



FITCHBURG
Massachusetts

City of Fitchburg, Massachusetts

MS4 Green Infrastructure and Low Impact Development Report

**An Assessment of Green Infrastructure and Low Impact
Design Guidelines in the City of Fitchburg**

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Acronyms and Abbreviations

DPW	Department of Public Works
DCIA	Directly Connected Impervious Areas
EPA	United States Environmental Protection Agency
GI	Green Infrastructure
IA	Impervious Area
IDDE	Illicit Discharge Detection and Elimination
LID	Low Impact Development
MCM	Minimum Control Measure
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
ROW	Rights of Way

1 Introduction

The City of Fitchburg is a listed permittee under the 2016 National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit. The permit includes a required assessment report of each permittee's rules, regulations, and local ordinances which address green infrastructure and low impact development (GI & LID) practices within their jurisdiction. The present report, fulfilling this requirement, reviews the various rules, regulations, and local ordinances which influence the development of green infrastructure. As required by the permit, recommendations, and implementation schedule of the recommendations are provided.

1.1 MS4 Permit

The City's stormwater is discharged to surface waterbodies throughout Fitchburg and is covered by the MS4 permit, which became effective on July 1, 2018. The City is currently in Year 4 of the 5-year MS4 permit term. The MS4 Permit includes six (6) minimum control measures (MCMs) that must be addressed by the Stormwater Management Program. These minimum control measures are:

- MCM 1 – Public Education and Outreach
- MCM 2 – Public Involvement and Participation
- MCM 3 – Illicit Discharge Detection and Elimination (IDDE) Program
- MCM 4 – Construction Site Stormwater Runoff Control
- MCM 5 – Stormwater Management in New Development and Re-development
- MCM 6 – Good Housekeeping and Pollution Prevention for Permittee Owned Operations

As part of the MCM 5 – Stormwater Management in New Development and Re-development requirements, the City must develop a report which assesses local regulating documents surrounding GI & LID practices. This report is due by the end of Year 4 of the NPDES MS4 permit term, on June 30, 2022. The requirements of this report, per the MS4 permit, are:

“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.”

MS4 Green Infrastructure and Low Impact Development Report

There are several primary goals of evaluating regulatory documents which promote the use of green infrastructure and using low-impact development design principles, they are:

1. reducing the hydraulic loading on stormwater conveyance infrastructure,
2. reducing the potential for flooding,
3. extending the useful life of existing stormwater infrastructure, and
4. reducing contaminant loading in natural waterways.

Promoting green infrastructure and low-impact development in the City will have an impact on the stormwater management systems owned and operated by the City and the regulated receiving waterbodies. Implementing regulatory measures that do not impede the application of and promote where appropriate, the use of green infrastructure and low-impact design practices will have positive impacts on receiving waterbodies' water quality, likelihood of future flooding, and the longevity of existing stormwater infrastructure.

2 Regulatory Documents in Fitchburg

A review of the current language in relevant local ordinances and regulations was performed to identify improvements and changes to encourage expanded use of GI and LID in the future. Fitchburg currently has the following relevant regulatory documents in the City:

- **Zoning Ordinance of the City of Fitchburg, Massachusetts (Chapter 181, 2021)** provides land-use limitations for zoned areas of the City.
- **Stormwater Management Ordinance (Chapter 154, 2020) and Stormwater Rules and Regulations**, govern stormwater management during construction activities and stormwater management requirements for new development and redevelopment within the City. Stormwater Management Ordinance Chapter 154 was adopted in 2020.
- **Rules and Regulations Governing the Subdivision of Land (Chapter 41, 1988 Rev. 2007)**, governs the laying out and construction of subdivisions, including new roads, sidewalks, and bikeways.

Each regulatory document was reviewed for language which directly impacts the accessibility and feasibility of implementing the three primary GI and LID practices outlined in the MS4 permit:

1. Green Roofs,
2. Infiltration Practices, and
3. Rainfall Harvesting.

Opportunities for adjustment to the Regulations and Bylaws are described in detail in Section 4.




