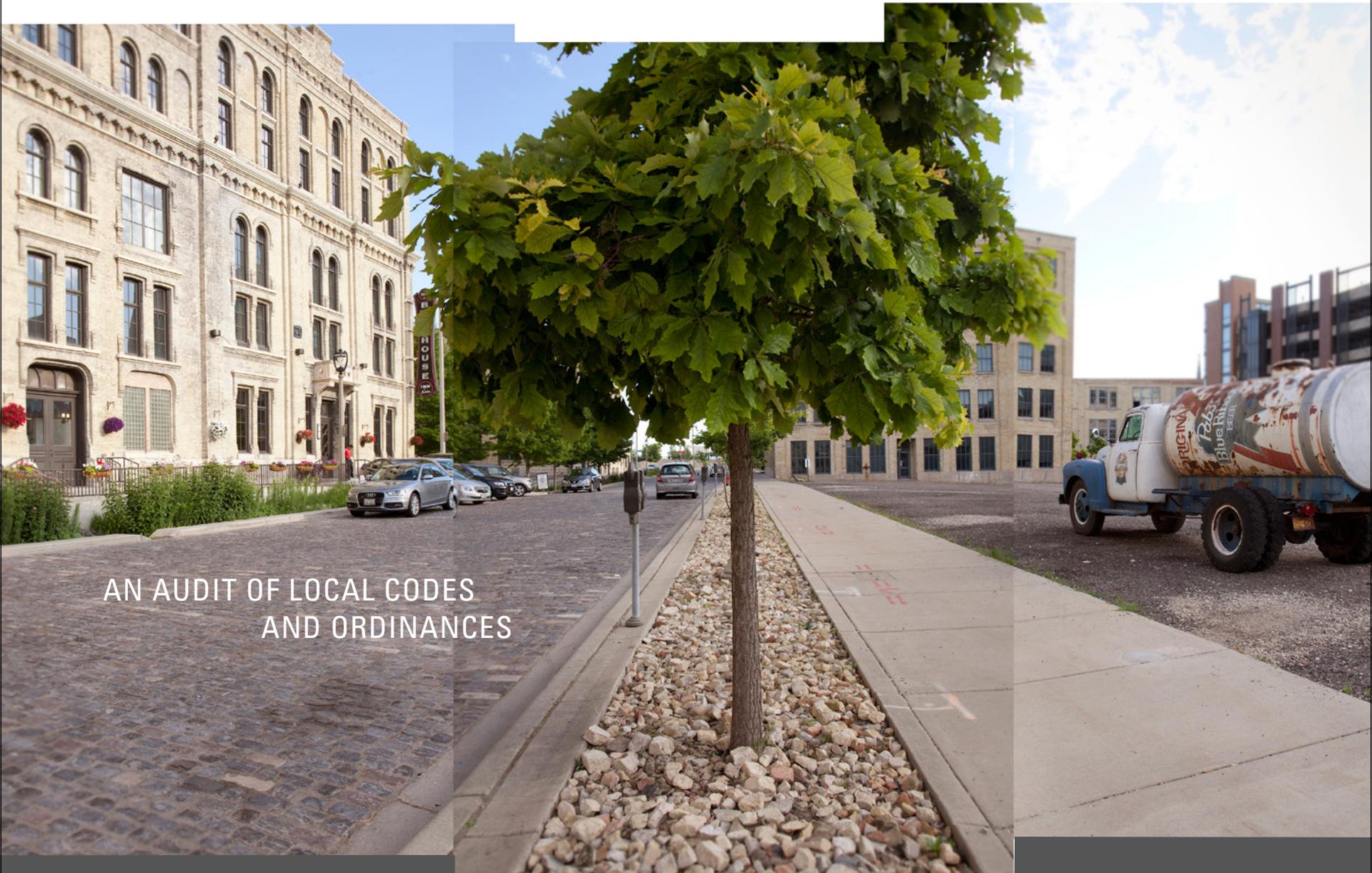


TACKLING BARRIERS TO Green Infrastructure



AN AUDIT OF LOCAL CODES
AND ORDINANCES

On the cover: Pabst Brewery, Milwaukee. All photography by Kevin J/ Miyazake.

TACKLING BARRIERS TO **Green Infrastructure**

AN AUDIT OF LOCAL CODES AND ORDINANCES

TACKLING BARRIERS TO Green Infrastructure

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GREEN INFRASTRUCTURE AUDIT TOOL



Mequon Nature Preserve



FOREWORD

Municipal stormwater management conjures images of gray concrete curb and gutter covered with prison-like grates. All too frequently, stormwater management is relegated to public works departments with instructions only to keep expenses down.

This workbook illustrates the opportunities of thinking differently about managing runoff. It will lead you through the process of introducing sustainable practices to manage stormwater. Implementing green infrastructure practices that use nature to mimic natural hydrologic processes to control stormwater can provide multiple benefits. Water can be managed more efficiently through the use of native vegetation, which can dramatically improve the aesthetics of a community, leading to increased property values. Public spaces naturally landscaped to reduce runoff become more inviting. Strategic tree planting to provide natural storage of rainwater can also provide additional shade that minimizes urban heat islands — which in turn reduces the need for air conditioning in nearby residences. Development that reduces the need for parking becomes more enjoyable for walking.

In addition to providing storage for excess rainwater in storm events, the best practices described in this workbook can help improve water quality. The right choice of vegetation near a stream or lake can slow down the flow of water as well as filter out pollutants

that run off streets and parking lots. Cleaner lakes and streams benefit everyone.

Based on the work we have done in dozens of Wisconsin communities, we partnered with the University of Wisconsin Sea Grant Institute to develop this user's guide to maximize the benefits of green infrastructure. With this workbook, you can lead your community through the process of revising codes and onto a more sustainable pathway to stormwater management.

Community participation is key to success. Changes in zoning should never be considered without significant and real community support. This support will come only through active citizen participation in the changes required to realize the greatest benefits of green infrastructure. By undertaking a process that identifies the barriers and opportunities for green infrastructure, cost-effective stormwater controls can be developed to meet the community's goals and inspire a sense of community pride.

At 1000 Friends of Wisconsin, we believe developing and implementing a new, more natural approach to stormwater management can transform a community's appearance and make the community stronger and more resilient for years to come.

Sincerely,

Steve Hiniker

Retired Executive Director, 1000 Friends of Wisconsin

BACKGROUND

This workbook would not have been possible without the work of 1000 Friends of Wisconsin who developed and implemented the green infrastructure municipal code project throughout southeastern Wisconsin from 2012-16. With funding support from the Fund for Lake Michigan, the Wisconsin Coastal Management Program and the Milwaukee Metropolitan Sewerage District (MMSD), 1000 Friends of Wisconsin and its partners developed a comprehensive audit process methodology and completed detailed audits of the codes and ordinances for the municipalities in the MMSD service area.

The project team consisted of 1000 Friends of Wisconsin, Milwaukee County Environmental Services, MMSD, Orion Planning and Design and the 28 participating municipalities.

1000 Friends of Wisconsin, with its focus on livable cities and protection of natural resources, led the project, bringing its strengths in communication and partnership building and engagement. Orion Planning and Design served as the project's planning consultant, bringing years of experience and expertise in best practices and up-to-date

research on the relationship between land use, ordinances and green infrastructure.

Milwaukee County Environmental Services provided expertise on green infrastructure installations and implementation, as well as lessons learned and best practices.

The health of rivers and streams and, by extension, the health of our communities, is bound to how we live on and use the land.

MMSD, a nationally recognized leader in green infrastructure, provided extensive data, local context and priorities established by a regional green infrastructure plan.

What makes this project unique among similar audits for green infrastructure? 1000 Friends of Wisconsin recognized the need for a “no judgement” approach in working with municipalities to audit, revise and prioritize codes and ordinances that inhibit the use of green infrastructure. Barriers to green infrastructure can vary widely within the code language, including specific rights, specific prohibitions, partial limits and practices mentioned with no guidelines for implementation or maintenance.

Therefore, solutions to code barriers need to be customized for the specific municipality and cannot be satisfactorily addressed by model ordinances or someone else's idea

of how the municipality “should” operate. Engaging county and municipal zoning and land use staff, planners, consultants and non-profit groups in reviewing, auditing and developing codes and ordinances that work for their communities is a critical part of the audit process.

Understanding how green infrastructure fits within a municipality's context is also a key ingredient in overcoming code barriers. What are the important local issues — the regional culture, the pattern of development and specific challenges regarding water quality or quantity — and how might greater use of green infrastructure help with those issues?

Finally, communication and teamwork are key. Kate Morgan, former water policy director of 1000 Friends of Wisconsin, noted, “With this project, we were building, in many cases, new relationships with municipalities and municipal staff. We wanted to do it right, taking the time to build a strong foundation and trust. We saw this not as a one-off-and-done project but rather an opportunity to set the stage for future partnerships and projects to improve water quality in the region.”



Green Infrastructure

Green infrastructure protects water quality and reduces the quantity of stormwater runoff by slowing it down, providing storage and infiltration, and allowing evaporation where it falls. These practices can be used at the site or building scale, neighborhood and public space scale or expanded to community-wide scale.

Examples of green infrastructure include:

- Bioretention areas, such as plantings in parking lot islands
- Green roofs
- Downspout disconnections into rain barrels, planter boxes and permeable areas
- Rain gardens
- Streets and alleys with permeable surfacing
- Bioswales
- Native plantings
- Wetland and floodplain preservation and restoration
- Conservation and protection of open lands, natural areas and green spaces
- Permeable and porous pavements and paved surfaces
- Urban tree canopy protection and restoration, tree planter boxes and tree trenches

City of Port Washington Wastewater Treatment Plant green roof

INTRODUCTION

The health of rivers and streams and, by extension, the health of our communities, is bound to how we live on and use the land. With development and the associated increase in impervious surfaces has come a parallel rise in the negative impacts of stormwater runoff on our natural resources and communities. (Impervious surface is any area that does not allow rainfall or snow melt to infiltrate into the ground.)

If the code language is not clear that green infrastructure is an acceptable or preferred approach to managing stormwater, green infrastructure will not likely be considered in development proposals, design plans or capital projects.

As rainfall or snowmelt flows over developed areas such as rooftops, roadways, parking lots, construction sites and lawns, it picks up and concentrates pollutants that end up in storm drains and combined sewer systems and are eventually discharged into local rivers and streams. Stormwater runoff pollution can include automotive fluids, heavy metals, sediment, nutrients, deicing salts, pesticides, fertilizers and bacteria from human and animal waste. In fact, stormwater

runoff is a leading source of pollution entering United States waterways.

Impervious surfaces and waterways altered through straightening and channel lining increase the quantity and velocity of stormwater runoff, which can lead to flooding, stream bank erosion, damage to property and degradation of aquatic habitat. In addition, more frequent extreme storm events, with large rainfalls occurring in short periods, are taxing traditional gray infrastructure systems — storm drain pipe networks and wastewater treatment facilities — that were designed for pre-21st-century precipitation rates and storm intensities.

Today, municipalities are looking increasingly to green infrastructure to help mitigate the impacts of stormwater runoff by managing it at its source, or, rather, where it falls. Mimicking natural hydrologic processes and systems, green infrastructure practices are site-specific stormwater management practices that spread out, store and allow evaporation or infiltration of rain and snowmelt. Distributed strategically across a drainage area, these practices can significantly reduce stormwater flow volumes and velocities that lead to flooding, property damage and in-stream erosion, and greatly reduce pollution loads into local waterways.

Although green infrastructure is a proven, effective means to mitigate stormwater

runoff, critical barriers remain to its implementation. Outdated, unclear or prohibitive local regulations are a major barrier and one that is readily addressed through a community audit process.

Green Infrastructure and Local Regulations

Municipal codes and ordinances govern many aspects of community life, including setting standards for roads and sidewalks, land use and development, maintenance of public and private property and many others that address public health and safety. Municipal codes also set forth the structure, process and procedures for governance in a municipality.

Many municipal codes and ordinances were written before the effects of land use and development on stormwater runoff were well understood. Outdated local regulations can have a broad impact on implementation of green infrastructure — and often will directly or indirectly discourage or prohibit its use. Even the absence of language in a code about green infrastructure is a barrier. Where codes are ambiguous or silent, code interpretation by municipal staff and administrators may affect whether the municipality, builders or developers are willing or able to use green infrastructure practices.

Municipal zoning regulations, in particular, have an outsized impact on the potential for implementation of green infrastructure. Standards and requirements for applications

Incorporating green infrastructure into site plan reviews

Original §CODE.code.1234	Amended §CODE.code.1234
A landscaping plan shall show the dimensions of planted areas and proposed species.	The landscaping plan shall incorporate the storm-water management approach and grading plan for the site and shall indicate clearly the location and size of all landscaped and vegetated areas, green roofs, rainwater storage systems and areas of permeable surfacing that are intended to provide stormwater treatment or control functions.

If the code language is not clear that green infrastructure is an acceptable or preferred approach to managing stormwater, green infrastructure will not likely be considered in development proposals, design plans or capital projects.

for development projects, site plans, storm-water management plans, landscaping standards, and parking and roadway requirements are particularly important for encouraging or even requiring the use of green infrastructure.

Codes and ordinances that encourage or require the use of green infrastructure can help a community improve the health of local waterways, promote public health, protect private and public properties from flooding and become, overall, more resilient to a changing climate and the impact of more frequent and intense storm events.

This workbook will provide a starting point for tackling barriers in local regulations. It has been developed to help communities review and revise their codes and ordinances under the lens of improving stormwater runoff mitigation and enabling, encouraging and promoting green infrastructure.

In this workbook we describe a community-oriented engagement approach to identify the individual needs of the municipality, provide a detailed codes and ordinances auditing tool, highlight common key challenges and recommend next steps.

Who Should Use This Workbook?

This workbook is intended to help communities identify and revise local codes and ordinances to allow for and support the implementation of green infrastructure. It may be useful if your community:

- has policies that support green and sustainable outcomes, or would like to move towards these goals
- must meet stormwater regulatory obligations (e.g., municipal separate storm sewer system (MS4) stormwater permits, total maximum daily load (TMDL) allocations)

- participates in FEMA hazard mitigation planning, the Community Rating System or other resilience planning programs
- experiences nuisance flooding and/or stream bank erosion
- is undertaking or planning an update of the comprehensive/master plan
- has natural water resources that are important to and recognized by the community, or integral to its identity

This workbook was written for use by county and municipal staff, particularly those with roles in zoning, land use, urban forestry, stormwater and engineering. Secondary audiences include planning and zoning commissioners and board members; local elected officials; and consulting civil engineers, landscape architects and planners who prepare development, landscape and engineering plans. Organizations, nonprofits, university extension and government agencies whose mission is to protect water resources and/or promote community resiliency might also be interested in using this tool to advance green infrastructure.

If you need assistance with this workbook or have questions and comments, please contact Julia Noordyk, water quality and coastal communities outreach specialist, University of Wisconsin Sea Grant Institute at jnoordyk@aqu.wisc.edu or (920) 465-2795.



Maryland Avenue Montessori School rain garden, Milwaukee

WHAT YOU NEED TO KNOW BEFORE THE AUDIT: KEY STRATEGIES AND COMMON BARRIERS

The audit focuses on five key strategies to reduce the negative impacts of runoff and overcome barriers in codes and ordinances to enable green infrastructure, reduce impervious surfaces and protect water quality.

Three of the strategies — reduction of impervious surfaces, disconnection of effective impervious areas and restoration of natural functions — relate directly to green infrastructure and other engineered practices that mimic hydrological processes to manage stormwater and snow melt. An effective impervious area is directly connected to stream channels via impervious surfaces and storm drains, without an intervening permeable surface or treatment system.

The fourth strategy recommends additional standards for specific land uses that can generate stormwater pollution and need special attention during development review. The fifth strategy looks at encouraging green infrastructure in comprehensive plans, grant applications and purpose statements as the preferred approach to stormwater management.

In the audit process, your community team will examine codes and ordinances to determine where these key strategies could encourage or require the use of green infrastructure, reduce runoff pollution and establish green infrastructure as the favored practice for stormwater management.

For each of the strategies, there are common code barriers (see Table 1). The following section describes the relationship between the strategies and regulations in more detail and also provides ideas for amending codes to overcome these barriers.

Reduce Impervious Surfaces and Disconnect Effective Impervious Areas

Surface Parking and Driveways

Parking requirements can yield significant opportunities to reduce impervious surfaces and to “green” parking areas. Amendments can both reduce the total surface area required and reduce the impact of those surfaces. Amendments can take the form of reducing the size of parking spaces, updating parking ratios of number of spaces required per square foot of building area, providing procedures and systems¹ to enable off-site and shared parking and allowing waivers if a use does not need the number of spaces required for the size of the building.

Expansive parking areas and wide driveways for residential properties can also result in the spread of impervious surfaces and increases in effective impervious areas. Reducing minimum required driveway widths, setting maximum driveway widths and reducing or eliminating limits on parking on lawns can keep these in check.

Encouraging the use of permeable materials through regulations can “green” parking lots, driveways, sidewalks, alleys, parking lanes and median strips.

Right-of-Ways and Street Widths

Regulations pertaining to streetscapes — street widths, right-of-way areas and setbacks — can either increase the overall amount of impervious surface or limit it. The use of grassy swales or ditches in appropriate areas, if permitted, rather than curb and gutter drainage, can also provide infiltration for stormwater runoff. Regulations can also be amended to allow for curb cuts and bump outs that channel stormwater into bioswales or bioretention areas (which often do double-duty as traffic-calming methods) to provide stormwater infiltration.

Streetscapes

Using trees and structural soils, which support tree health, can play a large role in streetscape stormwater management. Trees capture, store and release stormwater through the process of evapotranspiration as well as diffuse rain falling through the tree canopy, reducing erosion and slowing peak flows. Intricate root structures create greater soil porosity, enabling more stormwater to infiltrate the soil. Green

infrastructure-friendly streetscape regulations can require or encourage street trees and ensure there is adequate space and soil volume to support mature trees by providing for sufficient green space, tree boxes or tree trenches. Technical standards for tree pits and tree boxes that incorporate stormwater management can also be referenced in the code.

Surfacing Materials

Permeable and porous surfacing materials can mitigate stormwater runoff volumes and pollution by capturing runoff, which is either infiltrated or drained slowly after storms. Encouraging or enabling the use of permeable materials through regulations can “green” parking lots, driveways, sidewalks, alleys, parking lanes and median strips. The strategic, limited use of permeable surfacing in (for example) an alley, parking lane or portion of a parking lot can often have substantial water-quality benefits.

