Green Infrastructure and Low Impact Development Evaluation and Implementation Plan

Final Report

Prepared for the Town of Parma, NY

November 2011

GHD

STEARNS & WHELER
CLIENTS | PEOPLE | PERFORMANCE

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Project Background

An Overview of the Green Infrastructure and Low Impact Development Planning Project

In 2009 Genesee/Finger Lakes Regional Planning Council was awarded funding for regional comprehensive water quality management planning activities as described in Section 604(b) of the Clean Water Act. This project was funded from the New York State Department of Environmental Conservation's appropriations from the American Recovery and Reinvestment Act (ARRA). A full description of 604(b) ARRA awards and project requirements can be found on the NYSDEC website at the following address: http://www.dec.ny.gov/lands/58603.html.

The purpose of this *Genesee-Finger Lakes Green Infrastructure and Low Impact Development Evaluation* project was to produce a reliable inventory and assessment of potential stormwater "green infrastructure" retrofit projects within selected municipalities and to provide an assessment of the local regulatory framework to ensure compatibility with Low Impact Development (LID) practices. The following white paper summarizes the results of this inventory and assessment process.

This information can be used to help plan for local stormwater needs, meet existing stormwater regulations or water quality goals, and apply for implementation funds if and when they become available. To date, several municipalities – including the Town of Parma and the Villages of LeRoy and Penn Yan – have used the findings of this study to apply for funds made available through the NYS Environmental Facilities Corporation Green Innovation Grants program.[1]

A total of 9 municipalities in the Genesee-Finger Lakes region were selected to participate in this project. Project staff conducted field visits in these municipalities in the spring and summer of 2011 to identify and assess potential locations for green infrastructure stormwater facilities utilizing a standard approach created by the Center for Watershed Protection (CWP).[2] During that same time staff also assessed the body of local regulations within each project municipality utilizing the Center for Watershed Protection's Code and Ordinance Worksheet.[3]

This paper includes a brief explanation of the concepts of stormwater green infrastructure and Low Impact Development followed by a summary of the findings of this project relevant to the Town of Parma. These findings are intended for use by the Town of Parma and other project municipalities as they see fit.

Stormwater Retrofits *are stormwater management practices in locations where stormwater controls did not previously exist or were ineffective.*

Green Infrastructure *management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies.*

[1] NYSEFC Green Grants. http://www.nysefc.org/GreenGrants.aspx
[2] CWP's "Retrofit Reconnaissance Investigation" forms identified in Manual 3 of CWPs *Urban Subwatershed Restoration Manual Series* http://www.cwp.org/categoryblog/92-urban-subwatershed-restoration-manual-series.html
[3] CWP's "Codes and Ordinances Worksheet," available online at the following address http://www.cwp.org/documents/cat_view/77-better-site-design-publications.html


Webster
Walworth
Ogden
Parma
Dresden
Penn Yan
Spencerport
Churchville
Le Roy
Lake Ontario
Municipalities enrolled in the G-FL Green Infrastructure and Low Impact Development Evaluation and Implementation planning project.
RECOVERY.GOV
NYWORKS

What is Stormwater Green Infrastructure?

Why It Matters: An Excerpt from Managing Wet Weather with Green Infrastructure – US EPA[1]

Existing development, especially in urbanized and urbanizing areas, is responsible for currently degraded water quality and stream conditions. Changes in land cover and the increased imperviousness of the urban environment have resulted in larger volumes of runoff traveling at faster velocities. This has caused serious streambank erosion and has compromised aquatic habitat. Many of these areas were developed without adequate stormwater controls and must be addressed if urban streams are to be restored and water quality is to be improved.

Retrofits to stormwater infrastructure will be necessary to reduce runoff and pollution, but the capital investment is daunting. Upgrades to stormwater and combined sewer systems, like other utilities, are capital-intensive projects. The EPA has estimated that current wastewater infrastructure requires an investment in excess of $200 billion, with $10 billion needed for stormwater management and $60 billion needed for combined sewer overflow (CSO) correction. While this needed investment presents a significant economic burden, it also presents an opportunity to re-evaluate the most efficient way to invest in infrastructure and environmental programs.

Using green infrastructure for urban stormwater retrofits can reduce stormwater pollution while simultaneously reducing the burden and demand on existing infrastructure. However, water quality and quantity benefits are not the only advantages green infrastructure has to offer. Green infrastructure enhances communities by bringing aspects of the natural environment into inhabited space. Trees provide shade, act as wind breaks and noise barriers, and improve air quality. In many instances, green infrastructure has been found to be less costly than or cost-competitive with traditional infrastructure. Green infrastructure provides additional environmental and economic benefits for the investment rather than traditional stormwater management approaches that literally bury the investments out of sight. The additional benefits that green infrastructure provides include:

- Green infrastructure effectively counteracts urban heat island by substituting soils and vegetation for hard, heat absorbing materials common in urban areas, creating shade, and emitting water vapor.
- Green roofs and other vegetation incorporated on and around buildings, help shade and insulate buildings from wide temperature swings, decreasing the energy needed for heating and cooling.
- Green infrastructure improves air quality as vegetation absorbs gaseous air pollutants and absorbs particulates.
- Research indicates that property values increase when street trees are planted and vacant lots are greened, providing private benefits to homeowners, increased property tax revenue, and more livable communities.

The distributed green infrastructure network is designed to limit the conversion of precipitation to runoff by capturing rainwater where it falls, managing stormwater at the surface, and maximizing soil and vegetation contact during treatment. This combination allows green infrastructure to reduce stormwater volumes, peak flow rates, and pollutant concentrations.

Stormwater green infrastructure facilities work through a combination of

- Encouraging the infiltration of stormwater into the ground
- Encouraging evapotranspiration of stormwater through increased vegetation, and
- Capture and use

What is Stormwater Green Infrastructure?

Why It Matters

Green infrastructure is implemented through a variety of specific applications, including:

- Bioretention and Vegetated Swales
- Porous or Pervious Concrete and Asphalt and Permeable Block Pavers
- Rain Gardens
- Trees and Expanded Tree Boxes
- Reforestation and Canopy Restoration
- "Green Streets" which incorporate many of the above practices into one linear streetscape
- Green Roofs, Cisterns and Rain Barrels installed in individual homes and businesses

What is Low Impact Development (LID)?

Green infrastructure also includes better construction and design practices within new residential and commercial developments. This concept is explained through the comprehensive approach to development known as *Low Impact Development*.

Low Impact Development (LID) is an ecologically-friendly approach to site development and storm water management that aims to mitigate development impacts to land, water, and air. The approach emphasizes the integration of site design and planning techniques that conserve natural systems and hydrologic functions on a site. The practice has been successfully integrated into many municipal development codes and storm water management ordinances throughout the United States. Specifically, LID aims to:

- Preserve open space and minimize land disturbance
- Protect natural systems and processes (drainage ways, vegetation, soils, sensitive areas)
- Reexamine the use and sizing of traditional site infrastructure (lots, streets, curbs, gutters, sidewalks) and customize site design to each site (known as ***Better Site Design***)
- Incorporate natural site elements (wetlands, stream corridors, mature forests) as design elements
- Decentralize and micromanage storm water at its source[4]

Better site design (BSD) is a means of implementing Low Impact Development. BSD incorporates non-structural and natural approaches to new and redevelopment projects to reduce effects on watersheds by ***conserving natural areas***, ***reducing impervious cover*** and ***better integrating stormwater treatment***. Conventional design can be viewed as the style of suburban development that has evolved during the past 50 years and generally involves larger lot development, clearing and grading of significant portions of a site, wider streets and larger cul-de-sacs, enclosed drainage systems for stormwater conveyance and large "hole-in-the-ground" detention basins. The aim of better site design is to reduce the environmental "footprint" of the site while retaining and enhancing the owner/developer's purpose and vision for the site.[5]

GENESEE/FINGER LAKES Regional Planning Council

For further information regarding the concepts mentioned above, visit the *G/FLRPC Green Infrastructure Resource Guide,* available online at http://www.gflrpc.org/GreenInfrastructureResourceGuide.htm

[4] Summary on LID taken from the Low Impact Development Center's pamphlet *Municipal Guide to Low Impact Development*. http://www.lowimpactdevelopment.org/lid%20articles/Municipal_LID.pdf

[5] Summary on BSD taken from the NYSDEC Division of Water's guidebook *Better Site Design*. http://www.dec.ny.gov/docs/water_pdf/bsdcomplete.pdf

This paper separates the findings for the Town of Parma into two sections: *Stormwater Retrofit Reconnaissance Results* and *Code and Ordinance Assessment Results*.

