Reflo
Sustainable Water Solutions

GREEN INFRASTRUCTURE FOR MILWAUKEE-AREA SCHOOLS

A Resource Replication Guide | Spring 2016

DOCUMENT PROVIDED BY

Reflo-Sustainable Water Solutions

FUNDED IN PART BY

The Fund for Lake Michigan

SPECIAL THANKS TO OUR PARTNERS

The Fund for Lake Michigan,
Milwaukee Teacher Education Center,
Milwaukee Public Schools,
Milwaukee Environmental Sciences School,
Milwaukee Parkside School for the Arts,
Highland Community School,
Hawley Environmental School,
Fernwood Montessori School
and Arts @ Large.

TABLE OF CONTENTS

1 Introduction

2 Common Projects

3 Case Studies

4 Permitting & Approvals

5 Curriculum Connections

6 Developing Impact Plan

7 Funding

8 Resources

Acronyms

BMP ..... Best Management Practice
GSCM ..... Green Schools Consortium of Milwaukee
DPI ..... Department of Public Instruction
DIY ..... Do-It-Yourself
EE ..... Environmental Education
GI ..... Green Infrastructure
IB ..... International Baccalaureate
MES ..... Milwaukee Environmental School
MMSD ..... Milwaukee Metropolitan Sewerage District
MPS ..... Milwaukee Public Schools
MTEC ..... Milwaukee Teacher Education Center
O&M ..... Operations and Maintenance
PTO ..... Parent Teacher Organization
RFP ..... Request for Proposal

INTRODUCTION

INTRODUCTION

Executive Summary

This Resource Replication Guide is intended for schools, local governmental agencies, non-profit and for-profit organizations, foundations, and community members with an interest in developing green infrastructure (GI) at schools within the Milwaukee-area. The purpose of this guide is to provide information and resources to assist schools with the process of successfully implementing and maintaining GI projects at schools including rainwater harvesting, urban gardens, green walls, green roofs, aquaponics, rain gardens, bioswales, infiltration basins, ecosystem hubs, retention ponds, detention ponds, stormwater diversions, native landscaping, soil amendments, stormwater trees, and permeable surfaces. The topics covered in the Resource Replication Guide are included in the following sections:

1: Introduction
2: Common Green Infrastructure Projects
3: Case Studies
4: Permitting & Approvals
5: Curriculum Connections
6: Developing Impact Plans
7: Funding
8: Resources

In developing the Resource Replication Guide, the nonprofit Reflo – Sustainable Water Solutions (Reflo) and Milwaukee Teacher Education Center (MTEC) surveyed several Milwaukee area schools that have implemented GI practices on their property including Highland Community School, Fernwood Montessori School, Milwaukee Parkside School for the Arts, Hawley Environmental School, and Milwaukee Environmental Sciences School. From this process, Reflo and MTEC realized the importance of establishing a support group to help share the lessons learned between the schools, collaborate on future opportunities, and to further promote the use of GI at Milwaukee-area schools. This led to the development of the Green Schools Consortium of Milwaukee (GSCM).

THE MISSION OF THE GSCM IS TO PROMOTE GREEN INFRASTRUCTURE PROJECTS IN MILWAUKEE-AREA SCHOOLS THAT RESULT IN IMPROVED ENVIRONMENTAL OUTCOMES AND GREATER ECO-LITERACY AMONG STUDENTS, FAMILIES, EDUCATORS, AND COMMUNITY MEMBERS. THE GSCM ENVISIONS A CONSORTIUM OF MILWAUKEE AREA GREEN INFRASTRUCTURE PRACTITIONERS, AGENCIES, AND FOUNDATIONS WILLING TO SHARE OUR COLLECTIVE RESOURCES AND BAND TOGETHER TO BECOME A LEADER IN THE DEVELOPMENT OF MEANINGFUL GREEN INFRASTRUCTURE PROJECTS AND EDUCATIONAL OPPORTUNITIES FOR OUR SCHOOLS AND COMMUNITY.

INTRODUCTION

Through the development of the Resource Replication Guide and the GSCM, the organizations involved have agreed that to effectively implement engaging and meaningful GI at Milwaukee area schools, the following key pieces should be in place:

- An appropriately engineered and school specific, integrated conceptual **design and implementation strategy**;
- **Involvement of experts** in the design, construction, and management of GI projects;
- **Buy-in from the stakeholders** (educators, facilities staff, students, community, MMSD, MPS, funders, etc.);
- The capacity for **maintenance and monitoring** the project's impact on an ongoing basis; and
- A plan for integrating the project into the **curriculum** and life of the school.

The Resource Replication Guide and the GSCM were created to support GI. As more schools adopt GI practices and as the market for these types of practices evolves, the Resource Replication Guide is intended to be iteratively revised and reissued to stay as current and relevant as possible.

If you are interested in either learning more about the GSCM, becoming GSCM member, or contributing to further revisions of the Resource Replication Guide please contact Reflo at admin@refloh2o.com.

▼ *The Reflo team at the Guest House Community Pavillion*

SPECIAL THANKS

A special thanks goes to all those who contributed to the development of this document. Andrew Plier, Margaret Cope, Rose Hebein, Barbara Richards, and Justin Hegarty from Reflo-Sustainable Water Solutions, Dave Libert from Milwaukee Teacher Education Center, Denice Niebuhr from Milwaukee Parkside School for the Arts, Leana Nakielski and Kevin Driscol from Highland Community School, Lee Anne Chappelle from Hawley Environmental School, Matt Ray from Fernwood Montessori, Vicki Elkin from the Fund for Lake Michigan and The Milwaukee Metropolitan Sewage District (MMSD).

Introduction to Your Resource Replication Guide

Schools, especially in urban settings, can be large contributors of stormwater runoff. In addition to runoff from large buildings, numerous school yards have been paved over to reduce maintenance and to provide space for parking. While schools may be large contributors of stormwater runoff, they also offer some of the best opportunities for installing GI and providing educational curriculum connections. This resource guide is intended to help streamline the process of planning, designing, installing, and supporting GI at your school. Several schools through out the Milwaukee-area have installed successful GI projects and environmentally related educational opportunities. This guide is intended to promote the development of these types of projects by sharing common resources and lessons learned.

In response to the need to develop a process to get GI more widely implemented at schools and to help pool resources together, a group of practitioners, agencies, and foundations formed the Green Schools Consortium of Milwaukee (GSCM) in September 2014. Practitioners are interested in completing projects and engaging stakeholders. Agencies govern the standards and rules by which the practitioners abide. Foundations support these efforts with funding and other resources. The GSCM is comprised of representatives from multiple bodies within each of these perspectives in order to keep all required organizations apprised to the on-going efforts of the consortium and ensure progress is being made toward common goals. Much of the success of the following guide is attributed to the GSCM and the resource sharing which took place during its monthly meetings.

The intent of this all-inclusive approach is to ensure the GSCM is moving forward in a way that is supportive of current GI initiatives within Milwaukee, and that it offers educators a roadmap for how they can work with school administrators and partners to turn school yards into innovative learning centers.

It is recommended that any school interested in developing GI on their properties consider joining and/or contacting the GSCM. If you're interested in learning more about the GSCM please contact Reflo at admin@refloh2o.com.

▲

(Parkside School for the Arts) Picture of a typical Milwaukee area school playground, originally installed to reduce maintenance costs, but has resulted in increased stormwater runoff - increasing the instances of combined sewer overflows and impaired water bodies and has reduced green space for students, reducing play, outdoor eco-literacy opportunities, and educational outcomes

Approach to Implementation

The project approach is crucial to the success of any project. Successful projects include plans for physical implementation, ongoing maintenance and operation, and other support functions.

The suggested approach to successful implementation of GI at Milwaukee-area schools is two-fold:

Implementation of the physical infrastructure. This includes assessing, planning, designing, and constructing your project.

Implementation Support which is tied to physical infrastructure and will ensure long-term success of each individual project. This includes curriculum integration and planned operations and maintenance.

Implementation

Implementation refers to the following four steps:

- **A.** Site and Project Assessment
- **B.** Planning
- **C.** Design
- **D.** Construction

The time it takes to complete each step of a project will vary depending on size, scope of services, complexity, number of stakeholders involved, etc.

Funding Tip: *Funding may be considered an additional step. This task will need to be proactivley pursued throughout the life of the project to fund all aspects from planning through construction to ongoing maintenance. Early identification of the types of projects you plan to implement, the projected outcomes, and the potential sources for funding will be important to the success of your project. Additional information on this topic can be found at the end of this section and in Section 7 of this guide.*

▲ *Mayor Tom Barret at a community-organized GI project*

1A. Site and Project Assessment

The first step of implementing a project is an assessment. This is particularly important if you're consulting with outside parties and/or including multiple stakeholders. Simply put, it's the data collection step. The type of information you need to collect will vary for each project. Some basic questions to ask are:

- What are your goals for the project?
- What will have an impact on your project (grading, drainage, overhead lines, underground utilities, codes/permits, etc.)?
- What type of information do you need to collect to accomplish your project?

Data collection might include picture documentation, measurements, collecting existing drawings, researching available products, etc. A professional consultant should know what type of data is necessary for you to complete your project. You should consider doing your assessment(s) during nice weather for the ease of assessing existing conditions. Once you've collected all the data you need to move forward you can begin planning your project.

At this point, MPS schools are encouraged to reach out to the MPS Facilities Department to further consult on the feasibility of the GI project. The Facilities Department is responsible for MPS infrastructure related projects and has a great deal of experience designing and implementing these types of projects. Additionally, their approval will be necessary at MPS schools and involving the Department early on in the planning process is strongly advised.

1B. Planning

Planning is the most important step to increase your chances of long term success of your project. Don't treat your project as an individual item; plan for how this project fits into the long-term vision of your site. Reflo utilizes, and encourages the use of, the collaborative planning approach. This allows interested parties to participate in the planning of the project. Interested parties might include staff, students, and parents, local businesses and non-profit organizations, local officials and government agencies. The end product is something that project stakeholders helped create, building a sense of ownership, community, and pride amongst stakeholders. This helps to build long-term support and involvement for your projects.

Every planning process and end product will be unique. Some examples of project deliverables you might expect to produce through this process include:

- Marketable project plans and images showcasing your intent and end product
- Phasing plans for construction
- Cost estimates for each piece of the project

A construction phasing plan is the process of breaking a project plan down into more manageable pieces or line items. As funds for each line item are raised, you can begin to construct your project. Be careful, to organize your line items in a way that one fully funded item does not have to wait for another to be completed before it can begin.

Tip: *Reflo advises you to consult with an expert to help develop your construction phasing plans*

1C. Design

Design is a step that is utilized as needed. As you decide to start moving forward on specific items from your plan, some items, such as a physical structure, may need additional design work prior to construction. There should be a buffer in your total project plan that allows for further design if needed. If consulting with an outside agency for your design work, ensure the consultant has extensive experience with your particular type of project, enabling them to make the most efficient and effective use of your resources and have your best interest in mind.

1D. Construction

Once you have a plan for your site and the design completed for any necessary pieces, you can start planning for construction. Some project elements, such as a rain garden, may be simple and can be constructed using low skilled labor and/or volunteer help, which may include students, parents, or community member. Other project elements, such as a physical structure, may require skilled labor and for you to consult with a contractor. You may want to check your schools rules and processes on soliciting bids for contract work and insurance requirements during the planning phase to help better understand the time it may take to secure a contract for this type of work.

ENGAGE THE STAKEHOLDERS!

Be sure to identify all project stakeholders early in the process and include them in the discussions for all steps of development. This will help ensure the project is moving forward in a direction that meets everyone's needs.

Examples of possible stakeholders are the building leaseholder (MPS), local government agencies (MMSD, municipalities), local representatives (aldermen), the students, staff, and parents, local businesses, community partners, etc.

Maintaining open lines of communication between all these parties will generate interest in the project and will increase long term success.

▲ *Volunteers at Milwaukee's Guest House*

2. Implementation Support

It's highly recommended that you integrate the following items into your planning and implementation to ensure your project's logevity.