Using permeable materials successfully requires help from contractors and engineers with knowledge of where and how to design, install and maintain these products. Since permeable materials have specific maintenance requirements that vary by brand and type, adding reference in the code to standard specifications or performance standards for permeable materials can give developers and contractors important guidance.² Effective language in stormwater permits

Key Strategies to Mitigate Runoff with Green Infrastructure	Common Code Barriers
Reduce impervious surfaces and maximize vegetated/landscaped areas that promote infiltration, evaporation and evapotranspiration of rainwater	Dimensional standards: lot size, frontage, height, coverage, yards, parking Building codes and public works standards (drains, roads, curb and gutter, sewers, ditches)
Disconnect effective impervious areas and diffuse runoff to either vegetated areas or green infrastructure installations practices	Building codes, engineering and public works standards (drains, roads, sewers, ditches) Landscaping, buffers, trees and tree canopy
Restore and protect natural functions of soils and vegetation	Landscaping, buffers, trees and tree canopy, open space, erosion control requirements
Control pollution from specific sources, such as animal-related uses, outdoor storage and trash handling areas	Site plan review, special and conditional uses
Clarify the intent and purpose of codes to encourage green infrastructure use	Comprehensive plan, purpose statements, applications

Table 1: Key strategies for mitigating runoff with greater implementation of green infrastructure in municipal codes and corresponding common barriers. Courtesy of Juli Beth Hinds, Orion Planning and Design.

and maintenance plans also ensures maintenance information is passed to owners and building and grounds managers.

Fire Protection Standards

In some communities, written or informal standards related to access to buildings by firefighting equipment translate to required road widths, intersection dimensions, cul-de-sac radii and pavement requirements around buildings. Access requirements can lead to the construction of substantial areas of impervious surface on a site. Work with your fire department and city engineer to

discuss acceptable alternatives that can meet the need for public safety access but also reduce imperviousness. For example, permeable pavers can be used for part of the fire protection access needed for a building. Grass pavers have been used successfully for this purpose. Some fire departments will approve reduced impervious surface requirements if buildings are equipped with sprinkler systems.

Allowing permeable surfacing to be used for areas of a site that provide access for public safety and firefighting equipment but otherwise do not see regular use is an important

strategy in reducing stormwater pollution loads and runoff volumes. Municipalities must stipulate that 1) these areas will be snowplowed or otherwise kept accessible during the winter and 2) site plans require designated snow storage areas that do not impede access — an important site plan standard for any community to consider. Enforcement is always crucial in ensuring that site plan conditions are followed.

Restore and Protect Natural Landscape Functions

Most green infrastructure practices use the natural processes of plants to mitigate stormwater runoff. Incorporating stormwater control measures into regulations related to landscaping, native plantings and lawn requirements is a logical place to either encourage or require the use of green infrastructure in every new development or redevelopment project.

Parking Lot Landscaping and Screening

Parking lot landscape requirements are often prohibitive to green infrastructure. These regulations are rife with directives for bermed screening and conventional curbing for landscaped islands and edges of the parking lot. Amendments to these codes open the way for bioswales and bioretention areas at the edge of the lot and green practices in landscaped islands.

If standards are adjusted to ensure that visual screening occurs through a combination

If standards are adjusted to ensure that visual screening occurs through a combination of fencing and plantings, green infrastructure can be integrated almost anywhere landscaping is required for screening and aesthetic purposes.

of fencing and plantings, green infrastructure can be integrated almost anywhere landscaping is required for screening and aesthetic purposes. Codes that require a set number of plants per area, as well as the type of plantings required (e.g., dense evergreen hedge) can be amended to be less prescriptive and encourage the use of green infrastructure for landscaping.

Turfgrass

Turfgrass, as commonly installed, does not allow substantial infiltration due to its root structure and soil substrate. Turfgrass maintenance typically requires the use of herbicides, pesticides and fertilizers that add to stormwater pollution. Landscape codes that require turfgrass for landscaping can be amended to allow the use of native plants and even require soil amendments, which increase infiltration rates and reduce the amount of runoff entering local waterways.

Residential Landscaping

Restrictions on residential landscaping requiring turfgrass, a prescribed group of plants to fit community aesthetics or limits on plant heights all prohibit homeowners from using native plantings or installing rain gardens as methods to manage stormwater. This barrier can be overcome by adding affirmative guidance or standards for these practices, which can include requirements that native lawns or plantings be managed or delineated to keep an attractive appearance.

Shorelines, Riverbanks, Buffer Zones

While most local regulations will protect shorelines and riverbanks with requirements for designated buffers, many communities allow a mowed turfgrass area to serve as the required buffer. As stated above, turfgrass does not absorb and infiltrate stormwater effectively in most cases, and the maintenance of turf grass can contribute pollutants that are detrimental to the waterways the buffer was intended to protect. Requiring the use of native or deep-rooted vegetation, shrubs and/or trees rather than turfgrass for the buffer strip will greatly reduce runoff volumes into streams and reduce or eliminate the need for fertilizers and pesticides. Municipalities can also reduce these pollutants by adopting policies explicitly stating fertilizer and herbicide applications should be minimized within buffer areas.

Protection of Existing Vegetation and Trees

Existing vegetation can be given additional protection during construction projects with the inclusion of specific, detailed requirements to mark disturbance areas, protecting areas within the “drip line” of mature trees and existing vegetation at construction sites. Verification of these boundaries — which can simply be ribboned or fenced off — can be added to regular construction-phase inspections. These additional measures, which do not add to project costs, can be extremely valuable in preserving natural areas, soil functions and trees.

Pollution Source Reduction From Conditional/Special Uses

Conditional or “special” uses permitted in zoning districts such as animal-related facilities (e.g., doggie day care, veterinary hospitals, kennels, etc.), restaurants and supermarkets, contractor yards, landscaping and garden centers, and vehicle repair and fueling stations, can be direct sources of stormwater pollution. Pollutants from these uses include pathogens, sediment, nutrients, pesticides and herbicides, heavy metals and toxic fluids from vehicles.

To address pollution stemming from these uses, many common-sense standards can be developed and adopted that direct discharge or runoff away from storm drains, gutters, wetlands and waterways. In many cases, runoff can be redirected from (as an

example) an outdoor dog run or storage area to a grass or vegetated area and away from surface waters or storm drains. For other activities, standards might require more specific standards for collection, treatment and disposal of the discharge to the sanitary sewer. Providing for supplemental review of these uses by engineering staff during the development approval process often prevents situations from becoming water quality problems in the first place.

Outdoor Storage and Waste Handling

Dumpsters and trash storage areas are a chronic issue for watershed health. Poorly managed trash areas can allow animals to get into the trash or drainage from food waste to reach storm drains or surface waters, which can have outsized impacts on water quality, including significant discharges of bacteria to streams and lakes. Ensuring that trash areas are secure and reviewed for drainage impacts is essential. Outdoor storage and waste handling requirements should include provisions that waste and trash receptacles

be fully enclosed; surface areas for the receptacles be curbed and graded so runoff drains away from storm sewers and surface waters; and receptacles not permitted to be sited in a stream or wetland buffer. Ensuring that potentially dangerous materials are not stored in an open outdoor area and that drainage from other outdoor storage is buffered through a vegetated area rather than being directed to storm drains or surface waters will also curb runoff pollution from these uses.

Vehicle Storage and Maintenance

Similarly, uses that include storage, maintenance and cleaning of vehicles can require siting in such a way that all discharge or runoff be directed away from storm drains, gutters, wetlands and waterways. If water is used for cleaning shop floors and adjacent outdoor areas, the wash water should be contained and disposed of appropriately in the sanitary sewer (with review and concurrence from the sanitary sewer provider) or at an offsite disposal facility. Activities and materials that occur outside and could come in contact with rain and snow should be covered to prevent runoff contamination.

An additional standard can require the submission of a detailed plan for the collection, treatment and discharge of wash water and runoff. The inclusion of maintenance areas can be required information for review of the site plan.

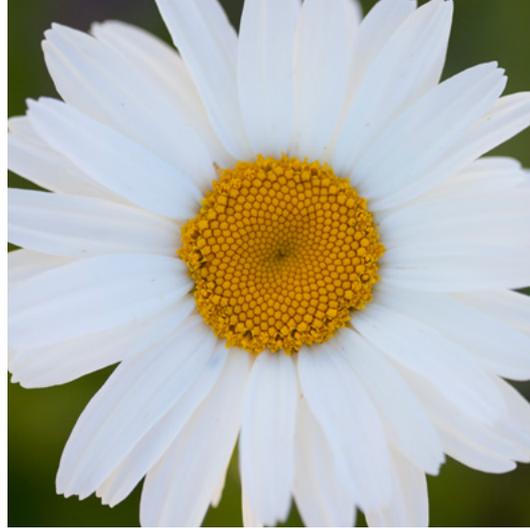
Bradford Beach, Milwaukee



Snow Storage

Snow storage is an often-overlooked but important component of site plan review. Snow storage typically occurs in or near parking areas, and snow piles can, in some cases, take up required parking or impede use of pedestrian access areas. Snow melt is a source of a variety of pollutants, including sediment, nutrients and heavy metals, as well as chlorides and other deicing chemicals. When properly sited, designed and maintained, snow storage areas can significantly reduce the discharge of poor quality meltwater to receiving waters and other sensitive areas.

Identifying snow storage areas on site plans and taking into account snowmelt runoff impacts can be incorporated into application checklists and site plan review standards. Vegetated or grassy swales³ can be used for snow storage and may be helpful in reducing snow melt peak flows through infiltration and in treating most pollutants associated with snow. However, when storing snow in landscaped areas, plant species should be selected based on their tolerance for snow storage. Plants should be salt-tolerant perennials that die back annually and shrubs/trees that can bend with weight without breaking. Spring maintenance might also be necessary for areas that accumulate a buildup of sand.



Maryland Avenue Montessori School rain garden, Milwaukee

Clarify the Intent and Purpose of Regulations and Standards

A community's comprehensive plan offers an opportunity to explicitly state that the protection of water resources and use of green infrastructure practices to protect those resources are part of the community vision. When these are incorporated, the comprehensive plan can integrate water quality and watershed health with its plans for growth and development. It communicates a clear intent to promote or require the use of green infrastructure through regulation, permits and plan review.

Purpose statements in zoning districts also can be used to set forth goals to incorporate stormwater management with landscape requirements and to reduce impervious surfaces. In some cases, zoning ordinances can also be amended to include on-site stormwater management as an allowable use, especially retrofits that add bioretention areas or restoration areas.

Development applications and plan reviews, planned unit development agreements and tax increment finance (TIF) applications are opportunities to require that a review for green infrastructure and stormwater management is brought into the early stage of a project or planned development. This signals to a developer alternative solutions for stormwater management are desired. A TIF policy can incentivize green infrastructure through the TIF's finance structure.

Some communities have department staff or elected officials who are advocates for sustainable water resource protection and who understand the importance of green infrastructure. This leadership is often seen in innovative programs and projects within the community. If, however, those priorities are not clearly codified in plans or purpose statements, they can evaporate with a change of leadership. Detailing goals for resource protection and establishing the importance of green infrastructure in purpose statements and comprehensive plans can translate leadership into legacy.



Rain garden or trash collector?

A community installs a rain garden with hopes of reducing stormwater pollution and beautifying its downtown. As it's the first time the city engineers have designed an urban rain garden feature, pretreatment and energy dissipation features are not included, and maintenance is not as frequent as required. Within a year, the rain garden has filled with sediment and trash, which causes it to overflow, ironically, into the river it was intended to protect. Now faced with the very public and visible failure of its pilot project, the community's leaders are hard-pressed to support new green infrastructure projects.

How can we change this story line? While we know that perceptions and experiences can be major barriers for a community to overcome, there are things citizens, boards and committees can do. First, this is an important opportunity to enhance dialogue between municipal departments and staff, particularly bridging planning and engineering. In addition, operation and maintenance responsibilities, frequencies and roles must be assigned and carried out. The people charged with these tasks must have proper technical support from others, such as local university extension staff

or engineering firms, to ensure these tasks are done correctly. Long-standing neighborhood associations, downtown business associations or business improvement districts can make great allies for green infrastructure maintenance through cooperative agreements because they develop a sense of ownership of projects located "in their backyard."

Perhaps even more important is the community's role in the upkeep of rain gardens and other bioretention systems. Residents and community groups who become caretakers can greatly increase the chance for success and improve public perception. They can often contribute to day-to-day aesthetic maintenance more often than municipal staff. In addition to some initial outreach and education with residents, the key to developing this sense of ownership is to give the project a healthy start with proper design, construction and frequent maintenance (watering) until the "bio" in the bioretention has become established. Then, it can be a source of pride for the residents who care for it.

HOW TO AUDIT MUNICIPAL CODES AND ORDINANCES

There are three main steps in the municipal codes and ordinances audit:

- 1. Community scoping** In this step, get to know how your community's experiences, attitudes and current rules and policies can affect efforts to implement green infrastructure. You will also explore your community's identity as related to aesthetics and culture and look for opportunities to build green infrastructure support as the results of the audit emerge.
- 2. Audit your community's codes and ordinances** Using the audit section, assess whether specific regulations are supportive (a practice is encouraged or required), prohibitive (a practice is not allowed), ambiguous (confusing) or absent (nothing is stated, for or against) on the use of green infrastructure. The questions are organized by code, policy and operational topics where barriers to green infrastructure practices are commonly found. The grading system will help identify which codes and ordinances pose the biggest barriers to green infrastructure implementation.
- 3. Prioritize recommendations and develop a strategy for adoption** Use the scoping information from step 1 along with the results of the audit to guide prioritization of recommended code revisions and amendments. This will help you develop a strategy that best fits the needs of your community and is met with greater acceptance.

Community Scoping: Get to Know Your Community

Understanding green infrastructure in the context of your community and its culture is central to making successful changes to your local regulations that enable and promote the use of green infrastructure in your community.

The effects of local regulations are partly a result of what is written in the code — the language itself — but also partly a function of how the community's elected and appointed officials, municipal staff and developers interpret the code during the review process. Perceptions about and experiences with green infrastructure from any sector of your community can help or thwart efforts to adopt code and ordinance amendments.

The background information you collect in this step is likely to indicate where you may encounter pushback and help you develop a strategy to counter that pushback. It will also help you identify natural allies — individuals, groups or businesses — to help you establish support to move your community toward greater green infrastructure acceptance and implementation.

In addition, knowing your community's preferences and concerns is critical to ensure that changes to local regulations will incorporate and build upon the preferences and priorities of the community. Green infrastructure can then be framed as a strategy to help the community achieve many broader goals.

The questions on the following worksheet will provide valuable background information about your community in the context of green infrastructure implementation. This worksheet will help identify obstacles, opportunities for troubleshooting and the most logical codes to prioritize for revisions.



City of Port Washington Wastewater Treatment Plant green roof, Milwaukee

COMMUNITY SCOPING WORKSHEET

Investigating concerns about or objections to green infrastructure can help you understand why a community may be hesitant to implement green infrastructure. A dialogue about these issues can provide valuable insight into the cause of the failure and give you critical information regarding the community's experience with green infrastructure.

Community Planning

1. Has a comprehensive plan been adopted for the community?

Yes No

If yes, how are the community's natural resources addressed in the comprehensive plan? _____

If yes, is there specific attention to the community's water resources in the comprehensive plan?

Yes No

If yes, is green infrastructure implementation listed as a key element for implementation?

Yes No

3. Has your municipality taken part in the development of a watershed restoration or other similar plan?

Yes No

Natural Assets

1. What are the natural resources of your community?

- rivers
- streams
- lakes
- public or private property with water frontage
- other important natural areas

2. Are those natural resources incorporated into the community's culture, such as for events?

Yes No

If yes, how? _____

3. Do these natural resources enhance the economics of the community?

Yes No

If yes, how? _____

4. Are there impaired or degraded resources that would be good targets for remediation or restoration?

Yes No

If yes, would green infrastructure be suitable for these sites (e.g., stormwater infiltration may NOT be feasible on a brownfield redevelopment)?

Yes No

If yes, these can often be good sites to demonstrate new ideas and practices.

Hazards

1. Is your community challenged with flooding issues?

Yes No

2. Does your community experience beach or swimming area closures after storms due to high bacteria levels?

Yes No

3. If streams or rivers are within your community's boundaries, are they on the state's 303(d) list of impaired and threatened waters?

Yes No

Community Identity and Character

1. Is being "green" attractive to new people moving into your community?

Yes No

2. Does your community have any environmental, sustainability or nature-based designations (e.g., Water Star Program, Green Tier Legacy Community, Tree City USA or Bird City USA)?

Yes No

If yes, is this a point of community pride?

Yes No

3. Is your community a sister city of a city in another country that has water issues?

Yes No

4. Have other environmental initiatives been started in your community?

Yes No

If yes, what has been their focus? _____

5. Do residents of your community like a homogeneous appearance to their neighborhoods or are individual residents' preferences tolerated or even celebrated?

6. Is turf grass the favored lawn cover or is there a more diverse approach to residential landscaping that can include native plantings, prairies and rain gardens?

Stormwater Regulations

1. Does the community have a stormwater utility?

Yes No

If yes, are the rates dependent on equivalent residential units (ERUs)?

Yes No

If yes, does the stormwater utility incentivize green infrastructure through the reduction of ERUs and the corresponding tax rate?

Yes No

2. Does the community's stormwater ordinance include green infrastructure practices as approved methods to address stormwater runoff in new development and redevelopment projects?

Yes No

3. What amount of development (e.g., half an acre of new or redeveloped impervious surface, any site plan, an acre or more of new development) triggers the requirement for a developer to submit a stormwater management plan?

When a stormwater development plan is required, are reviewers knowledgeable about green infrastructure and is it encouraged through the review process?

Yes No

4. Is your municipality required to have coverage under a municipal separate storm sewer system (MS4) permit?

Yes No

5. Does your community have total maximum daily load (TMDL) allocation requirements that it must meet?

Yes No

Current Green Infrastructure Usage

1. Have residents installed rain gardens or rain barrels?

Yes No

2. Have neighborhood associations or other organizations initiated green infrastructure projects such as rain gardens or stormwater tree programs?

Yes No

3. Are there community gardens?

Yes No

If yes, what's the water supply for irrigation?

4. Has your municipality implemented a downspout or foundation drain disconnection program?

Yes No

If yes, is this encouraged by the municipality, or simply allowed?

If yes, who would respond to questions or provide technical information on drain disconnection?

5. Has there been a municipal project that has piloted the use of permeable pavement or surfacing on public property or in the public right of way?

Yes No

If yes, what was the experience? _____

If yes, was the project perceived as a success?

Yes No

What product was used?