Stormwater Retrofit Reconnaissance Results

The following are the results of an assessment of potential green infrastructure demonstration and/or retrofit projects found within Parma. This list is not comprehensive in scope; the number of potential retrofit projects that can be found within any given municipality are virtually limitless. This assessment focused on specific stormwater goals that were discussed in advance, including:

- Further the Town's compliance with NYS stormwater regulations and improve its local stormwater program
- Protection of Northrup Creek which flows into Greece Ponds, a 303(d) impaired waterbody
- Local demonstration projects to educate Highway Department staff and the public on the design and function of green infrastructure stormwater facilities

A total of 25 potential projects were identified across the 9 project municipalities; four sites were initially identified in Parma which were later narrowed down to two.

The following locations were identified in the initial consultation between G/FLRPC staff and Town staff:

1. Parma Town Hall Park Complex
2. Parma Town Highway Garage
3. Collamer Road Regional Detention Facility
4. Valley Park Drive

After sites were identified, the project consultant – Stearns and Wheler GHD – performed the majority of technical analysis associated with green infrastructure retrofit design.

GHD conducted rapid field reconnaissance for each site listed above in order to gauge feasibility and then develop conceptual retrofit design sketches for the most feasible sites. In addition, GHD evaluated likely construction costs and the potential water quality benefits of each project, as well as other factors which may impact decision-making relative to the eventual construction of these facilities. Other factors include constructability, proximity to impaired waters, and other benefits, such as public education, diverting stormwater from municipal/private infrastructure, wildlife habitat, and flood storage capacity.

The assessment of individual sites includes a basic overview of site conditions, probable construction cost estimates, and conceptual plans of potential green infrastructure facilities.

Each proposed retrofit project was assessed for water quality and other benefits. A total of six criteria were used to assess and evaluate these projects:

1. Nutrient Removal
2. Total Suspended Solids (TSS) Removal
3. Nutrient Export to Impaired Waters (TP – Total Phosphorous; TN – Total Nitrogen)
4. Constructability/Maintenance
5. Probable Construction Costs
6. Other Unique Benefits

The key criteria are based on improvements to water quality and are similar to factors outlined in the U.S. Army Corps of Engineering, Wetland Functions and Values Assessments (1999). These include Nutrient Removal, Total Suspended Solids (TSS) Removal, and Nutrient Export to Impaired Waters. The other factors affect the potential implementation of these practices and include Constructability, Probable Construction Costs, and Other Unique Benefits.

The following is a description of the criteria used in this assessment.

1. Nutrient Removal. Based on Simple Method assessment of existing conditions (land-use, acreage, and rainfall) and treatment practice removal rates, as presented in Table A.4 of the NYS Stormwater Management Design Manual resulting in an **estimated lbs/year of nutrients removed**. It should be noted that these data were developed from conceptual sketches prepared using field measurements and are intended for planning purposes only.

Based on the assessment of the conceptual designs, each site was given a relative score of High, Moderate, or Low according to the following:

- High – TP removed was greater than 2.0 lbs/year
- Moderate – TP removed ranged from 1.0 – 1.9 lbs/year
- Low – TP removed was less than 1.0 lbs/year

2. TSS Removal. Based on Simple Method assessment of existing conditions (land-use, acreage, and rainfall) and treatment practice removal rates outlined in Table A4 of the NYS Stormwater Management Design Manual resulting in an **estimated lbs/year of TSS removed**. It should be noted that these data were developed from conceptual sketches prepared using field measurements and are intended for planning purposed only.

Based on the assessment of the conceptual designs, each site was given a relative TSS removal score of High, Moderate, or Low according to the following:

- High – TSS removed was greater than 500 lbs/year
- Moderate – TP removed ranged from 100 to 499 lbs/year
- Low – TP removed was less than 100 lbs/year

3. Nutrient Export to Impaired Waters. Evaluated a project site's proximity to an **impaired or sensitive water body**. Impaired waters were determined based on a review of the NYS 303 (d) and 305 (b) lists. For this project, impaired waters include the Rochester Embayment of Lake Ontario and Greece

Ponds (Buck Pond, Long Pond and Cranberry Pond). Northrup Creek and Black Creek are tributaries to these waterbodies. For this project, sensitive water bodies include **NYSDEC regulated wetlands**.

Each site was given a relative score of High, Moderate, or Low based on proximity to impaired waters.

- High – Direct discharge to impaired waters
- Moderate – Potential discharge to impaired water or direct discharge to tributary of impaired waters
- Low – No direct connection to impaired waters

4. Constructability/Maintenance. Evaluated for the potential "constructability" for each retrofit project, as well as the anticipated long-term operations and maintenance requirements. For example, a small rain garden was considered to have somewhat simple construction (**High**), whereas a large wetland complex was considered to require engineering design, permitting, and long period of construction (**Low**). Each site was given a relative score of High, Moderate, or Low based on our assessment of the potential upfront engineering and permitting efforts, as well as anticipated complexity of construction and need for the long-term maintenance.

- High – Required significant engineering/permitting, as well as complex construction and significant O&M
- Moderate – Limited upfront engineering or permitting with some construction complexities, such as limited space
- Low – Little anticipated need for upfront engineering/permitting, simple construction with limited long-term O&M

5. Probable Construction Costs. Established unit costs for each type of retrofit practice based on published sources, such as the NYS Stormwater Management Design Manual (2008 and 2010). The probable construction cost was calculated by multiplying the unit costs by the conceptual size of the practice. Some minor variation of unit costs were taken into account based on project complexities. Probable construction costs were used to develop Cost per Pound of Nutrient (TN and TP) Removed and Cost per Pound of TSS Removed. It should be noted that probable construction costs were developed based on conceptual sketches and may fluctuate based on final site specific circumstances or other various factors. These costs are intended for planning purpose only.

The cost per pound of TN and TP removed per year varied based on project size and type. For the projects within this study, relative scores of High, Moderate, and Low were derived based on the ranges of costs as follows:

- High – Cost per pound of total nutrients (TN and TP) is less than $5,000
- Moderate – Cost per pound of total nutrients (TN and TP) is between $5,000 and $15,000
- Low – Cost per pound of total nutrients (TN and TP) is greater than $15,000

6. Other Unique Benefits. Local and regional water quality is at the core of this project. However, many of the proposed retrofit projects result in additional benefits beyond water quality improvements. These include opportunities for public education, diversion of stormwater from municipal/private infrastructure, enhanced wildlife habitat, and flood storage capacity.

