WATER INFRASTRUCTURE

GREEN INFRASTRUCTURE

Natural ecosystems such as forests, floodplains, wetlands and prairies provide important services that benefit communities. These benefits are often called ecosystem services and they can protect communities from flooding and excessive heat; improve air, soil and water quality; enhance habitat for wildlife and pollinator species; and provide natural beauty. Green infrastructure refers to the natural systems that provide these ecosystem services for the benefit of people. Green infrastructure can be natural open space or green stormwater infrastructure that is designed and built to mimic natural processes.

On a regional scale, green infrastructure often refers to the patchwork of natural areas that provides ecosystem services. Green infrastructure has been addressed at a regional scale through the development of the *McHenry County Green Infrastructure Plan*. Several municipalities have also adopted green infrastructure plans. Ideally, municipalities, park districts or others will adopt the *McHenry County Green Infrastructure Plan* or use the Plan to tailor green infrastructure policies of their own.

On a local scale green infrastructure is a cost-effective, resilient approach to manage stormwater using methods that provide multiple benefits to communities. While conventional single-purpose gray stormwater infrastructure – such as conventional piped stormwater drainage systems - is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering multiple environmental, social, and economic benefits.

Green Infrastructure for Stormwater Management: *Communities, businesses, and homeowners should implement green infrastructure practices to manage stormwater, mitigate flooding, and protect water quality.*

Stormwater runoff is a major cause of flooding and water pollution in developed areas. When rain falls on roofs, streets, and parking lots in urban and suburban environments, the water cannot soak into the ground as it would under natural conditions. Instead the rain drains off as stormwater that flows over land and through gutters, storm sewers, and other engineered collection systems until it is discharged directly into nearby water bodies. The stormwater runoff can carry trash, bacteria, heavy metals, and other pollutants from the developed landscape. Higher flows resulting from heavy or prolonged rains also can cause flooding and erosion, damaging habitat, property, and infrastructure.

When rain falls in natural, undeveloped areas, most of the water is absorbed and filtered by soil and plants. The small amount of stormwater runoff that is produced is typically cleaner and less of a problem. Green infrastructure uses vegetation, soils, and other elements and practices to mimic some of the natural processes that are able to manage water and create healthier developed environments. The green infrastructure practices that mimic nature to soak up, store, and clean water are also commonly referred to as stormwater best management practices (BMPs) or low impact development (LID). These practices can be used to manage stormwater on most properties, regardless of size. Examples of these practices are described below.

Landscaping with Native Vegetation - can be an effective method for managing stormwater. Landscapes with intact native vegetation produce little to no stormwater runoff. They stabilize soil and have deep root systems that act like a sponge soaking up the majority of rainfall, allowing vegetation to absorb and transpire water back into the atmosphere. Remaining runoff continues to infiltrate into the ground following the deep roots through the soil. Native plant species do not require fertilizer and therefore do not contribute to water pollution. In fact, native vegetation filters out many pollutants from the water and air. Once established, native vegetation does not require additional watering and requires little maintenance. Native plants are best adapted to the local climate, growing season, and soils. Native plants and native pollinator species are dependent on each other so landscaping with native plants also provides habitat for wildlife.

Most turfgrass on the other hand only have root systems that extend down about an inch and require additional watering, maintenance, and commonly include applications of chemical fertilizers and pesticides. The soils under the shallow roots are typically compacted so areas of turfgrass may not promote infiltration. Instead, areas of turfgrass produce a significant amount of surface runoff which contributes to pollution and flooding. Although it would be unrealistic to convert all turfgrass areas to native species, it is practical to significantly expand the use of native species in landscaping around homes, businesses and public lands to better manage stormwater, reduce flooding, improve water quality, and enhance natural habitat.

*** Provide photo of natural landscaping and illustration of native vegetation roots ***

*** Callout for Land Conservancy Conservation@Home/Work ***

Raingardens - Raingardens are bioretention systems that can be a cost effective, efficient and attractive way to reduce runoff, promote infiltration, and purify stormwater. A rain garden is a depressed area in the landscape that collects rain water from a roof, driveway or street, temporarily holds the water, and allows it to soak into the ground. The raingarden is planted with native grasses and flowering perennials that are adapted to survive periods of inundation and drought. Raingardens can be installed on a variety of property types including residential or commercial properties, parking lots, road rights-of-way, parks, etc. If designed and properly installed, a raingarden can turn a problem into an asset.