6. Is there a new development that is using green infrastructure as part of its stormwater management plan?
 Yes No

If yes, how has it been received by the community?
 Positive impact Neutral Negative impact

7. Are there restrictions on the application and use of lawn fertilizers and/or pesticides?
 Yes No

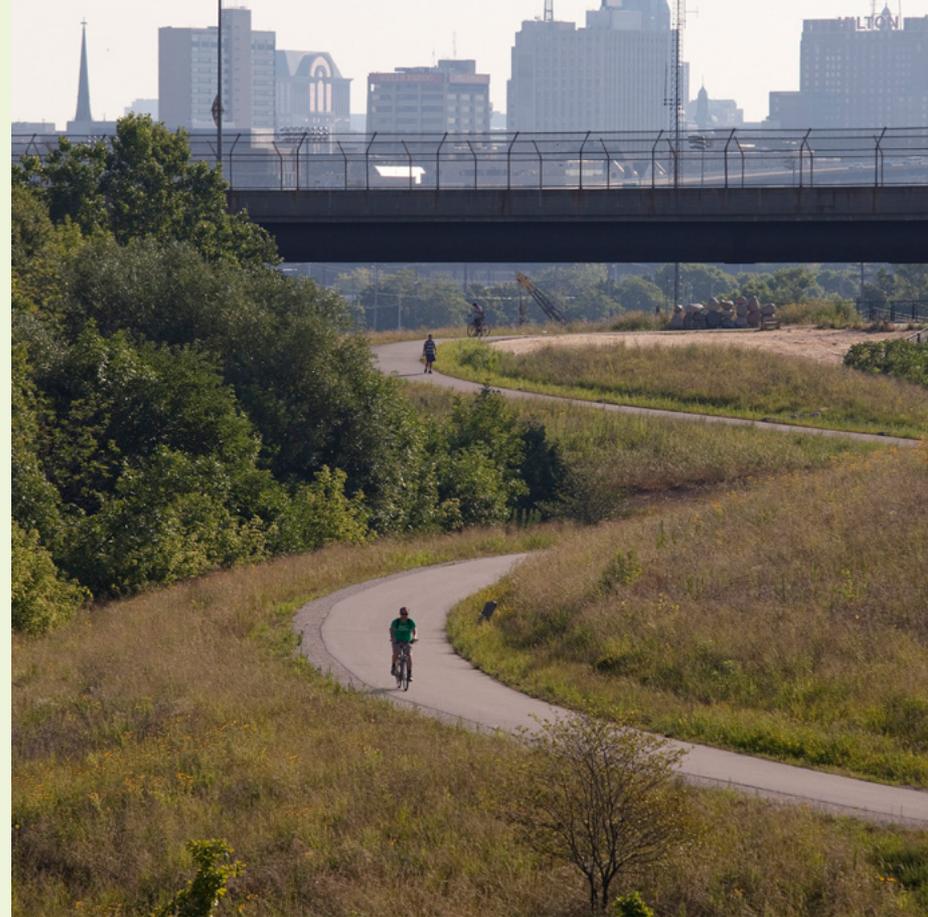
8. Are streams and rivers protected by regulated buffers?
 Yes No

If yes, how large a setback is required?

If yes, what type of vegetation is required/allowed?

9. Have any developers who have worked in your community used green infrastructure?
 Yes No

If yes, with what success?



Menomonee Valley Redevelopment and Community Park

Understanding Your Community

Learning about concerns or objections to green infrastructure can help you understand why a community may be hesitant to risk failure or not be in favor of codes that promote green infrastructure. A dialogue about these issues can provide valuable insight into the cause of the failure and give you critical information regarding the community's experience with green infrastructure.

10. Have green infrastructure practices been implemented in your community?

Yes No

If yes, which installations have been described as successful and which have been described as failed?

How were the successes and failures judged?

How well was each project or initiative received?

Learning about concerns or objections to green infrastructure can help you understand why a community may be hesitant to risk failure or not be in favor of codes that promote green infrastructure.

Was there community support for the projects?

Yes No

If yes, was significant outreach needed to secure community buy-in?

Yes No

Was the community opposed each step of the way?

Yes No

11. Is there a green infrastructure initiative that the community incorporated into its identity?

Yes No

12. Is there a government entity spearheading the acceptance and/or adoption of green infrastructure (e.g., a sewerage district, mayor's office, etc.)?

Yes No

Community Acceptance

1. What community groups or associations would be natural allies for green infrastructure (e.g., park friends group, a garden club, a Wild Ones chapter, a conservation committee, a school that has the environment or sustainability as an organizing theme, river or bay keepers, a Rotary Club, bicycling advocacy group or village beautification committee)?

2. Are there neighborhood associations with a strong environmental ethic and commitment to sustainability?

Yes No

3. Which companies or businesses (e.g., garden centers or landscaping contractors) within your community have a strong environmental ethic and commitment to sustainability?

4. Are there individuals who are advocates for green infrastructure and green practices in your community?

Yes No

5. Are there individuals who are opposed to green infrastructure and other environmental initiatives?

Yes No

If yes, what is the basis of their concern or objection?

6. If your community has implemented green infrastructure practices, who or what public body was most involved with the failure or success of a particular green infrastructure practice?



Reed Street Yards, Milwaukee

Audit Your Community's Codes and Ordinances

Using the audit section of this workbook (see the tabbed section), thoroughly review the codes and ordinances to identify barriers to the use of green infrastructure for stormwater treatment and control for private and public projects.

Prioritize Recommendations and Develop a Strategy for Adoption

Prioritizing Code Amendments

The report card will help your team identify areas where critical barriers exist. Those codes identified in the topic area with the most low scores are a logical starting point. There are likely, however, to be many codes and ordinances in several topic areas needing revision. If this is the case, it may be helpful to use additional criteria or information to prioritize the next phase of work.

Knowing what development pressures your municipality is facing can help determine which amendments to prioritize. Is your community built out with most development occurring as redevelopment? If so, this might lead to a prioritization of amendments that would enable shared or offsite parking and permit permeable materials for parking lot surfacing, green roofs or planter boxes for rainwater harvesting.

Does your community have large parcels available for new development? This might lead to the prioritization of regulations pertaining to the size of individual parking spaces and number required, or reducing the footprint of roads and culs-de-sac in subdivision standards. Parking lot landscaping requirements could be amended so landscaping is allowed or required to serve as stormwater management. If there is little development or redevelopment planned, a focus on enabling green infrastructure practices on residential properties could take priority.

Your municipality may have regulatory requirements in addition to a MS4 stormwater permit such as a total maximum daily load (TMDL) that requires the reduction of pollutants identified in a TDML implementation plan. Removing barriers to green infrastructure practices could help mitigate specific pollutants identified in a TMDL, which would make codes relevant to that area a high priority for revision.

The scoping information will also help in developing an approach that best fits your community and in assembling a team of local allies to encourage greater use of green infrastructure. This, in turn, can inform any public outreach and education efforts that might be needed to advance the adoption of the recommended changes.

The importance of a successful green infrastructure project to the goal of advancing green infrastructure in your community cannot be overstated. A failed project can have a crippling effect on subsequent green infrastructure initiatives.



Reed Street Yards, Milwaukee

Overcoming Other Hurdles

In addition to specific local regulations, perceptions about and experiences with green infrastructure can be significant barriers to widespread implementation of those practices. Concerns about failure, cost and maintenance will need to be addressed.

If a project has failed in the community or been poorly received, it is critical to determine the root causes of that failure. This information shapes development of a strategy to advance recommended amendments through the approval process, as well addressing resistance to proposed changes.

Before amendments are reviewed by the planning committee or municipal board, enlist the support of allies identified in the community scoping activity. Outreach to these allies builds understanding about the importance of the desired green infrastructure practice and potentially identifies early adopters for a particular initiative. Community allies can be called on to speak in favor of green infrastructure and associated ordinance changes in your local code adoption process whether that is at public hearings, subcommittee meetings or board or commission meetings.

Residential green infrastructure practices can also present challenges. Concerns about negative comments from neighbors can be a disincentive even if a practice is allowed in the community. While it may not work for all communities, some have found a simple permit that is easy to fill out and submit electronically for residential practices such as rain gardens, cisterns and natural yards can manage neighbor relations proactively.

For instance, if a resident would like to install a rain garden but is concerned that neighbors would complain, he or she can submit an application for a rain garden permit. This gives residents added reassurance to move forward with rain garden plans and enables municipal staff to communicate to concerned neighbors that rain gardens are an approved form of landscaping. This simple step provides a straightforward response to a complaint call, “Yes, it is allowable and your neighbor has a permit on file to use that practice.”

The cost of green infrastructure may be a concern among staff or elected officials. There are many well-researched studies and reports on this topic, comparing green infrastructure practices to conventional gray infrastructure and stormwater management approaches. Links to several of these reports are included in the resources section of this workbook.

Municipal staff may also cite maintenance of green infrastructure installations and efficacy concerns. Again, resources are available to counter these concerns, including case studies, strategies and maintenance manuals. Some of these are included in the resources section.

Follow Through

The complete code review — the revisions and subsequent adoption of recommendations — sets the stage for greater use of green infrastructure. With green infrastructure enabled, developers, contractors and municipal departments will consider green infrastructure as a potential component of their projects. When projects incorporate green infrastructure as a result of a code amendment, use the projects as opportunities to build greater acceptance for green infrastructure.

Track projects that are associated with the revised codes through the design, public input and installation phases to ensure a successful project. Strategic outreach to inform residents about new development, redevelopment or capital improvement projects that incorporate green infrastructure is critical to acceptance and will help ensure greater success and integration of green infrastructure. The importance of a successful green infrastructure project to the goal of advancing green infrastructure in your community cannot be overstated. A failed project can have a crippling effect on subsequent green infrastructure initiatives.

Outreach to allies builds understanding about the importance of the desired green infrastructure practice and potentially identifies early adopters for a particular initiative.



Menomonee Valley Redevelopment and Community Park



Reed Street Yards, Milwaukee

WHAT'S THE IMPACT?

The effects of local regulations on stormwater runoff management and green infrastructure implementation can be abstract and difficult to understand. Geographic information system (GIS)-based stormwater models offer an effective tool for demonstrating and communicating the impacts of green infrastructure-friendly codes and ordinances in your community.

The following examples highlight particular code revisions and amendments that would enable green infrastructure practices and reduced impervious surface at different sites in the greater Milwaukee area. The sites illustrate the potential benefits of:

- Incorporating bioretention in general landscaping requirements.
- Using native or deep-rooted plants with ample soils in place of turfgrass.
- Reducing the total impervious area associated with parking requirements.
- Allowing the use of permeable surfacing in parking lots, driveways, fire protection areas and alleys.
- Incorporating tree planting, native plants and soil amendments (use of aeration and top dressing with organic fertilizer to foster root development and increase infiltration in turfgrass).

For each parcel, the following question was asked: If development or redevelopment of this site occurred after the recommended code change was made, incorporating green infrastructure practices, what would be the impact on water quality and the quantity of runoff?

Modeling Methodology

For each site, a hypothetical redevelopment project was modeled to determine the associated stormwater runoff volume and pollution load reductions from existing conditions. The team used WinSLAMM version 10.2.0 to model the existing development conditions and a post-code revision redevelopment scenario with green infrastructure installations in place. ESRI ArcMap software was used to measure parcel attributes, including roofs, parking lots and turfgrass areas. Design assumptions for installed practices were based on engineering standards, constraints of the site, type of best management practice (BMP) and goal of BMP (water quality, water quantity, reduced peak flow rate, etc.).

Infiltration rates were determined using soil types provided by municipal and federal GIS soil layers. If the data were insufficient for the native soil type(s) on the parcel, a silty soil type was assumed because it represents an average runoff condition as compared with sandy and clayey soil options in the model and is commonly selected as the default soil type for modeling in southeast Wisconsin.



Mequon Nature Preserve

Bioretention practices were modeled using the same geometry (height of practice, drain sizes, etc.). Assumptions used in modeling bioretention practices included:

- Modeling software requirements of one 6-inch drain tile underdrain, vertical standpipe, broad crested weir⁴
- 24 inches of engineered soil⁵ (75% sand/25% compost)
- 12 inches of rock fill under engineered media⁶

Permeable pavement practices were modeled using the same geometry (material specifications, depths and underdrain sizes). Assumptions used in modeling permeable pavement included:

- Pavement thickness of 6 inches and porosity of 0.20
- Aggregate bedding thickness of 4 inches and porosity of 0.35
- Aggregate storage layer thickness of 12 inches and porosity of 0.35
- Initial infiltration rate of 100 inches/hour and surface clogging load of 0.06 pounds/square foot
- Underdrain diameter of 4 inches and elevated 4 inches from bottom of storage layer
- Subgrade seepage rate of 0.3 inches/hour
- TSS reduction rate for flow through pavement of 55%

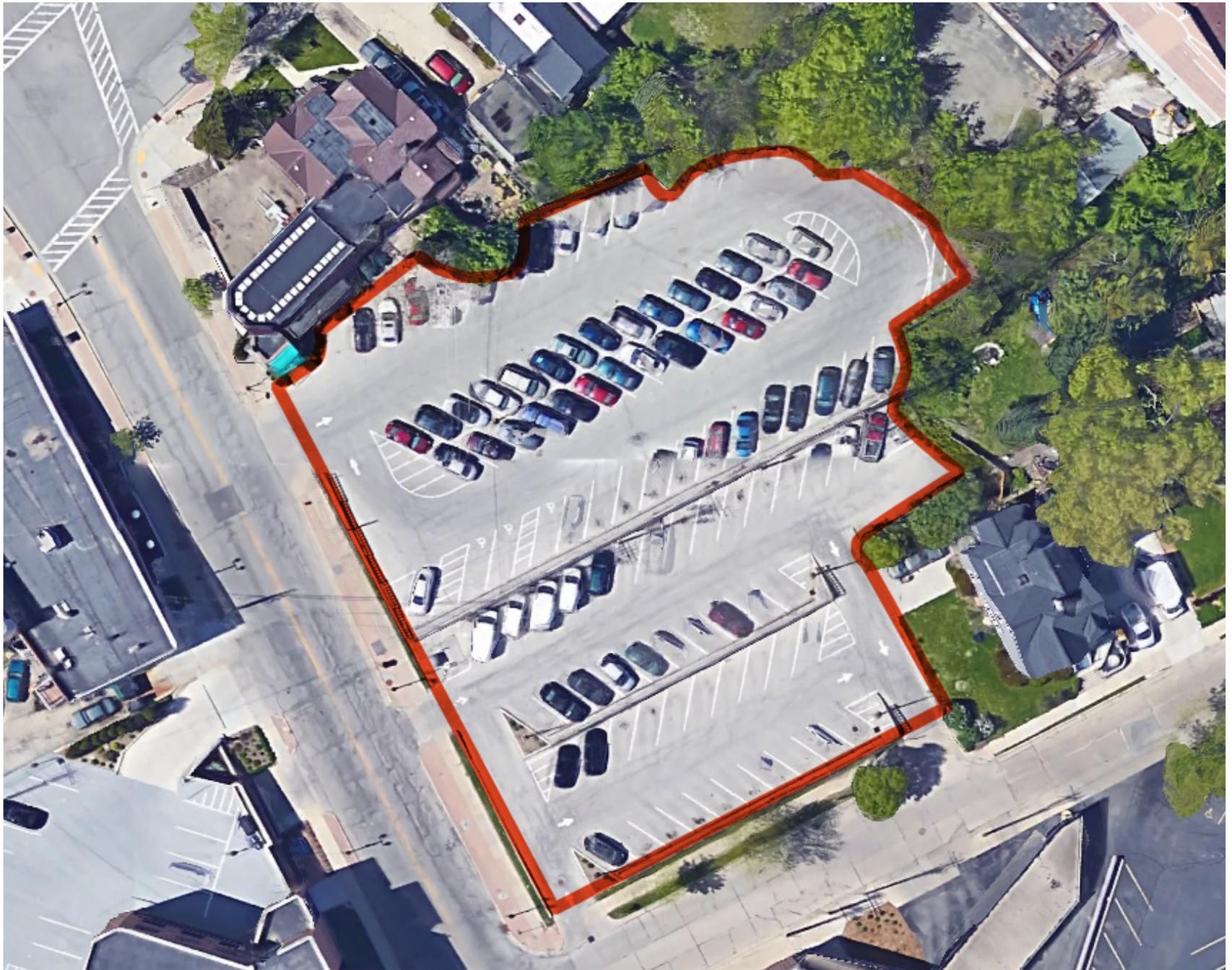
Conversion of turfgrass to native landscaping was modeled by changing the soil type from silty to sandy soil type. This represents the increased infiltration capacity created through establishment of deep-rooted native plantings and possible soil amendments.



Pabst Brewery, Milwaukee



Mequon Nature Preserve



WHAT'S THE IMPACT: NEW STANDARDS FOR PARKING LOT LANDSCAPING

Code Revision: Encouraging use of bioretention areas with curb cut inlets as parking lot landscaping

24.12.020 Perimeter Vehicular Use Area Landscaping and

24.12.030 Interior Vehicular Use Area Landscaping

The integration of depressed bioretention areas used for landscaping and stormwater management is are strongly encouraged. Where perimeter areas are designed specifically for stormwater management, the planting and dimensional requirements of 24.12.020(B)(1) above may be varied as necessary to ensure that the area functions effectively for stormwater treatment, so long as in the judgment of the [plan commission, city engineer] an equivalent amount of landscaping, planting or screening is provided.

Site: Parking lot redevelopment (total parking area 0.46 acre)
Addition of 2,310 square feet in bioretention

Runoff volume
reduction: **46%**

Total suspended solids
reduction: **59%**



WHAT'S THE IMPACT: SUBSTITUTING NATIVE VEGETATION FOR TURFGRASS

Code Revision: Encourage use of natives in lawn areas and limit total percent of site in turfgrass

Chapter 122 – ZONING

Landscaping. A general description of landscaping standards, screening, and parking lot treatments. Naturalized landscaping, the use of native vegetation, preservation of existing trees and wooded area, and tree planting that will provide additional tree canopy on the site are encouraged. The use of turfgrass should be limited to those areas intended for outdoor recreation or gathering areas.

Site: Non-residential development (lawn area 1.74 acres)
Substitution of native vegetation for entire lawn area⁷

Runoff volume
reduction: **74%**

Total suspended solids
reduction: **64%**



WHAT'S THE IMPACT: REDUCING TOTAL IMPERVIOUS AREA ASSOCIATED WITH PARKING

Code Revision: Reduce minimum parking ratio (spaces required per square foot of building area) and set a maximum number of drive-through lanes. A retrofit of the site would require the removal of two drive-through lanes to be in conformance with the ordinance.

Sec. 13-1-92 Parking Requirements.

(k) The Following Guide Specifies the Minimum Number of Parking Spaces Required.

(2) Retail Sales and Customer Service Uses; Places of Entertainment. Retail sales and customer service uses, and places of entertainment, except as specifically set forth below: one (1) space per two hundred (200) ~~one hundred fifty (150)~~ square feet of gross floor area of customer sales and service, plus one (1) space per two hundred (200) square feet of storage and/or office gross floor area, or if the use has at least eighty thousand (80,000) square feet gross floor area, one (1) space per two hundred (200) square feet of gross floor area.