These other benefits were given relative scores of High, Moderate, and Low based on the following:

- High – Direct potential for other benefits, such as sites located within parks

- Moderate – Potential for other benefits, such as improved wildlife habitat or improved aesthetics
- Low – Limited or no potential for other benefits beyond water quality improvements

Each stormwater retrofit design is documented on the attached *Conceptual Stormwater Retrofit Plans*. In addition, the benefits of each project are documented in the attached *Benefit Assessment Worksheet*.

In addition to the plans and worksheets, the retrofit projects were qualitatively ranked relative to one another, and this information is attached in the *Qualitative Assessment Table* (QAT). It is important to note that the scoring in the QAT is relative to the retrofit projects in this assessment only. Further, these retrofit projects, regardless of score, all provide water quality and other unique benefits.

GHD has developed the conceptual design plans and has assessed each site based upon the above reference criteria. Based on our review, it appears the proposed projects can be divided into three categories based on type of stormwater practice: Filtration Practices (bioretention, rain gardens, bioswales), Stabilization (outlet protection, bank stabilization) and Stormwater Ponds/Wetlands. These types of practices vary significantly in terms of construction costs, engineering requirements, and water quality improvements. While each of these projects has a direct water quality permitting benefit and should be evaluated as part each municipality's long-term plan, some general distinctions about each group can be made.

It appears that filtration practices generally have the lowest cost per pound of nutrients removed with the cost per pound of nutrients (TN and TP) removed per year combined generally less than $3,800. The stabilization projects appear to be the most cost effective at reducing TSS with the cost per pound of TSS removed typically below $10. These stabilization practices also appear effective at preventing nutrient loading due to the significant level of anticipated soil stabilization. Also, large-scale stabilization project can be an efficient method of nutrient removal. While stormwater ponds and wetland do not have the lowest cost per pound of nutrients or TSS removed, these practices do allow for the most quantity of nutrient and TSS to be removed annually. For example, the least efficient stormwater wetland in this study is anticipated to remove more than 3 lbs of TP and 18 lbs of TN per year. This is far greater than the majority of the smaller scale filtration practices and should be considered when reviewing the entirety of these projects. Similarly, smaller projects, such as rain gardens around public buildings, have an aesthetic benefit and can be used to educate and engage the public.

Two initial sites were narrowed down to the following high-value site:

1. **Town Hall (Bioswale)**. Another option for water quality treatment at this site is a linear bioswale (vegetated dry swale) installed along the eastern edge of the parking lot. Currently, the area east of the parking area is mowed lawn. The existing drainage patterns are evident within the lawn. The area drains to the south and collects in an undefined shallow area. Underdrains have been installed and could be re-used as part of the retrofit.

   The linear bioswale (approximately 300 feet long by 10 feet wide) would be designed to collect and treat runoff from the paved surface before discharging to the tributary of Black Creek. The area would be excavated and backfilled with a permeable planting and drainage medium to filter runoff. An underdrain would be installed and would connect to existing underdrain system as needed.

2. **Town Hall (Outlet Protection)**. This retrofit includes the restoration and stabilization of an existing eroded stormwater outlet along tributary of Black Creek. The existing 12-inch CPP outlet

is currently discharging to an unprotected patch of land which is actively eroding. The potential exists for advanced erosion to impact adjacent mature trees, resulting in increased sedimentation with the Creek. The conceptual plan calls for the installation of stone grade controls and turf reinforcement mat to reduce the potential for scour. Protecting this area will improve water quality locally in the tributary and regionally in Black Creek by limiting sediment loading.

3. **Town Hall (Porous Pavement).** The Parma Town Hall and Recreational Facilities are located adjacent to a tributary of Black Creek (impaired water). The eastern edge of the recreational area, near the tributary, is an existing parking area in excess of two acres. The parking area is likely to require improvements in the future and could include the use of porous paving.

   The conceptual sketch plan includes the retrofit of existing paved parking areas in athletic fields. The Town could plan to install a porous pavement system (i.e., porous concrete block, gravel pave) in parking bays, as part of parking lot improvements, to provide water quality treatment and runoff reductions. The available space within the parking bays appears to be adequate to treat the entire water quality volume.

4. **Highway Garage.** The retrofit at the Parma Highway Garage consists of a linear bioretention basin in existing lawn area south of parking lot. The area is currently a low spot located between the parking lot and an adjacent single family home. The area currently contains a drain inlet; however, it appears to be set high. Runoff from the parking and storage areas settles in the low lawn areas.

   The retrofit plan calls for the creation of a bioretention basin within the low lying lawn area. To do this, the area will be excavated and an engineered soil medium would be installed. A new underdrain would connect into an existing catch basin resulting in water filtration and improved water quality. The surface would be vegetated in accordance with NYS Stormwater Management Design Manual.

   In addition, a flush curb and gravel diaphragm should be installed to a level of pre-treatment for runoff entering the bioretention basin.

Parma Town Hall – Bioswale

Benefit Assessment Worksheet

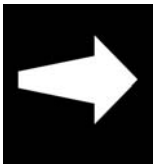
This retrofit projects includes the installation of a linear bioswale (vegetated dry swale) along the eastern edge of an existing parking lot near athletic fields. This site drains east towards a tributary of Black Creek. The system would be approximately 6 feet wide, with a shallow bottom, permeable substrate, and vegetated surface. An underdrain system is proposed within the bioswale which could connect to an existing drain system.

Nutrient Removal

Baseline TN and TP are approximately 17.6 and 2.0 lbs/year, respectively. Anticipating 50 percent and 40 percent removal rate based on a bioswale (vegetated dry swale) sized for the water quality volume (5,500 cubic feet), the **estimated pounds of TN and TP removed per year is 41.2 and 3.3**, respectively.

TSS Removal

Baseline TSS for this site is approximately 1,100 lbs/year. Anticipating an 85 percent removal rate based on a bioswale (vegetated dry swale) sized for the water quality volume (5,500 cubic feet), the **estimated pounds of TSS removed per year is 950.**



Nutrient Export To Impaired Waters

The project site discharges to Black Creek, a tributary of Northrup Creek which in turn is a tributary of Greece Ponds (specifically Long Pond). While this stream has been stressed from development, it is not listed as an impaired water; it does, however, drain to the Greece Ponds, which are listed as an impaired water.

Constructability/Maintenance

The construction of the bioswale adjacent to the existing parking lot is **Moderate** and would require a limited amount of advance engineering and permitting. Overall construction of bioswale does not require significant structures or major land disturbance, but does include the use of engineered soil medium and perforated underdrains. Project is not likely to require extensive routine maintenance.

Probable Construction Costs

A unit value of $17 per square foot for a bioswale retrofit was multiplied by the conceptual size of the retrofit practice (3,000 square feet) for a probable construction cost of $51,000. This results in an anticipated **cost per Pound (TN and TP) removed of $1,100** and **Cost per Pound (TSS) removed of $50**.

Other Benefits

The projects proximity to a high-use recreational area creates **substantial opportunities for public education and interpretation.**

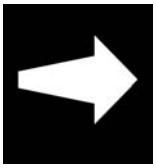
The conceptual plan calls for the installation of stone grade controls and turf reinforcement mat to reduce the potential for scour. Protecting this area will improve water quality locally in the tributary and regionally in Black Creek by limiting sediment loading.

Nutrient Removal

The level of anticipated TN and TP in mineral soils is expected be roughly 0.15 percent and 0.04 percent, respectively. Based on the amount of anticipate soils to be protected, the **estimated pounds of TN and TP removed per year is 0.75 and 0.2**, respectively.

