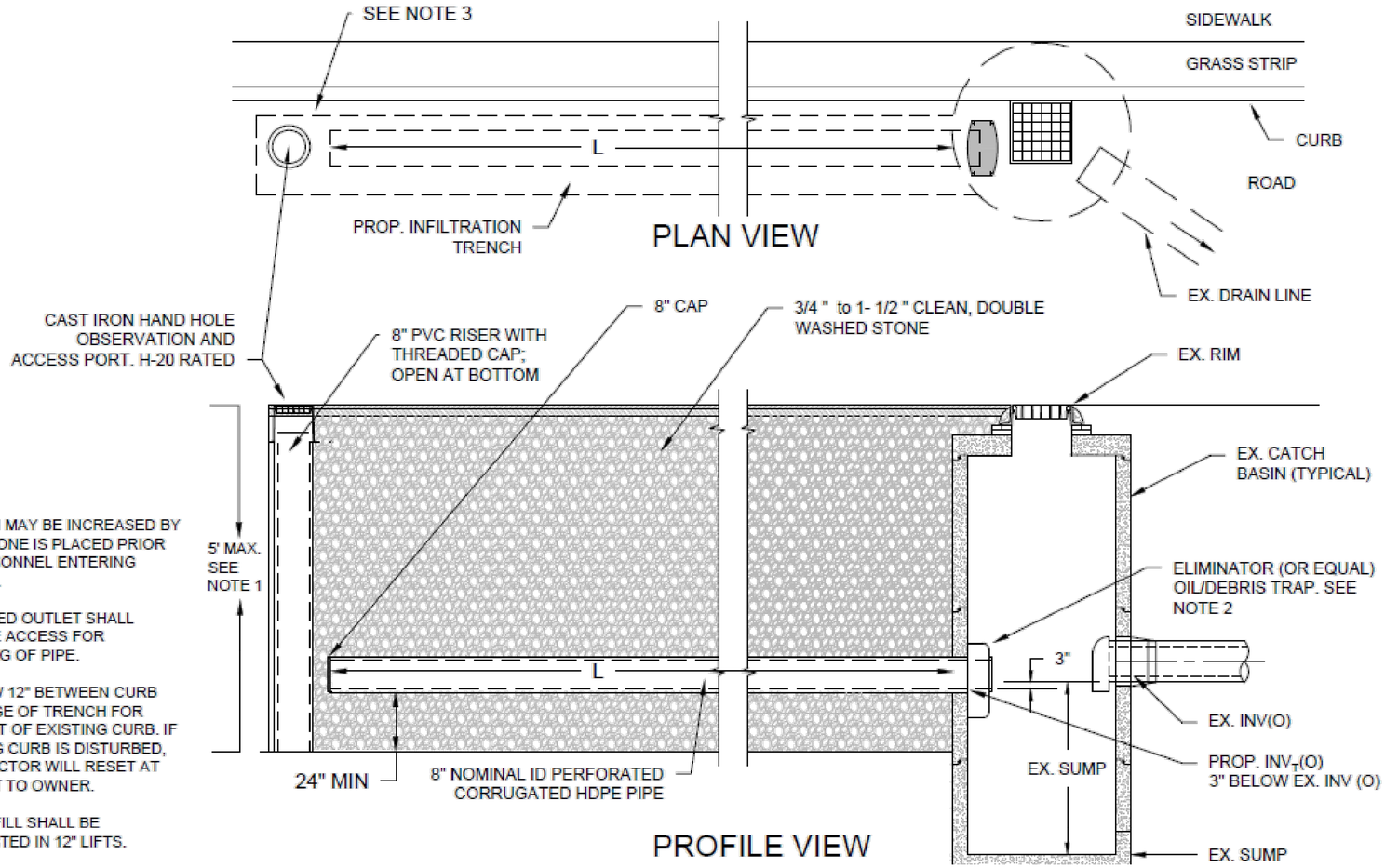
Town of ARLINGTON ENGINEERING DIVISION	TYPICAL SIDEWALK SECTIONS WITH GRASS STRIP	OCT. 2020 NOT TO SCALE REVISION ②	D-4



NOTES:

1. SAW-CUT NEAT LINE 6" FROM CURB LINE AND REMOVE BASE AND SUBGRADE, REPLACE WITH CEMENT CONCRETE. COVER WITH BINDER AND TOP COURSE TO CURB.
2. ANY DESIGNATED CEMENT CONCRETE THAT IS ACCEPTABLE UNDER SECTION M4 OF THE STANDARD MHD SPECIFICATIONS MAY BE USED; ALL TEST REQUIREMENTS ARE WAIVED. BITUMINOUS CONCRETE SHALL NOT BE USED AS A SUBSTITUTE.