3 Local Considerations and Challenges

3.1 Guidance for Green Infrastructure & Low Impact Design







There exists a broad range of design concepts and land-use planning concepts which can be classified as Green Infrastructure and Low Impact Design. An extensive list of Green Infrastructure and Low Impact Design elements which are encouraged by the United States Environmental Protection Agency (EPA) in multiple land-use conditions such as individual residential properties, subdivisions, municipal uses, etc., are provided in Table 1. The priority benefits of properly installed and maintained Green Infrastructure as defined by the EPA include: Cleaner Waterways, Enhanced Water Supplies, Community Benefits, Reduced Urban Temperatures, and Cleaner Air.


The design concepts highlighted in Table 1 have been divided into practice areas identified within the MS4 Permit requirements for this report (Green Roofs or Green Building practices, Rainwater Harvesting, and Infiltration practices).

Table 1. Design Elements of Green Building Practices

MS4 Practice Area	Design Element	Description	
Green Roofs/ Green Building	Green Roofs	Roofs covered with vegetation that absorbs rainfall and promotes infiltration.	
Green Roofs/ Green Building	Urban Tree Canopy	Planting of trees to promote interception of rainwater and its absorption in leaves.	
Green Roofs/ Green Building	Land Conservation	Protection of open space reduces flooding risk and improves water quality through natural filtration and absorption.	

MS4 Practice Area	Design Element	Description	
Rainwater Harvesting	Rain Barrels	Storage system that accumulates rainwater to be used for non-potable applications in future.	
Infiltration & Rainwater Harvesting	Downspout Disconnection	Redirection of rooftop drainage into rain barrels, cisterns, or permeable areas as opposed to stormwater drainage systems.	
Infiltration	Rain Gardens	Areas in which stormwater runoff can naturally infiltrate ground; basins designed to soak up runoff.	
Infiltration	Planter Boxes	Rain gardens situated in parking lots, sidewalks, or streets; effective in areas with limited space.	
Infiltration	Vegetated Swales and Bioswale	Drainage channels designed to convey, treat, and promote infiltration of runoff.	
Infiltration	Permeable Pavements	Porous or permeable materials allow stormwater runoff to infiltrate the surface.	

MS4 Practice Area	Design Element	Description	
Infiltration	Green Streets & Alleys	Integration of several methods of infiltration and provide space for stormwater accumulation (e.g., Permeable pavement street, bioswale, & rain garden on a block of a neighborhood).	
Infiltration	Green Parking	Integration of aspects parking lot design (e.g., Permeable pavement, rain gardens, & bioswales in a parking lot design).	
Infiltration	Constructed Wetlands	Similar to natural wetlands, filter stormwater and contribute to habitats for wildlife.	
Infiltration	Riparian Buffers	Protect areas where development is prohibited from disturbances.	
Infiltration	Vegetated Filter Strips	Dense areas of vegetation that direct runoff, commonly used in sloped areas.	
Infiltration	Sand and Organic Filters	Utilizes sand to remove contaminants from stormwater before entering the groundwater.	

MS4 Practice Area	Design Element	Description	
Infiltration	Bioretention Areas	Landscaped basins designed to pond rainwater and runoff and allow it to naturally infiltrate into the ground.	

4 Review of Improvement Alternatives

The following section outlines opportunities for improvement to existing regulatory documents governing GI & LID design elements during land development and re-development within Fitchburg.

The review of regulating documents for the City of Fitchburg did not identify any barriers to implementation of green infrastructure, low impact design principles, green roofs, or rainwater harvesting. As such, the following recommendations are provided as opportunities to increase the application of these design elements where appropriate.

The Department of Public Works relies heavily on consultants and contractors to assist with implementation of stormwater management program components. The DPW would require additional resources (funding and/or staffing) allocated to the department to implement any improvements in the City's regulatory documents or programs around green infrastructure.

4.1 Stormwater Management

The Stormwater Ordinance and Stormwater Management Rules and Regulations provide robust requirements for stormwater management in new developments and re-development. The rules require new and re-development sites to capture and treat stormwater runoff generated during specified precipitation events and/or remove specified percentages of Total Suspended Solids and Total Phosphorus in accordance with the MS4 permit. The regulatory documents also require that non-structural stormwater management strategies be implemented to the maximum extent practicable for new and re-development projects. Non-structural stormwater management strategies include minimizing impervious surfaces, providing low-maintenance landscaping that encourages retention, and other techniques. Low Impact Development (LID) site planning and design strategies and Green Infrastructure stormwater techniques must be used to the maximum extent feasible.