TSS Removal

Baseline TSS for this site is approximately 500 lbs/year based on volume of erosion (cubic foot) multiplied by 78 pounds per cubic foot. Anticipating a 100 percent removal rate based on a stabilized outlet, the **estimated pounds of TSS removed per year is 500.**



Nutrient Export To Impaired Waters

The project site discharges to a tributary of Black Creek. **Black Creek is an impaired water body.**

Constructability/Maintenance

The construction of the outlet protection is **High** and would require minimal advanced engineering and permitting. Overall construction would require a small machine for a limited period of time. Project is not likely to require extensive routine maintenance.

Probable Construction Costs

A unit value of $200 per linear foot for a stabilization effort was multiplied by the conceptual size of the retrofit practice (20 feet) for a probable construction cost of $4,000, resulting in an anticipated c**ost per Pound (TSS) removed of $8**.

Other Benefits

The project's proximity to a high-use recreational area creates **substantial opportunities for public education and interpretation.**

Parma Town Hall – Porous Pavement

Benefit Assessment Worksheet

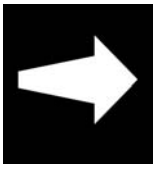
The conceptual sketch plan includes the retrofit of existing paved parking areas in athletic fields. The Town could plan to install a porous pavement system (i.e., porous concrete block, gravel pave) in parking bays as part of parking lot improvements to provide water quality treatment and runoff reductions. The available space within the parking bays appears to be adequate to treat the entire water quality volume.

Nutrient Removal

Baseline TN and TP is approximately 82.5 and 8.3 lbs/year, respectively. Anticipating 60 percent and 60 percent removal rate based on a bioswale (vegetated dry swale) sized for the water quality volume (5,500 cubic feet), the **estimated pounds of TN and TP removed per year is 49.5 and 5.0**, respectively.

TSS Removal

Baseline TSS for this site is approximately 70 lbs/year. Anticipating an 80 percent removal rate based on a porous paving installation sized for the water quality volume, the **estimated pounds of TSS removed per year is 890.**



Nutrient Export To Impaired Waters

The project site discharges to a tributary of Black Creek. **Black Creek is an impaired water body.**

Constructability/Maintenance

The construction of the porous pavement in the existing parking lot is **Moderate to Low** and would require advanced engineering and permitting. Overall construction would require sizing of substrate materials and underdrain systems. Project is likely to require extensive routine maintenance.

Probable Construction Costs

A unit value of $15 per square foot for a porous paving was multiplied by the conceptual size of the retrofit practice (8,000 square feet) for a probable construction cost of $120,000. This results in an anticipated **cost per Pound (TN and TP) removed of $2,200** and **Cost per Pound (TSS) removed of $134**.

Parma Highway Garage – Bioretention Basin

Benefit Assessment Worksheet

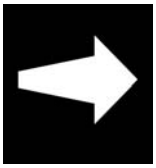
The retrofit plan calls for the creation of a bioretention basin within the low lying lawn area. To do this, the area will be excavated and an engineered soil medium would be installed. A new underdrain would connect into an existing catch basin resulting in water filtration and improved water quality. The surface would be vegetated in accordance with NYS Stormwater Management Design Manual.

Nutrient Removal

Baseline TN and TP are approximately 39.7 and 0.32 lbs/year, respectively. Anticipating 40 percent and 60 percent removal rate based on a bioswale (vegetated dry swale) sized for the water quality volume (5,500 cubic feet), the **estimated pounds of TN and TP removed per year is 13.6 and 1.6**, respectively.

TSS Removal

Baseline TSS for this site is approximately 149 lbs/year. Anticipating an 85 percent removal rate based on a bioretention basin with underdrain and overflow structure sized for the water quality volume, the **estimated pounds of TSS removed per year is 1,100.**



Nutrient Export To Impaired Waters

The project site discharges to a storm system. The storm system is likely to discharge to a tributary of the Black Creek. **Black Creek is an impaired water.**

Constructability/Maintenance

The construction of the bioretention basin is **Moderate** and would require a limited amount of advance engineering and permitting. Overall construction of bioswale does not require significant structures, but does include the use of engineered soil medium and perforated underdrains connected to an existing drain inlet. Project is not likely to require extensive routine maintenance.

Probable Construction Costs

A unit value of $17 per square foot for a bioretention basin retrofit was multiplied by the conceptual size of the retrofit practice (1,600 square feet) for a probable construction cost of $27,000. This results in an anticipated **cost per Pound (TN and TP) removed of $1,800** and **Cost per Pound (TSS) removed of $25**.

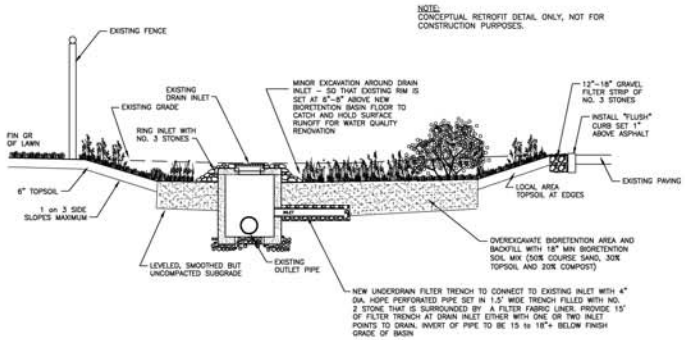
Other Benefits

The bioretention retrofit has limited additional benefits due to its location and proximity to public areas.

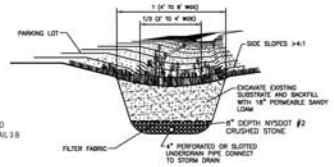
CALLOUT AREA A
TOWN OF PARMA HIGHWAY GARAGE

CALLOUT AREA B
TOWN HALL AND RECREATIONAL COMPLEX

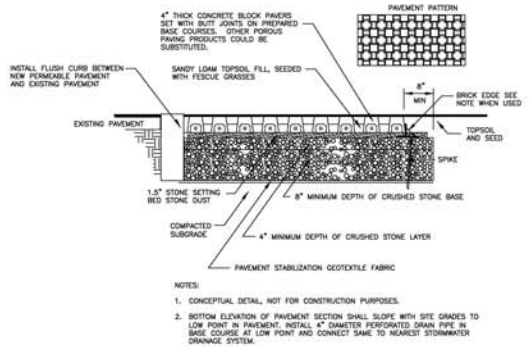
CONCEPTUAL SKETCH DRAWING FOR PLANNING PURPOSES ONLY. NOT INTENDED FOR CONSTRUCTION.



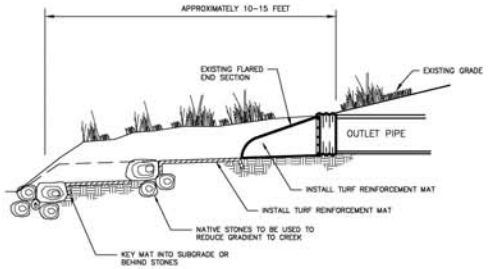
1 A BIORETENTION BASIN CROSS SECTION
DETAIL PROPORTIONAL, BUT NOT TO SCALE



1 B BIOSWALE DETAIL (VEGETATED DRY SWALE)
DETAIL PROPORTIONAL, BUT NOT TO SCALE



2 B POROUS PAVEMENT RETROFIT
DETAIL PROPORTIONAL, BUT NOT TO SCALE



3 B TURF REINFORCED OUTLET
DETAIL PROPORTIONAL, BUT NOT TO SCALE

CONCEPTUAL

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

Plot Date: 17 August 2011 - 1:12 PM Plotted by: Gregory S Liberman\United States\GHD\AU Cad File No: G:\8814591\CADD\Drawings\Civil\8814591_PARMA.dwg

This project has been funded by the American Recovery and Reinvestment Act of 2009 through the New York State Department of Environmental Conservation and New York State Economic Recovery and Reinvestment Counsel. For more information, please visit: www.recovery.gov, www.dec.ny.gov, or www.regionalcouncils.org

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Drawn GSL		Designer GSL	
Drafting Check		Design Check JL	
Approved (Project Director)			
Date	JULY 2011		
Scale	AS SHOWN	This Drawing shall not be used for Construction unless Signed and Sealed For Construction	

Client: GENESEE/FINGER LAKES REGIONAL PLANNING COUNCIL
Project: GREEN INFRASTRUCTURE RETROFIT PLANNING PROJECT
Title: CONCEPTUAL STORMWATER RETROFIT PLAN TOWN OF PARMA, NEW YORK

Original Size: Ansi D Drawing No: Rev: A

Note: original scale drawings have been provided to staff within each project municipality. Contact Stearns and Wheler GHD for more information.