Town of ARLINGTON ENGINEERING DIVISION	VERTICAL GRANITE CURB INSTALLATION	JAN. 2015 NOT TO SCALE REVISION ①	D-5



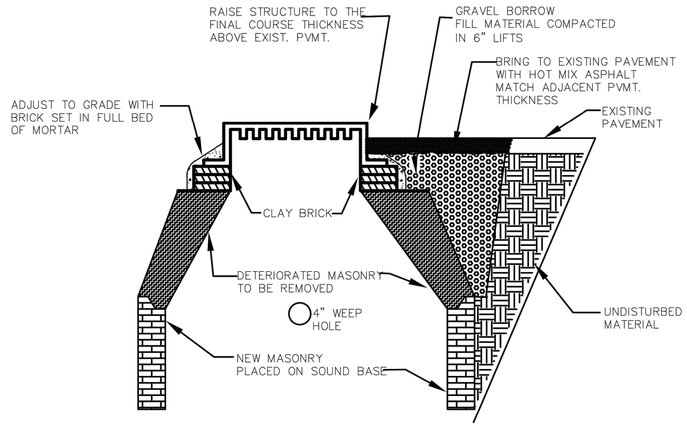
NOTES:

1. DEPTH MAY BE INCREASED BY 12" IF STONE IS PLACED PRIOR TO PERSONNEL ENTERING TRENCH.

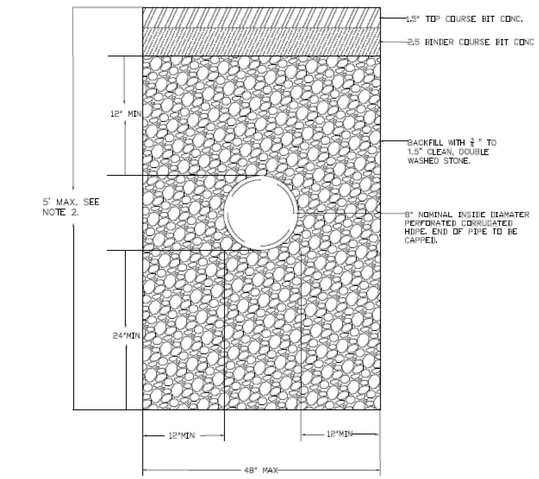
2. HOODED OUTLET SHALL PROVIDE ACCESS FOR CLEANING OF PIPE.

3. ALLOW 12" BETWEEN CURB AND EDGE OF TRENCH FOR SUPPORT OF EXISTING CURB. IF EXISTING CURB IS DISTURBED, CONTRACTOR WILL RESET AT NO COST TO OWNER.

4. BACKFILL SHALL BE COMPACTED IN 12" LIFTS.



TYPICAL REBUILD OF DRAINAGE/SEWER STRUCTURE



NOTES:

1. ALL BACKFILL SHALL BE COMPACTED IN 12 INCH LIFTS.
2. DEPTH MAY BE INCREASED BY 1 FOOT IF STONE IS PLACED PRIOR TO PERSONNEL ENTERING THE TRENCH.
3. MEASURES SHALL BE TAKEN TO PREVENT MIGRATION OF FINES INTO BACKFILL.
4. PIPE SPECS BASED OFF HD100EC PIPE MANUFACTURED BY LANE ENTERPRISES.

NOTES:

1. PLANS WERE DEVELOPED USING AVAILABLE AERIAL IMAGERY, EXISTING PLANS, AND ON-SITE OBSERVATIONS. A FORMAL SURVEY OF THE PROJECT AREAS WAS NOT CONDUCTED. UTILITY LOCATIONS AND INVERT MEASUREMENTS ARE APPROXIMATE.
2. CONTRACTOR IS RESPONSIBLE FOR NOTIFYING DIG-SAFE AND ALL APPLICABLE UTILITIES OF THE PROPOSED WORK PRIOR TO ANY EXCAVATION. THE TOWN OF LEXINGTON IS NOT A MEMBER OF DIG-SAFE AND MUST BE NOTIFIED DIRECTLY AT LEAST 72 HOURS PRIOR TO EXCAVATION BY CALLING THE TOWN OF LEXINGTON OPERATIONS AT 781-274-8300.
3. TRENCHES HAVE BEEN PROPOSED IN LOCATIONS WHERE NO UTILITY CONFLICTS WERE APPARENT. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING ALL APPLICABLE UTILITIES FOR APPROPRIATE MARK-OUTS AND CONFIRMING NO CONFLICTS ARE PRESENT. THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING THE ENGINEER SHOULD ANY EXISTING UTILITY CONFLICTS BE IDENTIFIED WITHIN PROPOSED TRENCH LIMITS.
4. CONTRACTOR IS RESPONSIBLE FOR NOTIFYING RESIDENTS AND ABUTTERS OF ANY WORK THAT MAY INTERFERE WITH DRIVEWAY AND WALKWAY ACCESS.
5. A RELATIVE LOCAL DATUM HAS BEEN SET FOR EACH TRENCH LOCATION. THE CATCHBASIN RIM ELEVATION HAS BEEN SET TO ZERO FEET (0.0') AT EACH LOCATION.
6. EXISTING ASPHALT SHOULD BE SAWCUT PRIOR TO EXCAVATION.
7. TRENCHES SHOULD BE BACKFILLED AND COMPACTED IN 12 INCH LIFTS.
8. CONTRACTOR IS RESPONSIBLE FOR APPROPRIATE CONSTRUCTION SIGNAGE AND BARRIERS AS NEEDED AND SHALL BE INCIDENTAL TO THE CONTRACT.
9. CONTRACTOR TO MAINTAIN CLEAN WORK ZONE AND SWEEP WORK SITE DAILY.
10. PAVING TO BE COMPLETED WEEKLY.
11. EROSION CONTROL SHALL BE USED WHEN NECESSARY AND CONSIDERED INCIDENTAL TO THE CONTRACT. ANY SEDIMENT THAT ENTERS THE TOWN'S STORMWATER SYSTEM AS A RESULT OF CONSTRUCTION SHALL BE REMOVED AT THE EXPENSE OF THE CONTRACTOR.
12. CONTRACTOR SHOULD TAKE CARE TO NOT IMPACT NEARBY TREES DURING CONSTRUCTION.
13. ANY AREA DISTURBED BY THE CONTRACTOR OUTSIDE OF THE LIMITS OF WORK SHALL BE RESTORED TO ORIGINAL CONDITION AT NO COST TO THE OWNER.
14. DO NOT PARK, IMPEDE ACCESS TO, OR STORE EQUIPMENT BEYOND RIGHT OF WAY, UNLESS PERMISSION HAS BEEN GRANTED IN WRITING BY THE TOWN AND/OR LAND OWNER.