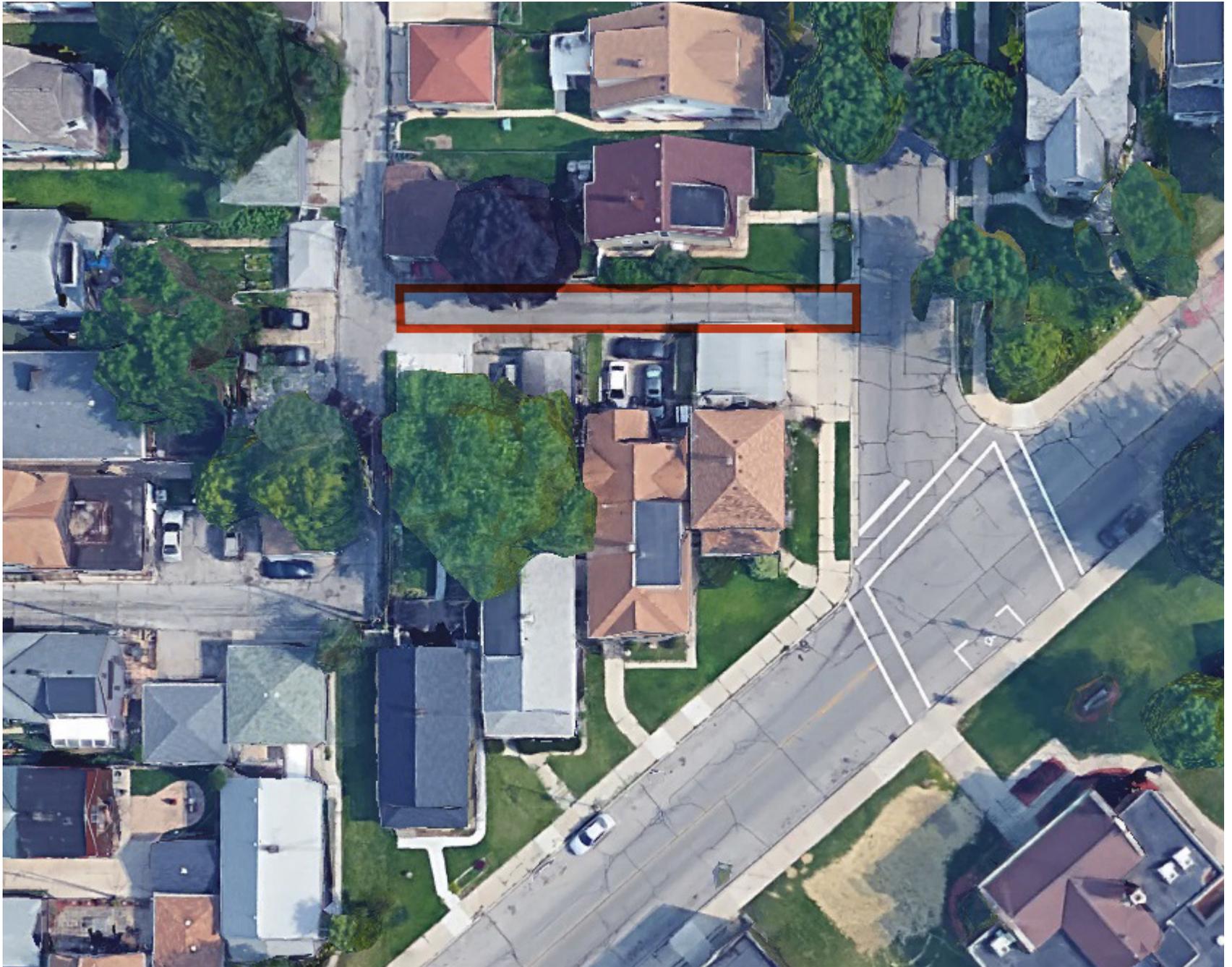
a. Financial Institutions: One (1) per two hundred (200) ~~one hundred fifty (150)~~ square feet of gross floor area of customer sales and service, plus one (1) space per employee for the work shift with the largest number of employees. Financial institutions with drive-through service facilities shall provide sufficient space for up to four (4) waiting vehicles at each drive-through service lane.

Site: Commercial bank (total drainage area 33,000 square feet)

- Remove two drive-through lanes
- Park at 5.5 spaces/1,000 square feet = 44 spaces instead of 64 spaces
- 21% impervious cover reduction (convert impervious to turf grass⁸)

Runoff volume
reduction: **19%**

Total suspended solids
reduction: **23%**



WHAT'S THE IMPACT: PERMEABLE ALLEYS

Code Revision: Allow use of permeable surfacing in driveways and alleys

(3) Surfacing. All driveways shall be surfaced in accordance with village standards and specifications so as to provide a durable and dust-free surface, and shall be so graded and drained as to dispose of all surface water. Permeable surfacing may be used upon review and approval by the village engineer.

Site: Residential alleyway (total drainage area 25,000 square feet)

Replace 5,600 square feet with permeable pavement

Runoff volume
reduction: **63%**

Total suspended solids
reduction: **63%**



WHAT'S THE IMPACT: LANDSCAPING WITH NATIVE GRASSES, TREE PLANTINGS AND BIORETENTION

Code Revision: Encourage use of bioretention as landscaping and landscape-based stormwater control

- i. All yards sodded or seeded on at least 4 inches of topsoil. Rain gardens defined in the Chapter may be incorporated into lawn areas where planned and designed to receive drainage or runoff.
- ii. Trees and shrubbery appropriate for the development, and according to the plan approved under subsection (a) above. The incorporation of amended soil areas, stormwater trees, and other vegetative stormwater control measures into landscaping plans is encouraged.

(c) Parking Lot Landscaping

1. Landscaping shall be provided on the perimeter and within the interior of all parking areas to provide screening, canopy cover, and stormwater treatment and control. The integration of vegetated stormwater control measures with parking lot landscaping is strongly encouraged. All landscaped areas shall be mulched or seeded in keeping with the overall landscaping plan. The Village may maintain a list of accepted species of tree and landscaping materials, including plants and trees suitable for use in vegetated stormwater control measures.
2. In parking lots, at least 5% of the interior parking area shall be landscaped with planting, and one tree of a minimum 2-inch caliper, for each 10 spaces, all as shall be submitted and approved as part of the plan provided for herein above. Planting required within the parking lot shall be in addition to, and not in lieu of, other planting requirements, such as for street trees. The planting plan may be varied to accommodate the design of vegetated stormwater control measures, so long as the total number of required trees is met within the overall parking area. The use of deciduous trees (which may function as stormwater trees, as defined in the Chapter) is encouraged to provide canopy shading within parking areas. Each interior landscaped area shall be a minimum of 75 square feet in size.

Site: Non-residential development (total area 4.12 acres)

- All parking areas drain to bioretention treatment or tree boxes (10,000 square feet)
- Rooftop drains to rain gardens in landscaped areas surrounding building
- Access drive drains through native vegetation filter strip
- All turfgrass replaced with native vegetation

Runoff volume
reduction: **56%**

Total suspended solids
reduction: **64%**



UWM School of Freshwater Sciences, East Greenfield Ave

APPENDIX 1

Sample Zoning Definitions for Green Infrastructure Practices

The following are examples of definitions of different green infrastructure practices. Providing an umbrella definition of “green infrastructure” or “vegetated stormwater management measures” is one way to enable green infrastructure in landscaped areas without the need to differentiate among such terms as “bioswale,” “bioretention area,” “rain garden” or “vegetated swale.”

Note that these definitions should be tailored to match the language structure of your local ordinance and to reflect local or state definitions and codes.

Green Infrastructure. Green infrastructure refers to those methods of stormwater treatment and control that use the natural capacities of soil and vegetation to prevent or reduce stormwater runoff and associated nonpoint source pollution. Green infrastructure methods often are combined with conventional or structural stormwater treatment systems, such as separators, ponds or underground systems, to create stormwater “treatment trains” that enhance stormwater treatment and water quality.

Amended soil areas. Amended soil areas are landscaped portions of a site where decomposed organic material has been incorporated into the soil to improve its performance for infiltration and growing

vegetation, enabling the area to function as a vegetated control measure.⁹

Best management practice, or BMP. Best management practice, or BMP, means structural or nonstructural measures, practices, techniques or devices employed to reduce peak flows and minimize sediment or pollutants carried in runoff.

Bioswale. Bioswale means a vegetated, mulched or xeriscaped channel that provides treatment and retention as it moves stormwater from one place to another.

Bioretention area or rain garden. A bioretention area or rain garden is an excavated area that is back-filled with a prepared or amended soil mixture, covered with a mulch layer and planted with a diversity of woody or herbaceous vegetation to which stormwater is directed to promote infiltration and evapotranspiration.¹⁰

Cistern. A roof runoff collection system that detains water in above-ground or underground storage tanks with a capacity of at least 100 gallons.¹¹

Connected imperviousness. Connected imperviousness means an impervious surface that is directly connected to a separate storm sewer or water of the state via an impervious flow path.

Critical time. Critical time means the period starting at the time of peak rainfall

intensity with a duration equal to the time of concentration of the watershed.

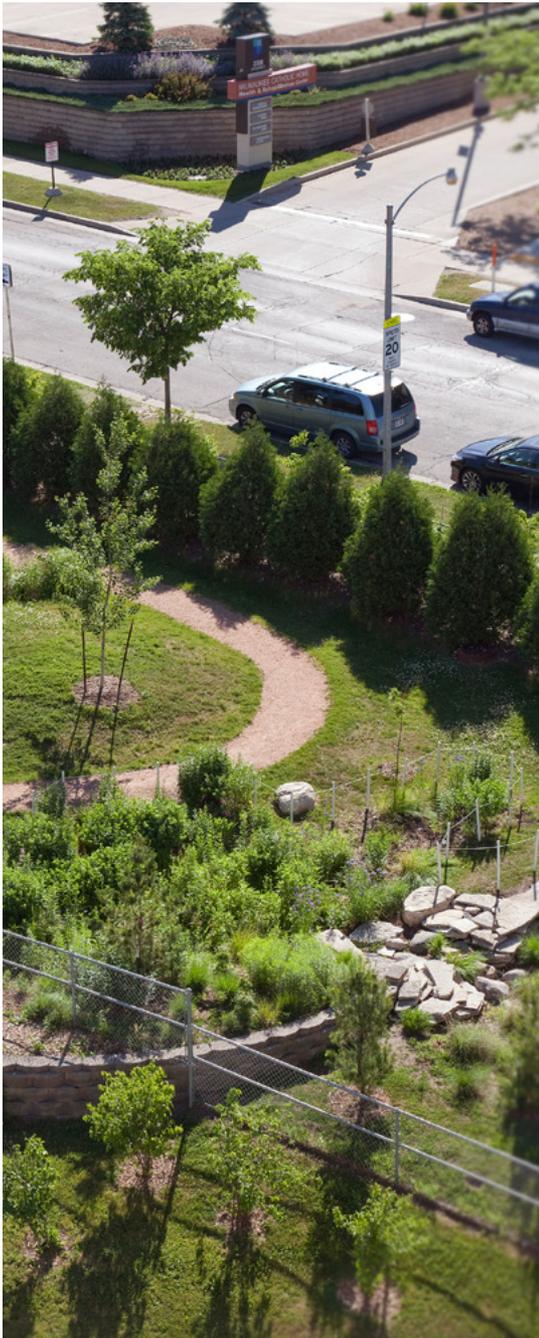
Downspout disconnection. Downspout disconnection means the rerouting of rooftop drainage pipes that are connected to storm sewers or that drain to impervious areas in order to drain rainwater to rain barrels, cisterns or permeable areas.

Green roof. An engineered roofing system that includes vegetation planted in a growing medium above an underlying waterproof membrane material designed to reduce the volume of stormwater runoff from building roofs.¹²

Green wall. The use of a supporting structure or wall panel that enables plants to grow vertically along the façade of a building or structure to provide air and water quality functions as well as aesthetic enhancement.

Impervious surface. Any pavement or structural element that prevents rain, surface water runoff or melting snow from infiltrating into the ground, including, but not limited to roofs and paved roads, driveways and parking lots.¹³

Permeable surfacing. A material or materials and accompanying subsurface treatments designed and installed specifically to allow stormwater to penetrate into it, reducing the volume of stormwater runoff



from the surfaced area. Permeable surfacing may include paver blocks, grassy pavers or similar structural support materials and permeable concrete or asphalt.

Planter box. Planter box means a structure with vertical walls and an open or closed bottom that may be attached to a building or structure and is planted with a soil medium and vegetation intended to collect, absorb and treat runoff from impervious surfaces.

Pocket wetlands. Pocket wetlands are small (typically under 1,000 square feet) constructed wetlands designed to reduce peak flows and runoff volumes, and remove pollutants via settling and bio-uptake.¹⁴

Rain barrels. Rain barrels are structures for the collection of roof runoff in containers, typically ranging from 50 to 100 gallons, with subsequent release to landscaped areas.¹⁵

Stormwater trees. Stormwater trees are trees selected and installed (either with or without an engineered box or structure) as integral components of a stormwater management plan, at points or sites where the tree(s) will have the effect of increasing the coverage of tree canopies to provide stormwater interception and evapotranspiration, stormwater uptake and increased infiltration.

Vegetated control measures. The term “vegetated control measures” refers to vegetated swales, bioretention areas, rain gardens, amended soil landscape areas, pocket wetlands, stormwater trees or similar plantings that are designed and intended to provide stormwater treatment and control, and to promote evapotranspiration and infiltration of stormwater.

Vegetated swales. Vegetated swales are stormwater conveyance systems routing stormwater flows through vegetated areas in a natural elongated depression or a constructed channel. A vegetated infiltration swale differs from a conventional drainage channel or ditch because it is constructed specifically to promote infiltration.

Maryland Avenue Montessori School rain garden, Milwaukee

APPENDIX 2

Green Infrastructure Resources

Wisconsin Regulations

Wisconsin Department of Natural Resources Chapter NR 151 — Runoff Management

bit.ly/RunoffManagement

Wisconsin Department of Natural Resources Conservation Practice Standard 1008 — Permeable Pavement

bit.ly/PermeablePavement

Wisconsin Department of Natural Resources Conservation Practice Standard 1004 — Bioretention for Infiltration

bit.ly/Bioretention

Wisconsin Department of Natural Resources Conservation Practice Standard 1002 — Site Evaluation for Stormwater Infiltration

bit.ly/StormwaterInfiltration

Wisconsin Department of Natural Resources Non-Agricultural Revisions to Chapter NR 151, Runoff Management Rule

bit.ly/RunoffManagementRule

Valuing Green Infrastructure

Banking on Green: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-wide.

American Rivers, American Society of Landscape Architects, ECONorthwest and Water Environment Federation, 2012.

Explores economic impacts of stormwater and how green infrastructure can help offset these costs.

bit.ly/BankingGreen

Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs. U.S. Environmental Protection Agency, 2013.

Uses 13 case studies from across the United States using various economic methods to determine cost-benefit analysis of green infrastructure and low-impact development projects.

bit.ly/EPASudies

Green Infrastructure for Climate Resiliency. U.S. Environmental Protection Agency, 2014.

Identifies how green infrastructure can help communities build climate resiliency.

bit.ly/2ehcGQN

The Value of Green Infrastructure: Guide to Recognizing Its Economic, Environmental and Social Benefits. American Rivers and Center for Neighborhood Technology, 2010.

Outlines the multiple economic, environmental and social benefits of green infrastructure and how to assess these diverse benefits to guide decision making.

bit.ly/GreenInfrastructureBenefits

The Value of Green Infrastructure for Urban Climate Adaptation. Center for Clean Air Policy, 2011.

Identifies benefits of green infrastructure to communities to manage extremes in precipitation and temperature.

bit.ly/UrbanClimateAdapt

Financing and Implementation of Green Infrastructure

Getting to Green: Paying for Green Infrastructure: Financing Options and Resources for Local Decision-Makers. U.S. Environmental Protection Agency, 2014.

Helps municipalities develop financial strategies and identify funding opportunities for green infrastructure.

bit.ly/PayingforGreen

Green Infrastructure Opportunities that Arise During Municipal Operations. U.S. Environmental Protection Agency, 2015.

Uses case studies to demonstrate how green infrastructure can be integrated into public works projects and includes discussion of cost and benefits, review plans and maintenance.

bit.ly/EPANEP

Managing Stormwater in Redevelopment and Greenfield Development Projects Using Green Infrastructure Economic Factors that Influence Developers' Decisions. ECONorthwest, 2011.

Covers stormwater management regulations and their impact on greenfield and redevelopment projects from the point of view of the developer.

bit.ly/ManagingStormwater

Reducing Stormwater Costs through Low Impact Design Strategies and Practices. U.S. Environmental Protection Agency, 2007.

Includes 17 case studies of developments that incorporated low-impact development, reduced project costs and improved environmental performance.

bit.ly/ReducingStormwaterCosts

Maintenance

Elements of a Green Infrastructure Maintenance Business Plan

U.S. Environmental Protection Agency, 2015.

This U.S. EPA report reflects findings from Milwaukee Metropolitan Sewerage District and local stakeholders regarding the suitability of different business models for conducting maintenance for developing a regional green infrastructure maintenance program.

bit.ly/MaintenanceBusinessPlan

Green City, Clean Waters: Green Infrastructure Maintenance Manual Development Process Plan. Philadelphia Water Department, 2012.

This plan outlines the process of developing a green infrastructure maintenance manual, including evaluating maintenance protocols, developing protocols, checklists and schedules; maintenance contract agreements; program evaluation; and budget development.

bit.ly/GreenCityCleanWaters

Staying Green: Strategies to Improve Operations and Maintenance of Green Infrastructure in the Chesapeake Bay Watershed. American Rivers. This report examines some of the major barriers to effective operations and maintenance of green infrastructure practices in the Chesapeake Bay region and identifies strategies and best practices that local governments, practitioners and other groups are using to develop and improve maintenance practices.

bit.ly/StayingGreen

Green Stormwater Operations and Maintenance Manual. Seattle Public Utilities, 2009.

This Seattle Public Utilities manual summarizes routine maintenance activities for the design of Natural Drainage System (NDS) Projects and includes a chart for scheduling and performing maintenance activities and images and descriptions for vegetation, hardscape, infrastructure and infiltration rates.

bit.ly/GreenStormwater

The Importance of Operation and Maintenance for the Long-Term Success of Green Infrastructure. U.S. Environmental Protection Agency, 2013.