Each project municipality's body of local laws and ordinances was reviewed utilizing the Center for Watershed Protection's (CWP) *Code and Ordinance Worksheet*. On average, most municipalities scored between 60 and 70 points out of 100 points, which denotes that opportunities exist to improve development rules in order to protect local aquatic resources in addition to the benefit of creating a site planning roundtable. Such a roundtable is described as a consensus process to encourage board members to make better choices in the design of their community. The primary tasks of a local roundtable are to systematically review existing development rules in the context of the model development principles, and then determine if changes can or should be made to the rules.

Genesee/Finger Lakes Regional Planning Council (G/FLRPC) collaborated with other regional entities, including the Stormwater Coalition of Monroe County, to identify the best methodology to use for this analysis. The CWP's *Code and Ordinance Worksheet* was selected due to its focus on the specific issue of local laws – namely, zoning, site plan review and subdivision law. The 77 site planning questions posed in the *Code and Ordinance Worksheet* are awarded specific points if the municipality's local law compares favorably with the benchmark.

Based on the 22 sections of the *Code and Ordinance Worksheet*, three major documents were necessary to fully complete it: the municipality's zoning ordinance, subdivision code, and design and construction criteria. In some cases, if the municipality is a regulated Municipal Separate Storm Sewer System (MS4), an erosion and sediment control ordinance and/or stormwater management ordinance was also reviewed.

The process established to complete the *Code and Ordinance Worksheet* was composed of two phases: the first phase allowed staff at G/FLRPC to complete the worksheet using the municipality's applicable local laws. The reviewer then sent this draft to the municipality's designated point-of-contact. The municipality then had the opportunity to review this draft before a meeting was set-up between the reviewer and the municipality. The dialogue between the reviewer and municipality was valuable in that many inconsistencies were found throughout the *Code and Ordinance Worksheet*.

The *Code and Ordinance Worksheet* clearly states that the reviewer "must identify the local, state, and federal authorities that actually administer or enforce the development rules within your community." Municipal staff that interact daily with these development rules are significantly more aware of these rules than the reviewer. Municipal staff readily pointed out to the reviewer where inconsistencies could be found. For example:

- Dead-end fire apparatus access roads in excess of 150 feet must provide width and turnaround provisions in accordance with Table D103.4 of the New York State Fire Code. In this case, a cul-de-sac must have a 96-foot-diameter. In Section 4: Cul-de-Sacs, the *Code and Ordinance Worksheet* awards 3 points for a radius less than 35 feet and 1 point for an answer between 36 feet and 45 feet. Neither benchmark corresponds with the 48-foot-radius minimum requirement according to D103.4: Dead ends of the New York State Fire Code.
- According to 511.2.1: Dimensions of the New York State Fire Code, driveways must provide a minimum unobstructed width of 12 feet. Section 14: Driveways of the *Code and Ordinance Worksheet* awards one point only if the answer is below 9 feet.
- Fire apparatus access roads must also have an unobstructed width of not less than 20 feet, except for approved security gates, according to 503.2.1: Dimensions. Therefore, the benchmark set

for 18 to 22 feet for Section 1: Street Width of the *Code and Ordinance Worksheet* does not necessarily comply.

Another area of discrepancy is Section 13: Sidewalks of the *Code and Ordinance Worksheet* with the Americans with Disabilities Act (ADA). State and local government facilities must follow the 2010 Standards for Accessible Design as of March 15, 2012. Before that date, the 1991 Standards or the Uniform Federal Accessibility Standards (UFAS) were used for projects.

An accessible route is defined in Chapter 4 of the 2010 Standards as one or more of the following components: a walking surface with a running slope not steeper than 1:20, doorways, ramps, curb ramps excluding the flared sides, elevators, and platform lifts. The clear width of walking surfaces can be 36 inches. However, if a clear width less than 60 inches is provided, passing spaces must be made available at intervals of 200 feet. Passing spaces can be either 60 inches minimum by 60 inches or an intersection of two walking surfaces providing a T-shaped space where the base and arms of the T-shaped space extend 48 inches beyond the intersection. The 1991 Standards states the minimum clear width for single wheelchair passage is 32 inches at a point and 36 inches continuous with a 60 inch minimum width for two wheelchairs to pass. The minimum clear width of an accessible route as defined by UFAS is 36 inches with passing spaces at reasonable intervals not to exceed 200 feet if the accessible route is less than 60 inches in width. The *Code and Ordinance Worksheet* awards two points for a minimum width of 4 feet or less allowed in the community.

One final discrepancy in the *Code and Ordinance Worksheet* can be found in Section 8: Parking Lots regarding the minimum stall width and length for a standard parking space. The *Manual on Uniform Traffic Control Devices* (MUTCD) is published and has been administered by the Federal Highway Administration (FHWA) since 1971. The manual is a compilation of national standards for traffic control devices installed and maintained on all public streets, highways, bikeways, and private roads open to public traffic. It is updated periodically to address changing transportation needs in the nation. The MUTCD became effective in New York State on January 15, 2010 with a NYS Supplement adopted on March 16, 2010. In this manual, a typical parking space is recommended to be 8 feet wide by 22 to 26 feet in length and an end space as 8 feet by 20 feet. The *Code and Ordinance Worksheet* awards one point for a stall width less than 9 feet and one point for a stall length less than 18 feet.

Overall, most municipalities scored between 60 and 70 points out of a total 100. Several municipalities scored below 60 points, which states that "serious reform of the development rules is needed." A score of 90 to 100 states that the community is "a real leader in protecting streams, lakes, and estuaries." A score of 60 to 69 and 70 to 79 basically states the community doesn't have adequate development rules to protect local aquatic resources and that significant opportunities exist. There were three questions that none of the municipalities scored any points on:

- At higher densities are parking lanes allowed to serve as traffic lanes (i.e., queuing streets). (Section 1: Street Width, 3 points available)
- If mass transit is provided nearby, is the parking ratio reduced? (Section 7: Parking Codes, 1 point available)
- Are there any incentives to developers to provide parking within garages rather than surface parking lots? (Section 9: Structured Parking, 1 point available)

As these questions seem "non-applicable," they should be considered for removal from the *Code and Ordinance Worksheet* and total maximum points awarded to each municipality.