DATE	REVISION	BY
1/22/21	VIEWPORTS	ML
1/25/21	DESIGN TABLES	ML
1/26/21	TRENCH LENGTHS	ML

STREET TRENCH DESIGNS AND LOCATIONS

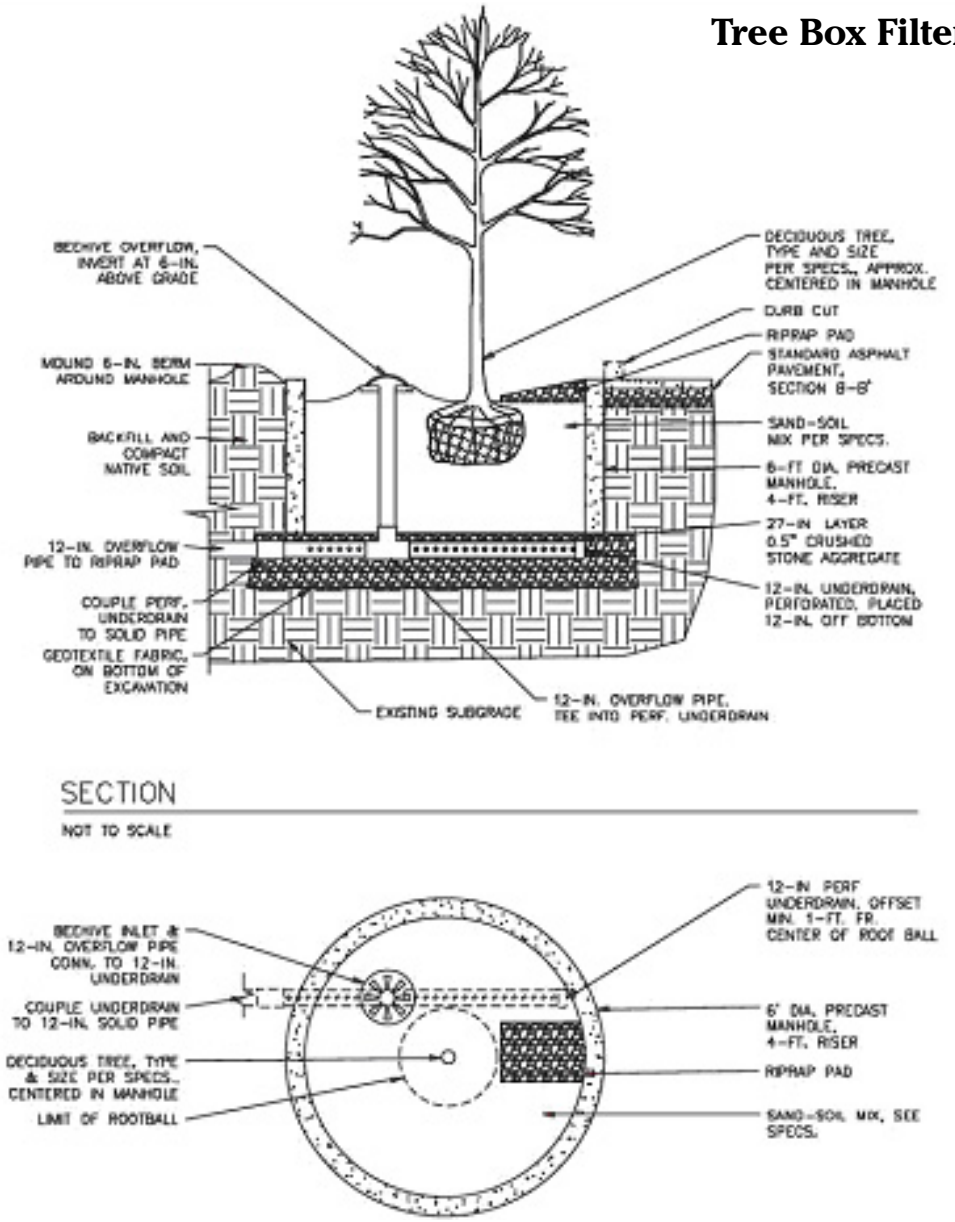
Town of Lexington
ENGINEERING DIVISION

DRAWN BY: ML | DATE: 1/20/21 | SCALE: N.T.S
DESIGNED BY: ML | CHECKED BY: MS
APPROVED BY:

SHEET 14

STREET TRENCH SHEET.DWG Plotted on 4-Feb-2021 2:23 PM

Tree Box Filter



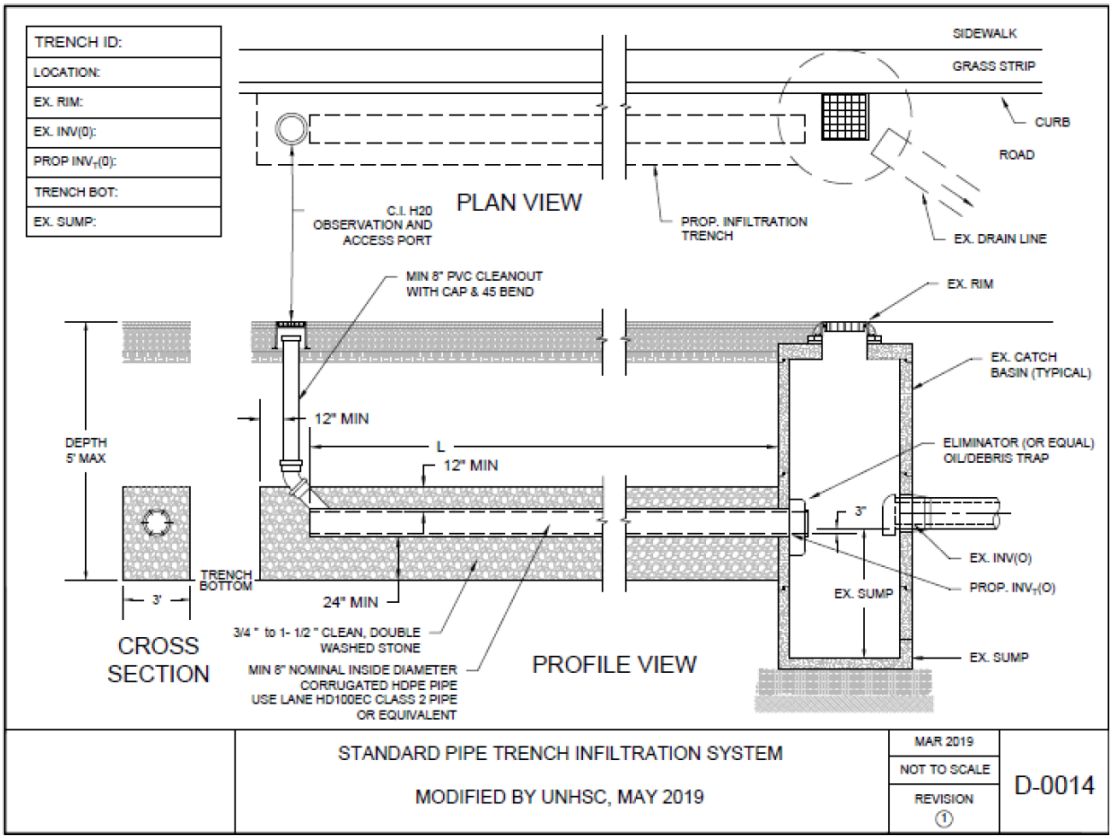
adapted from the Vermont Stormwater Manual

Maintenance

Activity	Frequency
Check tree	Annually. Expected tree life is 5-10 years.
Rake media surface to maintain permeability	Twice a year
Replace media	When tree is replaced

Trench Detail. Common design to be deployed at all locations. Originally piloted in Arlington, MA. Sites will be chosen from among the candidate locations on the attached map. All work will be in the public right of way.