A. Operations and Maintenance
B. Curriculum Integration

Both of these items should be discussed and developed during the planning phase. Previous project experiences have shown that without developing these vital project pieces and integrating them into the planning and implementation phases, issues quickly arise. GI requires regular maintenance in order to ensure proper function and project longevity. Allowing your GI to go unmaintained and underused will cause the project to fail and can discredit the GI movement.

2A. Operations and Maintenance

Every type of GI strategy will require its own unique Operations and Maintenance (O&M) plan. Operations is the day to day function of your new GI, such as open/closing valves, draining, watering, etc. Maintenance is the regularly scheduled work required to help prevent damage, increase life of products, and ensure products are functioning as intended and at maximum efficiency.

Prior to implementation of any project, research should be conducted, and experts should be consulted on the O&M requirements for your selected GI strategy. In some cases maintenance may require professional services. In other cases the O&M might be able to be accomplished by the students, staff, teachers, and parents of the school. Regardless of the requirements, prior to implementation you should ensure an O&M plan has been developed and will have the required long term funding (e.g. a "stewardship endowment") to sustain itself.

Additionally, it's recommended that each school appoints someone who is responsible for, or hires an organization that would be responsible for ensuring the O&M plan is being followed. This is important to the success of your project and the movement of GI.

Maintenance Tip: *Maintenance plans are critical to the success and lifespan of projects. Ignored maintenance often requires increased cost in the future to fix the issue or can cause irreparable damage to GI strategies.*

A Milwaukee Parkside School of the Arts teacher educates others about rainwater harvesting after being educated on the operations of the school's new cistern installation

2B. Curriculum

Tying curriculum to your projects is extremely important. GI strategies can offer significant educational opportunities. The more O&M you can tie into curriculum, the more likely your GI project will be effectively maintained. Hands-on GI learning also helps create more eco-literate students who understand the importance and work required to develop a more sustainable future. Additionally, it creates a sense of ownership and pride for the students in their school and their community.

If done properly, curriculum can be tied to all steps in the project development processes including assessments, planning, design, construction, and O&M. Taken a step further, it may present an opportunity to tie in business, financing, and other indirect project development tasks into lesson planning.

PLANNING CURRICULUM

The goal of curriculum planning is not necessarily to create new curriculum, but to find ties to existing programming. Consider turning a book lesson into an interactive, hands-on experience for you and your students!

A more detailed discussion about curriculum is included in Section 5 of this guide.

Funding

Funding is a vital aspect to any project and will be something that needs to be aggressively sought after throughout the life of the project. Reflo recommends that the school appoints someone with the sole responsibility of securing funds for these projects to increase chances of success.

There are many sources for funding depending on the type of project you're trying to accomplish. Milwaukee Public Schools has a grants office, which MPS educators should contact BEFORE you begin the grant process. This office can provide assistance in writing grants and should be made aware of current applications.

To date, it's often been difficult to find funding for planning and design work. The money for these steps often has to come from fundraisers, private donors, foundations, and/or money allocated from the school funds. Grants and other funding sources which support on-the- ground efforts for construction are somewhat more prevalent. Section 7 of this guide identifies multiple funding opportunities for GI related projects.

Grant Tip: *MPS schools that do not contact the MPS grants office are at risk of their project timeline being slowed or stalled. Be sure to contact them early in the grant application process as signatures of district leadership may be required and may take a couple weeks or more to obtain.*

COMMON PROJECTS

COMMON GREEN INFRASTRUCTURE PROJECTS

Types of GI Projects

The following are a few examples of GI related projects. The goal of this section is to help provide definition and understanding of various GI strategies. This will help schools make better decisions on the types of projects to implement.

Section 3 of this guide discusses several case studies where some of these GI strategies may have been implemented. Please consider consulting with one of the schools if you plan on implementing a similar project.

Water Harvesting

250-gallon rainwater harvesting totes and rain barrels are just a few examples of water harvesting systems

Water harvesting is the collecting and storing of rain for later use. Uses might include irrigation, vehicle washing, or for use in a facility. Sources of collection may include surfaces such as roofs, parking lots, streets, and property runoff. The collected water may need to go through treatment depending on the source and/or the intended end use. Water harvesting systems may include components such as a collection source, inflow piping, pre-screening, pre-treatment, storage units, outflow piping, post treatment, and overflow piping.

One can place the collection tanks above ground or below ground. Above ground systems often offer more educational opportunities, and make general operation and maintenance tasks easier. These options should be discussed with a professional prior to implementation. When choosing a consultant, look for someone with knowledge and experience in these aspects.

Benefits of Water Harvesting

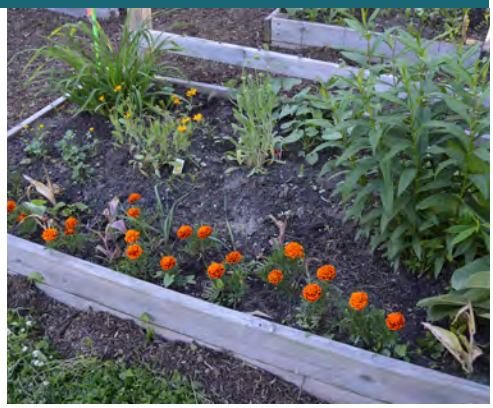
- Reduces demand on the city water supply
- Reduces local flooding and basement backups
- Rainwater is the healthiest source of water for plants
- Rainwater is free
- Conserves water and is environmentally friendly
- Reduces water bills

Considerations

1. Local and state plumbing codes may apply to this GI strategy.
2. Proper sizing of your storage volume, inflow, outflow, and overflow pipes, and any pumps are some design criteria that should be taken into consideration before constructing your water harvesting system.
3. The need for pre or post treatment should also be determined and in some cases may be required by code.

Urban Gardens

Local Example: Martin Drive Community Garden



Urban garden is a term used for gardens found in heavily urbanized areas. Urban gardens can be a small garden for personal use or a large multiple acre garden for community use, depending on the space available. Gardens, particularly vegetable gardens, have a high water demand, 1-2 inches of water per square foot per week. A source of water, and the cost associated with watering your gardens, should be taken into consideration prior to construction. Land use planning is a very important step when developing an urban garden.

There are local resources available to help plan your gardens such as the Victory Garden Initiative (VGI) and Milwaukee Urban Gardens (MUG).

Benefits of Urban Gardens

- Filters runoff pollution
- Urban community gardens increase a sense of stewardship
- Creates a better living environment by 'greening' the city
- Increases food grown and bought locally
- Helps to stop erosion and topsoil removal
- Can help to clean air and rain water

Considerations

1. Consider the amount of sunlight, type of soil, slope of the land, local hydrology, types of plants to be planted, water demand, and water source when planning your garden.
2. For an above ground water collection source in the City of Milwaukee, such as a roof, you need the roof size to be approximately 20-30% of the garden space in square feet.

Green Walls

A green wall, or living wall, is a wall that is partially or completely covered with vegetation and a soil medium. There are many types of green walls from Do-It Yourself (DIY) to professionally manufactured and installed. Green walls are a great insulator for sound, energy (heating and cooling), and light. If you're interested in building a green wall, it's recommended that you start by researching available options.

See Section 8 of this guide to help begin your research.

Benefits of Green Walls

- Dampen noise pollution
- Creates local jobs for design, installation and maintenance
- Creates a living work of art
- Cleans outside air of pollutants and dust
- Insulates and cools the building envelope
- Cleans interior air space by removing harmful toxins

Considerations

1. Approval and compliance with existing fire code may be required to construct green walls on the exterior of your school.
2. Design criteria to consider may be size, spacing, types of plants, growing media, additional loading to the existing structure, watering requirements, and access for watering.
3. If you would like a professionally manufactured and installed product, speak to a consultant recommended or certified by the manufacturer of the product you're interested in, and have them provide you with an estimate.

Green Roofs

MMSD Headquarters and 88.9 Radio Milwaukee Roof. Photo credit: MMSD

A green roof, or living roof, is a roof that is partially or completely covered with vegetation and a soil medium. Similar to a green wall, green roofs are great insulators for energy. They can also be a place of refuge for occupants of the building.

It is recommended that you always hire a qualified consultant/contractor prior to installing a green roof. Soils and vegetation have large loads that can affect the structural integrity of your building supports.

Benefits of Green Roofs

- Reduces water quantity and improves water quality
- Reduces stormwater runoff
- Creates additional recreational spaces
- Reduces cooling costs in the summer
- Protects roof from harmful UV breakdown and can extend roof life
- Reduces "heat island" effect

Considerations

1. A thorough analysis of your structures ability to support the load should be conducted prior to any installations or material purchases.
2. The installations are also complex and require a professional to ensure they are being implemented correctly.

Aquaponics


Local Example: Growing Power

Aquaponics is the combination of aquaculture and hydroponics through the creation of a symbiotic environment between aquatic animals and hydroponic plants. The animal excretions feed the plants, and the plants filter the water for the animals. As is the case with most GI strategies, the complexity and size of the system can range from a simple DIY project to a complex professionally manufactured and installed product.

The first step is to decide how large of a system you would like to implement. The second step is to decide what types of plants and aquatic animals you would like for your system.

Benefits of Aquaponics

90%↓
Aquaponics uses 90% less water than traditional farming

Plants grow twice as fast due to the naturally fortified water from the fish

No harmful fertilizer run off into the water shed

It's organic - conventional pesticides would kill the fish

Requires minimal labor - no fertilizing, weeding, or watering

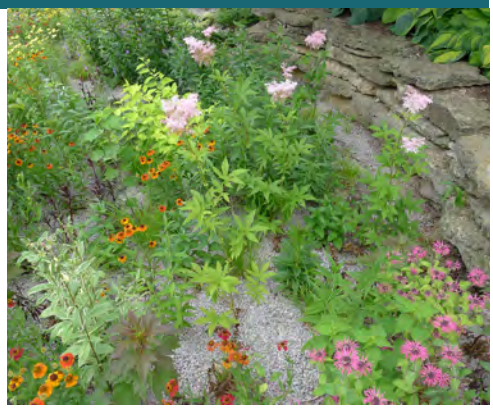
It can be grown almost anywhere, indoors or outdoors

Considerations

1. The plant and fish species selection process needs to be well thought out in advanced, as these symbiotic relationships are delicate and require knowledge on how to properly manage the relationship.

Rain Gardens

MillerCoors rain garden in Milwaukee. Photo credit: MMSD



Rain gardens are soil depressions planted with a specific selection of plants to help naturally absorb and infiltrate water. Rain gardens are meant to address relatively small quantities of stormwater with minor improvements to runoff quality from bio-sorption and degradation of stormwater captured and infiltrated. Often rain gardens can be considered a "GI strategy of opportunity" rather than specifically sized to address the full runoff volume from a capture area.

Rain gardens are typically used as a cost effective method to manage overflow water from gutters or water collection systems.

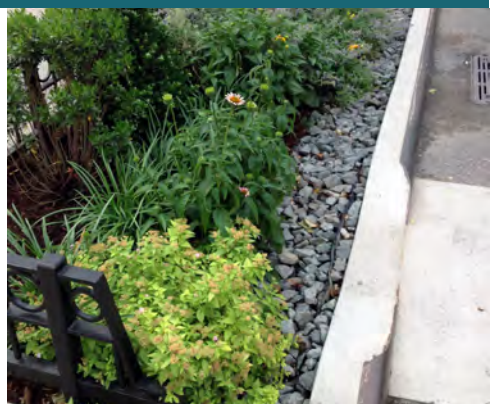
Benefits of Rain Gardens

- Creates a habitat for local birds and beneficial insects
- Sustainable through drought, flood and the summer break
- Enhancement of the building appearance
- On-site filtering of local polluted stormwater
- Low cost of installation and maintenance
- Absorption of rainwater runoff from rooftops, parking lots and playgrounds

Considerations

1. There are many decisions you must make when planning a rain garden, such as size, location, shape, and plant selection. UW Extension has a free rain garden how-to manual for homeowners. This manual is a great place to help you start planning your garden.

Bioswales



Bioswales are designed to remove pollution and settle solids from surface runoff water. They are engineered to physically and biologically treat a specified quantity of stormwater. They are not necessarily intended/designed to infiltrate stormwater and reduce peak discharge rates, but can be designed to dissipate runoff velocity and peak flow quantity. Improving stormwater quality is the primary objective with this type of GI strategy.