Another generalization about the *Code and Ordinance Worksheet* applies when dealing with a historic community versus contemporary ones. The Village of Spencerport, Le Roy, Penn Yan, Churchville and Dryden experienced growth and development much earlier than most towns participating in the local law analysis. A good deal of the land available in these villages has already been built upon; thus, street widths and lengths and lot setbacks and frontages have already been determined. These villages were also developed long before zoning and other standards and ordinances existed. The Towns of Ogden, Parma, Walworth and Webster are currently experiencing population growth due to suburban expansion. There are more opportunities with current regulatory processes to encourage low-impact design and development in these municipalities. Hence, the *Code and Ordinance Worksheet* may provide more opportunities for growing communities to score higher with new construction as opposed to historic communities with existing footprints. In this case, a scoring methodology that considers more retrofit-friendly frameworks, regulatory structures, and incentive programs is recommended in future reviews for historic communities.

Finally, each municipality discovered different strengths, weaknesses, and areas of opportunity through the *Code and Ordinance Worksheet* process. They are as follows:

Town of Parma
Total: 65

Strengths:
- Section 5: Vegetated Open Channels
- Section 11: Open Space Design
- Section 15: Open Space Management
- Section 20: Tree Conservation
- Section 21: Land Conservation Incentives
- Section 17: Buffer Systems
- Section 18: Buffer Maintenance
- Section 22: Stormwater Outfalls

Weaknesses:
- Section 6: Parking Ratios
- Section 8: Parking Lots
- Section 12: Setbacks and Frontages

Areas of Opportunity
- Gathering data to justify the amount of parking spaces actually needed is called a parking demand study. The Town of Parma could reduce the parking ratios based on this data. The code could also be interpreted as setting the maximum possible number of spaces as opposed to the minimum. The creation of excess parking occurs when ratios are set as minimums. Overall,

excess parking increases the amount of impervious cover, which increases the amount of stormwater runoff. This leads to higher stormwater management costs.

- "Land Use Administration and Design" in Chapter 3: Policy Plan of the *Town of Parma Master Plan Update* (1989) states, "Establish minimum standards for off-street parking and loading facilities to assist the planning board and Zoning Board of Appeals in their review of applications. Maintain discretionary authority in deciding on parking requirements in order to assure adequate facilities in unique circumstances." This statement provides opportunity for studies to take place, such as surveying various land use sites during peak parking periods.

Code and Ordinance Worksheets

The following pages contain the summarized results of the CWP Code and Ordinance Worksheets. Those results are organized into the following major and minor categories:

- **Residential Streets and Parking Lots**
  - Street width and length
  - Right of way width
  - Cul-de-sacs
  - Vegetated open channels
  - Parking ratios
  - Structured parking
  - Parking codes
  - Parking lots
  - Parking lot runoff
- **Lot Development**
  - Open space design
  - Setbacks and frontages
  - Sidewalks
  - Driveways
  - Open space management
  - Rooftop runoff
- **Conservation of Natural Areas**
  - Buffer systems
  - Buffer maintenance
  - Clearing and grading
  - Tree conservation
  - Land conservation
  - Stormwater outfalls

Areas found to be deficient with regard to stormwater green infrastructure or LID have been checked (☑) as "to be revised."

Where available, online resources have been cited under the "Notes" section and provide more information relevant to the category or subcategory. Interested readers should visit these resources to learn more about the issue and how their municipality can improve its local codes and operations therein.

RESIDENTIAL STREETS AND PARKING LOTS

1. and 2. Street Width and Length	**Is the minimum pavement width for low traffic residential streets (<500 average daily trips) between 18-22 ft.?** 20 *ft.* ☑ Yes □ No Section: Design Criteria and Construction Specifications □ No Standard *Action*: ☑ Leave as is □ To be revised Notes:	Score: 5 out of 8 points
	Can parking lanes serve as traffic lanes in higher density areas? □ Supportive language in code/ordinance Section: 130-15: Design Standards □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications ☑ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes:	
	Are alternatives to minimize street length allowed where appropriate (i.e. cluster developments, around cul-de-sacs, etc.)? ☑ Supportive language in code/ordinance Section: 130-15: Design Standards □ Site specific with Planning Board approval □ Incentivized in code/ordinance ☑ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	
3. Right-of-Way Width	**Is minimum ROW widths less than 45 ft. for a residential street?** 60 *ft.* □ Yes ☑ No Section: Design Criteria and Construction Specifications □ No Standard *Action*: □ Leave as is ☑ To be revised Notes: *Right-of-Way Improvements Manual*, City of Seattle, Washington. Available at: http://www.seattle.gov/transportation/rowmanual.	Score: 1 out of 4 points
	Can utilities be placed below the paved section of the ROW? ☑ Supportive language in code/ordinance Section: 130-15: Design Standards □ Site specific with Planning Board approval □ Incentivized in code/ordinance ☑ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	

4. Cul-de-Sacs	**Is the minimum required radius for cul-de-sacs less than 35 ft.?** ___70___ *ft.* □ Yes ☑ No Section: Design Criteria and Construction Specifications □ No Standard *Action*: □ Leave as is ☑ To be revised Notes: *Impervious Surface Reduction: Cul-de-Sac Design*, prepared for the Metropolitan Council by Barr Engineering Company. Available at: http://www.barr.com/clientre/Archives/BMPs/BMPfiles/03RPPImpCuldeSac.pdf.	Score: 1 out of 5 points
	Are landscaped or bioretention islands allowed in the center of cul-de-sacs? □ Supportive language in code/ordinance Section: □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications ☑Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: *Managing Wet Weather with Green Infrastructure: Municipal Handbook, Green Infrastructure Retrofit Policies*, U.S. Environmental Protection Agency. Available at: http://www.epa.gov/npdes/pubs/gi_munichandbook_retrofits.pdf.	
	Are alternatives to cul-de-sacs such as "hammerheads" allowed for permanent turnarounds? □ Supportive language in code/ordinance Section: 130-15: Design Standards □ Site specific with Planning Board approval □ Incentivized in code/ordinance ☑ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes: Recommend inclusion with code/ordinance.	
5. Vegetated Open Channels	**Are curbs and gutters required for most residential streets?** □ Supportive language in code/ordinance Section: □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications ☑ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	Score: 4 out of 4 points
	Are modified curb or gutter systems such as vegetated swales or curb cuts with rain gardens allowed to provide for stormwater infiltration and evaporation? ☑ Supportive language in code/ordinance Section: 128-6 & 128-26 □ Site specific with Planning Board approval □ Incentivized in code/ordinance ☑ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	

6. Parking Ratios	**Are the minimum required number of parking spaces less than:** 3 spaces per 1,000 sq. ft. for professional office building? □ Yes ☑ No Section: 165b Schedule II □ No Standard *Action:* □ Leave as is ☑ To be revised 4.5 spaces per sq. ft. for shopping centers? □ Yes ☑ No Section: 165b Schedule II □ No Standard *Action*: □ Leave as is ☑ To be revised 2 spaces per single family home? ☑ Yes □ No Section: 165b Schedule II □ No Standard *Action:* ☑ Leave as is □ To be revised Notes: *Parking Spaces / Community Places: Finding the Balance through Smart Growth Solutions,* U.S. Environmental Protection Agency. Available at: http://www.epa.gov/dced/pdf/EPAParkingSpaces06.pdf.	Score: 1 out of 5 points
	Are parking ratios expressed as both minimum and maximums? □ Yes ☑ No, minimum only □ No, maximum only □ No, Expressed as medians Section: 165b Schedule II *Action:* □ Leave as is ☑ To be revised Notes:	
7. and 8. Structured Parking and Parking Codes	**Is the use of shared parking arrangements promoted?** ☑ Supportive language in code/ordinance Section: 165-125: (G) □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	Score: 2 out of 5 points
	Are model shared parking agreements provided? □ Yes ☑ No Section: □ Shared parking not allowed *Action:* □ Leave as is ☑ To be revised Notes: *Model Shared Parking Agreements*, Town of Clinton: Recommended Model Development Principles for Protection of Natural Resources in the Hudson River Estuary Watershed. Available at: http://www.dec.ny.gov/docs/remediation_hudson_pdf/hrewbsdclin.pdf.	
	Are parking requirements reduced for shared parking arrangements, structured parking, areas near mass transit, and special districts? ☑ Supportive language in code/ordinance Section: 165-125: (G) □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: Parking ratios are reduced if shared parking arrangements are in place but there are no incentives to developers to provide parking within garages rather than surface parking lots.	