The City of Fitchburg has previously established an inter-departmental working group which consists of City department heads/representatives who review development projects that meet quarterly to review upcoming development projects to ensure they are meeting the requirements of various relevant permits and regulations within the City. It is recommended that the working group be re-established with current City staff and those charged with reviewing developments continue to review applicants' proposed non-structural stormwater management strategies and ensure developments are meeting the goals of the Stormwater Management regulatory documents.

Further, when the Stormwater Management Rules and Regulations are updated in the future, it is recommended that the Purpose section specifically identify encouragement of GI and LID practices as a purpose of the regulations.

4.2 Green Roofs & Green Building Practices

The City of Fitchburg regulatory documents do not limit the application of green roofs (where feasible), and actively encourage and promote the use of green building techniques as part of their Flexible Development rules in the City's Zoning Ordinance. The Purpose of the Flexible Development rules are:

1. *To encourage the preservation of open land for its scenic beauty and to enhance agricultural, open space, forestry, and recreational use;*

2. *To preserve historical and archeological resources; to protect the natural environment, including Fitchburg's varied landscapes and water resources;*
3. *To protect the value of real property;*
4. *To promote more sensitive siting of buildings and better overall site planning;*
5. *To perpetuate the appearance of Fitchburg's traditional New England landscape;*
6. *To facilitate the construction and maintenance of streets, utilities, and public services in a more economical and efficient manner;*
7. *To offer an alternative to standard subdivision development;*
8. *To promote the development of housing affordable to low, moderate, and median income families; and*
9. *To promote the development of housing for persons over the age of fifty-five.*

These special conditions are applicable to all Zoning Districts within the City. The Flexible Development rules are encouraged for use within the City but are not explicitly required to be applied in any specific development or redevelopment project.

The City, at its discretion, should assess the feasibility and applicability of requiring Flexible Development in some or all Zoning Districts as a way to improve the application of green building techniques and low impact site design practices.

4.3 Infiltration Practices

The City has numerous regulating documents which outperform EPA recommendations for required impervious cover in new developments. Decreasing the percent of impervious cover will increase the opportunities for infiltration. The City of Fitchburg has also developed the *MS4 Street Design and Parking Lots Report* in tandem with the development of the present report. That report includes an extensive review of opportunities to limit expansion of impervious cover in the City with an emphasis on increasing opportunities for infiltration.

Further, the City's stormwater management regulatory documents require developers to retain, infiltrate, or treat stormwater in accordance with MS4 permit performance standards. Developers are also required to employ LID techniques to the maximum extent feasible.

The City should continue to ensure that stormwater management and wetlands protection ordinances and associated regulations are enforced during development.

4.4 Rainwater Harvesting Devices

The City of Fitchburg does not have regulatory language which inhibits the use of water harvesting devices such as cisterns or rain barrels. However, the City also does not require the use of rainwater harvesting devices.

Annually, the City provides residents an opportunity to purchase rain barrels through the Great American Rain Barrel Company's community program. The community program offers an opportunity for discounted purchasing and distribution of residential rain barrels to help residents conserve water and save on their water bills while also promoting rainwater harvesting practices. The Great American Rain Barrel Co. is a local food importing company that has been repurposing shipping drums into Rain Barrels since 1988 and has been a MASS DEP approved vendor since 2010. The community program sets up program dates, takes orders and payments, and delivers rain barrels for a specified distribution event.

Continuing to encourage the use of rain collection devices by homeowners or larger property managers for non-potable applications, such as landscaping, will decrease the volume of runoff entering the municipal system and promote on-site use and infiltration.

It is recommended that the City develop public education materials and place them on the City's Stormwater Management webpage and at existing City building kiosks informing the public of the benefits of rainwater harvesting. This is likely to increase the utilization of such techniques.

4.5 Incentivizing Green Infrastructure

To encourage the adoption of green infrastructure or low impact development elements, incentives are crucial for communities. Figure 1 highlights incentives from the EPA's Municipal Handbook, *Managing Wet Weather with Green Infrastructure*, that can be enticing for communities or developers and can be used to promote positive changes in development in a relatively short period of time.