Bioswales are typically chosen when water quality is the main focus, such as treating runoff from a road or parking lot prior to entering a storm drain.

Bioswale cross section

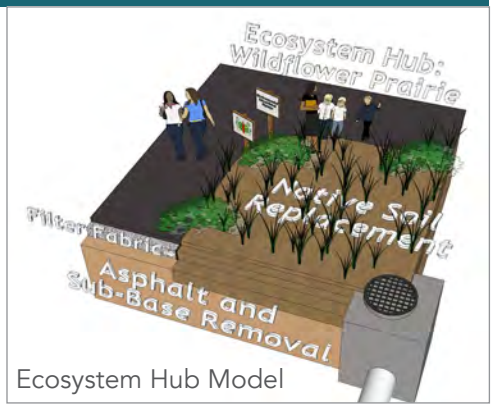
Benefits of Bioswales

- Reduces stormwater entering sewer systems
- Reduces non-point source pollution
- Creates habitat for wildlife
- Can be engineered to fit the characteristics of your site
- Increases green space and neighborhood aesthetics

Considerations

1. Bioswales are specifically engineered for each site. As such, consult with an engineer on the proper design considerations. This may include design storm, size, soil composition, plant selection, and plumbing.

Ecosystem Hub



Ecosystem Hub Model

An **Ecosystem Hub** is a Reflo design concept. Reflo defines it as an educational redevelopment GI strategy specifically designed to mimic natural ecosystems, such as Wisconsin Prairie or Birchwood Forest. An Ecosystem Hub is intended to enhance the environmental impacts of a site by reducing stormwater runoff and improving runoff quality, but is primarily intended to mimic natural native ecosystems and provide educational opportunities for local communities to reconnect with nature and learn about its natural water management.

An ecosystem hub is typically chosen when reducing stormwater quantity and linking it to specific educational activities is the primary objective.

Benefits of Ecosystem Hubs

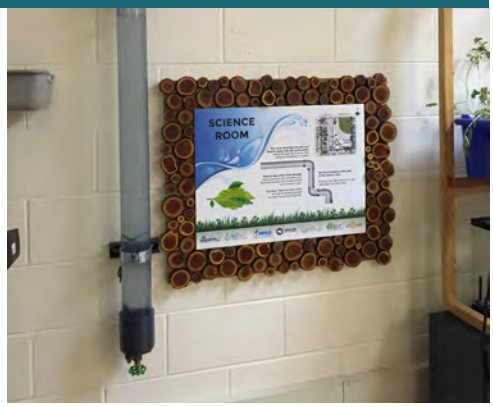
- Provides a shady calming environment
- Reduces heat on school playgrounds
- Restores native landscapes
- Reduces stormwater entering sewer systems
- Creates habitat for wildlife including birds, bees and butterflies
- Assists with groundwater recharge

Considerations

1. The primary functions of an ecosystem hub are to provide educational opportunities and mimic native ecosystems. When planning your ecosystem hub, first determine what your educational goals are. Next, determine what type of native ecosystem(s) can best accomplish your educational goals. Then, determine to what extent you can recreate the native landscape. Examples of natural environments you may intend to recreate could include soil profiles, plant life, wildlife, contours, or historic landscape features. The limiting factors to your design could include budget, space availability, safety concerns, and permitting.

Internal Storm Drain Diversion

Local Example: Milwaukee Environmental School



Many schools have a flat roof. Most flat roofs have **internal storm drains** to manage rainwater that falls onto the roof. These internal storm drains run through a series of pipes inside the building and connect to a main drain pipe. This main drain pipe eventually runs underground and connects to the sewer. Depending on your location, this might be a storm sewer or a combined (storm and sanitary) sewer.

These storm drains present an opportunity to divert some of this rainwater draining from your schools roof to a specified location for collection and reuse.

A licensed plumber should be consulted and contracted for this work.

Benefits of Internal Storm Drain Diversion

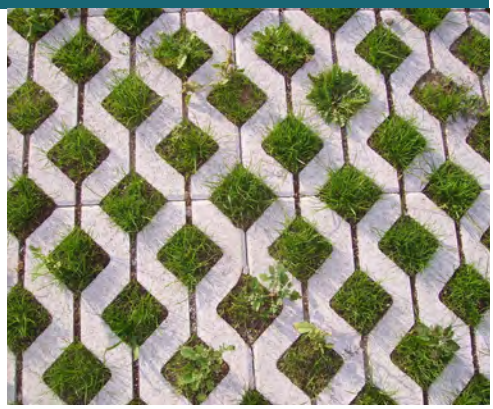
- Allows you to collect a large volume of high-quality water
- Water collected can be used for area landscaping and gardens
- Rainwater is better for plants than treated water
- Saves money by reducing potable water use
- Reduces the volume of water entering our sewer systems

Considerations

1. Do not create a situation in which the water could back up onto the roof, or leak into the school. If the system overflows to the property, as opposed to the original storm drain/sewer, you must be sure you're not going to create a flooding issue during heavy storms. This may require installation of a valve that allows diversion of the water away from the collection system and back to the original drainage pipes
2. Every situation will be different and all necessary engineering controls should be put in place to prevent unintended issues.

Permeable Surfaces

Photo Credit: City of Milwaukee EOC



There are many types of **permeable surfaces** such as permeable concrete and asphalt, pavers and various products that offer the ability to infiltrate stormwater while providing a structurally reinforced surface.

The most important installation step for most permeable surfaces is the preparation of the base and sub-base. This is because of how permeable surfaces are designed to function. Instead of the water shedding off the surface, such as with traditional non-permeable hard surfaces, the water seeps through the surface via void spaces between non-uniform sizes of aggregate. The water accumulates in the base under the surface where it slowly infiltrates into the sub-base and surrounding soils. As water moves it causes particles in the base and sub-base to shift positions.

Benefits of Permeable Surfaces

- Infiltrates large amounts of stormwater
- Reduces the risks of flooding
- Provides groundwater recharge
- Many options to help customize to personal taste.
- Aesthetically pleasing

Considerations

1. Be careful when preparing the base and sub-base. If these layers are prepared properly, the impacts of the particles shifting positions will be negligible. However, if these layers are poorly prepared, this movement could create void spaces in the base which may cause cracking and heaving of the hard surface.
2. Permeable surfaces can be combined with other GI strategies such as water harvesting. Determine if a combination of GI strategies is appropriate for your project and plan and design accordingly.

Soil Amendments

Photo Credit: MMSD

Soil amendments are used to alter the existing characteristics of your soil to achieve a desired result. A desired result could be more nutrients and moisture retention to aid in healthy plant growth. This is the more traditional use for soil amendments. Another desired result could be better infiltration and water storage. These are very different desired results and would require different types of soil amendments.

In both cases, one physical characteristic that could easily and cheaply be improved is air flow. Soil becomes compacted overtime which can restrict air flow, impede root growth, decrease nutrient transmission through the soil, and decrease insect and undergrowth biodiversity. Air flow can be increased by tilling or aerating. This process provides a good opportunity to add your soil amendments which can increase soil nutrient and keep the soil loose. Examples of nutrient providing amendments include compost, traditional fertilizers, coffee grounds, biochar, peat, sphagnum moss, and more.

Benefits of Soil Amendments

- Improves the overall health of poor soils
- Increases the soils water holding capacity
- Increases plant growth and crop production
- Stimulates soil biodiversity
- Increases carbon sequestering
- Provides affordable stormwater BMP

Considerations

1. If you plan on using the soil to grow crops, you should only use certified organic products.
2. If you intend to use soil amendments to increase nutrient content, you should be aware of where the runoff from your site goes. Nutrient rich runoff can have devastating impacts on water quality.
3. You should consider adding green infrastructure designed to uptake nutrients from stormwater runoff, such as a bioswale, if the runoff from your site drains directly to a storm sewer, street, stream, river, or lake.

Stormwater Trees

There isn't a definition specific to the term stormwater trees. The term is used to define the use, not the product. **Stormwater trees** are trees planted for the specific use of assisting in the management of stormwater. For example, trees planted in a forest are just trees. However, trees planted adjacent to a parking lot in a green space intended to manage runoff from the parking lot are stormwater trees.

Trees manage water by absorbing it into their roots, holding it on their leaves and branches, and evapotransporating it to the atmosphere. Tree selection will depend on many factors including aesthetics and environmental conditions. It is recommended you consult with a landscape architect to determine the best selection of stormwater trees for your unique space and project criteria.

Benefits of Trees

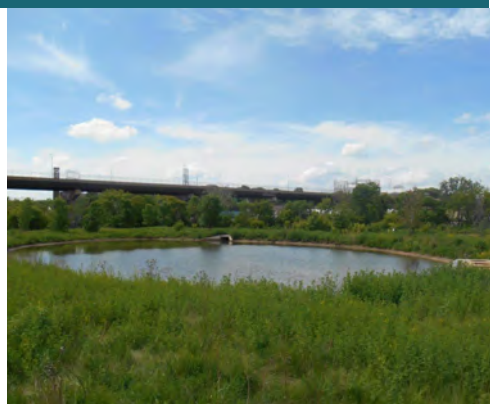
- Increases property value
- Increases neighborhood aesthetics
- Creates a habitat for wildlife
- Great use of volunteers for a community project
- Improves soil quality
- Improves air quality

Considerations

1. Design criteria to consider includes the inclusion/exclusion of an under-drain system, the size (fully mature) and spacing of the trees, adjacent landscaping, and the quantity and quality of the water being diverted to the trees.
2. Conduct an analysis of how much water is being diverted to your trees and what pollutants might be present

Dry Detention, Retention/Wet Detention Ponds and Infiltration Basins/ Trenches

Photo credit: MMSD



Detention/retention ponds and infiltration basins/ trenches are similar to one another; however, understanding the differences may help you understand what is right for your site. At first glance one might confuse these GI strategies with rain gardens, bioswales, and ecosystem hubs. Detention/ retention ponds and infiltration basins/trenches are typically much larger GI strategies meant to manage specific stormwater volumes from large sites. These GI strategies are more common in suburban settings and areas with enough open space to implement. These systems are engineered to hold a specified volume of water to reduce peak flow runoff volume and improve water quality by suspending solids and reducing re-suspension during additional storm events.

Retention ponds have water that fluctuates in response to precipitation and runoff from the contributing areas. Maintaining a pool discourages re-suspension and keeps deposited sediments at the bottom of the holding area. The difference between dry detention and retention ponds is that retention ponds are permanently pooled, while dry detention ponds are usually dry expect during and immediately after a precipitation event. Detention ponds slow down water flow and hold it for a short period of time, such as 24 hours, before draining it to the sub-base.

Infiltration basins/trenches are engineered to penetrate a specified volume of runoff to keep the total runoff of post-development sites lower or equal to that of pre-development characteristics. Infiltration basins are shallow artificial ponds designed to infiltrate stormwater through permeable soils. The water in an infiltration basin is managed by allowing it to infiltrate or evaporate under normal conditions. Infiltration basins are not effective in areas with high ground water, heavily compacted soils, high clay soil, and high level of stormwater sediment. Infiltrations basins are often installed with other GI strategies such as a wet detention or retention ponds, which act as pretreatment to settle the solids prior to entering the infiltration basin/trench.

Considerations

1. In all of these strategies, an emergency spillway is usually required for safety during flood events. These strategies can vary in size and shape, but they all function to reduce peak flows.
2. The land area available for construction, slope of the site and contributing area are all factors to be considered when planning for these type of GI strategies.