Appendix A: Arlington Infiltration Trench Concept Design



UTILITY NOTES

1. EXISTING CONDITIONS SURVEY ENTITLED,"EXISTING CONDITIONS SURVEY, THEODORE ROOSEVELT, ELEMENTARY SCHOOL, MELROSE, MASSACHUSETTS" PREPARED BY WELCH ASSOCIATES LAND SURVEYORS, INC., DATED JULY 31, 2000
2. PRIOR TO THE START OF ANY EXCAVATION FOR THE PROJECT BOTH ON AND OFF THE SITE, THE CONTRACTOR SHALL NOTIFY DIGSAFE AND BE PROVIDED WITH A DIGSAFE NUMBER INDICATING THAT ALL EXISTING UTILITIES HAVE BEEN LOCATED AND MARKED.
3. ENSURE ALL EXISTING (TO REMAIN), AND PROPOSED MANHOLE COVERS PROPERLY IDENTIFY UTILITY SERVICED.
4. BITUMINOUS CONCRETE ELEVATIONS AT CATCH BASINS TO BE 1/4 INCH ABOVE RIM ELEVATION SHOWN FOR CATCH.
5. CONTRACTOR TO ADJUST UTILITY ELEMENT MEANT TO BE FLUSH WITH GRADE (CLEAN-OUTS, UTILITY MANHOLES, CATCH BASINS, INLETS, ETC) THAT IS AFFECTED BY SITE WORK OR GRADE CHANGES, WHETHER SPECIFICALLY NOTED ON PLANS OR NOT.
6. LANDSCAPE ARCHITECT TO APPROVE LAYOUT OF ALL DRAINAGE STRUCTURES PRIOR TO INSTALLATION.
7. PIPES EXITING CATCH BASINS SHALL BE 12 INCH DIAMETER UNLESS OTHERWISE NOTED.
8. THE LOCATION AND ELEVATIONS OF EXISTING UTILITIES AS SHOWN ON THESE PLANS ARE BASED ON THE SURVEY NOTED ABOVE AND SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
9. THE LOCATION, SIZE, DEPTH AND SPECIFICATIONS FOR CONSTRUCTION OF PROPOSED PRIVATE UTILITY SERVICES SHALL BE INSTALLED ACCORDING TO THE REQUIREMENTS PROVIDED BY, AND APPROVED BY, THE RESPECTIVE UTILITY COMPANY (GAS, ELECTRIC, AND TELEPHONE). FINAL DESIGN AND LOCATIONS AT THE BUILDING WILL BE PROVIDED BY THE ARCHITECT. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF THE UTILITY CONNECTIONS WITH THE RESPECTIVE UTILITY COMPANY, PRIOR TO ANY UTILITY CONSTRUCTION.
10. ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH THE CITY OF MELROSE DEPARTMENT OF PUBLIC WORK STANDARDS.
11. REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATION OF UTILITY SERVICE STUBS AND EXACT LOCATION AND NUMBER OF DOWN SPOUTS AND ROOF DRAINS AT BUILDINGS.

PROPOSED LEGEND

- DRAIN MANHOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- DRAIN LINE
- HYD — FIRE HYDRANT
- W — WATER LINE
- TSV — TAPPING SLEEVE AND VALVE
- SS — SEWER LINE
- S — SEWER MANHOLE
- G — GAS LINE
- UGE,T,FA,C — UNDERGROUND ELECTRIC, TELEPHONE, FIRE ALARM AND CABLE
- T — TRANSFORMER PAD (SEE ELECTRICAL)
- FOUNDATION DRAIN
- RD — ROOF DRAIN (SEE ARCHITECTUAL FOR SIZE)

1. EXISTING MAIN TO BE REMOVED AND DISPOSED AFTER NEW PIPE HAS BEEN ACTIVATED AND APPROVED BY THE MWRA.
2. REPLACE 20" WATER MAIN TO PROVIDE A MIN. OF 4' COVER WITHIN MWRA TAKING LINE PER MWRA CONSTRUCTION SPECIFICATIONS.
3. CONTRACTOR TO FIELD LOCATE EXISTING WATER LINE (RECORD LOCATION SHOWN).
4. COORDINATE WITH THE MWRA ON TEMPORARILY SHUTTING DOWN THE EXISTING MAIN, WHICH CAN ONLY BE ALLOWED BETWEEN OCTOBER 15TH AND APRIL 15TH FOR A 2 WEEK MAXIMUM TIME PERIOD. SEE SPECIFICATIONS FOR REQUIREMENTS.
5. ALL JOINTS TO MEGALUG MECHANICAL JOINT RESTRAINTS OR APPROVED EQUAL.