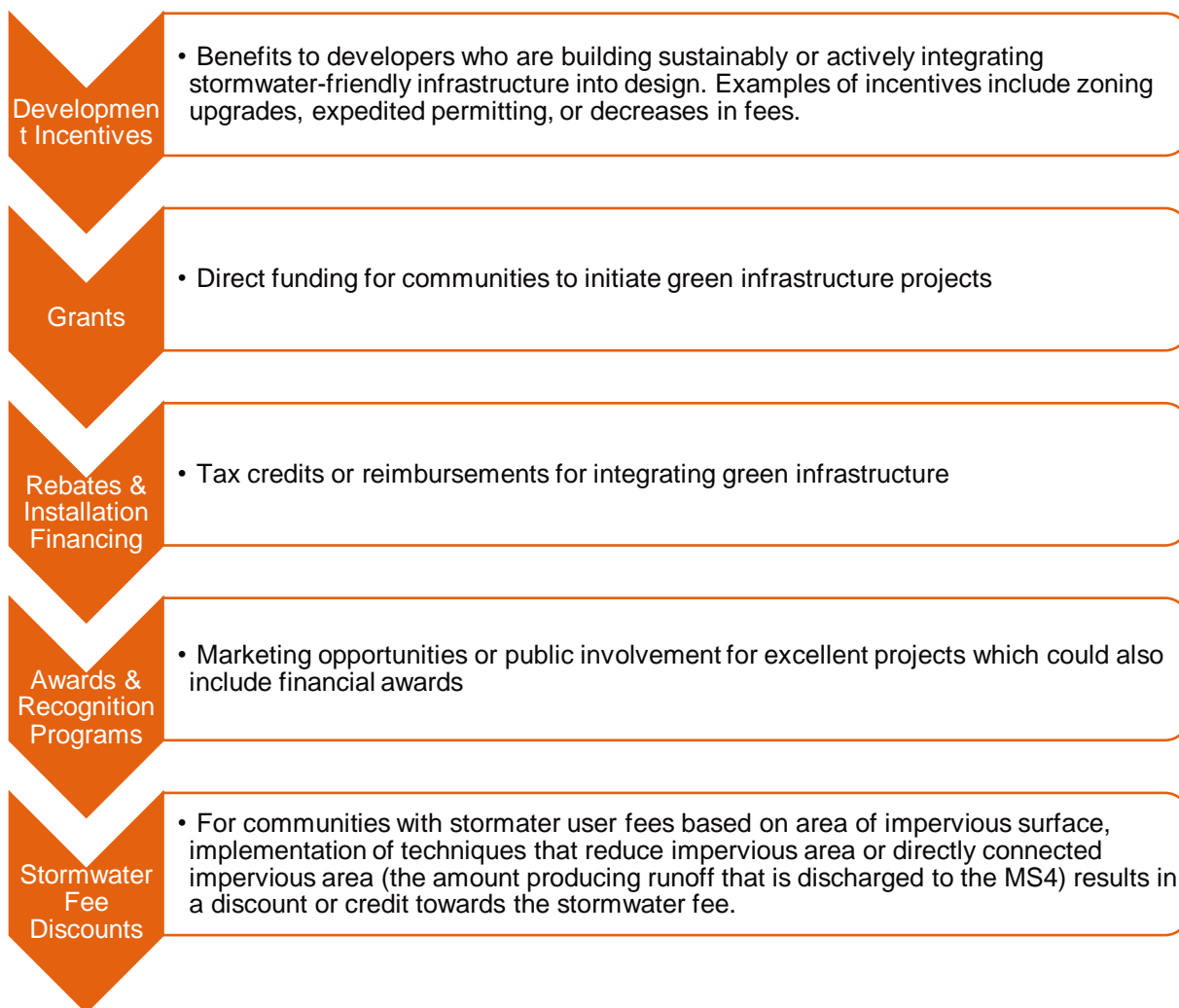


Figure 1. Sample Incentives for Stormwater-Friendly Infrastructure

In the State of Massachusetts, low impact development site design credits apply to projects that are subject to the Wetlands Protection Act and State Stormwater Standards. Site design credits are an incentive to encourage implementation of GI or LID into project plans. There are three types of credits that can be awarded as stated in Volume 3 Chapter 1 of the Massachusetts Stormwater Handbook.

- Credit 1, Environmentally Sensitive Development, rewards developers who scale down developments to preserve natural space on site.
- Credit 2, Rooftop Runoff Directed to Qualifying Areas, involves routing rooftop runoff to pervious areas where it can infiltrate instead of running off to municipal stormwater systems.
- Credit 3, Roadway, Driveway, or Parking Lot Runoff Directed to Qualifying Areas, which routes runoff from impervious roadways, driveways, and parking lots to pervious areas where vegetation provides filtration, and the ground provides exfiltration.