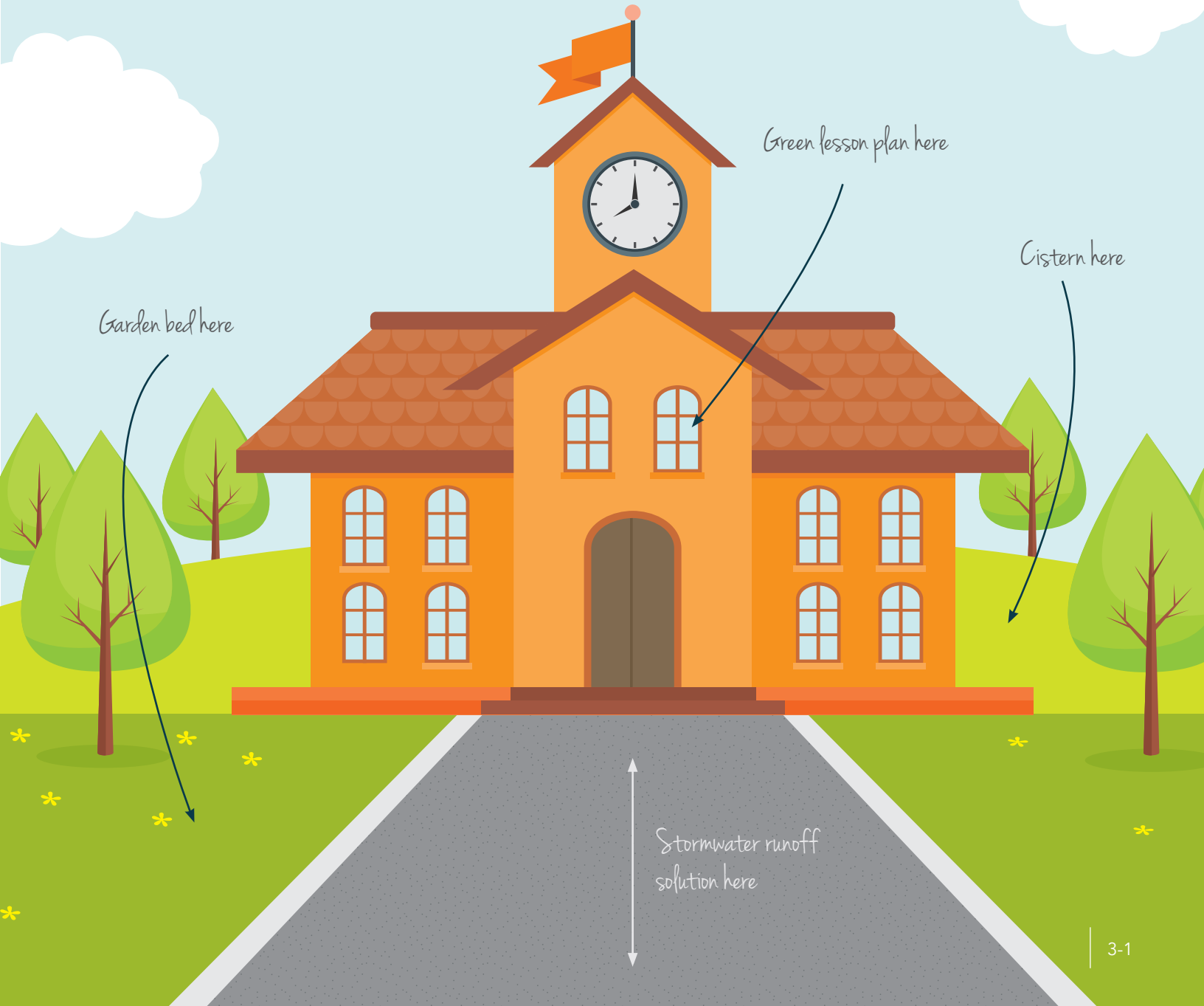
CASE STUDIES

CASE STUDIES

Case Studies

The following are five case studies to showcase real success stories of GI installation throughout the City of Milwaukee. Each case study includes a brief description of the school, the projects, successes, challenges, and lessons learned.

1. Milwaukee Environmental Sciences School
2. Milwaukee Parkside School for the Arts
3. Highland Community School
4. Hawley Environmental School
5. Fernwood Montessori School



Milwaukee Environmental Sciences School

1. Milwaukee Environmental Sciences School (MES) is a year round Expeditionary Learning "non-instrumentality" charter school located at 6600 West Melvina Street. MES currently leases its building from Milwaukee Public Schools (MPS). MES opened in August 2013 with approximately 150 students in K4 to 5th grade. MES will grow a grade level each year through 12th grade by 2020.

The MES approach to implementing GI strategies on their property did not follow the standard process of conducting an in-depth conceptual planning process for the entire school site prior to project implementation. Since MES is a startup school, they had limited resources to afford the planning phase for their entire site. This process highlighted the lack of grant opportunities available that will fund for these steps. These planning costs are typically funded completely by the school. Because this can be a cost burden, Reflo worked with MES to identify a set of small, but high impact projects, which fit with the long-term vision of the site, rather than planning for the entire site.

◀ *PVC tubing was installed to divert stormwater into a classroom, allowing students to test and analyze the water*

MES benefited from funds and partnerships developed from its parent organization, MTEC, which resulted in approximately $50,000 of grant funding for its initial eco-campus. These partnerships included Reflo, Stonehouse Water Technologies, and the Milwaukee Metropolitan Sewerage District (MMSD). The eco-campus project plan features 12 raised bed gardens, a stormwater re-use system, and an ecosystem hub to be constructed in the 2015-2016 school years. The stormwater re-use project will additionally serve as a demonstration site to share stormwater catchment strategies with other schools and community groups. The stormwater re-use system design includes:

- Diverting one internal storm drain from the storm sewer to two collection tanks
- Installing one 1,200 gallon water harvesting cistern in the courtyard with a rain garden to manage the overflow
- Installing one 1,300 gallon saddle vault cistern on the exterior of the school with the overflow sheet flowing across the existing pavement to an ecosystem hub.
- Installing an ecosystem hub to infiltrate the runoff water that drains to one of the catch basins on site

MES has recently decided to revisit the planning phase and is now working with Reflo to develop a full-fledged GI Conceptual Plan for the entire site, with the focus on prioritizing two targeted sections of the property.

Successes

One of the lead contributors to the success of MES's projects is its close relationship with MTEC which provided staff support in the form of a grant writer and project manager. This role helped to bring other project partners to the table and find outside funding sources to push the projects forward. This was a vital factor, contributing to the success of the MES project, and such a person, or project champion, should be considered by any group planning to redevelop their space into an eco-campus. Even an incremental project such as the one at MES requires at least 10 to 20 hours per month of a project champion's time in planning and guiding implementation.

Another contributing factor to the success of this project was the active engagement with all relevant project partners and government agencies including MMSD and MPS. MES approached MPS early on in the planning process to identify any possible issues and to provide updates. Similarly, MES engaged MMSD prior to opening its school and throughout its planning process, which resulted in helpful guidance and in-kind financial support for one of the two cisterns through a MMSD grant received by Storehouse Water Technologies.

MES successfully implemented the high impact projects with no issues, on time, and on budget. MES is in the process of developing a GI conceptual plan that will help implement future projects to be more integrated with the entire site plan.

Challenges and Lessons Learned

One lesson learned by MES was the importance of completing the planning step prior to construction. Planning helps put all pieces into place by ensuring that administrative challenges are efficiently managed. It also offers the opportunity to more effectively request funding with solidified budgets, and ensure that proper personnel are in place to implement and care for the project. All this improves the project's ability to be successful in the long term.

As a startup school, MES's funding options were limited. The priority items for the initial operational funds were targeted to one-time startup costs such as technology, textbooks, etc. As schools plan for their own projects they should consider laying out a timeline for planning and implementation over 12 to 18 months that incorporates possible funding sources and engages internal and external stakeholders. Schools should additionally be aware that the timeline for grant submission, awarding and payment may not always align with initial project plans and may require adjustments of the project timeline and management of cash flow. It would be wise for schools to consider setting aside operating funds and/or money fundraised by the school families of at least 25% of estimated project costs. This suggestion stems from experience in the difficulty of securing grants for planning and design.

Another challenge inherent in the GI process is the complexity of managing the myriad project partners, contractors, sub-contractors, budgets, and invoices. This was at times a challenging and time consuming task for MES as it lacked an in-house staff person with construction management experience. MES benefited from having Reflo as an "owner's representative" to help manage the GI projects. An owner's representative can manage all contractors and subcontractors, and is responsible for completing the project on time and on budget. This may increase the cost of the project, but significantly reduces the workload for the project owner and provides an additional level of expertise and accountability.

PHASE YOUR PROJECT 1/2/3

If you don't have necessary funds readily available, breaking your GI plan into construction phases helps accomplish work while fundraising is in process.

Your phasing plan should demonstrate how to successfully install all features of each phase into the big picture plan.

▲ *MESA courtyard cistern. Photo credit: Michael Timm*

Milwaukee Parkside School for the Arts

2. Milwaukee Parkside School for the Arts (Parkside) is a merger school between Tippecanoe School for the Arts and Dover Schools. The school is located at 2969 South Howell Avenue in Milwaukee, Wisconsin. One of Parkside's partners, Arts@Large, hired Reflo to work with the staff and students of Parkside to complete a GI Conceptual Plan for the under-utilized courtyard space on the school's property. The plan was completed in May of 2014 and was unveiled to the public at a well-attended outreach event in June of 2014. The event doubled as a fundraiser where over $3,000 was raised. The school has completed multiple aspects of their GI conceptual plan for their courtyard space including:

- Installing a 330 square foot rain garden
- Installing a green wall
- And developing curriculum to incorporate hands on learning with the new infrastructure

Parkside is currently raising funds for the projects from the conceptual plan that they are interested in implementing in the future.

Educational signs were installed in the courtyard to help students learn the benefits of green infrastructure. Photo credit: Michael Timm

Successes

Parkside, with the help of Reflo, successfully completed the GI conceptual planning step for their courtyard space. This included five design charrettes held during after-hours staff meetings. It also included one education seminar with an eighth grade class to include their ideas into the conceptual plan. Holding the conceptual planning charrettes during after-hours staff meetings meant the sessions were well attended by staff and a good level of participation was achieved.

During the conceptual planning process the Parkside staff successfully identified a "Green Team" who worked closely with Reflo during additional meetings to address additional planning details. The development and involvement of a Green Team was vital to the success of this project.

Parkside successfully planned and held a public unveiling meeting. The unveiling was planned around another school event which brought many students and parents to the school. This was a highly successful strategy to bring these plans to an audience that may otherwise not have seen them or had the opportunity to directly ask questions about them. The event was also well attended by many community stakeholders, including Mayor Tom Barrett.

Parkside has successfully implemented a handful of the smaller projects identified in the conceptual plan, including a rain garden, green wall, and curriculum development.

Challenges and Lessons Learned

To-date, raising money for the larger projects has been difficult for Parkside. A project manager and grant writer, similar to the champion described in the MES case study above, needs to be identified and involved in the project from the start. The grant writer needs to be highly motivated in seeking grants for these types of projects.

Additionally, grant opportunities need to be identified early in the process that may help fund anticipated projects. This will help facilitate future phases getting funding. One of the important aspects to a conceptual plan is to continue to make good progress in implementation. Without continued progress, project supporters tend to lose faith and motivation in pursing the plan.

CREATE A "GREEN TEAM"

Set your project up for success by creating a "green team" during the planning process. This dedicated group of individuals will help immensely, not only in providing feedback during the inital planning phase, but by continuing to act as stewards for future GI planning and fundraising. The more ownership you can give to the school and community members, the more likely your project will flourish.

Consider placing several teachers on your "green team" who can champion educational goals of the project, and assist in classrooms and events during and after the project.

Highland Community School

3. Highland Community School (Highland) is a parent-directed, Montessori MPS Charter School located at 1706 W Highland Avenue. Operating in one of the poorest neighborhoods in the city (66% of King Park residents live below the poverty line). Highland is a model of stability. In 2012, it expanded into the former MacDowell Montessori building, just its third site in the neighborhood over the past forty-five years.

Highland is currently undertaking a series of environmental upgrades, renovating its kitchen facilities, and developing a state-of-the-art natural playground for recess, physical education classes, and to serve as an extension of the Montessori classroom. This new initiative is called the Natural Grounds Redevelopment Plan (NGRP). A group, The Natural Grounds Committee, was developed to direct and oversee all activities of the NGRP.