RECORD DRAWING

This drawing has been reviewed by the General Contractor for the Project and to be best of his knowledge and belief represents the actual state of the work put in place.

Project: Roosevelt Elementary School, Melrose, MA

General Contractor: G. V. W., Inc. 1200 Bennington St., East Boston, MA 02128

NOTE:

1. USE A FORM, OBTAINED FROM THE PRECAST MANHOLE MANUFACTURER, TO FORM A FEMALE RECESS IN THE CAST-IN-PLACE MANHOLE BASE TO ACCEPT THE PRECAST MANHOLE RISER SPIGOT.
2. PLACE A HYDROPHILIC WATERSTOP AROUND THE 12-INCH MTRIFIED CLAY PIPE BEFORE PLACING CAST-IN-PLACE MANHOLE BASE. USE ADEKA ULTRA SEAL MC-2010M ADHERED WITH P-201.
3. DO NOT PLACE CONCRETE AROUND MTRIFIED CLAY PIPE BEYOND FIRST JOINT OUTSIDE OF MANHOLE.

⚠5 GENERAL NOTE

1. THIS PLAN HAS BEEN PROVIDED FOR MWRA USE IN CONSTRUCTING THE BYPASS SEWER LINE ONLY. EXISTING CONDITIONS AND PROPOSED DESIGN AS SHOWN ARE IN THE PROCESS OF CONSTRUCTION AND MAY NOT REFLECT ACTUAL CONDITIONS. ANY CONSTRUCTION OF THE BYPASS LINE IS TO BE COORDINATED WITH THE CITY OF MELROSE.

TAPPÉ ASSOCIATES, INC.
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Land Planning
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23 Washington Street
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DeVillis Associates Inc.
Civil Engineering & Land Planning
89 Washington Street
Wellesley, MA 02481
(781) 235-3600 t (781) 237-4144 f

ROOSEVELT ELEMENTARY SCHOOL

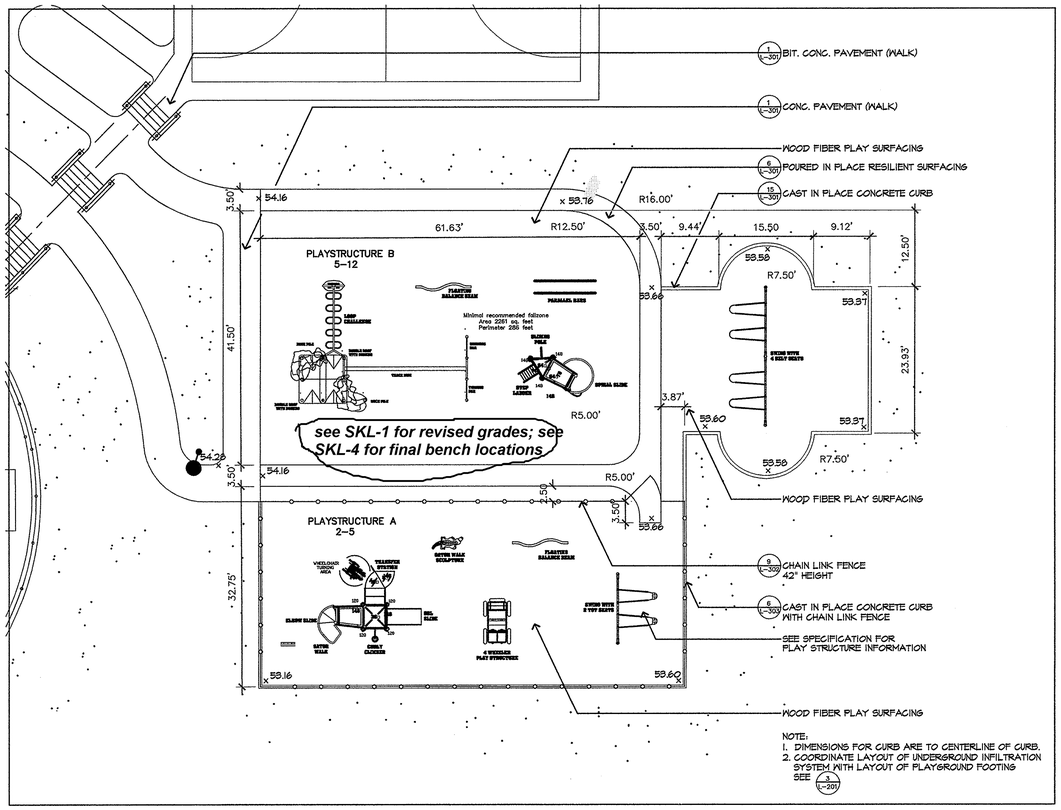
Melrose, Massachusetts

Drawing Issue Record:		
1.	10/21/01	MWRA COMMENTS
2.	11/28/01	MWRA COMMENTS
3.	04/04/01	MWRA COMMENTS
4.	04/10/01	MWRA COMMENTS
5.	06/15/01	MWRA BYPASS