9. Parking Lots	**Are minimum stall dimensions for standard parking spaces 9 ft. x 18 ft. or less?** 10 *ft.* *x* 20 *ft.* □ Yes ☑ No Section: 165-125: Off-street parking regulations (A) Design requirements □ No Standard *Action:* □ Leave as is ☑ To be revised Notes:	Score: 0 out of 5 points
	Are smaller compact car stalls required for at least 30% of total parking spaces? □ Supportive language in code/ordinance Section: □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications ☑ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: *Impervious Surface Reduction: Parking Lot Design,* Twin Cities Metropolitan Council. Available at: http://www.metrocouncil.org/environment/Water/bmp/CH3_RPPImpParking.pdf.	
	Can pervious materials be used for spillover parking areas? □ Supportive language in code/ordinance Section: □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications ☑ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: *Impervious Surface Reduction: Turf Pavers*, prepared for the Metropolitan Council by Barr Engineering Company. Available at: http://www.barr.com/clientre/Archives/BMPs/BMPfiles/06RPPImpTurfPaver.pdf.	
10. Parking Lot Runoff	**Does a minimum percentage of parking lots need to be landscaped?** ☑ Supportive language in code/ordinance Section: 165-125: (C) and 128-6 □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	Score: 4 out of 4 points
	Are bioretention islands or vegetated filter strips allowed within landscaped areas of parking lots? ☑ Supportive language in code/ordinance Section: 165-125: (C) and 128-6 □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	

Areas identified within Residential Streets and Parking Lots that are most in-line with Green Infrastructure principles:

☑ **Street Width**	□ **Parking Ratios**	☑ **Street Length**	□ **Parking Codes**
□ **Row Width**	□ **Parking Lots**	□ **Cul-de-Sacs**	□ **Structured Parking**
☑ **Vegetated Open Swales**	☑ **Parking Lot Runoff**		

LOT DEVELOPMENT

11. Open Space Design	**Are conservation subdivisions and/or cluster developments allowed?** ☑ Supportive language in code/ordinance Section: 165-47 and 165-54: EPOD (5) Woodlot Protection District (E) (4) □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: *Conserving Natural Areas and Wildlife in Your Community*, New York State Department of Environmental Conservation. Available at: http://www.dec.ny.gov/lands/50083.htm.	Score: 6 out of 8 points
	Is water quality or land conservation a major goal? ☑ Yes □ No Section: 165-42: Purpose and intent □ No Standard *Action:* □ Leave as is ☑ To be revised Notes: Recommend impervious cover reduction as a major goal for intent and objectives.	
	Are the application requirements for conservation subdivisions and/or cluster developments greater than for conventional developments? ☑ Yes □ No Section: 165-47(C) □ No Standard *Action:* □ Leave as is ☑ To be revised Notes:	
	Are conservation subdivisions and/or cluster developments permitted by zoning without a public hearing? □ Yes ☑ No Section: 165-47 □ No Standard *Action:* □ Leave as is ☑ To be revised Notes:	
12. Setbacks and Frontages	**Are irregular lot shapes (i.e. pie-shaped, flag lots) allowed?** ☑ Supportive language in code/ordinance Section: 130-15: Design Standards (D) 3 □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	Score: 2 out of 6 points
	Are reductions in frontage distances allowed where appropriate to minimize street length? □ Supportive language in code/ordinance Section: 165a Schedule I □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications ☑ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: *Better Site Design,* New York State Department of Environmental Conservation. Available at: http://www.dec.ny.gov/docs/water_pdf/bsdcomplete.pdf.	

	Are reductions in setback distances allowed where appropriate to minimize driveway lengths? □ Supportive language in code/ordinance Section: 165a Schedule I □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications ☑ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes:	
13. Sidewalks	**Is the minimum required width for a sidewalk 4 ft. or less?** 5 *ft.* □ Yes ☑ No Section: Design Criteria and Construction Specifications □ No Standard *Action:* ☑ Leave as is □ To be revised Notes: Continue to adhere to ADA Accessibility Guidelines.	Score: 3 out of 6 points
	Are sidewalks allowed on only one side of the street? □ Supportive language in code/ordinance Section: ☑ Site specific with Planning Board approval □ Incentivized in code/ordinance ☑ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	
	Are sidewalks sloped so that stormwater drains into the front yard as opposed to the street? □ Supportive language in code/ordinance Section: □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications ☑ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes:	
	Are alternative pedestrian pathway layouts allowed, rather than placement in road ROW? □ Supportive language in code/ordinance Section: ☑ Site specific with Planning Board approval □ Incentivized in code/ordinance ☑ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: Recommend inclusion with code/ordinance.	
14. Driveways	**Is the minimum driveway width 9 ft. or less (single lane) or 18 ft. (two lanes)?** 12 *ft.* _____ *ft.* □ Yes ☑ No Section: Design Criteria and Construction Specifications □ No Standard *Action:* □ Leave as is ☑ To be revised Notes: *Impervious Surface Reduction: Driveway Design*, prepared for the Metropolitan Council by Barr Engineering Company. Available at: http://www.barr.com/clientre/Archives/BMPs/BMPfiles/04RPPImpDriveway.pdf.	Score: 4 out of 6 points
	Are alternative materials and designs (i.e. porous pavers, two-track design, etc.) allowed? □ Supportive language in code/ordinance Section: □ Site specific with Planning Board approval □ Incentivized in code/ordinance ☑ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: Recommend inclusion with code/ordinance.	

	Are shared driveways allowed? □ Supportive language in code/ordinance Section: □ Site specific with Planning Board approval □ Incentivized in code/ordinance ☑ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: Recommend inclusion with code/ordinance.	
15. Open Space Management	**Does the community have requirements to allow homeowner associations or land trusts to manage open space?** ☑ Supportive language in code/ordinance Section: Article VIII: Environmental Protection Overlay Districts □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	Score: 5 out of 6 points
	Are conservation subdivisions and/or cluster developments located in close proximity required to consolidate their open space? ☑ Supportive language in code/ordinance Section: 165-47: (I) 11 □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	
	Does a minimum percentage of open space need to remain in its natural condition? □ Supportive language in code/ordinance Section: 165-47: (H) ☑ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: Recommend inclusion with code/ordinance.	
	Are uses for open space in residential developments defined? ☑ Supportive language in code/ordinance Section: 210-26 and 210-27 □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	

16. Rooftop Runoff	**Can rooftop runoff be discharged to yard areas?** ☑ Supportive language in code/ordinance Section: 128-26 □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	Score: 4 out of 4 points
	Is temporary ponding of stormwater allowed in front yards or on rooftops? ☑ Supportive language in code/ordinance Section: 165-83: Fire, safety and flood prevention regulations (D) □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	

Areas identified within Lot Development that are most in-line with Green Infrastructure principles:

☑ **Open Space Design**	☑ **Driveways**	□ **Setbacks and Frontages**
☑ **Open Space Management**	□ **Sidewalks**	☑ **Rooftop Runoff**