This report examines the operation and maintenance practices of 22 green infrastructure and highlights opportunities and challenges associated with green infrastructure O&M.

bit.ly/LongTermSuccess

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FOOTNOTES

- ¹ Systems include shared parking formulas, sample agreements and recording documents. These can ensure that as shared or off-site parking plans are developed they will be consistent with what is already acceptable to the municipal attorney and the burden is not on the applicants to develop these documents, which can make the cost and uncertainty go up significantly.
- ² State regulatory agencies, such as the Wisconsin Department of Natural Resources, provide technical standards and guidance for permeable surfacing. See Appendix 2. Green Infrastructure Resources.
- ³ Vegetated swales are graded, open and shallow engineered channels that help reduce peak stormwater discharge flow volumes and rates. The design of swales promotes the conveyance of stormwater at a slower, controlled rate and allows them to act as a filter medium, removing pollutants and allowing stormwater infiltration. Swales must be carefully designed and maintained to function properly. The vegetation is typically made up of flood-tolerant, erosion-resistant plants, such as thick grass.
- ⁴ The underdrain, standpipe and weir are filtration design parameters that ensure sufficient rapid drawdown of water within the bioretention practice if it were to become clogged or blocked. This safeguards against flooding, and subsequently, the possible death of the plants within the bioretention practice.
- ⁵ The engineered soil is the growing medium for plants in the bioretention practice. Sand and compost were specified to provide well-drained nutrient-enriched soil. Engineered soil infiltration rate was assumed to be 3.6 inches per hour with a void ratio of 0.27.
- ⁶ Rock is placed under the engineered soil to serve as a storage area for stormwater to reduce peak flows, store the water to allow infiltration and allow for the filtration of solids. Void ratio in stone storage was assumed to be 0.33.
- ⁷ Landscaped areas represent 26% of the total office park source area.
- ⁸ The addition of 5,700 square feet of bioretention in place of turf grass results in further reductions in runoff volume and total suspended solids (48% and 60.4%, respectively).
- ⁹ Adapted from Milwaukee Metropolitan Sewerage District Surface & Storm Water Rules Guidance Manual, Appendix L: Low Impact Development Documentation (24).
- ¹⁰ Adapted from Wisconsin Department of Natural Resources Conservation Practice Standard 1004, Bioretention for Infiltration; Conservation Practice Standard 1003, Infiltration Basin (25).
- ¹¹ Adapted from Milwaukee Metropolitan Sewerage District Surface & Storm Water Rules Guidance Manual, Appendix L: Low Impact Development Documentation (24).
- ¹² Adapted from Milwaukee Metropolitan Sewerage District Surface & Storm Water Rules Guidance Manual, Appendix L: Low Impact Development Documentation (24).
- ¹³ Adapted from Milwaukee Metropolitan Sewerage District Rules and Regulations, Chapter 13: Surface Water and Storm Water (26).
- ¹⁴ Adapted from Milwaukee Metropolitan Sewerage District Surface & Storm Water Rules Guidance Manual, Appendix L: Low Impact Development Documentation (24).
- ¹⁵ Adapted from Milwaukee Metropolitan Sewerage District Surface & Storm Water Rules Guidance Manual, Appendix L: Low Impact Development Documentation (24).

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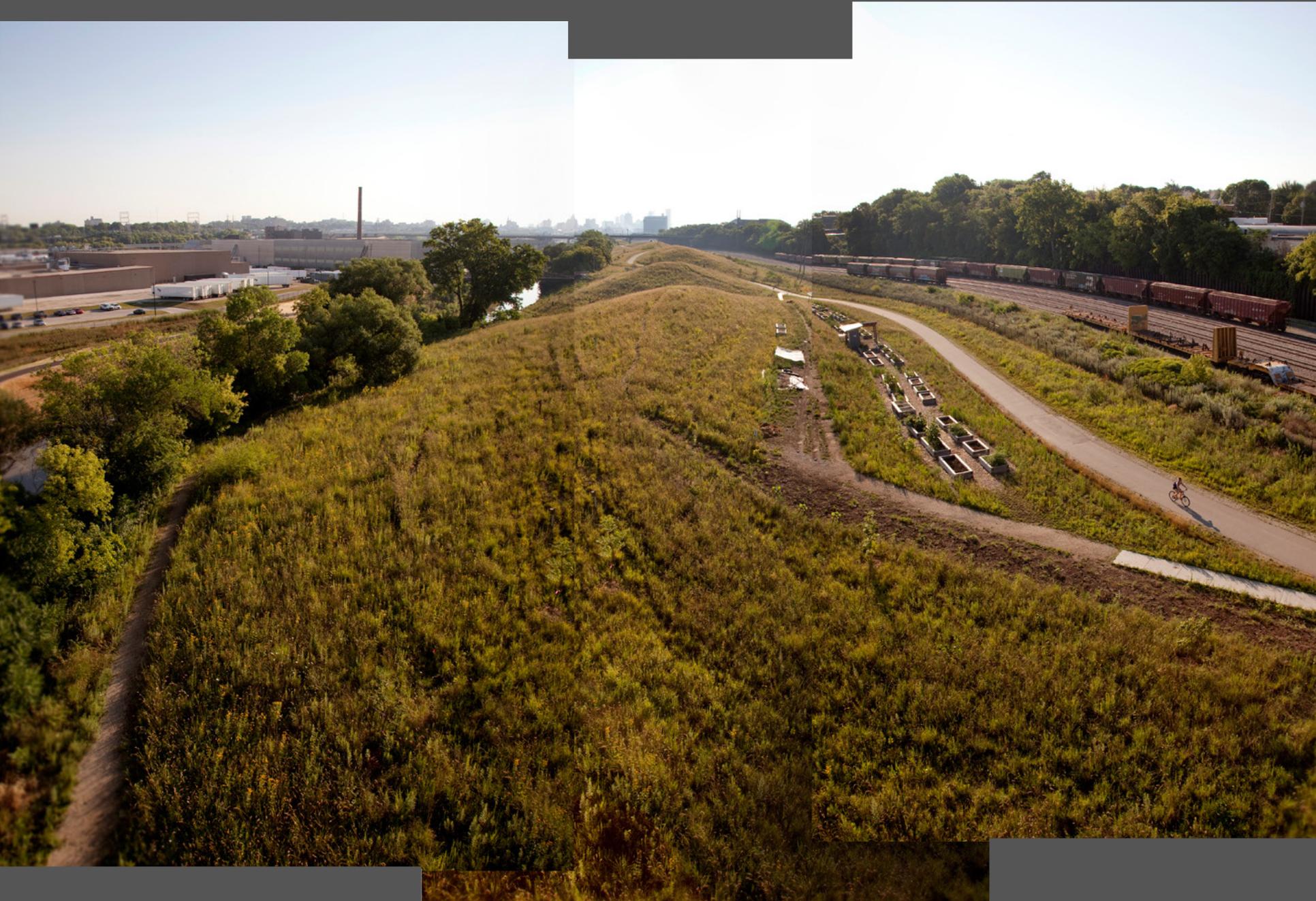
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Menomonee Valley Redevelopment and Community Park

“Examine each question in terms of what is ethically and aesthetically right, as well as what is economically expedient. A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.”

— Aldo Leopold, *A Sand County Almanac and Sketches Here and There*

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USING THE AUDIT TOOL

The goals of the audit tool are:

1. Identify regulations that prohibit or are ambiguous, contradictory or silent on the use of green infrastructure practices
2. Identify regulations pertaining to parking, frontage and streetscapes that could be updated and amended to reduce impervious surfacing requirements
3. Identify conditional uses in zoning districts that are potential sources of stormwater pollution and determine if additional standards are in place to protect water quality

Questions related to impervious surfacing requirements — parking standards, roadway widths, public safety access areas, etc. — are also included in the audit because the reduction of impervious surfaces and effective impervious areas reduces the volume of stormwater that must be managed, and can significantly improve water quality in a community's rivers and streams.⁽²³⁾

The worksheets also include questions regarding supplemental standards and review requirements for conditional or “hot spot” land uses. These are special land uses that have a higher potential to contribute to stormwater runoff pollution and include animal-related facilities; establishments producing grease and food waste; contractor and municipal yards with outdoor storage areas; landscaping and garden centers with outdoor use of water, pesticides and fertilizers; and gas stations and any type of vehicle repair or fueling station. Stormwater runoff from these types of land uses can be significant sources of bacteria and pathogens, sediment, nutrients and toxic chemicals.

Each worksheet addresses a key code and ordinance topic area where green infrastructure and impervious surfacing barriers are found. The topic areas are:

- Architectural Design Standards
- Coastal Hazards
- Community Outreach and Education
- Construction and Post-Construction Management
- Landscaping
- Parking
- Permeable Materials and Surfacing
- Pollutant Reduction Through Site Plan Review
- Post-Construction Stormwater Standards and Long-Term Maintenance
- Public Works Standards
- Purpose Statements and Community Plans
- Sanitary and Storm Sewer Disconnections
- Stormwater Management Standards
- Subdivisions and New “Greenfield” Development
- Zoning

Questions for each of these topics have been developed to determine if existing codes and ordinances are preventing green infrastructure implementation or resulting in the spread of impervious surfaces. Code language is considered a barrier to green infrastructure implementation if it:

- Contains language prohibiting or unintentionally discouraging the use of a green infrastructure practice;
- Includes ambiguous language regarding the use of a green infrastructure practice;
- Is silent on the topic or practice with no statement that expressly identifies green infrastructure as a potential, acceptable practice; or
- Allows a practice in one area of the code but is negated or disallowed in another.

Scoring

The worksheets provide a scoring matrix indicating whether a code, policy or operation is enabling, conditional, ambiguous, discouraging or conflicted with regard to green infrastructure. While a clear “yes,” “no” or “question” response would be ideal, in practice, an answer to a question is often more nuanced. For example, a “yes” response may be dependent upon staff approval. Your community’s audit team can modify this scoring matrix to suit your own community’s codes and interests.

You are likely to find a practice that is permitted in one section is contradicted in a different section of the regulations. For example, pervious pavement might be allowed in one section of the code, but in another, all paved surfaces are required to be seal coated, which cancels any benefit of using permeable material. The matrix helps identify this type of internal conflict.

The “code references and language” column on the matrix will help you identify which sections in the code to review for answers for that particular question. It may be necessary to check several areas within the code to determine if a practice is fully enabled or if it is restricted by other sections of the code.

Most municipal regulations are available online and can be downloaded as a document. As you use the worksheets to work through the codes and ordinances, highlight the language in the particular regulation for potential amendment and make note of it on the worksheets for easy reference.

EXAMPLE OF GRADING MATRIX CLASSIFICATIONS

Examples of code language for each classification and [justification or explanation]

Do parking lot edge landscaping requirements (islands and edges) specifically allow or encourage use as stormwater control areas? Is a standard adopted?		
Grade	Classification	Details and comments
A+	Practice is enabled and described specifically; clearly allowed and approved as-of-right	Perimeter landscape areas shall be designed and installed to function as stormwater management areas or, where not required for stormwater management, to provide naturalized landscaping. A combination of vertical features such as green walls and fencing, along with a mix of plantings, shall be used to provide sufficient visual screening of the parking lot area. [Landscape areas are clearly intended to be designed for stormwater management function.]
A	Practice is specifically allowable/as-of-right approval, but some ambiguity or potential conflict	The use of perimeter landscape areas to infiltrate and treat stormwater is strongly encouraged; however, the plan commission shall require at a minimum one tree or woody shrub every ten (10) linear feet within the perimeter landscape area. [Encourages use of landscaping for stormwater management, but requires woody plantings at specific intervals that could conflict with bioretention designs.]
A-	Practice is enabled or encouraged, with discretionary approval	The use of perimeter landscape areas for bioretention, swales or other stormwater may be approved by the plan commission so long as the visual screening intent of this Section is accomplished through a combination of fencing, tree planting and vegetation. [The plan commission has discretionary approval (may or may not approve) and the listed standards for what the applicant must accomplish are not specific.]
B	Practice is mentioned but without standards or guidance for use	Portions of perimeter landscape areas may be designed as swales if approved by the plan commission. [Approval is discretionary and standards for what situations would be approvable are not specified.]
C	No policy or standards adopted, but not disallowed	Perimeter landscape areas shall be designed to accomplish 75% opacity within two years of planting. [While it can be difficult to design a perimeter landscape as a bioretention area and to achieve 75% opacity, it is potentially allowable.]
D	Limitations or prohibitive language in the code, but could potentially be approved	Perimeter landscape buffers shall be comprised of landforms, lawn areas, ground cover, shade trees, flowering trees, evergreen trees, shrubs and flowers. [While stormwater management or bioretention is not specifically prohibited, neither bioretention nor 'grasses' are listed; language "shall be" often interpreted to mean that no plantings or uses are allowed other than those listed.]
F	Practice prohibited by code language, or an active conflict would prevent approval	Perimeter landscape areas shall be graded into a berm or landform with a minimum slope of 2:1 topped by a planting plan that will form a dense evergreen screen within two years of planting. [Does not allow for water inflow or native plantings.]

EXAMPLE OF COMPLETED AUDIT TOOL QUESTIONS

An example of a completed Architectural Design Standard section of the audit tool

Are rainwater-harvesting and stormwater-control elements acknowledged in design standards?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Design guidelines Architectural standards	Include illustrations or definitions of green roofs, planter boxes and cisterns; this ensures reviewers and designers will know that these elements are allowed or encouraged.	None. No mention of “rain barrel” or “cistern” anywhere in our municipal code, zoning or historic district, but it doesn’t say that they are not allowed. Zoning administration hasn’t had complaints but wonders if they’re legal within the required setbacks. [Select B for “not mentioned, not prohibited.”]	Add to the list of accessory structures in Section 24.3 that are exempt from zoning permits and setbacks, “a maximum of two rain barrels or cisterns up to 100 gallons each.” Ask at landscape center whether people have requested or bought larger rainwater tanks. Discuss if bigger tanks should require plan commission review during upcoming meeting on misc. zoning issues.	B

Are green infrastructure practices suitable for high-density areas (e.g., planter boxes, cisterns) allowed to extend into the right-of-way or onto sidewalks?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Design guidelines Architectural standards Table of dimensional standards	Most zoning ordinances specify what elements, like awnings or signs, may extend into the public right-of-way. Planter boxes and cisterns often need to be added to this list and allowed to extend at least 24 inches into the right-of-way or other setbacks.	Village Code Chapter 8.3(b) states, “No portion of any building or structure may extend into the right-of-way.” Zoning administration says a structural planter box might be allowed if trustees approved it but isn’t sure. [Select D for “prohibitive language, but possible option for approval.”]	Ask university extension staff for photos of planter boxes along village street and in other communities so the Architectural Advisory Committee can see what these look like and make a recommendation.	D

Do design standards allow siting of stormwater-control measures along façade?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Design guidelines Architectural standards Zoning setbacks	Zoning often will limit the structures that can be attached to a building façade or located within a setback. Codes should specify that rain barrels or cisterns and planter boxes may be sited along façades or extend into setbacks.	Village Design Guidelines show photos and illustrations of planter boxes along façades, but they don't say that they're for "stormwater control" or give allowable dimensions. [Select A- for "allowable, but no specific guidance or standards."]	In our next revision, add a note to the Design Guidelines that states: "Planter boxes are designed to treat stormwater runoff and approval by the village engineer is encouraged." Have the municipal planner make a note that planter boxes should be encouraged when talking to applicants.	A-

Do standards allow for the waiver of design or architectural provisions to accommodate stormwater-control measures (planters, cisterns, green roofs, etc.)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Design guidelines Architectural standards Zoning setbacks	Where a community provides for waivers of architectural standards, "siting of green infrastructure measures" should be a specific reason for the grant of a waiver.	The Historic Overlay District prohibits "non-historic features" from being attached to any building façade or sited in a front yard. [Select D for "limitations or prohibitive language in the code, but could potentially be approved."]	Could argue that rain barrel was used historically and not as limiting as "rain barrels shall not..." Add language allowing waivers from historic standards or roof design upon compatibility review by a design or historic commission.	D

Are pitched roofs required? If so, is a waiver or provision for green roofs or rainwater harvesting made?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Design guidelines Architectural standards Zoning setbacks	If design standards require pitched roofs of a certain slope (i.e., 3:1) or for buildings to match adjacent roof pitches, some allowance for changing pitch should be made for rainwater harvesting or green roof installation.	Design standards require new buildings to “match the prevailing roof pitch and design of the adjacent structures” or to have a minimum pitch. Select D for “limitations or prohibitive language in the code, but could potentially be approved.”]	Add language allowing a waiver where the review board finds that the intent of the regulations is met. Consult with a local architect on how to illustrate a compatible design that doesn’t “match” the roof pitch.	D

Are green infrastructure practices suitable for high-density areas allowed or encouraged in streetscapes (e.g., tree boxes, sidewalk bioretention areas, curb bump-outs)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Design guidelines Streetscape standards Architectural standards	Streetscape standards often need amendments to specifically enable stormwater trees, sidewalk bioretention or curb bump-outs to be included in renovated or new streets.	The streetscape for all new buildings in a commercial sub-district requires a specific pattern of concrete sidewalk and curbing at the end of each block. [Select F for “Practice prohibited by code language, or an active conflict would prevent approval.” Would likely require a code change to achieve.]	Cannot deviate from the adopted standard that precludes incorporation of green or vegetated features. Add a supplemental illustration and text showing an option for a curb bump-out that incorporates plantings and bioretention. Provide these alternatives to the city engineer for review.	F

YOUR GREEN INFRASTRUCTURE AUDIT

The grading matrix helps indicate whether a code, policy or operation is enabling, conditional, ambiguous, discouraging or conflicted with regards to green infrastructure. An example of an audit question and grading follows.

Most municipal regulations are available online and can be downloaded as a document. As you use the worksheets to work through the codes and ordinances, highlight the language in the particular regulation for potential amendment and make note of it on the worksheets for easy reference.

Record your grades on the report card in this book or download at gowisc.edu/greenreportcard.

A+	Practice is enabled and described specifically; clearly allowed and approved as-of-right
A	Practice is specifically allowable/ as-of-right approval, but some ambiguity or potential conflict
A-	Practice is enabled or encouraged, with discretionary approval
B	Practice is mentioned but without standards or guidance for use
C	No policy or standards adopted, but not disallowed
D	Limitations or prohibitive language in the code, but could potentially be approved
F	Practice prohibited by code language, or an active conflict would prevent approval

ARCHITECTURAL DESIGN STANDARDS

Design guidelines, architectural standards, streetscape designs and specific dimensional standards in zoning may need to be modified to enable green infrastructure practices. Reviewing standards with an eye to whether practices such as planter boxes, curb bump-outs, rainwater harvesting cisterns or green roofs would be allowed can highlight areas that may need revision.