The NGRP is creating a built environment that supports the school's Montessori curriculum and focus on "developing the child as a whole." NGRP plays a critical role in the child's development and Highland seeks to provide a space where the

Above: The school's greenhouse is used for hands-on learning for Highland's montessori program
Below: The school's natural playground
Photo credit: Michael Timm

children can develop intellectually, socially and emotionally, all within the context of understanding emerging environmental and social issues that relate to the health and well-being of the community. Ultimately, Highland is committed to using the built environment to provide an educational experience that is community-based and highlights the urban sustainable agricultural issues that help alleviate hunger and promotes health & wellness for Highland students and their families, Milwaukee, and our global community. Highland welcomes hundreds of individuals annually to tour the school and learn about its emerging green school campus. As a member of the GSCM, Highland disseminates its successes to other Milwaukee schools, local organizations, governments and multiple stakeholders all vested in developing green infrastructure projects in Milwaukee schools.

Successes

Center for Resilient Cities provided the conceptual design for the school grounds redevelopment, which was informed by parents, staff and community members over the course of a year of meetings, group sessions and opportunities for the community to provide feedback during the school's annual fall Open House. There have been a number of projects that have already taken place on the school's property, as well as the inception of additional education programs and activities.

Victory Garden Initiative (VGI) awarded Highland and its neighbors 30 fruit and nut trees, most which were planted on the school grounds as part of the urban agriculture program. The City of Milwaukee Forestry department planted 20 additional trees on the Highland school grounds and the property adjacent to the school in an effort to help green the urban environment. Keep Greater Milwaukee Beautiful has provided valuable environmental education to Highland students, raising awareness of local issues. The Urban Ecology Center is a long-standing partner of Highland, welcoming 24 field trips of Highland students annually to participate in the Neighborhood Environmental Education Project. Stone Creek Coffee and Highland adolescent students and staff opened the school's first community café, serving fair trade coffee and eventually value-added products made with fruits and vegetables the students grow. King Community Center sends children over every summer to work in the school/community gardens alongside Highland staff and students. The King Center has expressed great appreciation and gratitude for this opportunity as they currently do not have such a garden area."

The most recent developments have been the valuable partnerships formed with MMSD, the City of Milwaukee, and MPS in support of the NGRP. These organizations have teamed up to install bioswales on the Highland school grounds as well as along the southern side of Juneau Avenue directly bordering the school. The implementation of the bioswales will remove 450 square yards of pavement. This is anticipated to capture the first 0.5 inches of rain from the drainage area, approximately 1,300 gallons.

HIGHLAND PARTNERS

STONE CREEK COFFEE

CENTER FOR RESILIENT CITIES

MPS

URBAN ECOLOGY CENTER

City of Milwaukee

VICTORY GARDEN INITIATIVE

MMSD
PARTNERS FOR A CLEANER ENVIRONMENT

Challenges and Lessons Learned

The bioswale project is ongoing, however there were concerns addressed by MPS in regards to the installation. Schools considering doing similar project should include MPS in all planning and partner discussions prior to implementation as well as take these items into consideration during the planning process.

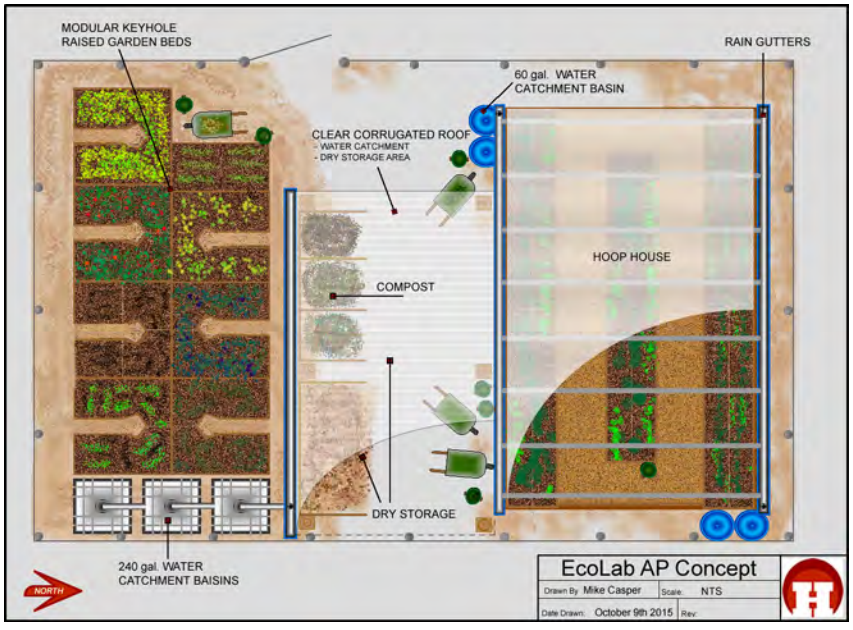
MPS wanted to have their maintenance personnel have the time to conduct a preconstruction condition assessment. They also requested to have their own inspector on site during construction efforts. This is something to consider when creating the budget and schedule for similar construction projects. Since this was a City managed project, the City agreed to coordinate all efforts.

Depending on the location of the bioswales, you may need to have a surveyor assess the property lines. This will determine who is responsible for maintaining it. A maintenance plan and budget needs to be established prior to implementing these types of projects.

ESTABLISH STRONG PARTNERSHIPS

Creating strong community relationships can make or break a project. Early in the planning phase make sure to research organizations in the community that align with your projects mission and goals.

Additionally, connect with MPS early and often. Not only will they provide guidelines for your project, but can act as a resource during and after installation.



EcoLab planning document
Credit: Highland Community School and Mike Casper

Hawley Environmental School

4. Hawley Environmental School (Hawley) is a MPS Charter and an International Baccalaureate (IB) candidate elementary school located at 5610 W. Wisconsin Ave. Hawley Environmental School focuses specifically on environmental education, and boasts a strong academic curriculum and teaching staff that ensures academic success for students grade K4-5.

The school's typical approach to implementing GI projects is systemic, collaborative, and rooted in the school's mission and vision. Project development begins with brainstorming sessions, followed by action plans that include onsite feasibility studies, cost analysis, and the development of a maintenance and sustainability plan. Through this process Hawley has learned that it is critical to plan early, develop a clearly stated request for proposals (RFP), if necessary, and ensure all stakeholders are involved throughout the process. The next step involved the development of environmental education (EE) curriculum. The school's science/EE implementer played a key role in developing a scope and sequence of units aligned with state science standards and the Department of Public Instruction (DPI) environmental education standards.

◀ *Pictured above: Prairie Garden (top), Raised Bed Gardens (middle), Sensory Garden (Bottom)*
Photo credit: Michael Timm

One of Hawley's highest impact projects is their gardens. The layout consists of three types - sensory, prairie, and four raised garden beds. The prairie and sensory gardens were constructed in 2002-2003. Prior to the development and construction of the gardens, Hawley participated in UW-Madison's Earth Partnership for Schools program. Several teachers attended a week-long seminar to learn about restoration of native plant species. The school's EE teacher created a curriculum to help students take responsibility for selecting and then planting the gardens. Construction of the gardens was taken on by one of the school's families who owned a landscaping business. This was a large cost savings to the project. The raised garden beds were constructed in 2003 by MPS contractors and funded by grants.

Hawley ensures these projects get used to their fullest potential by building curriculum that directly engages the students in hands-on activities with these new learning tools. They have many successful curriculum activity examples including:

- "Weed Out" Wednesdays - Each classroom is assigned one Wednesday a month during the fall and spring to help maintain and beautify the gardens.
- Prairie Garden Journals - Garden journals are used monthly for students to learn the lifecycle of a garden noting seasonal changes and plant adaptations.
- "Garden to Table" - Classrooms are active participants in the cultivating, planting and harvesting of vegetables and plants. Hawley utilizes an on-site composter to help with soil fertilization. Refuse from student lunches are also used in the composting process.
- Energy Conservation Days - Each month, Hawley promotes conservation of resources such as energy and paper by having "paper free days, and "low energy" days.

Hawley continues to implement projects with the completion of the newest one right around the corner, the installation of an Aquaponics lab. The lab is situated on the second floor adjacent to a classroom. It was designed in collaboration with Imagine Aquaponics as a hybrid Aquaponics system. Imagine Aquaponics applied for and received a grant of $1,000 on Hawley's behalf, from the Aquaponics Association. Imagine Aquaponics donated equipment to the project and also secured an additional $500 donation from a colleague at Miller Brewing Company. With the majority of the system in place, Hawley qualified for an additional grant from MPS (made possible through funds given by the NEA Foundation and AT&T). Hawley is currently looking into connecting stormwater/water harvesting with the Aquaponics lab.

COMMUNITY INVOLVEMENT

Parental involvement throughout the project as well as an active Parent-Teacher Organization can greatly contribute to the success of a GI project.

To be even more successful, think about involving other groups, such as your school's governance council, and groups who can advocate for Environmental Education.

Successes

Hawley has had tremendous success implementing the gardens due to efforts from involved parents and the EE science teacher, who were instrumental in securing grants from the Helen Bader and Petit Foundations. MPS Facilities and Maintenance and MPS contractors were very helpful with the construction of these projects.

Parents of Hawley have been very supportive in helping with the construction of gardens, maintenance, and helping with fundraising activities to provide additional resources and support. Governance Council Membership includes parents and community business partners who have helped with funding, networking, resource development, and sustainability of projects. Critical to the development and support of a strong EE program is the school's EE committee. The committee consists of a teacher's representative of each grade level. The EE committee plans and maps EE curriculum for each grade level. Much success is also attributed to the strong partnerships with the Department of Natural Resources (DNR), USDA Forestry, Keep Greater Milwaukee Beautiful, MMSD, and the Urban Ecology Center which have supported the EE curriculum needs and helps reinforce hands-on learning activities with the school's GI projects.

Challenges and Lessons Learned

Hawley has had the greatest challenge with the installation of the aquaponics lab. The initial phase of construction for the aquaponics system was put on hold due to concerns by MPS related to the structural integrity of the building. Most of the foundation for the system has already been built. The water capacity for the tanks, total loading of the system, and existing structural condition of the building still needs to be determined. Hawley has been unable to locate the schools original building design plans. As a result, the project has been suspended pending MPS approval of these plans.

Hawley had significant challenges with the approval process in applying for grants and developing RFP's. In the past they were very fortunate to have a point person to lead and organize many of the tasks involved with the planning and implementation of their GI projects. They recently lost their EE teacher, who had assumed this role. The EE committee appointed someone to fill this role. However, this person is also a classroom teacher, and has limited time to commit to these very time consuming tasks.

Photo credit: Michael Timm

Fernwood Montessori School

5. Fernwood Montessori School (Fernwood) is a Bay View Neighborhood school on Milwaukee's south side, serving over 700 children, grades K3-8. Fernwood prepares its students for active citizenship through self-development in an environment that fosters inquiry, flexibility, and responsibility. Fernwood Montessori believes that all things are interconnected; the need for food, water, shelter, transportation, conservation, etc.

Projects developed at Fernwood are typically joint classroom endeavors with at least one staff member championing the cause. In 2014 the Fernwood Fund began mapping out an "intentional learn-scape." However, Fernwood does not currently have a solidified approach or green GI plan guiding the decision making for the implementation of projects. Rather, they take opportunities for improvement as they come and allow the space to evolve on its own.

Fernwood's longest standing and most notable project is the Greenhouse/Aquaponics Lab (FGH). The FGH is a student-run facility which produces food that is used locally. The FGH is under constant modification to find the most efficient way to operate. For example, a ceiling fan and outlets were installed as part of the recent solar array project. Additionally, they are expecting to finish a thermal exchange project. This project includes using city water to keep the water temperature cool during the hot months of summer. The same water loop can be connected to a small hot water tank to heat the water in winter months.

Currently, Fernwood is anticipating an addition to their existing building: seven classrooms and a gymnasium. This presents the school with an opportunity to develop a GI plan to incorporate all the existing and planned projects into an interconnected outdoor learning environment for their students. Fernwood Montessori is currently trying to connect with MMSD in an effort to install trench drains as part of their holistic conservation project. Their stormwater management and water harvesting plan for this project includes the following aspects:

- Installing a trench drain (10-12'w 8" h) to divert rainwater from an impervious section of property
- Installing a 75-100 square foot prairie rain garden
- Re-build of the "labyrinth" landscaping in front of greenhouse which will include vegetable growth
- Address a current issue with the aquaponics system in which sediment accumulates in the grow beds which degrades the water quality. The plan is to install a cyclone filter with a central water vacuum system to eliminate this issue.