5 Recommendations and Implementation Schedule

The City of Fitchburg has an existing robust approach to stormwater management and many established rules and regulations which promote application of innovative and sustainable site design, development, and re-development. There are also potential opportunities to improve regulatory documents, design standards, and public education to further encourage low impact development practices and improve stormwater runoff quantity and quality.

The recommendations below are provided in order of priority with proposed implementation schedules. The implementation schedule for changes to the rules and regulations allows for studies to determine exact parameters for inclusion in regulatory language. Recommended priority grading is based on the largest impacts and were assigned based on the following criteria:

- Anticipated impact to stormwater runoff
- Feasibility, effectiveness, and ease of implementation
- Impact to community
- Desirability

Recommendations of this report are listed in order of priority:

1. Re-establish regular interdepartmental meetings to review projects and ensure proper enforcement of existing regulatory and permit requirements for employing GI & LID techniques in new development and re-development. This recommendation should be reviewed for applicability to City regulatory processes and implemented within 1 year.
2. Implement impervious area reduction regulatory recommendations per *MS4 Street Design and Parking Lots Report*, which was developed in tandem with the present report. These recommendations should be completed within between 2 and 10 years, see *Street Design and Parking Lots Report* for detailed breakdown.

In addition to the two recommendations to remove barriers to LID within the City of Fitchburg stated above, the list below provides opportunities to further encourage LID during development. These recommendations are not required as part of the City's MS4 permit, rather they are provided as information for future improvements to be pursued at the discretion of the City.

1. Review districts and project types which could be required to incorporate green building techniques, and/or which would not be subject to the Stormwater Management Bylaw (less than 1 acre) or Wetlands Protection Bylaw (not under Wetlands Protection Act jurisdiction).
2. Create rainwater harvesting public education materials for the City of Fitchburg Stormwater Management webpage. Make materials available at existing City building kiosks.
3. Evaluate opportunity to have the City provide incentives to those who employ GI practices in excess of minimum requirements or where requirements are absent.

References

Image References for Table 1.

Design Element	Image Reference
Green Roofs	https://www.epa.gov/green-infrastructure/what-green-infrastructure#downspoutdisconnection
Urban Tree Canopy	https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.nrs.fs.fed.us%2Furban%2Futc%2F&psig=AOvVaw3r24LyD0LflrFKlyP79kf&ust=1622818913709000&source=images&cd=vfe&ved=0CAMQjB1qFwoTCNjAgKPe-_ACFQAAAAAdAAAAABAD
Land Conservation	https://www.epa.gov/green-infrastructure/what-green-infrastructure#downspoutdisconnection
Rain Barrells	https://www.mass.gov/files/styles/embedded_full_width/public/rainwater_harvesting_1.jpg?itok=VXtKSk6M
Downspout Disconnection	https://www.researchgate.net/profile/Arturo-Casal-Campos/publication/280493291/figure/fig2/AS:614338012405760@1523481004135/Figure-S5-An-example-of-roof-downspout-disconnection-Source-US-EPA.png
Rain Gardens	https://bloximages.newyork1.vip.townnews.com/swnewsmedia.com/content/tncms/assets/v3/editorial/5/1b/51b1a1cf-4638-5446-95af-562b91445475/5e6ba15e8eb4a.image.jpg?resize=1200%2C900
Planter Boxes	https://semcog.org/desktopmodules/SEMCOG.Publications/GetFile.ashx?filename=LowImpactDevelopmentManualforMichiganSeptember2008.pdf#270
Vegetated Swales and Bioswale	https://www.watershedcouncil.org/uploads/7/2/5/1/7251350/2155340_9_orig.jpg
Permeable Pavements	https://www.epa.gov/sites/production/files/styles/medium/public/2015-09/permeable_pave_rev.jpg
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Green Parking	https://www.emht.com/news/2017/february/emht-engineers-dream-big-designing-a-sea-sized-green-parking-lot-to-manage-a-sea-of-stormwater/
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Bioretention Areas	https://upload.wikimedia.org/wikipedia/commons/e/ed/Bioretention_cell_rain_garden_US_winter.jpg

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