CONSERVATION OF NATURAL AREAS

17.Buffer Systems	**Is there an ordinance that provides for a river or stream buffer to protect water quality and habitat in streams and rivers?** 35 *ft.(minimum)* ☑ Supportive language in code/ordinance Section: 165-52: EPOD (4) Stream Corridor Protection District (E) 1 □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: □ Leave as is ☑ To be revised Notes: Recommend 75 feet or more as minimum buffer width.	Score: 3 out of 4 points
	Does the river or stream buffer include lakes, wetlands, and coastal waters to protect water quality and habitats? ☑ Supportive language in code/ordinance Section: 165-52: EPOD (4) Stream Corridor Protection District (E) 1 □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes: Recommend inclusion with code/ordinance.	
18. Buffer Maintenance	**Does the ordinance require that the river or stream buffer remain in its natural condition?** ☑ Supportive language in code/ordinance Section: 165-47 & 165-52: EPOD (4) Stream Corridor Protection District □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	Score: 4 out of 4 points
	Are uses in the buffer area defined by the ordinance? ☑ Supportive language in code/ordinance Section: 165-47 & 165-52: EPOD (4) Stream Corridor Protection District □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	
	Does the ordinance specify enforcement or education mechanisms? ☑ Supportive language in code/ordinance Section: 165-47 & 165-52: EPOD (4) Stream Corridor Protection District □ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications ☑ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	

19. Clearing and Grading	**Are there clearing and grading requirements that limit the amount of exposed soil at residential development sites to reduce the potential for erosion and sedimentation?** ☑ Supportive language in code/ordinance Section: 130-15: (L) ☑ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	Score: 3 out of 3 points
	Do reserve septic field areas need to be cleared of trees at the time of construction? □ Supportive language in code/ordinance Section: 130-15: (L) ☑ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications ☑ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	
20. Tree Conservation	**Are certain trees or stands required to be preserved at residential development sites?** ☑ Supportive language in code/ordinance Section: 130-15: (L) ☑ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	Score: 3 out of 3 points
	Do construction plans provide adequate documentation to limit the clearing of natural vegetative cover? ☑ Supportive language in code/ordinance Section: 130-15: (L) ☑ Site specific with Planning Board approval □ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	
21. Land Conservation Incentives	**Can developers or landowners utilize open space design, density bonuses, lower property tax rates, and other tools and programs?** ☑ Supportive language in code/ordinance Section: 165-14: Incentive zoning □ Site specific with Planning Board approval ☑ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	Score: 4 out of 4 points

	Is design flexibility permitted to meet regulatory or conservation restrictions? ☑ Supportive language in code/ordinance Section: 165-14: Incentive zoning □ Site specific with Planning Board approval ☑ Incentivized in code/ordinance □ Expressly allowed by design/construction specifications □ Typically not allowed *Action*: ☑ Leave as is □ To be revised Notes:	
22. Stormwater Outfalls	**Is stormwater required to be treated for quality before it is discharged?** ☑ Yes □ No Section: Article III: Illicit Discharges and Connections □ No Standard *Action*: ☑ Leave as is □ To be revised Notes:	Score: 6 out of 6 points
	Can stormwater be discharged directly into a jurisdictional wetland without pretreatment? □Yes ☑ No Section: Article III: Illicit Discharges and Connections □ No Standard *Action*: ☑ Leave as is □ To be revised Notes:	
	Are there effective design criteria for stormwater best management practices? ☑ Yes □ No Section: Chapter 128: Stormwater Management □ No Standard *Action*: ☑ Leave as is □ To be revised Notes:	
	Does a floodplain management ordinance exist that restricts or prohibits development within the 100-year floodplain? ☑Yes □ No Section: Chapter 59: Flood Damage Prevention □ No Standard *Action*: ☑ Leave as is □ To be revised Notes:	

Areas identified within Conservation of Natural Areas that are most in-line with Green Infrastructure principles:

☑ **Buffer Systems**	☑ **Tree Conservation**	☑ **Buffer Maintenance**
☑ Land Conservation Incentives	☑ Clearing and Grading	☑ Stormwater Outfalls

Total Score (out of 100): 65

Residential Streets and Parking Lots Score (out of 40): 18
Lot Development Score (out of 36): 24
Conservation of Natural Areas Score (out of 24): 23

Scoring (Out of 100 points)	
90 – 100:	Congratulations! Your community is a real leader in protecting streams, lakes, and estuaries. Keep up the good work!
80 – 89:	Your local development rules are pretty good, but could use some tweaking in some areas.

70 – 79:	Significant opportunities exist to improve your development rules. Consider creating a site planning roundtable.
60 – 69:	Development rules are inadequate to protect your local aquatic resources. A site planning roundtable would be very useful.
< 60:	Your development rules definitely are not environmentally friendly. Serious reform of the development rules is needed.

Summary of Green Infrastructure Sites

Qualitative Assessment Table

		Relative Assessment Scores (see Notes)						
		Nutrient Removal	TSS Removal	Proximity to Impaired Water	Constructability/ Maintenance	Probable Construction Costs	Other Unique Benefits	Total
Site	**Practice**							
Parma Town Hall	Bioswale (Water Qual Swale)	5	5	5	3	5	5	28
Parma Town Hall	Porous Paving	5	5	5	2	5	5	27
Parma Town Hall	Stabilization (Outlet)	1	5	5	5	5	5	26
Webster Town Hall	Stabilization (Bank)	5	5	3	2	5	5	25
Walworth Town Hall	Stormwater Wetlands	5	5	5	1	3	5	24
Churchville Village Hall	Rain garden (Filtration)	3	3	5	2	5	5	23
Webster Empire Blvd	Bioretention (Filtration)	5	5	1	4	5	3	23
LeRoy Mill Street Parking Lot	Bioretention (Filtration)	3	3	3	3	5	5	22
Spencerport Exempt Club	Rain garden (Filtration)	1	3	3	5	5	5	22
Ogden Maida Drive	Stormwater Wetlands	5	5	3	1	1	5	20
Parma Highway Garage	Bioretention (Filtration)	3	5	3	3	5	1	20
Penn Yan Spencer Street	Stabilization (Bank)	5	5	1	1	5	3	20
Walworth Laurel Court	Stabilization (Outlet)	1	5	5	3	5	1	20
Webster Finn Park	Stormwater Wetlands	5	5	3	1	3	3	20
Churchville DPW	Bioswale (Water Qual Swale)	1	3	5	3	5	1	18
Dresden Village Center	Rain garden (Filtration)	1	1	1	5	5	5	18
Leroy Elm Street	Bioretention (Filtration)	5	3	3	1	3	3	18
Penn Yan Lakeview Cemetery	Stormwater Wetlands	3	3	5	1	1	5	18
Walworth Highway Garage	Bioswale (Water Qual Swale)	1	5	1	5	5	1	18
Penn Yan Lake Street	Bioswale (Water Qual Swale)	3	3	1	4	5	1	17
Walworth Town Hall	Porous Paving	1	3	5	2	1	5	17
Torrey Highway Garage	Bioswale (Water Qual Swale)	1	3	1	5	5	1	16
Penn Yan Spencer Street	Stabilization (Outlet)	1	5	1	2	5	1	15
Webster Friar Tuck Lane	Stormwater Wetlands	3	3	3	1	1	3	14
Penn Yan Lake Street	Bioretention (Filtration)	1	1	1	4	5	1	13

Notes:

1. For description of criteria, see GHD Technical Memorandum dated September 2, 2011.
2. Scores: Low=1, Mod=3, High=5
3. Some variable of scores are present. High-Moderate = 4 & Moderate-Low = 2
4. Totals are relative to the projects included in this study.