*** Provide photos or graphics depicting different raingarden designs ***

Bioswales - A bioswale is very similar to a raingarden except that it is designed to convey runoff from one point to another. The bioswale typically consists of an excavated swale that is planted with native wetland and prairie vegetation. A comparable form of gray infrastructure would be a storm sewer whose sole purpose is usually to convey water. The bioswale on the other hand not only provides conveyance but also provides water quality treatment, flood storage, infiltration, wildlife habitat, aesthetic beauty, and improved resiliency for the community.

*** Provide photo and/or graphic ***

Naturalized Detention Basins - A conventional *detention basin* consists of an excavated area designed to control flooding by holding a designated volume of stormwater runoff and releasing it at a controlled rate, thereby reducing the potential for flooding downstream. Basins that are designed to permanently retain some volume of water are called *retention basins*. The primary function of conventional detention basins is to control the quantity of water, although some pollutants such as suspended solids may settle out.

Naturalized detention basins on the other hand are typically designed with shallower slopes and planted with native vegetation. In addition to managing the volume and release rate of water, *naturalized detention basins* also provide water quality treatment, stabilize the slopes of the basin to minimize erosion, enhance biodiversity, create wildlife habitat, and can be aesthetically pleasing. Typically the water inlet and outlet will be located as far apart as possible to prolong the duration of water flowing through the basin, thereby maximizing water quality treatment by increasing contact with vegetation and the amount of settling that can occur. In some basins, elevated berms are installed in the basin to force water to meander through the entire basin and further extend the detention time. These are referred to as *extended detention basins* and can increase the effectiveness for water quality treatment.

*** Provide photo or graphic ***

Sediment Forebays - A sediment forebay (forebay) is a pool and settling basin constructed to pre-treat runoff before it enters a larger detention basin. The purpose of the forebay is to provide retention for a portion of the first flush stormwater runoff - runoff at the beginning of a storm contains the most pollutants - and allow sediment to settle out from the incoming stormwater before it reaches the larger BMP. Forebays help isolate sediment deposition, provide additional water quality treatment, and facilitate the maintenance, effectiveness and lifespan of the larger BMP.

*** Provide photo or graphic ***

Permeable Paving - Permeable paver systems, along with porous concrete or asphalt, are paving systems with pore spaces that allow water to move downward through the paved surface rather than running off the surface and contributing to flooding. Common applications for permeable paving include parking lots, driveways and patios. In permeable paving systems rain or snowmelt infiltrates downward through the paved surface into the underlying stone base where it is temporarily stored, allowing for infiltration into the soil and/or slow release into a storm drain system through an underdrain. The storage of water in the stone base can also provide some filtration and treatment for improved water quality. Permeable paving systems can result in reduced winter maintenance and applications of road salt since snowmelt infiltrates down, preventing ponding and refreezing at night (which is typical on asphalt surfaces), and the need for repeated salt applications.

Under the McHenry County Stormwater Management Ordinance, a project with a permeable paver system may qualify as a “pervious surface” if the design shows that native soil will be used to infiltrate stormwater that falls on the paver area (no underdrains would be allowed in this case). If the permeable paving system is designed to have underdrains, no credit would be given and the paving systems surface area would be considered impervious.

*** Provide photo and/or graphic ***

Green roofs - Green roofs are vegetated roof systems designed to retain and slow rainwater runoff from the tops of buildings. Green roofs are commonly constructed with a lightweight planting medium and planted with drought tolerant vegetation such as sedum. There are two main types of green roofs: extensive and intensive. Extensive green roofs typically cover a large area and are primarily intended to manage stormwater, such as absorbing and retaining the first half inch of rain. Intensive roofs also provide stormwater management benefits but are usually designed with an emphasis on aesthetics and are constructed with a deeper planting medium that is capable of supporting a greater diversity of plant species. Because of their aesthetic value, intensive green roofs are often used for public spaces or areas with high visibility. Although green roofs require additional engineering and structural support than

conventional roofs, they usually have a much longer life span since the vegetation protects the roof from UV radiation and other elements. To reduce the risk of leaks, particular care should be made to hire qualified contractors who are experienced with installing green roofs.

*** Provide photo or graphic ***

Rain barrels - A rain barrel collects and stores rainwater from a roof that would otherwise be lost to runoff and diverted to storm drains and streams. Usually a rain barrel is composed of a 55 gallon drum that sits conveniently under a residential gutter down spout. Water stored in rain barrels can be used to irrigate lawns, gardens, and potted plants. This water is then absorbed and transpired by the plants or soaks into the ground, thereby reducing the volume of stormwater flowing off-site.