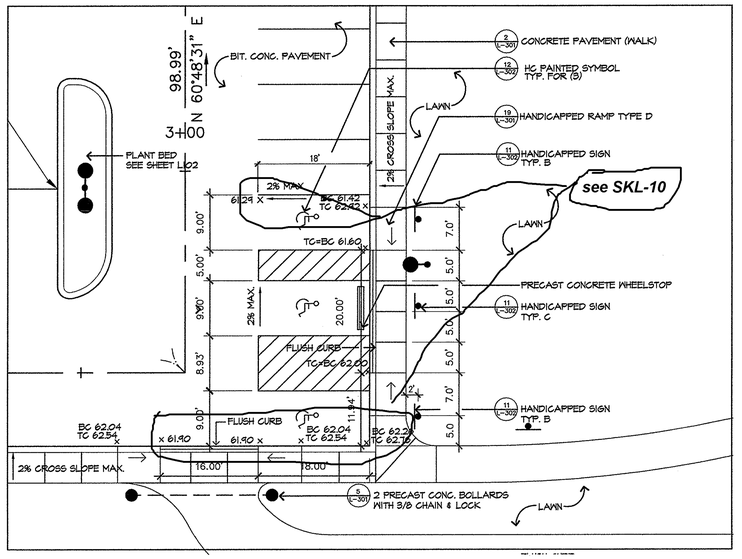
Project: 20057
Date: 9/01/01
Scale: 1" = 20'
Drawn By: FWB
Checked By: IAZ, JJD
FILE NAME: MWRA 4-02-01