For future endeavors, Fernwood plans to continue installing GI projects that have educational and environmental benefits. They would like to begin developing more long term installation and maintenance plans to ensure each individual project can be tied to the whole concept of the space.

Successes

Fernwood successfully installed their aquaponics lab and developed student activities to manage the O&M. This included a temperature controlled room for cultivation of perch and the incorporation of new curriculum surrounding the Aquaponics system, as well as the study of food systems.

Challenges and Lessons Learned

In general, funding projects is always a challenge. As stated in previous case studies, without a champion to undertake this effort, it falls in the hands of those who already often have too much going on. Collective buy in is critical for building the internal capacity of a school to accomplish these project. Developing and showcasing clear incentives helps drive projects forward. All projects need to provide a tangible incentive to be sustainable.

As is often the case with these types of projects, they are not common place. As such, it often takes longer than average to gain all necessary approvals. This requires patience and high level coordination and engagement with all stakeholders, particularly funders. Since grants often have to be used by specific dates, matching funding with approval timelines can be very difficult. Always include MPS Facilities and MPS Risk Management in all projects from the very beginning, and don't assume approval will be granted.

A PLANNED APPROACH

It's often easy to get excited about implementing a project once a plan is complete. Taking on too much at once can cause the project to stall, or fail. Sometimes the best approach is a slow methodical one.

Also, have a big picture plan, but do not etch it in stone. Many things change in five years and rigid plans will inevitably need to be adjusted.

PERMITTING & APPROVALS

PERMITTING AND APPROVALS

Permitting and Approvals

The following section is meant to provide guidance to schools with regards to the installation of some GI projects, as there may be zoning codes, ordinances, permits and other regulations associated with the activities. The information provided in this section is based off the experiences with the Section 3 case studies, detailing the process others have gone through in order to implement their projects. This section is not meant to be exhaustive of potential codes, ordinances, permit requirements, or regulation troubleshooting, but rather covers some of those faced in the case studies and most common for GI projects.

Cistern Installation

Governing regulations for your cistern installation will depend on many variables including location, type, size, and function. The main variable is whether your cistern will be installed above ground or below ground.

Above ground cisterns pose issues with security. From the MPS perspective, they want to ensure the cisterns will not be subject to tampering and will not pose safety risks. This may require the inclusion of additional security measures such as locks, tamperproof hardware, or enclosures as part of the design and construction.

Many underground cisterns require connections into existing pluming and/or sewer infrastructure. Any plumbing which ties into existing infrastructure will need to be completed by a certified plumber. Additionally, underground cisterns typically require a pump to be installed to retrieve the water. Electric pumps will require you to tie into an electrical source. Pumping water from an underground source may trigger state plumbing code requirements. This will also require a certified electrician to ensure local and state codes are being followed. This could have permitting requirements or cost implications. None of these criteria make underground cisterns an unfavorable choice, but project managers should take these additional criteria into consideration when planning.

▲

Rainwater cisterns at St. Francis Community Garden, Milwaukee's Guest House and Milwaukee Environmental Sciences School

Structures

When considering built structures, make sure the structure concept falls under one of the City of Milwaukee's defined building types, and be sure your structure meets the code requirements for that type of structure. Any structure being constructed in the City of Milwaukee must be permitted. Depending on the size and type of structure, various codes might apply. Additionally, MPS will have requirements on material use, size, and setback distances. The best way to proceed is to draw up a concept of what you intend to build, including the planned installation location. Also, contact the city permitting office to get details on the type of information that must be provided in order to receive a permit. In tandem with this work, schools should begin to facilitate communication with MPS to get approval of the concept. Once approval is received for the location and general concept of the structure, develop a detailed construction plan to be submitted to the City for approval. Prior to submitting to the City for your permit, you may want to consult with a local contractor to ensure the design plans are properly prepared for construction efforts.

Rainwater harvesting structure at the Martin Drive Community Garden

Internal Storm Drain Diversion

Internal storm drain diversion projects will require consultation and installation services from a certified plumber to ensure all local and state codes are followed. In addition to plumbing codes, MPS may have additional facility requirements. For example, pipe insulation for anything above the drop-ceiling has been discussed at previous sites as being a requirement. You may want to look into this prior to moving too far ahead. This additional requirement can have a large impact of total project costs or schedule if not investigated ahead of time. Another consideration is the planned reroute of the water line. Will this interfere with any other utilities such as electrical, which may have separation distance requirements? Keep MPS facilities in the loop on the design plans, and gain approval prior to implementation.

Green Walls

The use of green walls at many schools is to enhance the exterior of the primary building. Some green walls are constructed out of materials, considered to be flammable, such as wood. In the past, concerns about what types of materials would be allowable for installation on the exterior of the building has been discussed with MPS facilities staff. This is something to think about when planning a green wall. Be sure to include MPS in your discussions as the plan's progress.

CURRICULUM CONNECTIONS

CURRICULUM CONNECTIONS

Curriculum Connections

Curriculum integration is the core foundation of the Green Schools Consortium of Milwaukee. It is discussed throughout this guide as being one of the critical elements to ensure long term successes with GI projects at schools throughout the City of Milwaukee. Curriculum can be tied to all steps in the project development processes including assessments, planning, design, construction, and O&M. It may also present an opportunity to tie in business, financing, and other indirect project development tasks into lesson planning. The goal is not necessarily to create new curriculum, but to find ties to existing curriculum. Every subject presents an opportunity to provide hands-on interaction with the surrounding environment in a way that is more entertaining and beneficial to the students.

The GSCM is in the process of identifying the best approach to incorporate these activities into curriculum. As this approach develops, additional lesson plans, materials, and success stories will become available. Other organizations, such as the University of Wisconsin-Madison Arboretum have already begun creating some of these resources through their Earth Partnership for Schools program.

VISIT THE ARBORETUM'S WEBSITE

Find more information at http://uwarboretum.org/eps/.

CURRICULUM CONNECTIONS

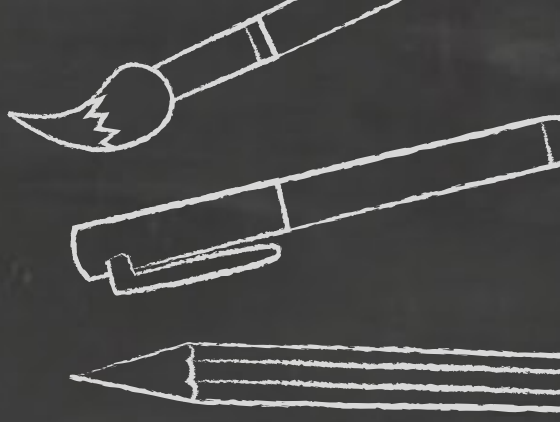
The examples below represent ways for schools to organize themselves to integrate GI into academics and the life of the school. The GSCM will continue to work with more explicit focus on how GI and the various subject areas can be integrated to address Common Core, Science and Social Studies standards. It's important to note that the following examples are not approaches to installing curriculum, but rather approaches to implementing and sustaining projects to allow for curriculum integration.

1 HAWLEY ENVIRONMENTAL SCHOOL EXAMPLE

Hawley School created an Environmental Education Club. The club is comprised of a Governance Council and a School Body Council. The Governance Council membership includes parents and community business partners who have helped with funding, networking, resource development, and sustainability of projects. The School Body Council membership consists of a student representative from each grade level, and a lead teacher. These student representatives meet with the environmental education lead teacher regularly to discuss environmental education project development and curriculum. The lead teacher reports to the environmental education committee comprised of one teacher from every grade level. This committee is headed by a chairperson who oversees key projects and helps create action plans for each grade to implement. Parents are also involved in this club through school newsletters and other forms of mass communication such as social media.

2 HIGHLAND COMMUNITY SCHOOL EXAMPLE

Highland created a committee called the "Natural Grounds Committee" to help manage the efforts of their GI projects. Two staff members were chosen for the key roles, a Facility Manager and a Director of Community Resources. Their roles are to lead the development of relationships and acquire resources for projects and programming. The staff members are supported by a large base of parent volunteers who have established their own Parent Committee. Communication is facilitated using Base Camp, an online project management tool.



3 PARKSIDE SCHOOL EXAMPLE

Parkside School created a "Green Team" during the conceptual planning phase for their courtyard redevelopment project. The Green Team is comprised of teachers from all grade levels, special education staff, and a parent coordinator. The team organizes school projects, seeks funding, and is tasked with making the school's property a more sustainable and beautiful space. Their goal is to create outdoor spaces to teach, share knowledge, and help students learn about nature. Parkside has already begun implementing some of the projects from the conceptual plan. The projects have roots in school-wide themes based on the environment. They involve the Arts (Visual Arts, Music, Movement and Drama). They also help teachers implement STEAM curriculum. The Green Team works closely with the Garden Club. The Garden club is comprised of students from third through eighth grade, teachers, and parents. The overall goal of these groups is to inspire students to appreciate, respect, and preserve nature.

4 FERNWOOD SCHOOL EXAMPLE

Fernwood Montessori School's sustainability initiatives are predominantly designed and administered by the Adolescent Program. Students work directly with the Bay View community to create symbiotic relationships. Students have found restaurants and a local food pantry who want the greenhouse produce and fish raised in the Aquaponics facility. They also organize field trips that inspire and add value to their urban food system studies, and seek out "green" projects such as a building-wide cafeteria composting campaign and solar panels to support their work in the greenhouse. In addition, the adolescent students can join the after school greenhouse club, "Fishheads", a dedicated group who manage the grow systems in the greenhouse. The students are mentored by their sustainability teacher and greenhouse supervisor. Additionally, these endeavors have the support of administration and the Fernwood Fund.

DEVELOPING IMPACT PLANS

DEVELOPING IMPACT PLANS

Developing Impact Plans

Quantifying and qualifying impacts is an important part of ensuring continued success of GI projects. The more data we can collect on the benefits of GI, the stronger case we can make for continuing to implement it. It also presents us with the opportunity to identify deficiencies in existing products and strategies. This information will help the market evolve to better meet the needs of future GI champions.

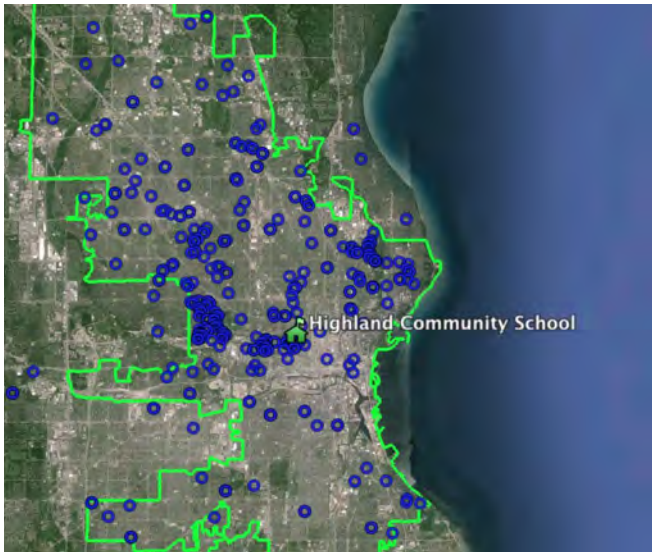
Funders often require impacts to be measured as a component of the grant. Having an understanding and formulating a plan on the types of impacts you expect to achieve, how you intend to measure the impacts, and how this information will be documented and disseminated for future use has many benefits beyond reporting to your funder.

This idea also presents schools with a unique opportunity to track the required maintenance of their own projects. For example, a school might decide to monitor how much water is being diverted away from a storm drain by a piece of permeable pavement recently installed. If, after five years, you see a reduction in the percentage diverted compared to the amount of rain, you may consider adding to the budget the cost of hiring a vacuum truck to come clean your porous pavement, restoring functionality.

PARTNER TO COLLECT DATA

Organizations which have programs that fall in-line with your project may have a vested interest in collecting data to help support their plans and goals. For example, MMSD may be interested in providing a flow meter to help measure pre and post implementation of a large green space, such as a rain garden, which is intended to reduce the amount of water entering the sewer system.