*** Provide photo or graphic ***

Stormwater Treatment Train - A stormwater treatment train incorporates at least two stormwater BMPs in sequence to maximize the effectiveness of managing water quality. The combination of stormwater BMPs can provide progressively improved water quality treatment as water flows from one BMP to the other. An example of a treatment train approach for a site may start with a parking lot with permeable pavers that directs runoff through a bioswale before flowing through a naturalized detention basin. If properly implemented, the runoff leaving the site would be significantly improved over conventional stormwater management systems.

*** Provide graphic ***

Green Infrastructure Maintenance - There is no such thing as maintenance free. All stormwater management systems, whether gray or green, require maintenance. Appropriate operation and maintenance activities ensure that green infrastructure will continue to function properly and yield expected water quality and environmental benefits, protect public safety, meet legal standards, and protect communities' financial investment.

To maximize the environmental benefits and reduce the cost of green infrastructure projects over the long-term, green infrastructure projects should be designed with maintenance in mind. This is particularly true for forms of green infrastructure that include live vegetation or relies on biological activity for treatment. For green infrastructure projects to perform as expected and properly capture and infiltrate stormwater, there are several factors to consider before project implementation.

- Type of maintenance necessary to maintain performance
- Frequency of maintenance and available personnel to perform maintenance
- Cost of component replacement (e.g., plants, shrubs, permeable pavement)
- Sufficient and dedicated funds to cover operation and maintenance activities, including cost of replacement components

Maintenance plans and strategies will vary depending on the green infrastructure project. Proper maintenance is essential to maximizing the environmental, social, and economic benefits of green infrastructure, as well as ensuring that projects perform as expected. Establishing written plans and procedures ensure proper long-term maintenance and are critical components to the success of any green infrastructure project. Below are ways to ensure that green infrastructure is maintained over the long-term.

- **Identify Staff Resources for Inspection and Maintenance –** The organization implementing a project needs to determine if green infrastructure inspections and maintenance can be accomplished with existing staff, if additional staff needs to be hired, if specialized training is needed, or if it would be more cost effective to hire an experienced contractor. Consider which departments have the equipment and skill sets to inspect and maintain green infrastructure, such as parks or public works. Training may be needed for both staff and contractors who perform inspections and maintenance. Effective operation and maintenance training should be provided in an easy-to-understand format, occur at regular intervals, and target the activities employees, residents, or volunteers are expected to perform. Education and training can also provide information on the water quality and environmental benefits that green infrastructure can yield when properly maintained.
- **Identify Maintenance Triggers -** It is important to identify common problems that require non-routine maintenance to aid inspectors in the field. Such maintenance triggers include excess invasive species, sediment accumulation, trash and debris, overgrown vegetation, dead or diseased vegetation, signs of erosion, structural damage, or standing water present more than 72 hours after a rain storm.
- **Update Standard Operating Procedures -** If organizations have standard operating procedures for routine landscape and infrastructure maintenance, they should be updated to incorporate green infrastructure maintenance triggers and remedial actions. Additionally, if contractors are used to maintain practices, include specific language in contracts that require training of maintenance crews and specify the performance standards that are expected to be achieved. Maintenance schedules should be set for each type of practice, and a tracking system should be in place to ensure that maintenance is performed as prescribed.
- **Secure Funding for Maintenance -** As with all infrastructure, expenses for green infrastructure maintenance are ongoing. Sources of funding that may be used to install green infrastructure projects, such as state and federal grants or loans, cannot be relied on for ongoing maintenance. Therefore local funding sources need to be identified to provide a stable source of funding for maintenance of green infrastructure practices.
- **Enlist the Help of Volunteers -** Some routine maintenance, such as removing trash and weeds from bioretention areas, can be accomplished by partnering with neighborhood organizations, greenway groups, or garden clubs to leverage their funds and volunteers.
- **Procure Equipment -** Organizations should also consider the equipment needed to maintain green infrastructure and determine if additional equipment is needed. Most of the necessary equipment is typical of general landscape maintenance. Heavy equipment is discouraged for routine maintenance, because it can cause soil compaction, which reduces the effectiveness of the practices.

*** Callout for Algonquin green infrastructure maintenance program ***