Are rainwater-harvesting and stormwater-control elements acknowledged in design standards?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Design guidelines Architectural standards	Include illustrations or definitions of green roofs, planter boxes and cisterns; this ensures reviewers and designers will know that these elements are allowed or encouraged.			

Are green infrastructure practices suitable for high-density areas (e.g., planter boxes, cisterns) allowed to extend into the right-of-way or onto sidewalks?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Design guidelines Architectural standards Table of dimensional standards	Most zoning ordinances specify what elements, like awnings or signs, may extend into the public right-of-way. Planter boxes and cisterns often need to be added to this list and allowed to extend at least 24 inches into the right-of-way or other setbacks.			

Do design standards allow siting of stormwater-control measures along façade?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Design guidelines Architectural standards Zoning setbacks	Zoning often will limit the structures that can be attached to a building façade or located within a setback. Codes should specify that rain barrels or cisterns and planter boxes may be sited along façades or extend into setbacks.			

Do standards allow for the waiver of design or architectural provisions to accommodate stormwater-control measures (planters, cisterns, green roofs, etc.)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Design guidelines Architectural standards Zoning setbacks	Where a community provides for waivers of architectural standards, “siting of green infrastructure measures” should be a specific reason for the grant of a waiver.			

Are pitched roofs required? If so, is a waiver or provision for green roofs or rainwater harvesting made?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Design guidelines Architectural standards Zoning setbacks	If design standards require pitched roofs of a certain slope (i.e., 3:1) or for buildings to match adjacent roof pitches, some allowance for changing pitch should be made for rainwater harvesting or green roof installation.			

Are green infrastructure practices suitable for high-density areas allowed or encouraged in streetscapes (e.g., tree boxes, sidewalk bioretention areas, curb bump-outs)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Design guidelines Streetscape standards Architectural standards	Streetscape standards often need amendments to specifically enable stormwater trees, sidewalk bioretention or curb bump-outs to be included in renovated or new streets.			

COASTAL COMMUNITIES

Located at the end of the watershed “pipe,” coastal communities face unique challenges related to stormwater management, including beach swimming advisories, excess nutrients and eutrophication, and coastal erosion. Taking a look at local codes and ordinances that deal with stormwater outfalls, ravine and bluff protection, and erosion control can help reduce the amount of sediment and contaminants entering coastal areas.

Is protection of bluffs and ravines described in the Comprehensive Plan and ordinance?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Comprehensive plan Zoning Special purpose ordinance	Provide a policy basis in the comprehensive plan that supports the adoption and revision of standards, such as, “Adopt setbacks and planting standards that will lead to the creation of a buffer along vulnerable bluffs and ravines.”			
Are there review procedures over and above other code provisions for activities in proximity to bluffs and ravines?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Comprehensive plan Zoning Special purpose ordinance	Requiring setbacks for new or expanded structures and impervious surfaces, and limitations on clearing or grading where erosion could be exacerbated are common provisions of a bluff and ravine protection ordinance.			

Grades:

Are there provisions or setbacks from bluffs and ravines for new or expanded structures?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Comprehensive plan Zoning Special purpose ordinance	Requiring setbacks for new or expanded structures and impervious surfaces, and limitations on clearing or grading where erosion could be exacerbated are common provisions of a bluff and ravine protection ordinance.			

Are there provisions or setbacks from bluffs and ravines for new impervious surfaces?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Comprehensive plan Zoning Special purpose ordinance	Requiring setbacks for new or expanded structures and impervious surfaces, and limitations on clearing or grading where erosion could be exacerbated are common provisions of a bluff and ravine protection ordinance.			

Are there provisions on clearing and grading near bluffs and ravines?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Comprehensive plan Zoning Special purpose ordinance	Requiring setbacks for new or expanded structures and impervious surfaces, and limitations on clearing or grading where erosion could be exacerbated are common provisions of a bluff and ravine protection ordinance.			

Can foundation drain, roof leaders or sump pump discharges be sited where discharge will exit on the slope of a bluff or ravine? What is the review process, if any?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Comprehensive plan Zoning Special purpose ordinance	Ensuring some review of clear water discharges can identify cases where relocation or re-direction to a permeable or vegetated area may provide better protection against erosion.			

Has the community identified stormwater outfalls flowing directly onto beaches or into streams that flow directly to beaches?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Comprehensive plan Zoning Special purpose ordinance	Identification of outfall locations and contributing drainage areas helps prioritize investments in stormwater improvements.			

COMMUNITY OUTREACH AND EDUCATION

Local activities and investments also support implementation of green infrastructure. Pilot projects, education and training for boards, and staff training on handling inquiries about downspout disconnection or rain barrels are all important parts of a green infrastructure strategy.

Is there a local ordinance or policy limiting the application of pesticides or herbicides on public property?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal policy Staff knowledge	Pesticides and herbicides can affect soil function and capacity to absorb water and pollutants. Many communities have adopted policies or procedures limiting the use of pesticides and herbicides for noxious and invasive plants to spot treatments.			

Has green infrastructure education been provided to staff involved in plan reviews? This includes staff in public safety, engineering, parks and recreation, economic development, and planning and zoning.

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal policy Staff knowledge	Training staff, appointed boards and elected officials helps provide a common base of knowledge about green infrastructure techniques and their applicability in this climate and region.			

Has green infrastructure education been provided to planning boards and elected officials?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal policy Staff knowledge	Training staff, appointed boards and elected officials helps provide a common base of knowledge about green infrastructure techniques and their applicability in this climate and region.			

Has a rain barrel or rain garden pilot program been done in your community?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal policy Staff knowledge	Pilot projects allow the public to visit and “see for themselves” how green infrastructure techniques look and work once installed.			

Is a review or procedure in place for rain garden construction and planting native plants in yards and lawns?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal policy Staff knowledge	Having a written procedure (even if not formally adopted) for common requests greatly facilitates both the use of these techniques and managing neighbor inquiries and public concerns. It is equally important to ensure that all staff know to transfer questions to a knowledgeable person or department.			

Is a review or procedure in place for downspout disconnection and rain barrel installation?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal policy Staff knowledge	Having a written procedure (even if not formally adopted) for common requests greatly facilitates both the use of these techniques and managing neighbor inquiries and public concerns. It is equally important to ensure that all staff know to transfer questions to a knowledgeable person or department.			

Is a review or permit process in place to facilitate the disconnection of foundation drains?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal policy Staff knowledge	Having a written procedure (even if not formally adopted) for common requests greatly facilitates both the use of these techniques and managing neighbor inquiries and public concerns. It is equally important to ensure that all staff know to transfer questions to a knowledgeable person or department.			

Who answers inquiries and what is his or her level of knowledge?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal policy Staff knowledge	Having a written procedure (even if not formally adopted) for common requests greatly facilitates both the use of these techniques and managing neighbor inquiries and public concerns. It is equally important to ensure that all staff know to transfer questions to a knowledgeable person or department.			

CONSTRUCTION AND POST-CONSTRUCTION MANAGEMENT

Many municipal code provisions relate to how previously open and unbuilt land is managed during and after construction. Construction-phase provisions focus on limiting erosion and also on preventing damage to trees, plants and soils, all of which maintain natural functions including stormwater control. How open-space areas are planted, maintained and managed after construction also affects stormwater management and natural functions. It should be considered during development planning and review.

Does the ordinance require or promote preservation of native vegetation at development sites?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance [construction provisions] Subdivision Planned unit development	Many planned unit developments or subdivision provisions encourage or require areas of well-established or native vegetation, particularly stands of mature trees, to be incorporated into reserved open space or landscaped areas on the site where possible.			
Does the ordinance require or encourage limiting clearing and grading at development sites (e.g., construction-site phasing, clearing limit demarcation requirements, prohibitions on construction equipment storage)?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance [construction provisions]	Requiring construction phase activities and limits of disturbance to be identified is an important and straightforward measure. Inspections should include limits of disturbance, tree protection and hydric soil areas.			

Are the limits of disturbance shown on site plans required to be physically marked on the construction site?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance [construction provisions]	Requiring construction phase activities and limits of disturbance to be identified is an important and straightforward measure. Inspections should include limits of disturbance, tree protection and hydric soil areas.			

Does the ordinance include construction-phase inspection of limits of disturbance?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance [construction provisions]	Requiring construction phase activities and limits of disturbance to be identified is an important and straightforward measure. Inspections should include limits of disturbance, tree protection and hydric soil areas.			

Do site and erosion control plans require identification, site marking and protection of mature trees?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance [construction provisions] Site plan Subdivision Landscape standards	Requiring construction phase activities and limits of disturbance to be identified is an important and straightforward measure. Inspections should include limits of disturbance, tree protection and hydric soil areas.			

Are native or hydric soils required to be identified, demarcated and protected from disturbance and construction activity?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance [construction provisions]	In areas where infiltration is needed to manage stormwater or where soils are highly erodible, these should be identified on erosion control plans and specifically protected from disturbance and compaction during construction.			

Are management plans required for open space and conservation areas set aside in development?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Planned unit development	The value of open space areas for habitat, stormwater management and natural functions is affected by both vegetative cover (e.g., trees, plantings) and by management (e.g., mowing, removing invasive plants). Reviewing a plan for vegetation and management helps identify opportunities for resource protection and the level of maintenance needed.			

If open space or conservation areas are required, does a minimum percentage have to be managed in a natural condition (e.g., maintained as woodland, deep-rooted plantings or native vegetation instead of turf)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Planned unit development	The value of open space areas for habitat, stormwater management and natural functions is affected by both vegetative cover (e.g., trees, plantings) and by management (e.g., mowing, removing invasive plants). Reviewing a plan for vegetation and management helps identify opportunities for resource protection and the level of maintenance needed.			

Are there supplemental provisions for protecting or buffering wetlands that are above state requirements?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Planned unit development Supplemental regulations	Many communities require additional setbacks and/or demarcation with fencing or plantings along wetland buffers.			

Has the community identified historic stream channels and waterways? Are any of these features protected from modification or development?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Planned unit development Stormwater ordinance	Areas where historic stream channels and ponds have been filled in or modified are often prone to flooding. They may be good areas to incorporate into stormwater management features, open space or landscaping.			

LANDSCAPING

Each landscaping feature can be considered a critically important water quality protection measure. The design and management of “everyday” landscaping features — including trees, medians, tree lawns, buffer strips, landscaped borders, foundation plantings and how snow storage is handled — can greatly benefit water quality without adding cost for applicants or municipal projects.

Do preliminary or sketch plans include stormwater measures and landscape techniques for initial review?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Procedures [Site plan, Planned unit development, Subdivision]	Early review of land use concepts helps identify opportunities to integrate green infrastructure into landscaping and drainage.			

Is a consolidated plan for landscaping, grading/drainage and stormwater-control measures encouraged or required?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Procedures [Site plan, Planned unit development, Subdivision] Stormwater ordinance	Putting grading/drainage and landscaping plans on the same sheet illustrates where and how landscaping and stormwater management can be integrated.			

Is the use of deep-rooted or native plants, plants with habitat value, or edibles allowed or encouraged in the landscaping standards?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Landscape standards Design guidelines	Explicitly listing or illustrating the use of native plantings, deep-rooted plants or other alternatives to turfgrass and shrubs tells site planners up front that the community encourages these types of plantings.			

Is there a process or standard to waive numerical, spacing and species requirements for stormwater-control measures in required landscape areas?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Landscape standards Design guidelines	Specific dimensional standards, such as a requirement to space trees 25 feet apart, may conflict with the design of vegetated stormwater controls. Waivers can allow variation where needed to accommodate green infrastructure.			

Do visual buffer and screening provisions enable a variation in plantings or substitution of fencing if co-designed for stormwater?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Landscape standards Design guidelines	Codes often require buffers between properties or uses be composed of a “dense evergreen hedge” or similar. Codes can be modified to provide an option for integrating vegetated stormwater-control measures where needed using a combination of fencing and plants for screen and buffer areas.			

Do vegetated stormwater management areas such as bioretention areas, rain gardens, stormwater trees or other plantings count toward required landscape minimums?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Landscape standards Design guidelines	Requiring ornamental landscaping in addition to bioretention areas or other green infrastructure is a significant barrier; often, there will not be enough area on the site to accommodate both.			

Is berming of setback and landscape areas along right-of-ways required and/or habitually preferred as a method of visual screening?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Landscape standards Street standards Design guidelines	Requirements for berms will limit or entirely prevent the use of "edge" areas and road frontage for stormwater management.			

Are naturalized landscaping standards and requirements promoted for use in stormwater treatment practices?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance Landscape standards Subdivision	Communities may have standards that encourage or require naturalized landscaping or native plantings in and around stormwater ponds and swales.			

Are there minimum landscaping requirements for parking lots? Perimeters, islands or both (e.g., percentage of parking landscaped, number of trees per parking spaces, canopy coverage)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Site plan Parking standards Landscape standards	Parking lot landscaping —both perimeter and island — can mitigate urban heat island effects and can be co-designed as green infrastructure for stormwater treatment.			

Is there a minimum size for parking lot landscape islands?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Site plan Parking standards Landscape standards	Parking lot islands must be large enough (typically a 100-square-foot minimum) to have sufficient soil volume for healthy tree and plant growth.			

Do parking lot edge landscaping requirements (islands and edges) specifically allow or encourage use as stormwater-control areas? Is a standard adopted?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Site plan Parking standards Landscape standards	Actively encouraging the use of islands and perimeters for green infrastructure gives important direction to site planners.			

Are flush curbs and/or curb cuts allowed to direct runoff into vegetated landscaped islands?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Site plan Parking standards Landscape standards	Allowing breaks in curbs or the use of wheel stops/barriers enables co-design of islands and perimeters for storm-water, while also protecting adjacent landscaping.			

Are green walls defined or encouraged? Do they count toward required landscaping?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Landscape standards Definitions Design guidelines	Green wall systems are gaining popularity and have many applications for landscaping and screening; some definitions of “fence” may be too specific to allow green walls.			

Is turfgrass required in new subdivisions or construction? Could deep-rooted plants be substituted?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Landscape standards Site plan Stormwater ordinance [construction provisions]	Subdivision regulations often require lots to be “sodded.” Standards should state that native or deep-rooted plantings may be used, even if temporarily, on new residential lots.			

Do the standards encourage or require that turfgrass be used only for active recreation areas?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Landscape standards Site plan Stormwater ordinance [construction provisions]	In subdivisions or planned unit developments with common open space, or large-lot commercial development, limiting turfgrass to active recreation areas encourages the use of deeper-rooted plants and trees that reduce runoff volumes and sediment loads.			

Are snow storage areas required to be shown on site plans?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Landscape standards Site plan Stormwater ordinance [construction provisions]	Snow storage should be required to be shown on site plan applications. Storage should be located in areas where melting and infiltration can occur and spring residue removed, without affecting the performance of stormwater treatment practices or leading to sedimentation and pollution in adjacent streams and wetlands.			

Is snow storage in bioretention areas prohibited or discouraged, unless the area is specifically designed for snow storage (i.e., grass swales)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Landscape standards Site plan Stormwater ordinance [construction provisions]	Snow storage should be required to be shown on site plan applications. Storage should be located in areas where melting and infiltration can occur and spring residue removed, without affecting the performance of stormwater treatment practices or leading to sedimentation and pollution in adjacent streams and wetlands.			

Are street trees required or encouraged along streets (residential, commercial, other or all)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Site plan Subdivision Landscape standards Public works specifications Design guidelines	Street trees help attenuate stormwater flows and pollutants, especially if planted in sufficient volumes of well-aerated soils. This can be specified in a stormwater management plan.			

Are tree lawns and terraces allowed or encouraged to be designed as stormwater treatment areas rather than turfgrass and trees only?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Landscape standards Public works specifications Municipal code	Some tree lawn or terrace areas may be suitable for use as stormwater management areas or can be landscaped with deeper-rooted plantings. Maintenance responsibility and an approval procedure should be specified.			

Can landscaped islands for stormwater treatment be created within culs-de-sac or medians?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Public works specifications	If standard specifications do not allow for different engineering designs (i.e., "all medians shall be composed of..."), some variance procedure or alternative standard may be needed.			

Are native plantings specifically allowed in front yards or lawn areas?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Nuisance weeds ordinance Landscape standards	Consider establishing a written review or approval procedure, simple standards requiring demarcation of edging and bordering with native and deep-rooted plants and a procedure for mowing if noxious weeds or lack of maintenance occurs.			

PARKING

Measures that allow for reductions in the total impervious area devoted to parking, both through reductions in the total volume of required parking and in the requirements for landscaping and surfacing, are crucial to reducing stormwater runoff volumes. In addition to the landscaping issues discussed above, zoning regulations govern parking space sizes and the total number of spaces required on individual development sites, and whether parking can be shared among uses in a building, shopping center or office park.

Do parking ratios reflect current Urban Land Institute or Institute of Transportation Engineers recommended ratios of spaces per square feet of gross floor area?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards	Parking ratios should be updated to reflect recent professional survey data on parking demand for uses such as restaurants, medical offices and banks to reflect changing consumer and worker patterns.			

Are the uses in the parking regulations updated to reflect contemporary development types (e.g., drive-through pharmacies, large home improvement stores) and eliminate outdated ones (e.g., video rental, photo processing, men's clothiers)				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards	The table of uses can be reviewed to incorporate expected types of development and eliminate outdated ones, so that parking requirements are both easy to administer and not excessive.			

Note: Vehicle trip end refers to the origin or destination of a vehicle trip (e.g., work commute, grocery run). Each trip has two ends.

Are parking ratios set as maximum or median (rather than minimum) requirements?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards	Many communities set maximum parking ratios, which effectively prevent “over-parking.” In some cases, the required amount of parking is the maximum that may be built; in others, up to 120% of the requirement is allowed.			

Do dense districts eliminate on-site parking requirements or have reduced requirements?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards	In downtowns or mixed-use districts where walking among uses can be expected, parking ratios per individual use may be substantially reduced or even eliminated, especially if municipal or on-street parking is available.			

Is the parking ratio reduced if shared parking arrangements are in place or multi-modal transit (e.g., mass transit, bike-n-shower facilities) is provided nearby? (Note distance to transit.)

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards	Parking ratios can be reduced where transit access is likely to reduce vehicle trip ends, or for offices, etc., that provide storage and other facilities promoting bicycle commuting.			

Are there incentives to developers to provide parking within garages rather than surface parking lots [structured parking funded/incentivized where suitable to zoning district]?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
TIF policy Zoning Planned unit development Development agreements				

Is the minimum stall width for a standard parking space 9 feet or less?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards				

Is the minimum stall length for a standard parking space 18 feet or less?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards				

Are flexible space sizes and/or compact parking spaces allowed or encouraged? What percentage or limits?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards	Allowing a certain number or percent of spaces (often 20% to 25%) to have reduced sizes and to be labeled “compact” can reduce total parking surface area.			