Think about these potential partnerships and reach out to any organizations you think may be interested in partnering to collect this data.



This map shows the impact of just one school. Depicted is Highland Community School and the diverse distribution of the students that attend the school. The impact of "greening" a school can expand far beyond the school's property boundaries

Types of Impacts

There are many types of impacts ranging from direct to indirect, environmental to social. You should clearly define the types of impacts you hope to achieve and plan to measure. The following is a short list of potential impacts of green infrastructure. Think about how your project may apply to some of these.

01

Environmental

Environmental impacts are the most obvious direct impacts achieved from GI. There is a wide range of environmental issues including:

- Water quality, quantity, and conservation
- Wildlife habitat improvements
- Improved air quality
- Climate change adaptation
- Improved climate resiliency

02

Economic

GI implementation has direct and indirect economic impacts. Some of the direct impacts are related to the environmental impacts. By reducing water volumes entering our sewers during heavy rains, you reduce the risk of local flooding, basement backups, and sewer overflows. One of the indirect impacts GI has on economics is growth in an emerging job market. As interest and implementation of GI strategies gains popularity, the market will respond in a positive way. Projects at your schools can be used as training sites for these new skilled workers.

03

Social/Socioeconomic

Social impacts are indirect impacts of GI. There is research available that has linked increased green spaces to increased health and welfare of the general population and reduced neighborhood crime. These impacts may be difficult to measure; however, there are many organizations interested in gathering this type of information. Think about how your projects may have these types of impacts and how you could help collect the data.

How to Measure Your Impacts

Every project is unique, and the way in which you choose to measure your impacts depends greatly on the type of impact you are looking to quantify or qualify, as well as your intended outputs. Consulting with professionals and/or government agencies is recommended. The following are a few hypothetical examples of how one might go about measuring impacts of various GI projects.

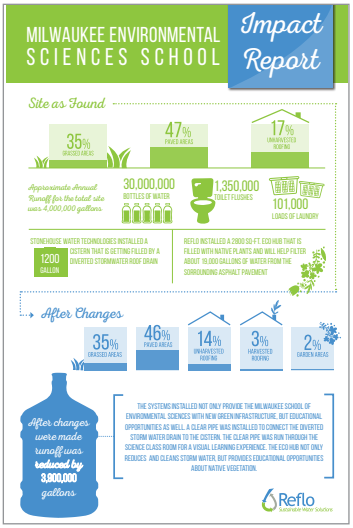
Environmental Example - Water Quantity

In this example, a school plans to remove a large section of pavement around an existing catch basin on in their play lot. The pavement will be replaced by densely planted native Wisconsin vegetation. The type of impact to be measured is the reduction in water volume during rain events which produce more than 0.1 inches of rain. The intended output is a four year engineering estimate of annual volume, a one year pre-installation measured volume, a one year post-installation measured volume, and a one month long bi-annual measured volume over ten years. The purpose is to show the immediate measured reduction in water volume entering the sewers and to monitor any increase or decrease to this percentage over a ten year period. A decrease may indicate maintenance needs to be performed. An increase may indicate the plants are becoming more established.

In order to collect the proper data, the school plans to work with a local municipality to have a flow meter installed at a downstream manhole on their property one year prior to construction. The school intends on following any necessary calibration requirements to ensure the equipment is working properly. This may cause gaps in data, but will ensure a higher level of accuracy on the data collected. After one year, the results will be complied and analyzed by the students as a tie to curriculum. After construction is complete, the flow meter will be recalibrated and installed in the same location. Once again, after one year, the results will be compiled and analyzed by the students. This data will be made publically available to all interested stakeholders immediately. The school will then continue to monitor the flow rates at this location during one month each year, over the next ten years. The purpose of this is to monitor any change in activity so this information may become available for future studies of green infrastructure.

Additionally, this school has decided to take a proactive approach to initiating curriculum additions related to this project. Their curriculum plans include:

- Students will be involved in the planning, designing, constructing, and maintaining the garden to be installed through the garden club
- Quizzes will be developed for the biology class on plant, animal, insect, and habitat identification
- A rain gauge will be installed and measured by students to help track rainfall quantity
- Assignments will be developed for the math class to calculate infiltration rates, flow rates, and water volumes during rain events. This data will be compared to the measured results



Report Tip: Consider making your impact report into an infographic. The result is an easy-to-read document that anyone at any level of the project can understand.

Economic Example - Increased Property Values

In this example, a school plans to harvest some of the rainwater that falls on the roof of the primary building. The school is able to divert 4,000 square feet of roof space to an underground cistern. They plan to use the harvested water as the primary source of irrigation on the football field, while city water will be used as a backup supply. They would like to use this project to predict results and compare these results to annual data in the following areas:

- Annual gallons of water harvested
- Annual gallons of harvested water used for irrigation
- Annual gallons of City water used for irrigation
- Payback period for implementation costs
- Annual cost savings post payback period

The school is will setup curriculum in the math classes to develop the preconstruction estimates, as well as, the post construction monitoring and calculations necessary to track the results. The school partnered with the City and plans to have separate water meters installed on the water harvesting irrigation line and the City irrigation line. As part of the design plans for the water harvesting system, the school also has plans to have the diverted storm drain run through one of their classrooms in clear PVC pipe with a flow meter installed, so students can see their project in action and track the results in real-time. They plan to use the money saved after the payback period to fund their next project to divert additional roof water for the baseball field.

Social Example - Reduction of Crime

In this example a school in a high crime neighborhood is planning on working with a local organization to install large amounts of green infrastructure such as rain gardens, bioswales, native wildflower and wild grass prairies, as well as over 50 trees in a two block radius surrounding the school including on the school's property. Additionally, the school plans to work with a local artist to help beautify the area with subtle natural art pieces. They plan on engaging the local residents and community members in these activities to help build pride and ownership in their neighborhood. In order to increase success of neighborhood involvement, the school plans to reach out to local leaders including faith-based leadership, local business owners, and government representatives, to help encourage the residence to participate in this project, and to care for it after implementation.

Prior to implementation the school decides it wants to track projected crime reduction related to these installations. They plan to engage their social studies and math classes in collecting pre-implementation crime data and neighborhood survey information. These same curriculum activities can continue for years after implementation and tracked from year to year in the classes. Additionally, the school has plans to partner with the local police department to help gauge the level of reduction in various areas of crime. At the end of post-implementation year five, the school plans to reach out to local universities and municipalities to see if anyone would like to utilize this data to prepare a report and continue collecting data.

FUNDING

FUNDING

Funding

Obtaining financial and in-kind support for your GI project is one of the most important tasks, however it can be extremely daunting and time consuming. There are multiple sources for funding, detailed in this section, and it's recommended you consider all possible sources for your projects. During the planning process it will be beneficial to develop a funding plan. This plan should include an approach to each funding source and a list of potential sources. Don't anticipate that you will be able to secure your funds from every source in your list, and plan backup sources.

Additionally, as explained in earlier sections, developing a construction phasing plan during the planning process will help break your project up into manageable pieces. The phased pieces of your overall project should be completed as funding can be secured. This allows you to begin construction while continuing to pull in money for additional work. This also allows you to get initial project success under your belt, which helps leverage additional funds. However, if an opportunity arises to fund your entire project, which may happen with very large scale grants, this may be the approach you want to take.

School Funds

Schools should contact the MPS Grant Department for potential funding. This should be done during the planning process so any stipulations placed on the project by the grant department can be addressed early in the process.

Some schools have allocated funds for these types of projects in their budgets. This is a very good source of funding to consider. Many grants require fund matching. For example, they may offer up to $10,000 in funds if you can provide proof that you can match $10,000. These allocated funds can be used as match money. This helps the school dollars go further.

In-Kind Support

Work to develop partnerships with other organizations that can offer in-kind support. This can come in the form of volunteer services such as consulting and construction, educational support, resource sharing, and much more. These partnerships often help shape the final outcome of the project. Involving more of the community in your project leads to developing an extended network. This can lead to greater success rates of securing other types of funding.

Grants

Grants are one of the best sources of funding for this type of work, however, they are very difficult to manage and secure. The approach you should consider taking is to locate available grants, vet them to ensure your resources are spent going after the grants which you have best chances of award, and ensuring you have a plan and available personnel to manage and administer the grant. The personnel necessary includes:

A person responsible for finding, vetting, and writing grants

A person responsible for administering the grant including allocating the funds necessary and ensuring all reporting and submittal requirements of the grant are being met

A person available to manage the projects. This includes communicating with all stakeholders, project partners, government agencies, consultants, and contractors. It also includes ensuring the projects are being completed correctly, on time and on budget

MPS

All MPS schools should reach out to the MPS grants department before applying to any grant opportunities. A letter of intent form and application process may be required before pursuing opportunities. Additionally, the MPS grants department may have opportunities already identified so be sure to check in with them often if you are interested in a specific project.

The resources available for locating grants is very expansive, however, the sources, dollar amount, and requirements are constantly changing. Additionally, every project is unique and may be applicable for different types of grants. This makes providing a single resource for grants very difficult.

There are a few good sources for getting up-to-date information on grants. These sources are listed below. It's encouraged that you become familiar with these sources and keep in close contact with them for updated information.

- Marquette Funding Center. They release an annual directory of Wisconsin foundations, which is categorized by topic. You must go to the library to access the directory
- The Grantsmanship Center online funding source: http://www.tgci.com/funding-sources
- Wisconsin Grant Seekers on LinkedIn. You can create a LinkedIn account and gain acceptance to the group

Fundraising

There are many ways to fundraise money. Fundraising is often a good way to raise money for small projects, support materials for projects, and/or match funds for grants. The most important step to ensuring successful fundraising is creating a marketing plan to ensure you connect with the full reach of your target audience.

To do this you must first define your target audience. Are you trying to have a selective audience? This is often the case when looking to involve large investors or to stimulate interest among a target group, such as parents. Or, are you trying to reach a large, general, audience? In any case, you will want to have time for event planning, creating marketing materials such as event flyers, distribution time, and plenty of RSVP time. People don't want to be told about a large event the week before it's happening. The more time you plan in advance, the more time you will have to reach out to potential attendees.

Once you've identified your audience you can determine the best way to communicate your intent. If you're trying to reach a large, general, audience consider all forms of media for communication, such as TV, radio, newspaper, online event planning groups, etc. This may require additional money, but it may attract another crowd of people for future networking.

A Reflo volunteer talks with a community member during the Milwaukee Parkside School of the Arts Public Unveiling

Events

Planning events requires a significant amount of effort to organize and promote, and it often requires some upfront funding to pay for things such as rental space, food and beverages, marketing materials, entertainment, etc. The goal is that you can recuperate this investment and draw revenue from the event. There are all different kinds of events you could sponsor. The following is a short list of ideas.

- Silent Auction
- Run/Walk
- Sales (plant,apparel, bake, brat, etc.)
- Concerts
- Live Art Events
- DIY Build Days (rain barrels)
- Education Seminars
- Project Solicitations

Milwaukee Parkside School for the Arts had a successful event which they cosponsored with Reflo, called a "Public Unveiling Event." This is also discussed in Section 3 of this guide. Once the conceptual plan was completed for their courtyard redevelopment project, Parkside held the public unveiling event to stimulate interest and raise money for the project. The event included food, beverages, student entertainment, a presentation, and a tour of the project site with the proposed plans displayed on poster boards throughout the site. The event was held in tandem with another school event which helped attendance.

Social Media/Crowd Source Funding

Social media and crowd source funding are great ways to spread the word about your efforts, stimulate interest, plan events, raise money and much more. The biggest benefit to using social media is the relatively low overhead expense and the ability to reach a large audience with relatively little effort. However, a release strategy should still be considered when planning on using social media to assist your efforts.

Consider utilizing multiple sources when planning a social media funding effort. The images to the right list sources for social media and crowd source funding.

CREATING A MARKETING PLAN

Before you jump into the world of social media, you'll need a good marketing plan. This includes how to present your information and how to appropriately release the information to ensure a large audience is reached.

Similar to an emergency contact tree, you may want to have a marketing release tree in place. This same tree can be used for follow-up reminders and coordination efforts.