SITE UTILITIES PLAN

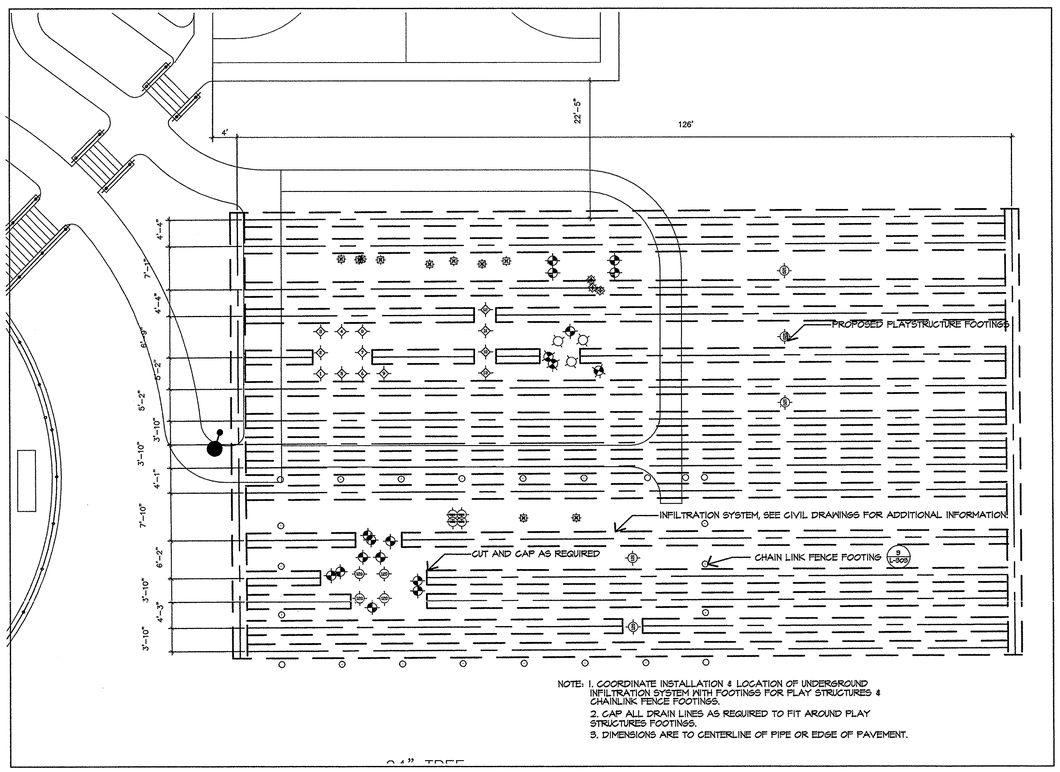
C-1



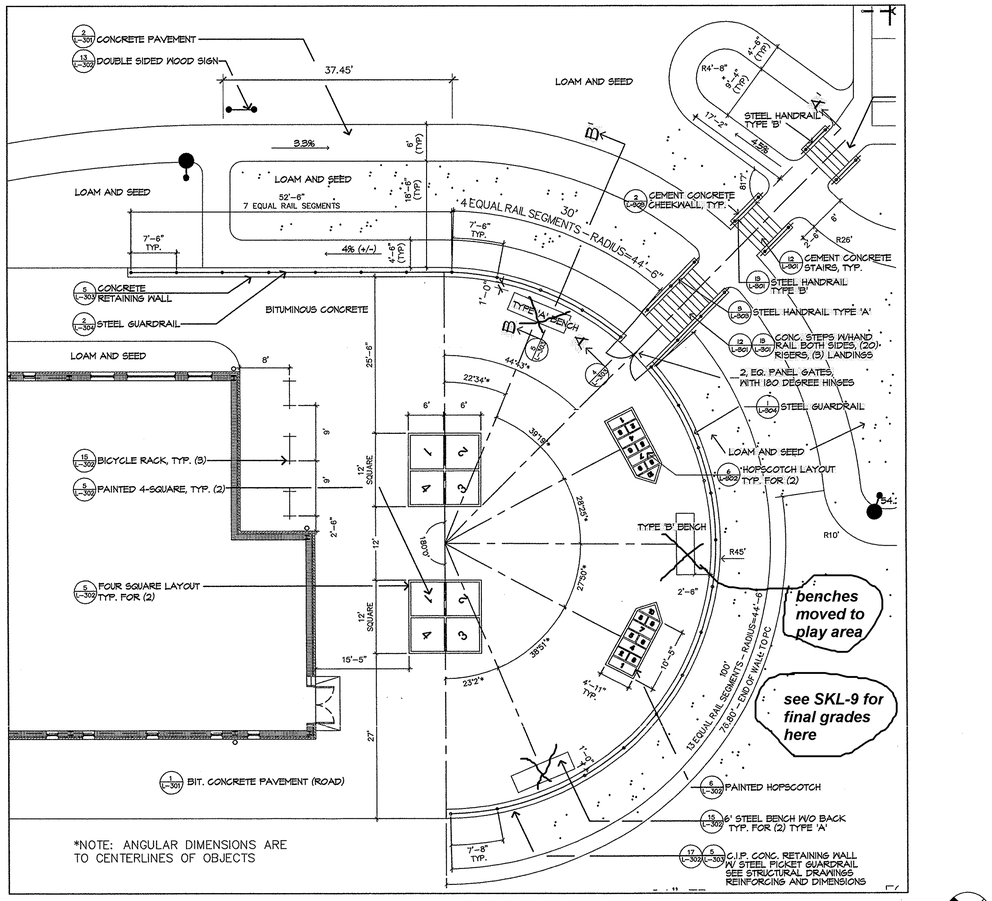
1 PLAYGROUND ENLARGEMENT
SCALE: 1"=10'-0"



2 HANDICAP PARKING ENLARGEMENT
SCALE: 1"=10'-0"



3 PLAY EQUIPMENT AND UNDERGROUND FILTRATION SYSTEM LAYOUT
SCALE: 1"=10'-0"



4 PAVED PLAY AREA ENLARGEMENT
SCALE: 1"=10'-0"

RECORD DRAWING

This drawing has been reviewed by the General Contractor for the Project and to be best of his knowledge and belief represents the actual state of the work put in place.

Project: Roosevelt Elementary School, Melrose, MA

General Contractor: G. V. W., Inc. 1200 Bennington St., East Boston, MA 02128

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ROOSEVELT ELEMENTARY SCHOOL
Melrose, Massachusetts

Drawing Issue Record:	
4-28-00	NOT FOR CONSTRUCTION - ISSUED FOR PRICING ONLY
5-5-00	FOR SITE REVIEW ONLY
6-1-00	NOT FOR CONSTRUCTION - ISSUED FOR STATE REVIEW
7-28-00	NOT FOR CONSTRUCTION - 75% CD SUBMITTAL
8-23-00	NOT FOR CONSTRUCTION - 100% CD SUBMITTAL
10-25-00	ISSUED FOR BID

Project:	20057
Date:	10-13-00
Scale:	1" = 20'
Drawn By:	TFC
Checked By:	MPR
FILE NAME:	CD-BASE.DWG

ENLARGEMENTS

L-201