Is the use of shared parking arrangements promoted?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards	Encouraging shared parking among uses in the same building or on the same site is a key strategy to reduce parking surface area.			

Is a shared parking agreement format, calculation and administration procedure for changes in use in place?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards	Rather than requiring each applicant to justify the number of spaces in a shared parking plan, a table with formulas can be provided to streamline the process. Providing a simple format for tracking changes in use also makes administration and enforcement easier.			

Is the use of off-site parking arrangements promoted?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards	Required parking may be provided on properties owned by others, provided an agreement is recorded ensuring that the spaces will be made available to the permitted use.			

Is an off-site parking agreement or recording document provided or adopted?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Staff knowledge	Providing a sample agreement acceptable to the municipal attorney facilitates administration and enforcement.			

How many off-street parking spaces per residence are allowed or required? How many driveway spaces are allowed or required?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards Subdivision Municipal code	Residential parking requirements affect the amount of impervious cover on individual home sites.			

Is there a maximum number of cars or area of off-street or driveway parking per single family residence?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards Subdivision Municipal code	Setting a maximum number of vehicles or off-street spaces can avoid expansive driveways. Alternatively, any driveway area above and beyond what is required for a standard driveway can be required to be permeable or grasscrete surfacing.			

Is there a prohibition on parking on vegetated areas or required yards*?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Off-street parking and loading standards Subdivision Municipal code	Allowing vehicles to park on required yards or vegetated areas results in soil compaction and reduces infiltration capacity. Cars and RVs can be required to be parked on improved or graveled areas.			

*A required yard is the area that lies between a property line or right-of-way and an object required to be set back, such as a structure. A yard is more commonly known as a setback.

PERMEABLE MATERIALS

Standards for parking, driveways and loading areas tend to be included in zoning, while standards for construction of driveway aprons, streets, alleys, sidewalks and streetscapes usually are found in public works standards or even municipal code.

Does the municipality have experience with permeable material, curbless streets or other green infrastructure measures?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Local knowledge	Taking a group tour to a permeable paving site or bringing in university or state departments of natural resources or environmental protection staff to talk about options can help build knowledge.			

Are standard specifications or performance standards adopted or referenced for permeable materials?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Public works standards Local knowledge	Many state departments of natural resources or environmental protection and the American Society of Civil Engineers publish standards that can be referenced in local standards or codes.			

Must a sealant be used on improved surfaces, and, if so, can that provision be waived?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Public works standards	When adding allowances for permeable surfacing, communities must ensure that any requirement for sealants is modified or waived for permeable surfacing.			

Are low-volume street sections allowed or encouraged to be permeable?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Subdivision Public works standards and specifications	A good place to start can be to write a general waiver in the code allowing permeable surfacing “upon review and approval of the village/city engineer,” or making an as-of-right allowance in parking stalls, with other areas allowed with engineering review.			

Can parking lanes along streets be constructed with permeable surfacing?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Subdivision Public works standards and specifications	A good place to start can be to write a general waiver in the code allowing permeable surfacing “upon review and approval of the village/city engineer,” or making an as-of-right allowance in parking stalls, with other areas allowed with engineering review.			

Is the width or total surface area of driveways limited (e.g., as percent of lot area)? Can permeable driveways exceed that limitation?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning (lot coverage or general regulations) Public works standards	Many communities limit driveway widths to 20 feet for residential and 24 feet or 30 feet for non-residential uses, or limited as a percent of total lot area. In dense settings, permeable driveways may be allowed to exceed limits.			

Are driveway aprons allowed or encouraged to be permeable?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning (lot coverage or general regulations) Public works standards	Many communities require all driveway aprons to be constructed of concrete. This can have the effect of prohibiting installation of French drains at driveway aprons. A provision ensuring that French drains for infiltration or permeable surfacing can be allowed behind the apron can be added to the code to ensure this important storm-water reduction option is allowable.			

POLLUTANT REDUCTION THROUGH SITE PLAN REVIEW

A number of uses have the potential to cause polluted runoff unless outdoor areas are properly managed and reviewed. Providing additional review of these uses can be especially important where TMDLs are in place or where receiving waters are used for swimming, boating and fishing.

Are standards and requirements adopted for trash areas and dumpsters?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Zoning Supplemental regulations Conditional use requirements	Ensuring that trash is covered and fully contained, with trash storage areas graded or curbed to drain away from storm drains and surface waters, both prevents animals from getting into trash and prevents polluted runoff.			

Are trash/dumpster areas required to have four-sided enclosures?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Zoning Supplemental regulations Conditional use requirements	Effective measures require a four-sided enclosure with a locking gate rather than simply "visual screening."			

Are trash/dumpster areas required to be covered?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Zoning Supplemental regulations Conditional use requirements	Some communities with swimming beaches or sensitive water resources require trash and dumpster area covers, which reduce the potential for bacterial transport. Covers are not inexpensive but are available from commercial suppliers.			

Are trash/dumpster areas reviewed for drainage?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Zoning Supplemental regulations Conditional use requirements	A provision can be added to ensure that drainage from trash and dumpster areas is generally directed away from storm drains toward a grass or vegetated area, or at a minimum that storm drains are not located directly under dumpsters.			

Are there supplemental standards for potentially polluting uses?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Zoning Supplemental regulations Conditional use requirements	Better trash and outdoor area management at any business or activity that handles food or animals, such as dog day care centers or restaurants, can reduce bacteria, grease/oil and nutrient loads to the storm drain system. See the "Stormwater Pollution Prevention for Restaurants" video at go.wisc.edu/ok7974 .			

Are there standards for gas and auto repair stations?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Zoning Supplemental regulations Conditional use requirements	Auto-related uses should be reviewed to ensure fueling or repair areas meet published standards, and no potentially polluting materials such as washer fluids, oil or parts are stored outside unless completely covered.			

Are there standards for food-related uses?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Zoning Supplemental regulations Conditional use requirements	Food-related uses warrant extra scrutiny to ensure trash-handling areas, delivery areas and grease traps are properly designed and installed.			

Are there standards for animal-related uses (e.g., dog daycare centers, kennels)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Zoning Supplemental regulations Conditional use requirements	Outdoor areas at animal-related facilities should be reviewed to ensure that drainage from washing or rainfall will be directed into a sanitary drain or vegetated area well away from storm drains, surface waters or wetlands.			

Are there standards for outdoor storage areas?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Zoning Supplemental regulations Conditional use requirements	Outdoor storage and contractors' yards can become substantial sources of nutrients, toxics, metals or sediment in runoff. Review should ensure vegetated buffers, grading plans or other measures are in place.			

Are there standards for contractors' yards?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Zoning Supplemental regulations Conditional use requirements	Outdoor storage and contractors' yards can become substantial sources of nutrients, toxics, metals or sediment in runoff. Review should ensure vegetated buffers, grading plans or other measures are in place.			

Are there standards for other potentially polluting uses?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code Zoning Supplemental regulations Conditional use requirements	Locally, other uses such as nurseries and garden centers might benefit from supplemental review of outdoor areas and activities.			

POST-CONSTRUCTION STORMWATER STANDARDS AND LONG-TERM MAINTENANCE

Having methods in place to inspect and manage stormwater treatment systems during and after construction is important to the long-term performance of green infrastructure.

Does the municipality have a stormwater utility or user fee to provide a dedicated funding source for stormwater management?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Municipal code	Many communities have local, fee-based funding or a formal utility for stormwater management. Where fees are not currently charged, these may be adopted by referendum under some state laws.			

Is there construction-phase inspection of stormwater treatment practices to ensure conformance with the site and stormwater management plan?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance Written policies and procedures	Stormwater ordinances should explicitly require inspection of stormwater treatment systems during the construction phase, which is critical to function and performance.			

Is there a process for regular post-construction inspection of stormwater treatment practices for both private and publicly maintained facilities?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance Written policies and procedures	Regular post-construction inspections can be reported to the municipality, if a tracking system is in place, or system owners may keep their inspection reports on file.			

Are maintenance agreements required for stormwater treatment practices and landscaped areas that accept stormwater runoff?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance Municipal maintenance agreement	Providing a model maintenance agreement ensures that developers understand the municipality's requirements for ongoing maintenance and reporting.			

Have model maintenance agreements been developed or adopted?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance Municipal maintenance agreement	Plan review and public works staff benefit from a working knowledge of green infrastructure maintenance needs, such as sweeping frequencies for permeable surfacing or how to identify invasive plants in bioretention areas.			

Have maintenance needs for green infrastructure practices been communicated and understood among staff involved in plan review or inspection?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Staff knowledge	Plan review and public works staff benefit from a working knowledge of green infrastructure maintenance needs, such as sweeping frequencies for permeable surfacing or how to identify invasive plants in bioretention areas.			

PUBLIC WORKS STANDARDS

Public works standards, which may be part of subdivision regulations, adopted as a separate ordinance or adopted administratively by the municipality, control key aspects of municipal infrastructure and stormwater systems. Public works staff and commissioners should be actively involved in audits and provide input on how different changes or alternatives would work.

Do drainage systems allow any use of drain restrictors to hold water back on streets for temporary stormwater storage during larger storm events?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Subdivision Department of public works standards	In some communities, providing temporary flood storage on streets can decrease the need for large (and costly) storage facilities. In others, however, this is not practiced.			

Is the minimum pavement width for local streets in medium density residential developments less than 22 feet? Can other widths be reduced?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Subdivision Department of public works standards	Contemporary standards for roadway widths often are much narrower than what is required in subdivision or public works standards. Comparing local standards against updated guidance can identify where local standards may be changed.			

Are private streets allowed? If so, are reduced roadway widths or alternative drainage permitted for private streets?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Subdivision Department of public works standards	Some communities will allow reduced street widths or waive curb-and-drain requirements if streets are designated as private roads. This can be a strategy for reducing effective imperviousness.			

Is there a maximum driveway width (e.g., 20 feet for residential/24 feet at roadway opening, 26 feet for commercial/30 feet at roadway opening)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Subdivision Department of public works standards	Driveway widths and widths at roadway openings can be limited to support both better access management and reduced imperviousness.			

Do codes allow utilities to be placed under the paved section of the right-of-way or tree lawns? Under what circumstances?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Subdivision Department of public works standard	If utilities can be placed under a paved surface rather than requiring an additional grass strip adjacent to the right-of-way, the total area in paved plus grass strip surface is reduced.			

What is the minimum cul-de-sac radius (e.g., <35 feet)? Can it be modified, and by whom, when and why?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Fire protection ordinance Department of public works standards	Contemporary engineering standards for culs-de-sac call for a 35 foot radius (70' diameter).			

Are alternative turnarounds such as "hammerheads" allowed? What is the approval process?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Fire protection ordinance Department of public works standards	"Hammerheads" and T-style turnarounds can reduce the total land consumption and impervious area needed on a site, especially in subdivisions and commercial sites.			

Can grasscrete be used to meet public safety and fire access needs?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Fire protection ordinance Department of public works standards	Many types of commercially available permeable surfacing have sufficient structural strength to support fire trucks and can be plowed; these can be substituted for asphalt in areas of a site that must provide fire truck access to buildings.			

Can minimum sidewalk or multi-purpose path width in the community be varied by path segment and type (note widths)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Department of public works standards Subdivision Planned unit development	Varied widths for sidewalks and recreation paths allow flexibility to reduce impervious surface where appropriate but ensure wide paths where greater use is expected.			

Are vegetated open channels allowed in lieu of curb and gutter, and for what uses (e.g., residential, commercial)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Department of public works standards Subdivision	Options for swale drainage, or partial curb-and-drain profiles with inlets for bioretention can allow for enhanced water quality and infiltration.			

Can traffic calming measures be co-designed as stormwater-control measures?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Department of public works standards Streetscape standards	It is helpful to state specifically that islands and bump-outs that act as traffic calming measures are encouraged to be co-designed to provide stormwater management or green infrastructure functions.			

Is a standard or review process defined for removing impervious surface?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Department of public works standards	In communities that are redeveloping, it is useful to have a standard for demolition or removal of impervious surface and replacement with sufficient soil and vegetation to enable stormwater infiltration. The Environmental Protection Agency Great Lakes Region has developed a useful model standard.			

Is the specified width of tree lawn based on street section and neighborhood type? Is it adequate to support trees at maturity (6 feet in most cases)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Department of public works standards	Tree lawns or terraces should be at least 6 feet wide in most cases, with sufficient soil depth and composition to support healthy tree growth. A municipal forester or extension staff can advise on widths, soils and depths.			

PURPOSE STATEMENTS AND COMMUNITY PLANS

Ensuring that comprehensive or master plans specifically call out green infrastructure, water quality and watershed protection in goals and objectives will provide crucial policy support for updating regulations, securing grant funds for pilot projects and setting a tone for integrating water resource protection into municipal investments and development review.

Are watershed water quality and green infrastructure implementation stated goals in the master plan?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Master and comprehensive plan	Example: "It is the goal of the Municipality to implement policies, investments, standards and actions, including the use of green infrastructure, that will protect and enhance water quality within the Municipality and its watersheds."			

Does the master plan describe green infrastructure and water quality outside the 'drainage' or 'infrastructure' chapter?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Master and comprehensive plan	Many older comprehensive plans do not discuss stormwater other than as a utility issue (i.e., drainage, flood control). Park and recreation, natural resource, landscaping, design and sustainability goals all can reference the potential for multiple benefits from incorporating green infrastructure techniques in private and municipal projects.			

Do master plan objectives and recommended actions include green infrastructure pilot projects, new standards, design manual or other measures?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Master and comprehensive plan	Specific language such as “complete a permeable paving demonstration project in a municipal parking lot” or “update the downtown design guidelines to include green infrastructure features” helps in grant applications.			

SANITARY AND STORM SEWER DISCONNECTIONS

Stormwater and other “clean water” sources should not be directly connected to the sanitary sewer system and may be prohibited from connection in combined sewer areas. Infrastructure inspections help ensure that illegal connections and potential bacteria sources are eliminated. Green infrastructure such as green roofs and cisterns or other practices that direct clean water discharges to rain gardens or permeable areas can reduce demands on the storm drain system, reduce street flooding and provide a water supply for landscape features.

Is an inspection process in place that verifies that clean water sources do not enter the sanitary sewer in separate sewer areas?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Operational Sewer ordinance	Some communities have specific procedures for determining if clean water sources are connected to sanitary sewers and for requiring property owners to disconnect or replumb if found. These sources usually include air conditioner condensate, sump pump discharge and roof downspouts.			

Are there restrictions on downspouts being directly connected to the sanitary sewer?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Sewer ordinance Public works standards Building code	In combined sewer overflow areas, downspout connections may be prohibited by the sewer ordinance.			

Can rooftop runoff, air conditioning condensate, sump pump discharges or other “clean water” sources be discharged to pervious areas?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Code (plumbing, building or sewer)	Code language can clarify how these sources should be treated, for example, “Clean water sources including but not limited to...may be discharged to lawns or pervious areas a minimum of three (3) feet from any building foundation or property line and provided no water is discharged in such a manner as to cause icing on any improved surface.”			

Is temporary storage of rainwater on rooftops permitted?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Code (building, plumbing, public works specifications)	Look for any prohibition that would prevent using drain restrictors or a green roof from holding back drainage rather than sending it directly into a downspout.			

At any routine point-of-sale, is the condition of lateral sewer pipes inspected?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Operational Sewer ordinance	Most communities only inspect at time of initial construction. Point-of-sale inspections may be done if there is a private property infiltration or inflow reduction program. Community education on sewer laterals also can be valuable.			

STORMWATER MANAGEMENT STANDARDS

Technical provisions in the stormwater ordinance are particularly important to review with the municipal engineer or consulting engineer. Involving applicants' engineers who are familiar with how provisions are interpreted also can be helpful in understanding where and how the ordinance or standards could be modified to encourage use of green infrastructure.

What design criteria (such as those from state departments of natural resources, environmental protection or conservation) are adopted or referenced in stormwater management plan requirements?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance	Referring to your state's conservation practice standards (if applicable) or other published design criteria can help designers and plan reviewers gain confidence that green infrastructure measures are designed correctly.			

Have primary types of green infrastructure practices (e.g., bioretention/rain gardens, permeable surfacing, rainwater harvesting, vegetated swales, green roofs) been defined in the stormwater ordinance or zoning regulations?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance	Adding definitions of different green infrastructure practices is especially important to providing guidance and encouragement to applicants and effective standards for its use in the community.			

What design storm is used for sizing stormwater-control measures?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance	Requirements to size stormwater systems for very large storms can discourage the use of green infrastructure or distributed practices, and may lead to other maintenance issues. A one- or two-year storm typically is consistent with the use of green infrastructure practices and with state standards.			

Do sizing requirements vary by soil type?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance	If designers must assume a “D” soil regardless of on-site conditions, runoff volumes will be larger than otherwise needed, which may discourage the use of green infrastructure practices. Most state standards provide for variation in curve numbers based on soil type.			

Are green infrastructure practices counted toward meeting the volume control requirements for a site?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance	It is very important for the local ordinance to be clear about how the local engineer will “credit” the volume managed by different green infrastructure practices. Some communities limit the volume credit for permeable surfacing, which discourages its use. Often, state departments of natural resources or environmental protection and university extension staff can provide guidance on this issue.			

Are green infrastructure practices counted toward meeting the water quality requirements for a site?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance	The local ordinance should specify that green infrastructure practices are acceptable to the municipal engineer for meeting TSS and pollutant reduction goals.			

Does the use of permeable materials reduce the stormwater quantity required to be managed? If so, is this a written or informal standard?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance	To encourage the use of permeable surfacing, stormwater management plans must “count” these areas as permeable (or at least at a lower runoff curve number than impervious surfaces) and provide credit for volume reduction as well.			

Are there reduced [or modified] stormwater-control requirements for redevelopment and infill sites (e.g., waivers of quantity control requirements, fee-in-lieu options)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance	Providing less stringent volume and treatment requirements for small or “infill” projects helps encourage infill and redevelopment.			

Is there a process for identifying or requiring measures that reduce stormwater runoff when existing developed sites are modified, even if a full stormwater management plan is not required?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater ordinance	Through zoning or stormwater ordinances, communities can require applicants to make “low-hanging fruit” modifications to sites to improve stormwater management when development occurs, even if a full stormwater management plan is not required. These include modifying parking lot landscaping to accept sheet flow, replacing low-use paved areas with permeable surfacing, replacing turfgrass with deeper-rooted vegetation and adding trees.			

Is there a reported preference for wet ponds with fountains as an aesthetic approach?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Staff knowledge	Moving community preferences from encouraging wet ponds with fountains towards distributed, naturalized stormwater treatment can take time and education. A statement in the stormwater ordinance or comprehensive plan encouraging consideration of different landscaping and stormwater strategies is important.			