Having a plan in place will make sure your messaging stays consistent and will keep potential funders and project participants updated on your efforts and achievements.

FUNDING RESOURCES

- inc!ted — The Crowdfunding Community for Education
- investedin — We Power Crowdfunding!
- INDIEGOGO
- KICKSTARTER
- crowdrise
- RocketHub

SOCIAL MEDIA RESOURCES

RESOURCES

RESOURCES

Resources

The following is a list of project based resources. This section attempts to provide additional information on products, consulting and construction resources, curriculum, and pricing. More resources are available than listed here. Also, please note that the pricing resources are subject to change. The best way to obtain an accurate quote is to speak with consultants and contractors about your specific project and site. Do not use the pricing numbers given here as a means to develop your final budget.

Water Harvesting

What is Water Harvesting?

- **MMSD -** http://www.freshcoast740.com/Learn/Rainwater-Harvesting?sc_lang=en

Popular Products

- **Rain Harvest Systems -** http://www.rainharvest.com
- **RainXchange -** http://www.rainxchange.com
- **Contech Engineered Solutions -** http://www.conteches.com/products/stormwater-management.aspx

Consulting/Construction

- **Reflo Sustainable Water Solutions -** www.refloh2o.com

Pricing

Above ground water harvesting systems require a collection device, foundation, and base. The average cost of an above ground tank is $0.75/gallon. The average cost of foundation materials needed is $30/cubic yard.

Below ground water harvesting systems require a collection device, earthwork, a pump, and backfill materials. If using an electric pump and no source is located near the site, electricity will need to be ran to the site. The average cost of below ground tanks is $1.15/gallon. The average cost for excavation and earthwork is $350/cubic yard. This includes disposal fees. The average cost of an electric pump is $400. The average cost of backfill material is $25/cubic yard. If you need to run electricity to your site including installing a meter box, plan an additional $5,000 for this installation.

Curriculum

- **The Water Project -** http://thewaterproject.org/resources/lesson-plans/
- **Storm Water Curriculum and Teaching Guide -** http://myfairlakes.com/pdf/stormWaterCurriculum.pdf
- **Project WET -** http://www.projectwet.org/
- **Great Lakes in My World -** http://www.greatlakes.org/glimw
- **NOAA Education -** http://www.education.noaa.gov/teachers.html
- **EPA Teacher Resources and Lesson Plans -** http://www.epa.gov/students/teachers.html
- **Water Science School, USGS -** http://water.usgs.gov/edu
- **Kids Ecosystem, USGS -** http://education.usgs.gov/kids/index.html
- **Green Schools Alliance -** http://www.greenschoolsalliance.org/page/curriculum-lesson-plans-education

Urban Gardens

What is an Urban Garden?

- **Wisconsin Department of Public Instruction -** http://fns.dpi.wi.gov/fns_f2sgarden
- **UW Extension -** http://milwaukee.uwex.edu/agriculture/

Popular Products

- **Kompost Kids** - http://kompostkids.org/

Consulting/Construction

- **Victory Garden Initiative -** http://victorygardeninitiative.org/

Pricing

Plan approximately $200 per 4 x 8 garden bed. This includes material and installation by a local community organization.

Curriculum

- **Wisconsin Department of Public Instruction -** http://fns.dpi.wi.gov/sites/default/files/imce/fns/pdf/tn_usda_gard.pdf

Green Walls

What is a Green Wall?

- **Greenscreen -** http://www.greenscreen.com/Resources/download_it/IntroductionGreenWalls.pdf

Popular Products

- **Wolly Pockets -** www.woollypocket.com
- **Live Wall -** http://livewall.com/

Consulting/Construction

Choose a product that you think accomplishes what you're trying to do. Contact the manufacturer and ask if they have any local consulting services to stop out and help plan, design, and quote your project.

- **Reflo Sustainable Water Solutions -** www.refloh2o.com

Pricing

Developing unit pricing for greenwalls is very difficult. Green walls can be DIY projects or professionally installed. All products, installation strategies, and corresponding pricing has a very wide range. Consulting with a contractor or product manufacturer will provide you with an accurate quote.

Curriculum

- **Woolly Pockets -** http://www.woollyschoolgarden.org/index.php/tools-for-teachers

Green Roofs

What is a Green Roof?

- **MMSD -** http://www.freshcoast740.com/Learn/Green-Roofs
- **Green Roof Technology -** http://www.greenrooftechnology.com/resources

Popular Products

Allow your contractor to select the best product for your application.

Curriculum

- **Green Living Technologies -** http://agreenroof.com/education-3/

Consulting/Construction

- **Vegetal ID -** http://www.vegetalid.us/en/
- **Live Roof -** http://liveroof.com/
- **Pioneering Roofing -** http://www.pioneerroofing.net/index.html

Pricing

Green roofs, on average, are $12-$15/square foot for installation. Consult with your contractor to get an accurate quote on your green roof installation.

Native Landscaping

What is Native Landscaping?

- **MMSD -** http://www.freshcoast740.com/Learn/Native-Landscaping

Popular Products

- **Agrecol -** http://www.agrecol.com/
- **Minors Garden Center -** http://www.minorsgardencenter.com/Retail.aspx

Consulting/Construction

- **Reflo Sustainable Water Solutions -** www.refloh2o.com
- **Green Roofs and Gardens -** http://www.grglandscapes.com/

Pricing

Native landscaping cost will vary greatly depending on type of plantings and density. Work with your contractor to determine costs.

Curriculum

- **Wisconsin Native Plant Resources and Restoration Consultants -** http://clean-water.uwex.edu/pubs/pdf/nativeplants.pdf
- **Schoolyard Habitats across Wisconsin, US Forest Service -** http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5274832.pdf
- **Native Plan, National Organization -** http://www.for-wild.org/hotlinks.htm
- **Wildflowers of Wisconsin -** http://uswildflowers.com/wfquery.php?State=WI
- **UWSP Freckmann Herbarium -** http://wisplants.uwsp.edu/namesearch.html
- **LEAF program, UWSP -** http://www.uwsp.edu/cnr-ap/leaf/Pages/default.aspx

Rain Gardens

What is a Ran Garden?

- **MMSD -** http://www.freshcoast740.com/Learn/Rain-Gardens

Popular Products

- **Agrecol -** http://www.agrecol.com/

Consulting/Construction

- **Reflo Sustainable Water Solutions -** www.refloh2o.com

Pricing

Rain gardens are often DIY projects. This reduces costs significantly. However, if you decide to have the rain garden installed by professional, plan for $5/square foot for labor. The material cost depends on the type of plants, density, and if you replace any of the soils. You can plan $3/square foot for materials.

Curriculum

- **Renew Our Waters -** http://www.renewourwaters.org/Rain-Garden-Curriculum.html
- **Rain Gardens -** http://raingardens.us/urban-stormwater-management-curriculum/
- **Rain Garden Curricular Sample, UW-Madison Arboretum -** http://uwarboretum.org/eps/content/RainGardenSampler2011.pdf
- **Rain Garden Network -** http://www.raingardennetwork.com/schoolgardens.htm
- **Rain Gardens, Wisconsin DNR (* includes information for an educators kit from UW-Extension) -** http://dnr.wi.gov/topic/stormwater/raingarden/
- **Rain Gardens, MMSD *video -** http://www.mmsd.com/en/gi/Green-Infrastructure/Rain-Gardens.asp

Aquaponics

Popular Products

- **Nelson Pade -** http://aquaponics.com/

Consulting/Construction

- **Growing Power -** http://www.growingpower.org/

Curriculum

- **The Aquaponic Source -** http://theaquaponicsource.com/aquaponic-garden-curriculum/

Pricing

The Fernwood aquaponics facility cost approximately $72,000 for the facility installation and $9,000 for the aquaponics system installation. This example facility has two large growing spaces, each 6 x 15 feet, and a separate temperature controlled room for cultivation of perch.
It's recommended that you consult with a professional to get an accurate quote.

Ecosystem Hubs

What is an Ecosystem Hub?

Ecosystem Hubs are a product design of Reflo. Consult with Reflo on options and costs.

- **Reflo Sustainable Water Solutions -** www.refloh2o.com

Dry Detention, Retention/Wet Detention Ponds and Infiltration Basins/ Trenches

What is a Retention/Detention Pond? Infiltration Basin/Trench?

These GI strategies are large scale water management tools. Consult with a local engineering firm on design and construction options and costs.

- **Reflo Sustainable Water Solutions -** www.refloh2o.com

Internal Storm Drain Diversion

Popular Products

This is not a product based application

Curriculum

No curriculum currently exists for the GI strategy

Consulting/Construction

- **Reflo Sustainable Water Solutions -** www.refloh2o.com
- **Roga Plumbing -** http://www.rozgacorp.com/

Pricing

Cost will vary depending on complexity of existing plumbing, design, and length of diversion. Consult with a local contractor. The internal storm drain diversion for MES cost approximately $13,000. This diverted one roof drain to two different locations in the facility.

Permeable Surfaces

What is a Permeable Surface?

- **MMSD -** http://www.freshcoast740.com/Learn/Porous-Pavement

Popular Products

- **Spancrete -** http://www.spancrete.com/
- **Interlock Concrete Products Inc -** http://www.interlock-concrete.com/

.

Curriculum

No curriculum currently exists for the GI strategy

Consulting/Construction

- **Reflo Sustainable Water Solutions -** www.refloh2o.com

Pricing

Contact the product manufacturers for a quote on your project.

Bioswales

What is a Bioswale?

- **MMSD -** http://www.freshcoast740.com/Learn/Bio-Swales

Popular Products

This is not a product based GI Strategy

Pricing

Check with a consultant to get an accurate quote.

Curriculum

No curriculum currently exists specifically for Bioswales, however, raingarden curriculum can be used.

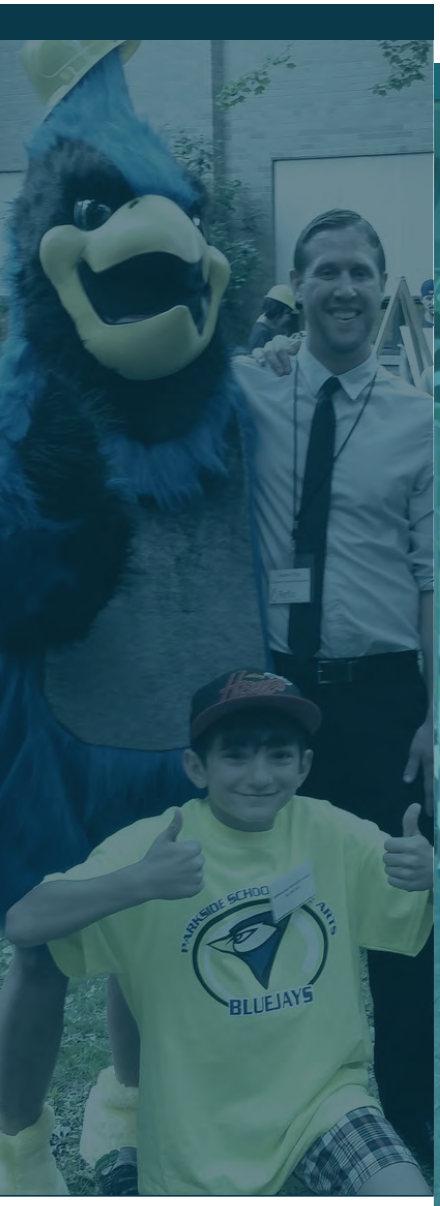
Consulting/Construction

Contact a local engineering firm to help design and provide a cost for your project

- **Reflo Sustainable Water Solutions -** www.refloh2o.com

Other

- The following are resources about Green Infrastructure in other cities:
- http://bairwmp.org/projects/school-district-green-infrastructure-capacity-building-pilot-projects
- http://www.saveitlancaster.com/local-projects/schools/
- http://www.phillywatersheds.org/what_were_doing/green_infrastructure/programs/greenschools
- http://www.cnt.org/water/projects/green-infrastructure/demonstration-projects/st-margaret-mary-church/
- http://www.healthyschoolscampaign.org/programs/space-to-grow/



Reflo
Sustainable Water Solutions

www.refloh2o.com