Are incentives provided (within the utility fee structure or elsewhere in the code) to developers who reduce impervious cover, conserve natural areas or implement stormwater reduction practices such as green rooftops, rain barrels and rain gardens (e. g., reduced stormwater utility fees, stormwater credits)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Stormwater utility ordinance credit policy	Where municipalities have a stormwater utility or fee, it is very helpful to provide language that specifically allows credits for treatment with green infrastructure practices as well as "ponds."			

SUBDIVISIONS AND NEW “GREENFIELD” DEVELOPMENT

Are there provisions that encourage minimizing total impervious surfaces on new development sites (if they are consistent with building patterns in the zoning district)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Planned development unit regulations	Reducing lot widths and minimum sizes reduces the amount of land area disturbed for new development, the total length of roadway and associated impervious surface required, and the amount of turf-grass for lawn — all of which reduce the volume of runoff and pollutant loads associated with new development. Guidance on conservation subdivisions or “smart growth” can provide useful standards and examples.			

Are flexible dimensional criteria available for developers using planned development units, open space or cluster design options (e.g., setbacks, lot sizes and shapes, road widths)?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Planned development unit regulations	Reducing lot widths and minimum sizes reduces the amount of land area disturbed for new development, the total length of roadway and associated impervious surface required, and the amount of turf-grass for lawn — all of which reduce the volume of runoff and pollutant loads associated with new development. Guidance on conservation subdivisions or “smart growth” can provide useful standards and examples.			

Are flexible standards (planned development units, open space or cluster options) as-of-right or discretionary? What is the minimum lot size for an open space subdivision or a planned development unit?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Planned development unit regulations	Reducing lot widths and minimum sizes reduces the amount of land area disturbed for new development, the total length of roadway and associated impervious surface required, and the amount of turf-grass for lawn — all of which reduce the volume of runoff and pollutant loads associated with new development. Guidance on conservation subdivisions or “smart growth” can provide useful standards and examples.			

Can lot frontage requirements be waived in a planned development unit or open space subdivision?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Table of dimensional standards Planned development unit regulations	Lot frontage requirements (i.e., length of a lot that must abut a street) are often a hold-over from earlier zoning goals. Reducing lot frontage requirements can help spur redevelopment along commercial strips and, in subdivisions, reduces the total length of roadway required. Provisions can be drafted that ensure each lot has sufficient legal access to a public roadway, without requiring large frontages.			

Are the frontage requirements standard, minimal or above usual practice

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Table of dimensional standards	Reduced setbacks (frontage, front, side and rear) can allow for reduced roadway and driveway length, and smaller areas of turfgrass.			

Are the front yard setbacks standard, minimal or above usual practice for the zoning district?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Table of dimensional standards	Reduced setbacks (frontage, front, side and rear) can allow for reduced roadway and driveway length, and smaller areas of turfgrass.			

Are the side yard setbacks standard, minimal or above usual practice for zoning district?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Table of dimensional standards	Reduced setbacks (frontage, front, side and rear) can allow for reduced roadway and driveway length, and smaller areas of turfgrass.			

Are the rear yard setbacks standard, minimal or above usual practice for the zoning district?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Table of dimensional standards	Reduced setbacks (frontage, front, side and rear) can allow for reduced roadway and driveway length, and smaller areas of turfgrass.			

Can stormwater-control measures be sited within required yard or setback areas? If so, are there any limitations on siting ponds within yards or setbacks?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning General regulations [definitions of setbacks or yards] Staff knowledge	Allowing ponds, bioretention areas or other surface stormwater controls within setbacks typically increases the density that can be achieved on the site.			

Are shared driveways allowed/encouraged? For what land uses?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Subdivision Zoning and site plan Public works standards	Allowing shared driveways among parcels or land uses can reduce both curb cuts and impervious surface area.			

ZONING

Specific aspects of the structure of a zoning code can be modified or clarified to ensure that green infrastructure practices are clearly allowed or encouraged in development and in municipally sponsored projects.

Is a description or definition of “low impact development” or “green infrastructure” included in the zoning code or stormwater ordinance?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Definitions	An inclusive definition of green infrastructure can be: “Vegetated stormwater management measures. Swales, bio-retention areas, rain gardens, amended soil areas, pocket or modular wetlands, stormwater trees, vegetated or green roofs, and similar practices specifically designed to provide water quantity and water quality treatment of stormwater runoff, and to promote evapotranspiration and infiltration of stormwater.”			

Do purpose statements in zoning specifically include encouraging green infrastructure or naturalized drainage?				
Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Establishment [individual zoning districts]	Example: “It is the purpose of these standards to promote the use of green infrastructure or vegetated stormwater management measures, where suitable, to manage stormwater runoff volumes and quality.”			

Is there a clear process for approving green infrastructure, flood management or environmental restoration projects? Would these projects be allowed in all zoning districts?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Individual zoning districts [site plan procedures]	The zoning code should note whether land modifications to implement wetland or stream restoration, construct stormwater retrofits or modify landscaping and grading requires plan commission, elected board or staff approval and whether approval goes through site plan, conditional use or another approval process.			

Do allowable uses for parks and other open space areas specifically include stormwater retrofits or green infrastructure projects?

Type of Barrier	Tips	Code References and Language	Notes, Ideas and Strategies	Grade
Zoning Table of uses [individual zoning districts]	Depending on the community, the list of permitted or conditional uses may need to include "stormwater management and green infrastructure installations" or a similar use to enable stand-alone projects.			

Green Infrastructure Audit Tool Report Card

A quick-reference summary to determine whether a code, policy or operation is enabling, conditional, ambiguous, discouraging or conflicting.

ARCHITECTURAL DESIGN STANDARDS

- Are rainwater-harvesting and stormwater-control elements acknowledged in design standards?
- Are green infrastructure practices suitable for high-density areas (e.g., planter boxes, cisterns) allowed to extend into the right-of-way or onto sidewalks?
- Do design standards allow siting of stormwater-control measures along façade?
- Do standards allow for the waiver of design or architectural provisions to accommodate stormwater-control measures (planters, cisterns, green roofs, etc.)?
- Are pitched roofs required? If so, is a waiver or provision for green roofs or rainwater harvesting made?
- Are green infrastructure practices suitable for high-density areas allowed or encouraged in streetscapes (e.g., tree boxes, sidewalk bioretention areas, curb bump-outs)?

COASTAL COMMUNITIES

- Is protection of bluffs and ravines described in the Comprehensive Plan and ordinance?
- Are there review procedures over and above other code provisions for activities in proximity to bluffs and ravines?
- Are there provisions or setbacks from bluffs and ravines for new or expanded structures?
- Are there provisions or setbacks from bluffs and ravines for new impervious surfaces?
- Are there provisions on clearing and grading near bluffs and ravines?
- Can foundation drain, roof leaders or sump pump discharges be sited where discharge will exit on the slope of a bluff or ravine? What is the review process, if any?
- Has the community identified stormwater outfalls flowing directly onto beaches or into streams that flow directly to beaches?

COMMUNITY OUTREACH AND EDUCATION

- Is there a local ordinance or policy limiting the application of pesticides or herbicides on public property?
- Has green infrastructure education been provided to staff involved in plan reviews? This includes staff in public safety, engineering, parks and recreation, economic development, and planning and zoning.
- Has green infrastructure education been provided to planning boards and elected officials?
- Has a rain barrel or rain garden pilot program been done in your community?
- Is a review or procedure in place for rain garden construction and planting native plants in yards and lawns?
- Is a review or procedure in place for downspout disconnection and rain barrel installation?
- Is a review or permit process in place to facilitate the disconnection of foundation drains?
- Who answers inquiries and what is his or her level of knowledge?

CONSTRUCTION AND POST-CONSTRUCTION MANAGEMENT

- Does the ordinance require or promote preservation of native vegetation at development sites?
- Does the ordinance require or encourage limiting clearing and grading at development sites (e.g., construction-site phasing, clearing limit demarcation requirements, prohibitions on construction equipment storage)?
- Are the limits of disturbance shown on site plans required to be physically marked on the construction site?
- Does the ordinance include construction-phase inspection of limits of disturbance?
- Do site and erosion control plans require identification, site marking and protection of mature trees?
- Are native or hydric soils required to be identified, demarcated and protected from disturbance and construction activity?
- Are management plans required for open space and conservation areas set aside in development?
- If open space or conservation areas are required, does a minimum percentage have to be managed in a natural condition (e.g., maintained as woodland, deep-rooted plantings or native vegetation instead of turf)?
- Are there supplemental provisions for protecting or buffering wetlands that are above state requirements?
- Has the community identified historic stream channels and waterways? Are any of these features protected from modification or development?

LANDSCAPING

- Do preliminary or sketch plans include stormwater measures and landscape techniques for initial review?
- Is a consolidated plan for landscaping, grading/drainage and stormwater-control measures encouraged or required?
- Is the use of deep-rooted or native plants, plants with habitat value, or edibles allowed or encouraged in the landscaping standards?
- Is there a process or standard to waive numerical, spacing and species requirements for stormwater-control measures in required landscape areas?
- Do visual buffer and screening provisions enable a variation in plantings or substitution of fencing if co-designed for stormwater?
- Do vegetated stormwater management areas such as bioretention areas, rain gardens, stormwater trees or other plantings count toward required landscape minimums?
- Is berming of setback and landscape areas along right-of-ways required and/or habitually preferred as a method of visual screening?
- Are naturalized landscaping standards and requirements promoted for use in stormwater treatment practices?
- Are there minimum landscaping requirements for parking lots? Perimeters, islands or both (e.g., percentage of parking landscaped, number of trees per parking spaces, canopy coverage)?
- Is there a minimum size for parking lot landscape islands?
- Do parking lot edge landscaping requirements (islands and edges) specifically allow or encourage use as stormwater-control areas? Is a standard adopted?
- Are flush curbs and/or curb cuts allowed to direct runoff into vegetated landscaped islands?
- Are green walls defined or encouraged? Do they count toward required landscaping?
- Is turfgrass required in new subdivisions or construction? Could deep-rooted plants be substituted?
- Do the standards encourage or require that turfgrass be used only for active recreation areas?
- Are snow storage areas required to be shown on site plans?
- Is snow storage in bioretention areas prohibited or discouraged, unless the area is specifically designed for snow storage (i.e., grass swales)?
- Are street trees required or encouraged along streets (residential, commercial, other or all)?
- Are tree lawns and terraces allowed or encouraged to be designed as stormwater treatment areas rather than turfgrass and trees only?
- Can landscaped islands for stormwater treatment be created within culs-de-sac or medians?
- Are native plantings specifically allowed in front yards or lawn areas?

PARKING

- Do parking ratios reflect current Urban Land Institute or Institute of Transportation Engineers recommended ratios of spaces per square feet of gross floor area?
- Are the uses in the parking regulations updated to reflect contemporary development types (e.g., drive-through pharmacies, large home improvement stores) and eliminate outdated ones (e.g., video rental, photo processing, men's clothiers)?
- Are parking ratios set as maximum or median (rather than minimum) requirements?
- Do dense districts eliminate on-site parking requirements or have reduced requirements?
- Is the parking ratio reduced if shared parking arrangements are in place or multi-modal transit (e.g., mass transit, bike-n-shower facilities) is provided nearby? (Note distance to transit.)
- Are there incentives to developers to provide parking within garages rather than surface parking lots [structured parking funded/ incentivized where suitable to zoning district]?
- Is the minimum stall width for a standard parking space 9 feet or less?
- Is the minimum stall length for a standard parking space 18 feet or less?
- Are flexible space sizes and/or compact parking spaces allowed or encouraged? What percentage or limits?
- Is the use of shared parking arrangements promoted?
- Is a shared parking agreement format, calculation and administration procedure for changes in use in place?
- Is the use of off-site parking arrangements promoted?
- Is an off-site parking agreement or recording document provided or adopted?
- How many off-street parking spaces per residence are allowed or required? How many driveway spaces are allowed or required?
- Is there a maximum number of cars or area of off-street or driveway parking per single family residence?
- Is there a prohibition on parking on vegetated areas or required yards?

PERMEABLE MATERIALS

- Does the municipality have experience with permeable material, curbless streets or other green infrastructure measures?
- Are standard specifications or performance standards adopted or referenced for permeable materials?
- Must a sealant be used on improved surfaces, and, if so, can that provision be waived?
- Are low-volume street sections allowed or encouraged to be permeable?
- Can parking lanes along streets be constructed with permeable surfacing?
- Is the width or total surface area of driveways limited (e.g., as percent of lot area)? Can permeable driveways exceed that limitation?
- Are driveway aprons allowed or encouraged to be permeable?

POLLUTANT REDUCTION THROUGH SITE PLAN REVIEW

- Are standards and requirements adopted for trash areas and dumpsters?
- Are trash/dumpster areas required to have four-sided enclosures?
- Are trash/dumpster areas required to be covered?
- Are trash/dumpster areas reviewed for drainage?
- Are there supplemental standards for potentially polluting uses?
- Are there standards for gas and auto repair stations?
- Are there standards for food-related uses?
- Are there standards for animal-related uses (e.g., dog daycare centers, kennels)?
- Are there standards for outdoor storage areas?
- Are there standards for contractors' yards?
- Are there standards for other potentially polluting uses?

POST-CONSTRUCTION STORMWATER STANDARDS AND LONG-TERM MAINTENANCE

- Does the municipality have a stormwater utility or user fee to provide a dedicated funding source for stormwater management?
- Is there construction-phase inspection of stormwater treatment practices to ensure conformance with the site and stormwater management plan?
- Is there a process for regular post-construction inspection of stormwater treatment practices for both private and publicly maintained facilities?
- Are maintenance agreements required for stormwater treatment practices and landscaped areas that accept stormwater runoff?
- Have model maintenance agreements been developed or adopted?
- Have maintenance needs for green infrastructure practices been communicated and understood among staff involved in plan review or inspection?

PUBLIC WORKS STANDARDS

- Do drainage systems allow any use of drain restrictors to hold water back on streets for temporary stormwater storage during larger storm events?
- Is the minimum pavement width for local streets in medium-density residential developments less than 22 feet? Can other widths be reduced?
- Are private streets allowed? If so, are reduced roadway widths or alternative drainage permitted for private streets?
- Is there a maximum driveway width (e.g., 20 feet for residential/24 feet at roadway opening, 26 feet for commercial/30 feet at roadway opening)?
- Do codes allow utilities to be placed under the paved section of the right-of-way or tree lawns? Under what circumstances?
- What is the minimum cul-de-sac radius (e.g., <35 feet)? Can it be modified, and by whom, when and why?
- Are alternative turnarounds such as “hammerheads” allowed? What is the approval process?
- Can grasscrete be used to meet public safety and fire access needs?
- Can minimum sidewalk or multi-purpose path width in the community be varied by path segment and type (note widths)?
- Are vegetated open channels allowed in lieu of curb and gutter, and for what uses (e.g., residential, commercial)?
- Can traffic calming measures be co-designed as stormwater-control measures?
- Is a standard or review process defined for removing impervious surface?
- Is the specified width of tree lawn based on street section and neighborhood type? Is it adequate to support trees at maturity (6 feet in most cases)?

PURPOSE STATEMENTS AND COMMUNITY PLANS

- Are watershed water quality and green infrastructure implementation stated goals in the master plan?
- Does the master plan describe green infrastructure and water quality outside the ‘drainage’ or ‘infrastructure’ chapter?
- Do master plan objectives and recommended actions include green infrastructure pilot projects, new standards, design manual or other measures?

SANITARY AND STORM SEWER DISCONNECTIONS

- Is an inspection process in place that verifies that clean water sources do not enter the sanitary sewer in separate sewer areas?
- Are there restrictions on downspouts being directly connected to the sanitary sewer?
- Can rooftop runoff, air conditioning condensate, sump pump discharges or other “clean water” sources be discharged to pervious areas?
- Is temporary storage of rainwater on rooftops permitted?
- At any routine point-of-sale, is the condition of lateral sewer pipes inspected?

STORMWATER MANAGEMENT STANDARDS

- What design criteria (such as those from state departments of natural resources, environmental protection or conservation) are adopted or referenced in stormwater management plan requirements?
- Have primary types of green infrastructure practices (e.g., bioretention/rain gardens, permeable surfacing, rainwater harvesting, vegetated swales, green roofs) been defined in the stormwater ordinance or zoning regulations?
- What design storm is used for sizing stormwater-control measures?
- Do sizing requirements vary by soil type?
- Are green infrastructure practices counted toward meeting the volume control requirements for a site?
- Are green infrastructure practices counted toward meeting the water quality requirements for a site?
- Does the use of permeable materials reduce the stormwater quantity required to be managed? If so, is this a written or informal standard?
- Are there reduced [or modified] stormwater-control requirements for redevelopment and infill sites (e.g., waivers of quantity control requirements, fee-in-lieu options)?
- Is there a process for identifying or requiring measures that reduce stormwater runoff when existing developed sites are modified, even if a full stormwater management plan is not required?
- Is there a reported preference for wet ponds with fountains as an aesthetic approach?
- Are incentives provided (within the utility fee structure or elsewhere in the code) to developers who reduce impervious cover, conserve natural areas or implement stormwater reduction practices such as green rooftops, rain barrels and rain gardens (e. g., reduced stormwater utility fees, stormwater credits)?

SUBDIVISIONS AND NEW “GREENFIELD” DEVELOPMENT

- Are there provisions that encourage minimizing total impervious surfaces on new development sites (if they are consistent with building patterns in the zoning district)?
- Are flexible dimensional criteria available for developers using planned development units, open space or cluster design options (e.g., setbacks, lot sizes and shapes, road widths)?
- Are flexible standards (planned development units, open space or cluster options) as-of-right or discretionary? What is the minimum lot size for an open space subdivision or a planned development unit?
- Can lot frontage requirements be waived in a planned development unit or open space subdivision?
- Are the frontage requirements standard, minimal or above usual practice?
- Are the front yard setbacks standard, minimal or above usual practice for the zoning district?
- Are the side yard setbacks standard, minimal or above usual practice for zoning district?
- Are the rear yard setbacks standard, minimal or above usual practice for the zoning district?
- Can stormwater-control measures be sited within required yard or setback areas? If so, are there any limitations on siting ponds within yards or setbacks?
- Are shared driveways allowed/encouraged? For what land uses?

ZONING

- Is a description or definition of “low impact development” or “green infrastructure” included in the zoning code or stormwater ordinance?
- Do purpose statements in zoning specifically include encouraging green infrastructure or naturalized drainage?
- Is there a clear process for approving green infrastructure, flood management or environmental restoration projects? Would these projects be allowed in all zoning districts?
- Do allowable uses for parks and other open space areas specifically include stormwater retrofits or green infrastructure projects?





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